Exploring and Assessing the Disaster Response Strategy Being Applied in Urban Communities Vulnerable to Flooding in Maputo, Mozambique

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“Trust in the Lord with all your heart and lean not on your own understanding. In all your ways acknowledge Him and He will make your paths straight”. This was a Biblical scripture that I always went back to and leaned on for support. So first and foremost, I would like to acknowledge God and give Him glory for the completion of this work. It was His strength, His wisdom and His Love that has carried me through.

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Abstract

In recent years, the urge to address climate change as a global emergency has risen due to its increased intensity and frequency. From deadly heat waves in South Asia, to devastating floods in Southern Africa, natural disasters are the most visible impacts of the effects of an ever-changing climate. Mozambique is a country situated in the Southern region of Africa that experiences cyclic natural disasters such as droughts and floods. Its vulnerability is mainly due to its geographical location, but factors such as unplanned rapid urbanisation, high poverty levels, and lack of adequate infrastructure also contribute to its vulnerability. Literature has demonstrated that communities play a central role in responding to and addressing natural disasters, therefore, this study set out to explore and assess the disaster response strategies being applied in urban communities vulnerable to flooding in Maputo. The objectives include:

a) To identify community-based strategies being implemented by urban communities vulnerable to floods in Maputo.
b) To appraise the role of stakeholders in aiding communities to adapt to the impacts of floods.
c) To construct/develop a best practice approach to enhance community resilience to the impacts of floods in urban communities.

Theoretically, the study is based on the concept of vulnerability, with the Model of Vulnerability (Smit and Wandel, 2006), The Sustainable Livelihood Framework (Chambers (1980); and Scoones (1998)) and the Pressure and Release Model (Blaikie et al, 1994) guiding the research. The key elements of these models are combined to produce a novel conceptual framework, namely the 'Community Adaptation Practices' Framework (CAP), which is a major contribution to this study.

Philosophically, the study adopts pragmatism with an interpretive approach, primarily because it uses both qualitative (in depth interviews and follow up interviews) and quantitative (online questionnaires) methods to collect data. These research methods are used to better understand Maputo's flood response mechanisms, with study participants being a small community sample, and agencies and institutions that assist in times of crisis.

A thematic analysis was chosen to analyse the findings, and from that process, four themes emerged: community involvement, culture, intersectoral dynamics, and infrastructure. The study has shown that there needs to be greater pro-active, rather than reactive actions in vulnerable

communities from both communities and relevant stakeholders; training of community committees needs more emphasis on adaptive activities; response and adaptative strategies must be inclusive of people with disabilities, and cultural factors must be appreciated as they influence how people perceive climate risks and in turn, their willingness to adopt adaptation strategies.

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List of Abbreviations

CAP: Community Adaptation Practices Framework

CBA: Community-Based Adaptation

COP: Conference of Parties

DFID: Development for International Development

FAO: Food and Agricultural Organisation

GHG: Green House Gases

GIS: Geographic Information System

ILO: International Labour Organisation

INGC: Institute of Disaster Management

IPCC: Intergovernmental Panel on Climate Change

MICAO: Ministry of the Co-ordination of Environmental Affairs

NAPA: National Adaptation on Plan for Action

NDF: Nordic Development Fund

NWF: National Wildlife Federation

PAR: Pressure and Release Model

SDG: Sustainable Development Goals

SLF: Sustainable livelihood Framework

UN: United Nations

UNDP: United Nation Development Programme

UNEP: United Nations Environment Programme

UNFCCC: United Nations Framework Convention on Climate Change

UNISDR: United Nations Office for Disaster Risk Reduction

WHO: World Health Organisation

CHAPTER 1: INTRODUCTION

1.1 An Introduction to the thesis

The impacts of climate change have increasingly been recognised as a global issue which needs to be addressed with national strategies (United Nations, 2023). This thesis sets out to explore and assess the disaster response strategies being applied in urban communities which are vulnerable to flooding in Maputo, Mozambique. Maputo city was selected as the study context primarily due to its frequent experience of flooding. This urban setting experiences flooding due to several factors such as a lack of adequate waste disposal facilities, homes being built on flood plains, blocked drains and residents not adhering to proposed building codes. In brief, the thesis explores climate change, the concept of vulnerability and factors contributing to flood vulnerability, community-based strategies being implemented and disaster management structures in place. The research emphasises the role communities play in adaptation as they have the potential to implement strategies which can significantly reduce the negative impacts of floods. Additionally, their experiences are a valuable source of information for policymakers. By combining the local knowledge and experience communities possess with an understanding of the vulnerability context and factors which exacerbate vulnerability, communities and policymakers can collaborate and be in a better position to identify long-term and sustainable solutions.

Theoretically, the thesis engages with the concepts of vulnerability and community-based adaptation. It does so by critically evaluating the Model of Vulnerability (Smit and Wandel, 2006), the Sustainable Livelihood Framework (SLF) (Scoones, 1998) and the Pressure and Release (PAR) Model (Blaikie et al, 1994). Based on the limitations of these models in the context of Maputo and its city's response strategy, a new framework, namely, Community Adaptation Practices' Framework (CAP) is proposed. This conceptual framework is the key theoretical contribution of this thesis as it offers a more contextualised approach to assessing the vulnerability context and implementing adaptation strategies. From a practical perspective, the conceptual framework benefits both communities and policy makers in terms of understanding and responding to floods in ways that address underlying issues of vulnerability and adaptation in Maputo. Furthermore, the framework has the potential to be replicated and applied in other similar settings, such as Malawi, Zimbabwe, and Zambia, which have all experienced flooding in urban areas (UNICEF, 2019). Additionally, while

the proposed framework was developed based on a flood response, it can be adjusted and modified to other disasters worsened by climate change, such as droughts and cyclones (World Health Organisation, 2020), both of which are prevalent in these countries.

The remainder of this chapter gives an overview of the study context and based on that, justifies the value of this thesis by outlining the factors which contribute to Maputo's vulnerability to flooding. Subsequently, the research aims and objectives are stated.

1.2 Introduction to the study context: Maputo, Mozambique

Maputo, the capital city of Mozambique, is in the Southern region of Africa (*Figure 1.1*), with a population of 1.1m (World Population Review, 2022). As a former Portuguese colony, Mozambique gained its independence in 1975, and has since grown despite several political and economic challenges (Britannica, 2022).

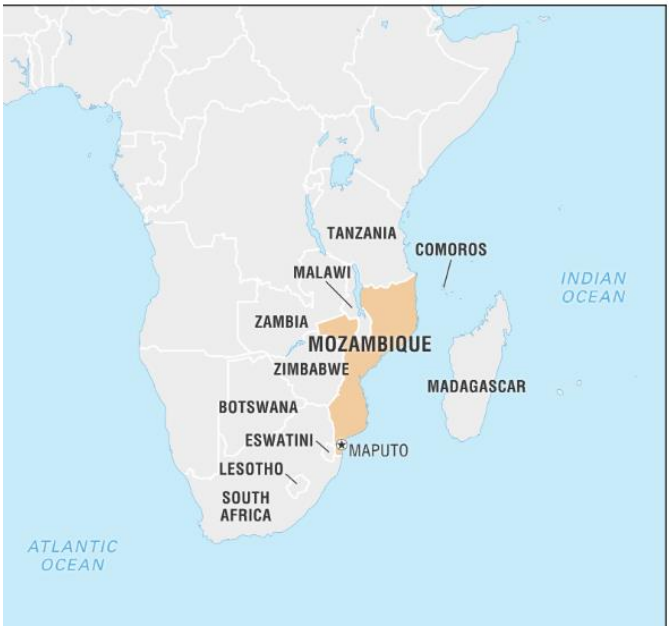


Figure 1.1: Map of Mozambique (Britannica, 2022)

However, owing to its geographical location, which includes its vast 2,700 km coastline along the Indian Ocean, the city's location along nine main rivers, and lowland coastal region, Maputo is particularly vulnerable to floods (INGD, 2020; Udelsmann, 2019). This vulnerability is exacerbated by the overly dense urban population, which in 2023 was 1,162,793, representing an annual growth rate of 2.09% (World Population Review, 2023). This is coupled with the fact that most of the houses are in low-lying areas and occupied by the poorest, who possess limited adaptive capacity (UNDP, 2019). According to the UN Global Assessment Report on Disaster Risk Reduction (2019),

Mozambique is the third most vulnerable country to disaster risk in Africa. This is also supported by its high ranking in the Climate Risk Index (GermanWatch, 2019) *(Figure 1.2)*:

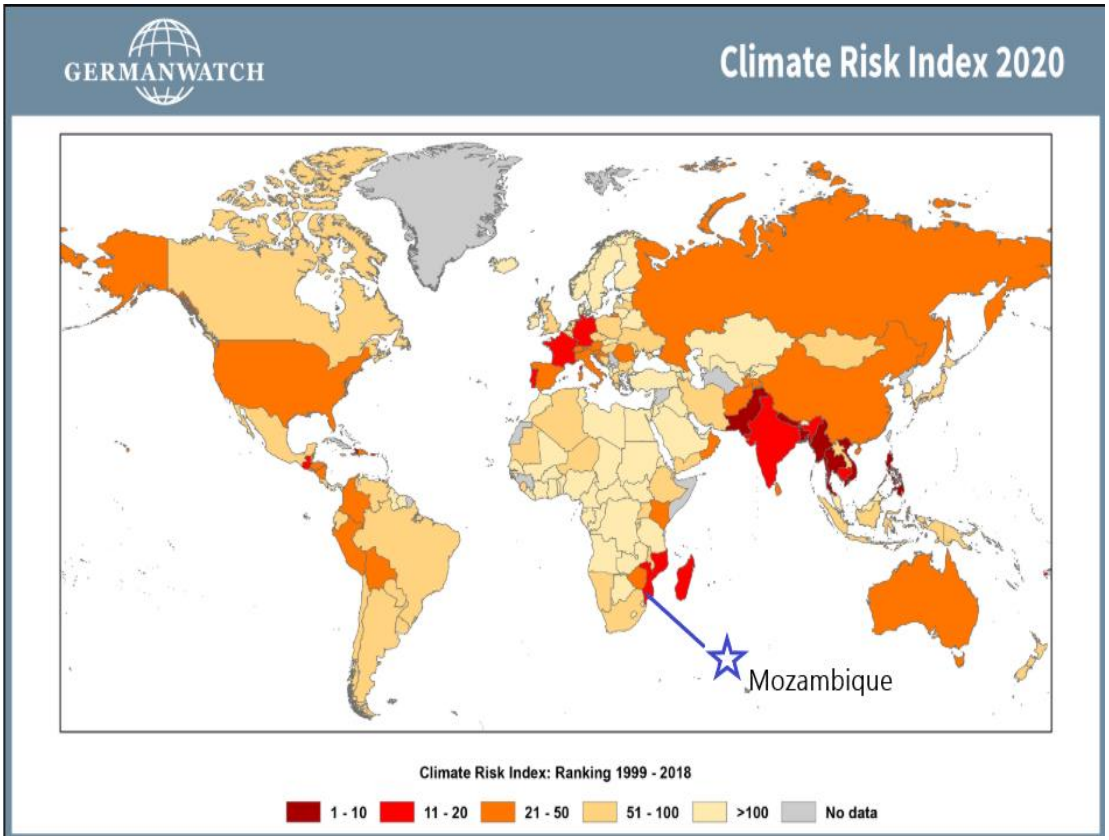


Figure 1.2 Climate Risk Index (GermanWatch, 2019)

Whenever flooding is discussed in Mozambique, most people remember the floods in 2000, which were caused by five weeks of heavy rainfall accompanied by tropical cyclones (Club of Mozambique, 2020). The impacts were felt across the country: a quarter of the population was displaced, more than 700 people lost their lives, damages were estimated at $449.5m, and its GDP fell to 1.5% from a forecasted 7% that year (GFDRR, 2014). Additionally, 600 primary schools were damaged, hospitals, roads and bridges were swept away, and approximately 544,000 were forced to move. Agriculture, which was and continues to be an essential economic activity, was particularly affected with the loss of about 70-80% of livestock. In a study conducted by Zehra et al (2019), residents in Maxaquene A, which is one of the poorest neighbourhoods in Maputo, reported that rainwater had remained stagnant for days, and in some instances, it had taken three months for floodwaters to drain. In the same neighbourhood, flooding was exacerbated due to diminishing soil infiltration, lack of urban planning and the absence of functioning drainage systems (Zehra et al, 2019). Even after twenty years, residents still bear the effects of the floods, with mould growing inside homes that, due to continued moisture, cannot dry out, resulting in public health implications (ibid).

The devastation of the 2000 floods was partly a result of the formation of Maputo's poor urban communities, which can be traced back to colonial past. In 1799, Maputo was recognised as a

Portuguese colony and, in 1868, the Portuguese built a city facing Maputo Bay which served as a defence structure for the city. Citizens from surrounding districts and provinces began to migrate to Maputo for better employment opportunities. At the same time, neighbouring South Africa was experiencing an economic boom because of the farming and mining sectors, which led to the construction of a rail line connecting the two countries, as well as a port, resulting in more labour opportunities within Maputo (Reite, 2021).

Reite (2021) describes Maputo as having a 'dualistic structure': with the wealthy side depicted by tall buildings and efficient public services, and the poor neighbourhoods right next to it, characterised by poorly built houses. RioOnWatch (2017) characterise this 'dualistic structure' based on the construction material which was used; 'cidade cimento,' or 'cement city' which represents the built-up environment, and 'cidade caniço,' literally 'reed city', because caniço is a material similar to reed or cane. Migrants were often forced to settle in the unplanned periphery of the city. The government treated these areas as temporary settlements; hence, residents were not offered land tenure rights, and houses were constructed with inadequate housing materials such as reeds and iron sheets (Udelsmann, 2019). Such trends continued without substantive change in government policy until independence in 1975. Shortly thereafter, a civil war between FRELIMO and RENAMO (the two dominant political parties), which lasted between 1977 to 1992, also resulted in a steep rise of migrants to Maputo from surrounding provinces. Maputo alone was home to 45% of poor urban dwellers in the whole of Mozambique, with 50% living below the poverty line (UN Habitat, 2010). This led to an even greater population density on the peripheries; Barros et al (2014) explained how it was normal to have four families living on a 15m² piece of land, all sharing a common bathroom, resulting in major sanitation issues.

Over time, these regions have expanded into densely populated areas with various problems, such as unregulated growth, poor sanitation, inadequate roads, lack of property rights, poor education and lack of public services (Zehra et al, 2019; Lundgren, 2020). Together, these have made Maputo's poor neighbourhoods, and by extension the city as a whole, vulnerable to flooding, cyclones, and other natural disasters. Another factor which has increased Maputo's vulnerability to floods in particular is the exponential growth of unplanned settlements in marshy areas with inadequate infrastructure (Lundgren, 2020).

The impact that the civil war had on the country's adaptive capacity describes what the United Nations refer to as ' Emergencies': "a humanitarian crisis in a country, region or society where there is a total or

considerable breakdown of authority resulting from internal or external conflict and which requires an international response that goes beyond the mandate or capacity of any single agency and / or the ongoing United Nations country program" (UNHCR, 2001, p.1). Before 1999, the National Institute for Disaster Management (INGC), which is the agency in charge of preparing and managing the impacts of natural hazard-induced disaster, dealt with the impacts of the civil war. This meant that before 1999, the country did not have a national agency in charge of addressing the impacts of natural hazard-induced disasters, and therefore meant that the agency had to quickly restructure itself to meet the arising need of responding to disasters. Arguably, that would have been a fragile period as the country tried to both cope with the conflicting political parties and the devastation of the floods in 2000.

Apart from dealing with the impacts of the civil war in the past, a current threat which Mozambique faces is the armed conflict by an affiliate Islamic state group in the Northern province of Cabo Delgado since 2017. These attacks suffered a significant rise in 2020 with over 1,600 deaths (BBC, 2021). The root causes of these conflicts lies in the levels of poverty, lack of access to land and jobs, and most importantly, the discovery of natural gas reserves in the province (BBC, 2021). Apart from dealing with armed conflict, the province of Cabo Delgado also suffered the impacts of Tropical Cyclone Kenneth. The Red Cross Crescent Climate Centre (2022) analysed the impact that the cyclone had on the armed conflict and found that the conflicts spread more after the cyclone than during the cyclone. The report concluded that "these compounding risks of climate and conflict have brought to light some of the complex dynamics of governance, conflict, and climate change and their exacerbation of insecurity and vulnerability…" (The Red Cross Crescent Climate Centre, 2022, p. 6).

Another aspect of complex emergencies is the involvement of international agencies and other humanitarian organisations. Agencies which are heavily present in Mozambique include the World Bank, USAID and various United Nations agencies. The UN Migration Organisation is the Governments key advisor in providing support for migration, governance and management, hence, it works closely with the Government and other relevant stakeholders (IOM UN Migration, 2021). The World Bank is another organisation with a strong presence in Mozambique. Over the years, the organisation has aided the government in areas such as health, education, road construction, etc. Their latest strategy is the 'Country Partnership Framework 2023-2027' which is aligned with the

governments National Development Strategy for 2015-2035 which aims to provide financial support in infrastructure, governance and economic reforms (World Bank, 2023). The above examples describe the complex emergencies and emphasise the governments reliance on external financial support.

The formation of poor urban communities is also arguably a result of inadequate government policy enforcement; Barros et al (2014) describe how, in the 1990's, municipalities started to become so overwhelmed with the increasing numbers of residents that they only took legal action when residents would occupy land which had been bought by someone else. However, there is also a political reason for involvement; Barros et al (2014) note that corrupt FRELIMO (dominant political party) members and municipal managers made land ownership almost impossible for the less wealthy by allowing land prices to rise to roughly eighty times higher than the minimum salary, which meant that only the wealthy had the financial means to purchase land (Barros et al, 2014).

This has also resulted in a process referred to as gentrification: when wealthy buyers buy land from poor communities to expand the wealthy parts of the city, which further expands the gap between the poor and rich and is visibly evident. Tulier et al (2019, p.1) define gentrification as "an interactive process in formerly declining, under-resourced, predominantly minority neighbourhoods involving economic investment…and in-migration of new residents, generally with a higher socio-economic status". Gentrification can be experienced in various forms; the definition above implies that new, wealthy residents move into the lower-class neighbourhoods, which can generate benefits such as improved sanitation systems, better health care and education providers. However, in Maputo, residents are forced out of their neighbourhoods to allow space for better house developments. Examples of neighbourhoods in Maputo which have undergone this process include 'Sommerschield', 'Polana Cimento', 'Polana Canico A' and 'Triunfo' (Barros et al, 2014). Residents who once lived in these neighbourhoods, especially those without land rights, were persuaded to sell their houses. TRF News (2019, p.12) explain that "it is hard to reject an offer that apparently will change your life forever. Most of the buyers not only offer a price for the infrastructure, but they also provide fully documented land in the newly designated habitational zones outside the city". Although this might seem like an 'attractive deal', urban residents make a huge contribution towards the informal urban economy by serving as maids, gardeners, council cleaners, waitresses and security guards (TRF News, 2019). Thus, their relocation to areas further away from the city centre means that their livelihoods are affected and their quality of life diminished.

Poverty among urban dwellers incapacitates their ability to cope with natural disasters, which are becoming more prevalent and severe due to climate change (Barros et al, 2014), because of their limited access to resources. For example, without financial resources to acquire land many construct their homes in floodplains. Because poor urban areas house so many people living in inadequate conditions, events such as floods pose a greater risk to them. A challenge urban inhabitants in Maputo face is the regular cycle of floods coupled with high poverty levels. This leads a decreased ability to prepare for future flooding.

To conclude, Maputo is an important context for investigating questions of vulnerability in the context of a changing climate. Based on Maputo's geographical and historical characteristics, it is clear that through time, the country has undergone changes which when combined, intensify the impacts of natural disasters. Geographically, the city is positioned parallel to a vast coastline along the Indian Ocean and has nine main rivers flowing through it. Historically, since the civil war, Maputo has experienced an exponential influx of migrants who, due to their economic status, were forced to settle in the periphery of the city. Over time, the periphery city grew without adequate building materials and any government interventions, which resulted in them being built with weak building materials. As the most affected group, communities have the potential to collectively implement strategies to address natural disasters, therefore this study centres around combining the concepts of vulnerability and community-based adaptation to create sustainable adaptation strategies.

The next section provides a rationale of the study by briefly discussing key elements on which the study is based, namely, climate change, informal settlements, urbanisation, and adaptation.

1.3 Rationale of the study

At the moment, the topic of climate change is one of the most significant current global discussions. Nations around the world are struggling to reverse the impacts climate change is having on their economy, weather, health, and food security (UN, 2022). For a country highly susceptible to natural disasters due to the factors outlined above, it remains imperative to find solutions for the most vulnerable. Thus, the section below will briefly examine the foundational components of this study and provide justification to its importance by discussing climate change (Section 1.3.1), informal settlements (Section 1.3.2), urbanisation (Section 1.3.3) and adaptation (Section 1.3.4).

1.3.1 Climate Change

Climate change is a phenomenon which has been globally recognised and is experienced worldwide in different ways, such as with rising sea levels, increasing severity and unpredictability of weather events and more extreme temperatures (IPCC, 2022). One of the leading advocates for acting to combat climate change, Sir David Attenborough, argued that we are now past the point of going back on our actions and “it’s already too late” (Sky News, 2021, p.1). Instead, efforts must prepare societies to adapt to the impacts of climate change, including floods (Hritonenko and Yatsenk, 2022) and this is where this thesis plays a critical role: there is a need to identify mechanisms which will enable urban residents to withstand the impacts of floods.

It is projected that an increase in temperatures and changes in precipitation will increase the frequency and intensity of the occurrences of natural disasters with temperatures rising from a minimum of 1°C to a maximum of 4.6°C between 2010 and 2090 (IPCC, 2022). In the case of Mozambique, despite efforts by the government, donor agencies and NGOs to minimise the impacts of climate change, a number of challenges are still present, such as providing effective warning systems, enhancing planning capacity at national and local levels, and overcoming existing financial constraints (USAID, 2017). As an illustration of the severity, in March 2019, the country experienced one of the deadliest cyclones (Idai) to hit the African continent, causing 603 deaths (UNICEF, 2019). To exacerbate an already vulnerable situation, within weeks another cyclone (Kenneth) made landfall, affecting 245,700 individuals (ibid).

Scientific evidence has shown that there is a link between climate change and natural hazard-induced disasters. In simple terms, as the atmosphere gets warmer, it can hold more water vapours. In instances when the air temperature drops, these water vapours transform into droplets which then

result in heavy rainfall (Action Aid, 2023). Another link between climate change and flooding is that higher temperatures have caused the melting of ice caps, which in turn increases the sea levels. This makes coastal cities and towns particularly vulnerable as they are close to the sea. Extreme weather events resulting in flooding are being caused by anthropogenic climate change, which are climate change occurrences caused by humans (Pedersen et al, 2012). The authors argue that the events which lead to flooding in particular is the occurrence of heavy storms. Suter and Aagaard (2023) explored natural disasters as an impact of climate change and report that although climate change will not have a direct influence on the number of hurricane and tropical storm occurrences, it will cause a rise in sea levels, and increase both the rate and intensity of cyclones and floods.

1.3.2 Informal Settlements

UN Statistics (2019) notes that there are over one billion people globally living in informal urban settlements, *(Figure 1.3*), with Eastern and Southern-Eastern Asia housing more than 370m in urban regions, followed by Sub-Saharan Africa, with around 238m residents in urban neighbourhoods (UN Statistics, 2019):

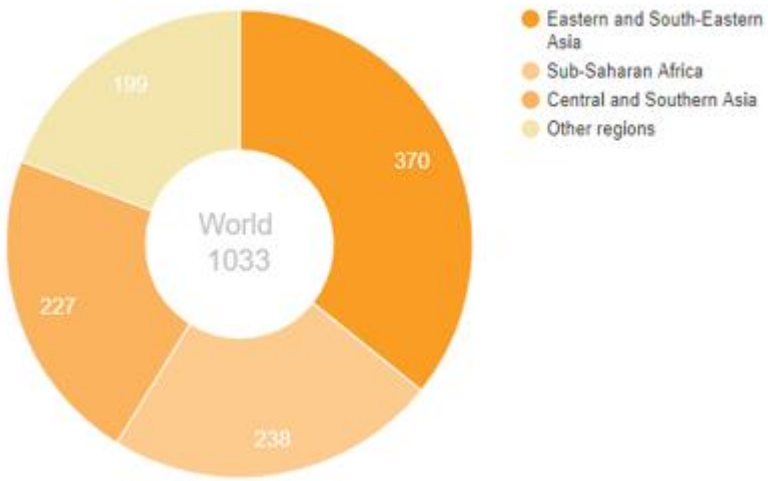


Figure 1.3 Urban population living in informal settlements (UN Stats, 2019)

According to Harris (2009), informal settlements have always existed, but became more prominent because of the industrial era. Whilst the growth of these residential areas have been controlled in developed nations because of stricter housing regulations, this has not been the case in developing countries.

Harris (2009, p.1) characterises a slum as *"a residential area with substandard housing that is poorly serviced and/or overcrowded, and therefore unhealthy, unsafe and socially undesirable".* While this

definition can be used to characterise any single house, it describes a large residential area which is overpopulated with residents who have limited resources to improve their livelihoods. To develop an operational definition, UN-HABITAT considered a household as a unit of analysis and developed the following definition: “a slum household is a group of individuals living under the same roof in an urban area who lack one or more of the following 5 conditions…durable housing…sufficient living area, access to improved water…access to sanitation…secure tenure” (UN-HABITAT, 2018, p.20). Both these definitions shed light on the physical and social aspects of these residential areas, i.e., they tend to be overcrowded with limited social services. Other terms used to describe slums include ‘informal settlements’, ‘ghettos’, ‘shanty town’, ‘squatter cities’ and ‘skid row’, therefore, this thesis uses the terms ‘informal settlements’ and ‘poor urban areas’ interchangeably.

With reference to the definitions above, informal settlements are particularly vulnerable to flooding for two reasons: firstly, their lack of resources hinders their adaptive capacity, which the Sustainable Livelihood Framework (SLF), one of the main models in this thesis, demonstrates. Secondly, the over crowdedness and compactness of the houses signifies that there is less flood water absorption and increased surface runoff.

1.3.3 Urbanisation

UN Statistics (2019) predicts that by 2030, over three billion people will face inadequate housing conditions, and UN Habitat (2016) projects that by 2050, Africa’s urban dwellers will reach 1.2 billion people. This growth of people requiring adequate housing is due to inexpensive and unsatisfactory housing construction being outpaced by the rate of urbanisation and population growth (UN Statistics, 2019). Poor urban communities form because of different factors. One of them is the migration of people from rural to urban areas (UNHABITAT, 2020). Many of the people who migrate come from a low-income background with limited resources and consequently are forced to settle in the peripheries of cities. Rural inhabitants are attracted to urban areas in search of better employment opportunities, educational and healthcare services (Zehra et al, 2019), however, many poor countries are faced with an overwhelming number of rural migrants and are not equipped to provide them with essential services. There are two sides to this argument; on one hand, urban centres are not equipped to provide for the urban migrants, however, on the other hand, urban migrants are not able to afford adequate housing; both scenarios forcing migrants to settle on the peripheries.

Another factor resulting in the formation and growth of informal settlements is poor governance policies, especially in developing countries. As mentioned in the previous section, developed nations have been able to monitor the growth of these settlements by placing stricter health and housing regulations (Harris, 2009). In the Kibera slum in Kenya for example, the government has made several attempts at demolishing the area by passing regulatory laws of construction. However, these laws are not being obeyed and people continue to construct houses using sheets of steel and timber, with no windows and a single door. While the number of household members may vary, an average 8.2m² house can accommodate around eight people (World Habitat, 2019). Zehra et al (2019) agree with the existence of poor governance in African nations and argue that the lack of government resources hinder them from reinforcing construction and planning regulations.

Governments attitude towards urbanisation and their refusal to consider urban planning in their policies also leads to the expansion of informal settlements (Zehra et al, 2019). In Mathare, another slum community in Kenya, government officials have neglected to understand the root causes of slum growths, and instead perceive them as a problem which needs to be eradicated. The lack of willingness to tackle the problem is exacerbated by the governments lack of public services and poor technical knowledge (Buchir and Detzel, 2022). Kenya also faces challenges of corruption within governments which hinder effective measures from being implemented; this is also the case in Maputo as discussed in Section 1.2.

Otto-Zimmermann (2011) argues against viewing poor urban settlements as a negative issue and proposes that the forms of resilience developed on the ground should be used as a platform to enhance urban planning strategies. This is significant as it highlights the importance of past experiences that communities have faced and can be used to enhance future resilience. The strategies which they have developed through time should be appreciated and used as a basis to policy makers and relevant stakeholders involved in developing national strategies for natural hazard-induced disaster risk reduction plans.

1.3.4 Community Adaptation Strategies

Before 2001, climate change was understood as being an issue caused by excess pollution, which consequently meant that efforts were focused on finding ways to reduce greenhouse gas emissions. However, after 2001, it was acknowledged that society had reached a point where instead of mitigating the impacts, it had to adopt strategies to adapt to the changing severe climatic conditions (IPPC, 2001). Adaptation is defined as "…adjustment in natural or human systems in response to

actual or expected climatic stimuli or their effects, which moderated harm or exploits beneficial opportunities" (IPCC, 2007; cited in Bulkeley & Betsill, 2013, p.145).

Community Based Adaptation (CBA) is a concept based on the belief that communities possess the necessary skills, abilities and knowledge needed to develop initiatives to enhance resilience to the impacts of climate change (Dodman and Mitlin, 2013). It is important to acknowledge and incorporate past experiences that communities possess in order to create effective adaptation strategies. Clarke et al (2019) believe that CBA is crucial in creating sustainable adaptation as it keeps the focus on the community and takes into consideration their contexts. As a response to cyclic climatic occurrences, Mozambique has responded by forming and training local community committees in vulnerable regions. Since 2005, these committees have been trained to function as first responders in the event of floods.

Apart from placing communities in the centre, CBA also considers enhancing community resilience. Adger et al (2005, p.1036) define resilience as "the capacity of linked social-ecological systems to absorb recurrent disturbances such as hurricanes and floods, so as to retain essential structures, functions and feedbacks". This definition emphasises that resilience is determined by a communities' capacity to both recover and 'bounce back' to normal after a disaster. Resilience is built when strong adaptive measures which can withstand extreme conditions are in place. Blazquez et al (2017, p.228) attribute the application of resilience to climate change to a realisation of a need to shift from a "predict-and-prevent approach" to a "resilience building approach that may respond to a wider range of expected and unexpected climatic risks". A predict-and-prevent approach focuses on anticipating and preparing for specific climate risks, whereas a resilience-building approach concentrates on enhancing preparedness to a wide range of potential shocks, which is more forward thinking. For resilience to be effective, it needs to shift to a targeted community approach which involves equipping communities so they are better prepared to withstand natural hazard-induced disasters (Lundgren, 2020). Thus, these two concepts (adaptation & resilience) are central in this research for two reasons; firstly, adaptation strategies adopted in Maputo are explored and evaluated, and secondly, they form the basis for the best practice approach proposed in the novel conceptual framework (CAP).

1.4 Research aims and objectives

The previous section established the importance of four interrelated areas of interest: climate change, informal settlements, urbanisation, and adaptation. In the context of this study, urban communities in Maputo city are frequently and severely affected by floods, which are made worse due to climate change. As explained previously (Section 1.2), flooding in Maputo is exacerbated by several key factors:

- Geographical location: Maputo is located along the Indian Ocean; therefore, it is more prone to natural hazards such as floods and cyclones. The country has nine main rivers flowing through it, which increases the chances of river banks bursting. And finally, it is in a lowland coastal region which means it is closer to regions susceptible to rapidly rising sea levels.
- High levels of poverty: The less economically advantaged construct their homes on the outskirts of the city, which are also areas prone to flooding, as they are built on floodplains. Moreover, the poorer people are more exposed to flooding as they have lower coping mechanism and access to support.
- Lack of adequate infrastructure: Inadequate roads mean that there is higher surface runoff in the occurrences of rains. Poor solid waste management combined with lack of effective drainage systems result in residents dumping solid waste in roads pavements, which result in blockages in the drains during rainy periods Structure of houses: Homes are built on floodplains without following adequate housing regulations and building codes, making them more fragile in the event of flooding as the homes disintegrate.
- Roads and pavements: These are constructed in a way which does not soak up rainwater as efficiently as trees and grass, therefore, when it rains the natural flow of water is disrupted causing increased water runoff.

(UNHABITAT, 2020; Zehra et al, 2019; Lundgren. 2020; Tvedten & Candiracci, 2018).

Based on the above, this study intends to explore and assess the disaster response strategy being implemented in Maputo's urban communities vulnerable to flooding. Then, based on the information gathered, develop best practices for communities and policy makers to implement which will enhance resilience. Empirically, the study draws on data gathered from agencies providing flood support, local institutions (stakeholders) and a representation of community members. The researcher believes that it is crucial to combine the thoughts and opinions of all stakeholders involved because many times policy makers believe they know what communities need, which in fact, it might not always be the case. Previous studies (Zehra et al, 2019; Dewa et al, 2022; Lundgren

and Strandh, 2022); Macorreia, 2020) have explored adaptation strategies on a community level. However, as Udelsmann (2019), Walawalkar et al (2022), Bang et al (2019) and Lundgren (2020) have shown, it is important to identify solutions to flood vulnerability that account for both community and stakeholder perspectives to floods. Since 2005, the most vulnerable communities have been trained and equipped by the National Institute of Disaster Management (INGC) to act as 'first responders' in the event of natural hazard-induced disasters, therefore, they play a crucial role in minimising the negative impacts of floods. Local governments and municipalities have the responsibility of establishing multisectoral collaborations to effectively respond to floods; this ensures that there are clear roles set out to avoid duplications, and that resources are directed to the correct areas. Thus, this thesis contributes to identifying adaptive strategies both groups can incorporate in their efforts to mitigate the impacts of floods.

In pursuit of the above, this thesis sets out to meet the following aim and objectives:

Aim:

To explore and assess the disaster response strategies being applied in urban communities vulnerable to flooding in Maputo, Mozambique.

Objectives:

1. To identify community-based strategies being implemented by urban communities vulnerable to floods in Maputo.
2. To appraise the role of stakeholders in aiding communities to adapt to the impacts of floods.
3. To construct/develop a best practice approach to enhance community resilience to the impacts of floods in urban communities

To meet these objectives, the thesis proceeds by reviewing existing literature about climate change, vulnerability, and community-based adaptation. This is followed by an empirical investigation of these issues in the context of Maputo. The next section outlines the structure of the thesis.

1.5 Structure of the thesis

The overall structure of the study takes the form of six chapters.

Chapter 1, the current chapter, introduces the thesis. It provided the rationale of the study by combining four elements: climate change (Section 1.3.1), informal settlements (Section 1.3.2), urbanisation (Section 1.3.3) and adaptation (Section 1.3.4). It subsequently identified the different factors contributing to flood vulnerability in Maputo such as its geographical location, high poverty levels, lack of adequate infrastructure, the structure of houses and the construction of roads and pavements which increase surface runoff of flood waters (Section 1.4). Finally, aims and objectives were outlined.

Chapter 2 overviews climate change as a phenomenon that has increased the intensity of frequency in which natural hazard-induced disasters are experienced (Section 2.2). The theoretical underpinnings of the concept of vulnerability are then reviewed, including the Model of Vulnerability (Smit and Wandel, 2006) (Section 2.3.1), Sustainable Livelihood Framework (SLF) (Chambers, 1980 and Scoones, 1998) (Section 2.3.2) and the Pressure and Release Model (PAR) (Blaikie et al, 1994) (Section 2.3.3). The key elements of these models and frameworks are drawn out to be incorporated into a new conceptual framework developed in this thesis (CAP), focusing solely on the vulnerability component of the framework (Section 2.4). The second part of this section delves into a discussion about adaptation, focusing on Community Based Adaptation (CBA) (Section 2.5). As CBA is a central part of this study, its principles are incorporated into the novel framework (Section 2.6).

Chapter 3 presents the methodological approaches used in this thesis. The study adopted a pragmatic approach with constructivism lens. This was deemed the most appropriate method for two reasons. Firstly, it allowed the researcher the flexibility to use more than one source and method of collecting data, which was valuable during the Covid pandemic. Secondly, due to the nature of vulnerability and natural hazard-induced disasters, it was important for the researcher to construct knowledge from participants perspectives. Therefore, to reflect the philosophical stance, mixed methods (Section 3.5) were used in the form of two rounds of interviews and one questionnaire. The first interviews are the dominant method, and address objectives one and two, whereas the second round of interviews are follow-ups based on the results of the first round and questionnaires. The validity and reliability of the research is explored in relation to triangulation and reflexivity (Section 3.10) The chapter concludes ethical considerations (Section 3.11)

Chapter 4 presents and analyses the findings of the study, and is divided into two parts. Part A presents the findings of the in depth interviews were the dominant data collection method (Section 4.2) and the questionnaire findings (Section 4.4). and this is presented in section 4.2. In total, 34 responses were gathered from experts in the field of flood response and adaptation as well as some community members. Part B presents the findings from the second round of interviews which was comprised of three expert participants, two of which took part in the first round of interviews as well as the questionnaire (Section 4.6). The primary reason why a second round of interviews was conducted was to enhance the validity of the data. This was done by presenting the questionnaire and first round of interview responses to the participants and asking them to comment upon them, challenge them if necessary or simply agree.

Chapter 5 starts by recapping the process of theme identification using Gill et al's (2004) four stages (Section 5.1). The in-depth interviews were the dominant method. In total, twelve in depth interviews were conducted. From the data gathered, four themes emerged: Community Involvement (Section 5.2); Culture (Section 5.3), Intersectoral Dynamics (Section 5.4) and Infrastructure (Section 5.5). Subsequently, these themes are used to further build the conceptual framework (Section5.7).

Chapter 6 concludes the thesis and reflects on the extent to which the objectives have been met (Section 6.2.1). Recommendations (Section 6.3) are suggested based on the gaps which were identified, such as: installing recycling bins, invest in climate resilient infrastructure and streamline the early warning information system. The final section discussed the limitations of the study (Section 6.4) and the implications of the findings to future research (Section 6.5).

CHAPTER 2: Climate Change, Vulnerability, Community and Adaptation

2.1 Introduction to the chapter

One of the fundamental concepts involved in the study of climate change adaptation is vulnerability (Adger, 2006; Hammer et al, 2019; Pandey et al, 2018; Lundgren 2020). After contextualising the thesis in literature about the impacts of climate change (Section 2.2), three models of vulnerability are discussed: The Model of Vulnerability (Section 2.3.1), the Sustainable Livelihood Framework (2.3.2) and the Pressure and Release Model (Section 2.3.3). These models have been applied to tackling natural hazard-induced disasters, while also acknowledging that root causes of vulnerability to natural hazard-induced disasters lies not only in the lack of access to resources, but also in the deeper political and economic ideologies of societies. One shortfall of these models is that it neglects to practically demonstrate how communities can play an active role in disaster response and management, consequently, origin and principles of community-based adaptation are then introduced, and its importance explored. Sustainable adaptation strategies are then discussed, including their principles and the challenges associated with decision making and implementation. Drawing together the review of existing literature, the chapter concludes by developing a novel conceptual framework (Section 2.6), which forms the starting point for this thesis' research in the empirical context of Maputo, Mozambique. The conceptual framework also supports the methodology (Chapter 3) and empirical research (Chapter 4) undertaken.

2.2 An Introduction to climate change

The term 'climate change' is one which has increased in popularity throughout time and been the topic of global public debate (Brundtland Report, 1987; Steffen et al, 2015). One of the most recognised bodies in the climate change field is the Intergovernmental Panel on Climate Change (IPCC). The IPCC was jointly established with the United Nations Environmental Panel and the World Meteorological Organisation and is an organisation made up of climate change experts who contribute objective and scientific information to produce credible global reports (Maslin, 2014). Thus, the IPCC reports are recognised as the most "authoritative statements of scientific knowledge about climate change" (Dessler, 2016, p. 9; Maslin, 2014).

IPCC (2012) define climate change as: “a change in the state that can be identified by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer” (IPCC, 2012, p.557).

National Geographic (2020) takes a slightly different perspective in relation to time and refer to climate change as changes which are currently impacting the worlds weather and climate. While climate and weather refer to temperature, they have distinct differences in relation to time. Weather refers to “the actual state of the atmosphere at a particular time” whereas climate is “a statistical description of the weather over a period of time, usually a few decades” (Dessler, 2016, p.1). In simple terms, weather describes the short-term behaviour of the atmosphere (from minutes to months), and characteristics can range from brightness and precipitation to wind and cloudiness (NASA, 2005). The notion of time is important because for climate to be noticeable, scientists have had to rely on recording greenhouse gases concentration over a few centuries, as shown in *Figure 2.1* (NASA, 2022) Similarly, the UN describes climate change as a gradual change in temperature and weather.

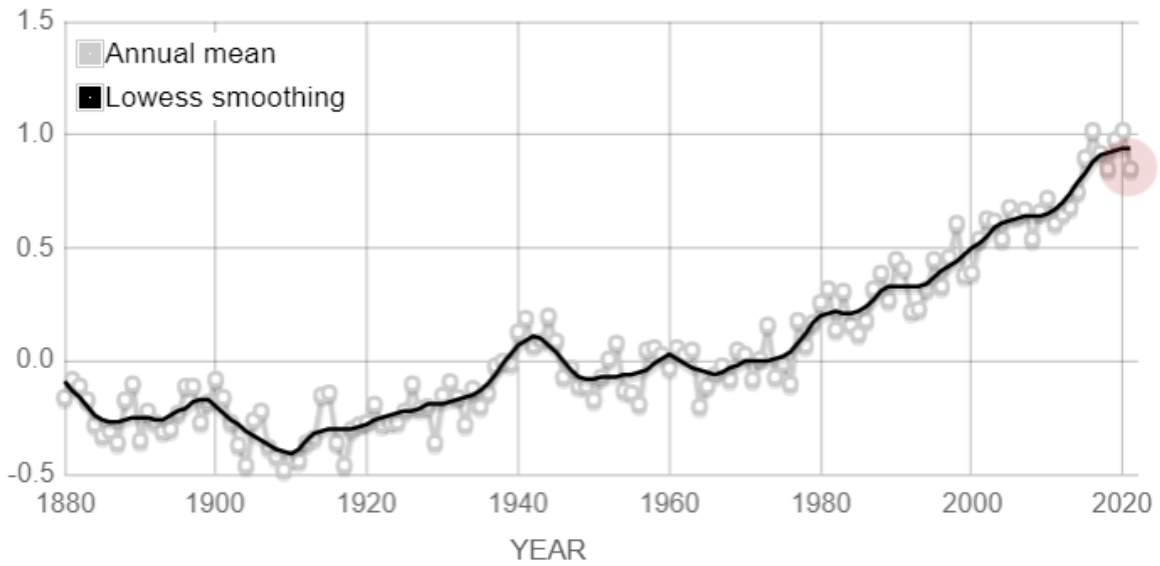


Figure 2.1: Global Temperature Index. NASA (2022)

In 1988, the world first began to acknowledge the reality and seriousness of climate change, however, it was only until the Rio Earth Summit in 1992 when countries began to meet and agree on strategies to tackle its impacts. Before 2001, the IPCC had focused solely on the mitigation of climate change which was aimed at reducing global levels of greenhouse gases (Bassett & Fogelman, 2013). Although mitigation is seen as a way to reduce greenhouse gases, there is overwhelming evidence that society has reached a point where the legacy of GHGs emitted into the

atmosphere over the past century has to result in societies being prepared to adapt to the consequences of changing climatic conditions (Bulkeley & Betsill, 2013).

After 2001, IPPC directed members to a new thought process when it came to climate change; members of the panel were encouraged to reflect on adjustments that had been made or that should be made to reduce climate change variability and vulnerability (Bassett & Fogelman, 2013) As a result, the vulnerability concept and climate change adaptation were linked for the first time, and adaptation was defined as "…adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderated harm or exploits beneficial opportunities" (IPCC, 2007; cited in Bulkeley & Betsill, 2013, p.145).

An early understanding of climate change was largely focused on pollution as a problem, causing adaptation efforts to be aimed at reducing global emissions. This led to climate change being widely tackled from a top-down approach by using Global Climate Models (van Aalst et al, 2007). The models would be modified to better suit a regional situation. Although they provided a theoretical understanding, these models could only offer a simplified explanation of the impacts of climate change in a region. Another downfall of using a global model was that they were based on uncertain future climate predictions and "under unknown future socio-economic circumstances" (van Aalst et al, 2007, p.167). This gap in knowledge led to the United Nations Environmental Programme (UNEP) United Nations Framework Convention on Climate Change (UNFCC) to search for ways in which climate change could be understood from a local scale (van Aalst et al, 2007). As a result, bottom-up approaches were introduced. This approach is based on two principles: firstly, it involves local players, and secondly, it uses current and local knowledge, policies and strategies to address current weather events.

While adaptation is considered as a step ahead compared to mitigation, Pelling (2010) notes that what makes adaptation to climate change particularly challenging is the lack of certainty of the scale and speed of climate change combined with the absence of links in day-to-day life. Berrang et al (2011) take the same stance and argue that adaptation is not as straight forward as mitigation as it involves considering different scales, i.e., from local adaptation to global adaptation, and additionally, it needs to consider different stakeholders, such as households, individuals and governments. Moreover, adaptation is difficult to monitor, causing governments and policy makers to be more reluctant to support adaptation interventions (Berrang et al, 2011); Laukkonen et al (2009, p.289) states that adaptation puts governments in a position where they must use already

scarce public resources to tackle an ‘invisible threat’, which according to Bulkeley & Betsill (2013), could have political, policy and financial implications (Bulkeley & Betsill, 2013).

Climate change is a process: human activities such as burning fossil fuels like gas and oil, farming activities, waste disposal, clearing extensive masses of land all generate greenhouse gases (carbon dioxide, methane, nitrous oxide) (Bulkeley & Betsill, 2013). These gases then contribute to creating a ‘blanket’ in the ozone layer of the earth which traps the heat and ultimately causing temperatures to rise (ibid). This increase in temperature has meant that the earth is 1.1°C warmer compared to the late 1800’s (United Nations, 2022). According to the Paris Agreement, in order to avoid a global catastrophe, countries must commit to maintain worldwide temperature rise below 2°C, as well as to minimise temperature increase by 1.5°C (ibid), however, IPCC (2022) predicts that that’s unlikely to happen as it is projected that global temperatures will reach 3.2°C by the end of the century: “without a strengthening of polices beyond those that are implemented by the end of 2020, GHG emissions are projected to rise beyond 2025, leading to a median global warming of 3.2C by 2100” (IPCC, 2022, p.2).

After protesting for the Swedish government to meet their carbon emissions target, environmental campaigner Greta Thunberg inspired millions of young people around the world to follow her steps (BBC, 2021). Climate activist Sir David Attenborough has been an activist for centuries and his appeal to the world has not wavered: the world must act now before it too late. In 2021, the United Nations Development Programme (UNDP) in collaboration with the University of Oxford conducted the largest ever public opinion on climate change, involving over 1.2million respondents, equating to over 56% of the global population, across 50 countries. Although results varied between countries and age, overall, 64% of participants viewed climate change as a global emergency. Results also showed that 81% of respondents from the UK and Italy agreed that climate change is a global emergency, whereas respondents from Moldova were less convinced (50%) (University of Oxford, 2021). The generational gap indicated that 69% of respondents under the age of 18 believed in climate emergency; this figure dropped to 58% among respondents over 60 years of age (ibid). Despite these differences, there is a consensus and recognition for countries to increase their commitment levels in achieving targets set within the Paris Agreement.

International efforts such as the Hyogo Framework for Action (2005-2015) and the SENDAI Framework (2015-2030) have produced global guidelines on prevention, preparedness and mitigation for countries to implement. While the SENDAI framework is internationally accepted and

recognized, it is important to consider the contexts in which the targets, goals and priorities must be implemented. In the case of African countries, challenges such as development, poverty and governance must be taken into consideration (van Niekerk et al, 2020). Similarly, Broto et al (2015) draw attention to the fact climate change strategies need to be considered together with other development priorities such as poverty, infrastructural provisions, which combined provide communities with the supply of services they need and in turn a greater capacity to adapt.

2.2.1 Climate change impact: Natural hazard-induced disasters

Climate change is not simply constrained to the reality that the atmosphere is getting warmer, but the implications are much more complex. Rising global temperatures have meant that fnatural hazard-induced disasters have become more frequent and intense, but also harder to predict (IPCC, 2022). Natural disasters are defined by Watson et al (2007, p.1) as: “catastrophic events with atmospheric, geologic and hydrologic origins. Disasters include earthquakes, volcanic eruptions, landslides, tsunamis, floods and droughts”.

Scientific evidence has also shown that there is a link between climate change and natural hazard-induced disasters (Thomas, 2017; National Wildlife Federation, 2019; Zommers & Alverson, 2018). According to an article published by United Nations Environmental Programme (UNEP) (2023), human activities is the main cause of climate change, with the constant release of greenhouse gasses in the atmosphere which cause global temperatures to increase. The most present gas in the atmosphere is carbon dioxide, which is caused by the burning of fossil fuels (hence, manmade). Warmer seas result in more vapour being released into the atmosphere, which in turn produce more ‘fuel’ for rains, hurricanes, and tropical storms. Because the earth is a system, climate change impacts are experienced on a global scale; these experiences include rising sea levels, droughts, floods, water scarcity, hurricanes, storms, among others (United Nations, 2022). Global sea levels have been rising 3.2 millimetres each year (National Geographic, 2020). Rising temperatures are also evidenced with some regions experiencing floods, while other regions suffer from severe droughts. Catastrophes such as the American and Australian wildfires, hurricanes and tornadoes in the Caribbean, and flooding in Southern Africa and Southeast Asia all act as a wake-up call to the reality of the impacts of climate change. Although events such as tropical storms and hurricanes are more complex in their formation, simple events such as heatwaves and rainfalls have been directly linked to human activities (Independent, 2017; Zommers & Alverson, 2018).

A report by United Nations Climate Change (UNCC) (2021) states that extreme weather events such as fires and floods, have an influence on each other, showing how climate related hazards are interconnected. An illustration of this was how in 2020, high temperatures which were experienced in the Artic contributed to the state of Texas experiencing freezing temperatures (UNCC, 2021). As briefly mentioned above, warmer seas act as fuel for events such as torrential rains and hurricanes: "most climate scientists agree that over time, climate change will exacerbate chaotic severe weather events" (Zurich, 2023, p. 12). A report published by Zurich (2023) argue that increased lengths of heat and cold can be attributed to global warming: "hurricanes are behaving differently…they dump a lot more water on the land because they've picked up more water [due to global warming] while they've been over the ocean". (Zurich, 2023, p.10).

Thomas (2017) states that humans have stopped being the victims of climate related disasters and are instead responsible for greenhouse gas emissions into the atmosphere, a factor directly associated with extreme temperatures. The National Wildlife Federation (NWF) (2019) estimates that if emissions continue to rise, 74% of the global population face being subjected to deadly heatwaves. India is an example where heatwaves and floods have been deadly; in 2015, the country faced temperatures of 40°C, which resulted in more than 2,400 deaths. In the same year, floods killed over 500 people and left around 1.8m people homeless (The Years Project, 2019). Another impact of increased temperatures in the atmosphere are the formations of wildfires. In the United States and Australia, high temperatures have resulted in more severe, intense, and frequent wildfires (NWF, 2019). In Indonesia, country officials are moving the capital city away from Jakarta because it is predicted that by 2050 the city could be under waters (BBC, 2019). Kazakhstan is the 7th largest wheat exporter and many countries in Central Asia depend on it for their bread supply, however, increased droughts and changes in precipitation have threatened its position as prices and supply of wheat have fluctuated (UNDP, 2020). These examples illustrate how climate change is experienced differently in each country.

2.2.2 Climate Change in Africa

According to UN Environment (2019) and Giordano et al (2019), Africa is the continent which will suffer the most severe climate change impacts due to its geographical location, limited capacity to adapt and widespread poverty, despite being the continent that has contributed least to the total global carbon emissions (2-3%) (United Nations, 2006; Collier et al, 2008). The continent has begun experiencing the effects of climate change such as higher temperatures in Ethiopia and South

Sudan, longer heat waves in Kenya and irregular raining patterns in Sierra Leone (UN Environment, 2019).

The agricultural sector, which plays a vital role in both Africa's economy and people's livelihoods, is highly dependent on the weather. A key reason why agriculture is so threatened by climate change lies in the fact that most agricultural systems are water-fed as opposed to irrigation (Pereira, 2017; Giordano et al 2019; One Acre Fund, 2018), and with rain being so unpredictable, farmers are left vulnerable. One Acre Fund (2018) reported that if by the end of 2100, temperatures increase by 4°C, maize production is forecasted to decease by 20%. The Food and Agricultural Organisation (FAO) (2009) predicts that by 2100 Sub-Sahara's agricultural sector would have suffered a loss of between 2-7% of its GDP; 2-4% in Western and Central Africa and 0.4-1.3% in Northern and Southern Africa. However, FAO (2009) also notes that climate change will bring positive influences on some regions in Africa. For instance, because of increased temperatures and rainfall, Ethiopia and countries in the Southern African region are forecasted to have their growing season extended, bringing higher food security.

Although extensive research in Africa is focused on droughts and floods, heatwaves have been described as a 'silent killer', (Climate Change News, 2018) especially in the northern countries close to the equator which experience temperatures near to the human capacity. A recent study conducted by an International Research Team concluded that if temperatures continue rising at the current rate, by 2030, 20 billion people in Africa will be exposed to the human threshold temperature (40.6ºC), and by 2060, this figure would have jumped to 45 billion people (Science Daily, 2019). Health in the continent is also likely to be affected with waterborne diseases such as malaria and cholera likely to spread. The World Health Organisation (WHO, 2020) predicts that between the years of 2030 and 2050, climate change is expected to cause 250,000 additional deaths: 38,000 caused by extreme heat affecting the elderly, 48,000 because of diarrhoea, 60,000 and 95,000 caused by malaria and childhood undernutrition respectively (WHO, 2020).

Having established the importance of tackling climate change and its impact on natural hazard-induced disasters, the next section will explore vulnerability and the components which contribute to societies and communities being vulnerable. The section establishes that the fundamental principles of vulnerability by exploring three models. Firstly, the Model of Vulnerability (Smit and Wandel, 2006) which argues that vulnerability is made up of three elements: exposure, sensitivity and adaptive capacity. Secondly, the Sustainable Livelihood Framework (Chambers and Scoones,

1980 &1998 respectively) whose framework explores the relationship between livelihoods and vulnerability and argue that the more assets' communities or households possess, the less vulnerable they are. Finally, the section discusses the Pressure and Release Model (Blaikie et; al, 1994) that argues that vulnerability is a progression from root causes, followed by dynamic pressures and ends with unsafe conditions. What follows is a synthesis of the models to create the vulnerability component of the novel framework (Community Adaptation Practices Framework). Subsequently, adaptation is discussed, specifically, community-based adaptation. The chapter concludes by building on the vulnerability aspect of the novel framework and adding the adaptation element.

2.3 What is Vulnerability?

The state of being vulnerable is defined as being susceptible to the likelihood of being attacked, either physically or emotionally (Cambridge Dictionary, 2022). Regardless of how it occurs, vulnerability is associated with a certain level of anxiety and possible fear of the unknown as the timeframe in which defence measures can be implemented is either lacking or diminished. In the academic field, vulnerability is a term that has been multidisciplinary in its use (Cutter, 1996; Cutter et al, 1996, Adger, 2006; Blaikie et al, 2014) and therefore challenging to conceptualise. When discussed within the natural disaster context, vulnerability has been largely influenced by the 'hazard' literature (e.g. Cutter, 1996; Cutter et al, 2000; Janssen & Ostrom, 2006), as well as disciplines such as political economy, food security and development studies (Soares et al, 2012). Adger made significant contributions to the study of vulnerability by analysing famine, hazards and entitlements, where the term was applied to describe the state of individuals and societies coping with variability and stress (Adger and Kelly, 1999). This thesis has formulated an understanding of vulnerability by drawing together definitions from several key authors, as shown in the table below *(Table 2.1):*

Author	Definition	Implication
Smit et al (2000, p.238)	"*the degree to which a system is susceptible to injury, damage and harm*".	This definition is arguably very general and does not stipulate the hazard being studied.
Blaikie et al (2014, p.11)	*"...the characteristics of a person or group in terms of their capacity to anticipate, cope with, resist and recover from the impact of a natural hazard"*	This definition clearly identifies social systems (i.e. an individual, a community, a city) and their characteristics (capacity to anticipate, cope with...) as the subject of analysis and it also recognizes natural hazards as the source of harm.
Adger (1999, p.249)	*"the exposure of groups or individuals to stress as a result of social and environmental change, where stress refers to unexpected changes and disruption to livelihoods".*	This definition shifts the focus of vulnerability in terms of hazards, physical dimensions and insecurity and takes a social perspective on vulnerability.
IPCC (2007, p.3)	*"the degree to which a system is susceptible to and unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude and rate of climate change and variation to which a system is exposed, its sensitivity and its adaptive capacity*".	This definition is broader in its scope but specific regarding the hazard affecting the system. The definition also incorporates three-elements making up vulnerability, namely, exposure, sensitivity, and adaptive capacity, Furthermore, this definition also acknowledges that a system, or a country, can be affected by various degrees of impacts of climate change, i.e., its variabilities and extremes.

Table 2.1: Vulnerability definitions. (Smit et al, 2000; Blaikie et al, 2014; Adger, 1999; IPCC, 2007)

Despite the range of understandings of vulnerability in the context of climate change-influenced natural hazard-induced disasters shown in *Table 2.1*, two fundamental principles are highlighted: a) the multiscale nature of the disturbances and their effects on systems and b) the fact that socio-ecological systems are usually exposed to multiple, interacting perturbances. These two principles are relevant to this thesis as it's important to acknowledge that hazards do not occur in a linear manner; and hence, systems need to be able to be ready to respond to the occurrence of simultaneous disasters. Poverty, which is a perturbance in Maputo, is a factor which significantly hinders the capability residents possess to adapt. If one finds themselves in a constant cycle of floods while experiencing poverty, it will be challenging to break out of that cycle. According to the UNDP's Human Development Index, Mozambique ranks 181 out if 189 countries, highlighting its exponential poverty levels (UNPD, 2020). There is a clear relationship between poverty levels and disaster risk reduction measures: the poorer the community, the less resilient and able to cope with disasters they are, especially when the disaster is recurrent.

Having briefly explored definitions of vulnerability, the remainder of this chapter will explore three models / frameworks have been used to further understand and explain vulnerability: Model of Vulnerability (Smit and Wandel, 2006), Sustainable Livelihood Framework (Chambers and Scoones, 1980 & 1998 respectively), the Pressure and Release Model (Blaikie et al, 1994).

2.3.1 Model of Vulnerability

Smit and Wandel (2006) view vulnerability as a system of interlinked forces. The authors believe vulnerability to be a function of exposure, sensitivity and adaptive capacity *(Figure 2.2):*

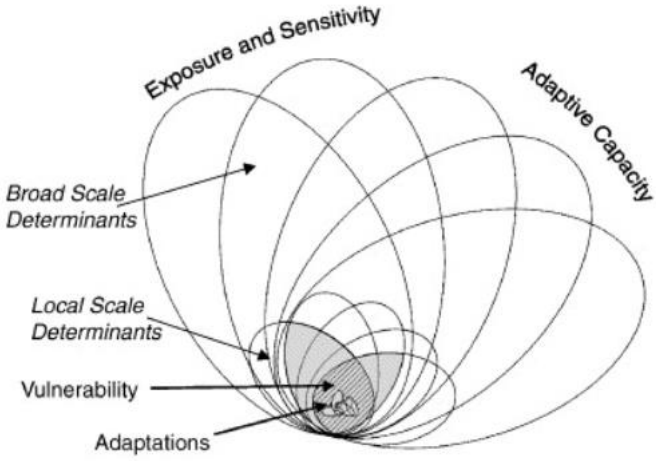


Figure 2.2 Model of Vulnerability, Smit & Wandel (2006)

Table 2.2 describes components of the model:

	Definition	Explanation
Sensitivity	*"the degree to which a system is modified or affected by perturbations"* (Adger, 2006, p.270)	Describes how a system responds to an external disturbance, whether it can resist change or how quickly it can return to its original state after the disturbance (the more adaptive capacity a system has, the quicker it can return to its original state). Within the climate change context, sensitivity describes how a system is modified because of climate stimuli; for example, how a community is affected by a flood. For Gallopin (2006), sensitivity can include the level of transformation experienced by the system after the perturbation, meaning that the system doesn't necessarily have to return to its original state.
Adaptive capacity	*"system's ability to adjust to disturbance, moderate potential damage, take advantage of opportunities, and cope with the consequences of the transformation that occurs"* (Gallopin, 2006, p. 296).	It is an attribute of the capabilities of the system's existence before any perturbations. Adaptive capacity are the factors which influences a system's ability to adapt. Adaptive capacity is highly dependent on individual status and institutional actions within a community; for individuals and communities, their multiple sources of income and access to resources is an important factor. Adaptive capacity can also de determined in terms of ranges: individuals and communities can be able to adapt to and even recover from minor climatic disruptions, however, when exposed to extreme conditions, their adaptive capacity, being out of their scope, isn't strong enough.
Exposure	"*the degree, duration and/or extent in which the system is in contact with, or subject to, the perturbation*" (Gallopin, 2006, p. 296).	Exposure highlights the relationship between the system and the perturbation. Exposure to shocks and perturbations can be viewed an opportunity to re-organise and renew the system, rather that solely focusing on the ability of a system to cope and return to normal function (Folke, 2006).
Resilience	*"the capacity of linked social-ecological systems to absorb recurrent disturbances such as hurricanes and floods, so as to retain essential structures, functions and feedbacks".* Adger et al (2005, p.1036)	a system which is resilient can recover in such a way that it is better than when it first experienced the hazard. Through time and with each hazard, a systems' resilience increases, making it less vulnerable. Adger et al (2005) and Aldunce et al (2014) point out that 'self-reliance' or 'self-organisation' is also an essential principle of resilience; a system is said to be more resilience if it can 'bounce back' on its own without relying solely on external aid.

Table 2.2 Elements of vulnerability (Adger, 2006; Gallopin, 2006)

Stresses and forces are represented by the larger set, and they determine "exposure and sensitivity and shape adaptive capacity at the local or community level" (Smit and Wandel, 2006, p.286). The overlap between the three functions represent their interdependence. However, Gallopin (2006) does not view 'exposure' as an element of vulnerability; instead, he views it as the relationship between the system and the environment. The author illustrate this by using the effects flooding can have in a community: houses built of clay or bamboo are likely to be more damaged compared to the ones built of concrete (**sensitivity**); in most cases, houses built of poor materials are located in low land areas which are more prone to floods (**exposure**); and finally, individuals or families who have access to and own resources are able to repair any damages (**adaptive capacity**). Additionally, **resilience,** which is likened to adaptive capacity, is also a fundamental concept in vulnerability as it determines the ability a system has to withstand and 'bounce back' from a disturbance. Heijmans (2009) believes that for resilience to be effective, it needs to shift from a central notion to a more community targeted approach by making communities better able and prepared to deal with natural hazard-induced disasters themselves.

The model is relevant to the study as it highlights key consideration of vulnerability. In assessing the disaster response strategy of Maputo, it will be important to consider the level of exposure that is, how external factors impact the system. Adaptive capacities can be explored by highlighting the defence mechanisms in place, such as community committees discussed in section 1.3.4.

Thus, the model of vulnerability shows that vulnerability encompasses several factors, which when combined, determines a system's level of vulnerability. It can be argued that the most important element is 'adaptive capacity'; if a country has strong adaptive measures and is able to withstand extreme conditions, then it builds up resilience. In other words, the level of sensitivity or exposure will be of less relevance in the face of its adaptive capacity. Another important consideration that the model raises is that adaptive capacity needs to be considered on a context specific basis. Adger and Kelly (1999) note that adaptive capacity is highly dependent on individual status and institutional actions within a community and their multiple sources of income and access to resources is also an important factor. It is also important to note that a country's adaptive capacity does not remain static but changes with time in response

to economic, political, ecological, and social conditions (Smit and Wandel, 2006). As an illustration, a community which is dependent on firewood for sustenance may have their adaptive capacity diminished because of forest depletion; likewise, their adaptive capacity may increase due to the installation of radio service in the community which can be used as early warnings.

2.3.2 Sustainable Livelihood Framework

The concept of sustainable livelihoods stem from studies of development and rural poverty introduced by Chambers and Scoones, in the mid-1980 and 1998 respectively (Newton & Franklin, 2011) (*Figure 2.3*):

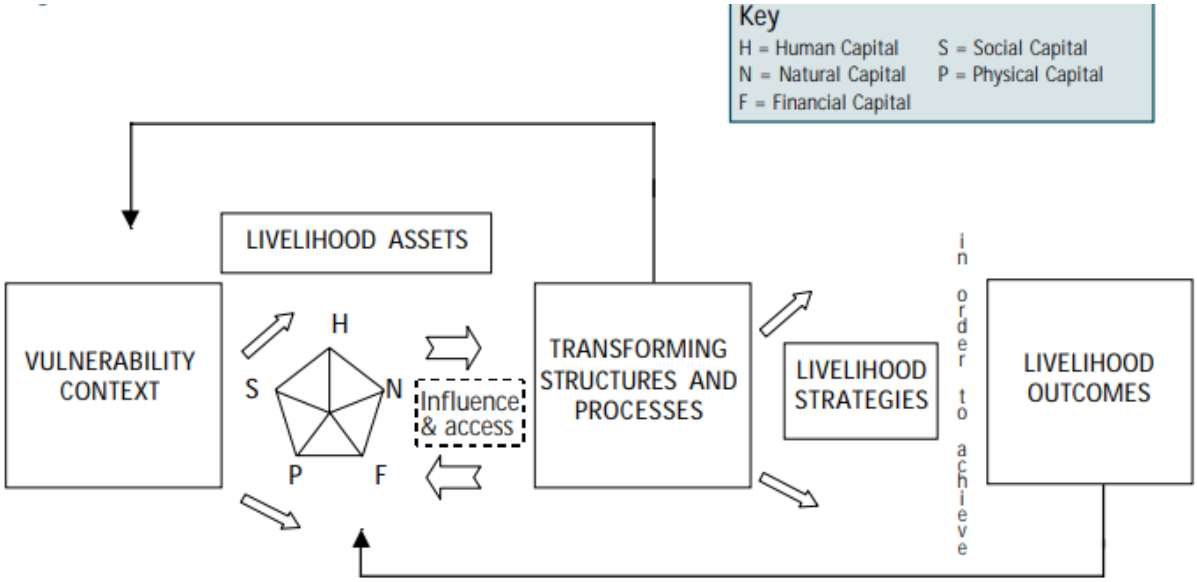


Figure 2.3 Sustainable Livelihood Framework, DFID (1999)

The framework offers a holistic and people centred way of thinking about vulnerability and is founded on the principles that for livelihoods to be sustainable, they must accentuate people's already existing and possessed assets, skills, activities, knowledge, and capabilities to reduce vulnerability (Tao & Wall, 2009; Teresa et al, 2010).

Chambers and Conway (1992) define livelihood as "comprising the capabilities, assets and activities required for a means of living" (cited in Lloyd-Jones and Rakodi, 2002, p.3). Taking this into consideration and acknowledging the importance natural resources are for rural communities, a livelihood is said to be sustainable when "it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base" (Carney, 1998, p.4; cited in Rakodi, 2002, p.3).

The framework considers the vulnerability context, which is characterised by individuals and household circumstances, as well as external shocks such as

economic crisis, natural hazard-induced disasters, and political instability. In the context of the framework, vulnerability is seen as a failure to access and sustain livelihoods. The framework also illustrates how sustainable livelihoods, depending on the context in which they exist, are obtained through access to livelihood assets (human, natural, financial, political and social capitals). These assets are then combined to create different livelihood strategies such as migration and crop diversification.

Both Crawford (2008) and Tao & Wall (2009) agree that a fundamental principle of the framework is the need to understand the context in which households exist. Households are required to manage their assets while considering their vulnerability context as well as policies, processes and institutions. In this context, development and economic growth is not dependent solely on employment, but rather livelihoods. Furthermore, Tao and Wall (2009, p.91) explain that the approach sheds light on the "multi-sectorial" elements of everyday life, which encompasses social, economic and environmental aspects into an all-inclusive framework, paving the way for a "cross sectorial and cross-thematic approach", representing a sustainable approach of thinking. *Table 2.3* explains the elements of the framework:

Elements of the framework:

	Summary	Implication
Vulnerability Context	Describes the external environment in which people find themselves in. Vulnerability occurs when people are faced with sudden threats and shocks and are inadequately prepared to respond (GLOPP, 2008). Trends: population trends, technological trends; shocks: natural, economic, human health or a sudden conflict; seasonality: employment opportunities, prices and production (DFID, 1999).	These are occurrences which are out of the control of individuals and communities. They can either be positive (employment opportunities, technological advancements) or negative (inflation, natural disasters).
Livelihood Assets	For people to attain positive outcomes, they must possess certain assets/capitals (GLOPP, 2008). The five assets are **human** (skills and knowledge), **social** (family support, trust relationships), **financial** (savings, access to credit), **natural** (land, access to water), and **physical** (infrastructure, electricity).	The more assets/capital an individual or a community possess, the stronger their adaptive capacity (refer to previous model of vulnerability).
Transforming structures and processes	Policies, institutions and processes play an integral part as they influence peoples' livelihoods by determining what kind of capitals they have, which livelihood strategies they adopt, and how much decision-making power they possess (GLOPP, 2008). These include the organisations, institutions and policies shaping people's livelihoods. Culture is one of the elements in processes which play a major role in	The more access to institutions individuals and communities possess, the more able they are to adapt. Culture can play a role in power relations within a community and cause a particular group of people to be neglected.

	achieving sustainable livelihoods, but one which according to Daskon and Binns (2010) has been neglected.	
Livelihood strategies	Describes the activities and choices made by people on order to attain livelihood outcomes (DFID, 1999). They are dynamic in nature with households combining different activities across time. For example, farmers who have access to abundant land and water, can diversify their livelihood strategies to include harvesting crops and tending to animals.	The more diverse the livelihood strategies, the more resilience and likely they are to withstand external disturbances. Livelihood strategies are also determined by the assets and capitals people possess.
Livelihood outcomes	Livelihood outcomes are the results achieved from the livelihood strategies. These can include: more income, increased well-being, reduced vulnerability, improved food security and more sustainable use of the natural resource base (DFID, 1999). The importance of each outcome will depend on each individual household or community; some households may place more value on money while others may prioritise food security. Livelihood outcomes can also be intangible (Newton & Franklin, 2011): more time to spend with families, increased sense of security, improved self-esteem, and a general sense of happiness.	Livelihood outcomes enable individuals and communities to be more resilient to future events. It looks different for each individual and community. Measuring intangible outcomes is challenging and can question the extent to which its beneficial.

Table 2.3 Elements of the Sustainable Livelihood Framework (Chambers & Scoones, 1980 & 1998)

One of the most important considerations for using the Sustainable Livelihood Framework is that it places great emphasis on enhancing already existing assets and to be sustainable, which aligns with the aim of this research. Combining and applying the SLF and Pressure and Release models (both discussed below), which are both contextual in nature, provides a pathway for identifying sustainable strategies communities can adopt.

Implementing projects which have been design with community needs as the main priority ensures its longevity and sustainability as community members are more likely to experience a sense of ownership and therefore be more willing to be involved in. As an example, Perez (2002) explored the concept of sustainable livelihoods in Mexico and found that although the community had benefitted from a harvesting project, a lack of community involvement in decision making and a lack of consideration for traditional strategies meant that the community remained vulnerable.

One of the criticisms of the framework is the difficulty of measuring the different capitals and the fact that each will be measured differently. For instance, even though land ownership can be measured in terms of size, in some instances it is more complex as land ownership can be scattered. In the African context, where land is in some cases inherited, Morse et al (2009) highlight that access to and land ownership can be temporal and therefore must be differentiated. Another criticism related to using assets as a unit of analysis is that it neglects to show the relationship of each asset or how they develop over time (Mdee, 2002). A further limitation of the framework is the risk of viewing households as a homogenous group. With regards to policy intervention, some households may be able to implement change while others might be unable to do anything significant. Morse et al (2009) explain that within the framework, different actors are involved in different stages, hence, the actors involved in conducting the research may not be the ones responsible for implementing change or managing resources. That creates a gap in the information link.

Distinct from the Model of vulnerability, which expresses vulnerability as a combination of various components, the SLF discusses vulnerability in relation to livelihoods and the ability of individuals and households to access and sustain livelihood assets. In other words, the more assets individuals and communities poses, the less vulnerable they are, therefore, the SLF adopts a contextualised approach.

In the context of this study, the framework is relevant as it can be used to identify vulnerability causes (vulnerability context, livelihood assets and transforming structures & processes) and solutions (livelihood strategies and outcomes). Moreover, it acknowledges that the role of stakeholders such as institutions can either hinder of facilitate adaptation strategies. This is significant as Mozambique is a highly bureaucratic country which has proven to delay development (BTI, 2022 Country Report).

Niboye and Farai (2020) investigated the importance of combining local community with national disaster strategies in Zimbabwe using the SLF. The authors viewed development as allowing people to exploit the resources available to them to attain better living standards; consequently, a lack of a hindrance of these resources increased their vulnerability. In other words, the more resources, or assets they possess, the less vulnerable they are and the faster they can recover from disasters (Niboye & Farai, 2020). Musevenzi (2012) explored rural diversification in Zimbabwe and also applied the SLF with the addition of the political capital. The study found political capital to be important because they influence transforming structures and processes. An important point to note is that these two studies were conducted within an African setting, in which politics plays a role with poverty eradication. Society's where corruption is present, politicians will either be less likely to help poor communities or communities will be faced with resistance to change (Niboye and Farai, 2020). It can be argued that these models were successfully used as they both used the same country and reached similar conclusions.

Although the SLF was designed to be used a rural setting, the justification for considering the model in this study is twofold: firstly, only relevant aspects of the model are being considered, such as the vulnerability context and livelihood assets. And secondly, livelihood assets can be applied both in rural and urban settings in the case of Maputo. Informal settlers in urban communities face similar challenges as those in rural communities such as lack of waste collection, the construction of homes in flood plains and agriculture and farming being the main form of livelihood asset.

The next section will explore the Pressure and Release Model which demonstrates how risk forms when a vulnerable system collides with a hazard. According to the model, vulnerability

is experienced through a linear progression comprising factors in three phases: root causes, dynamic pressures and unsafe conditions.

2.3.3 Pressure and Release Model

The Pressure and Release model (PAR) (*Figure 2.4*) is arguably one of the most internationally recognised models used for conceptualising disaster and vulnerability (Hammer et al, 2019), both in practice and in theory (Rauken & Kelman, 2010).

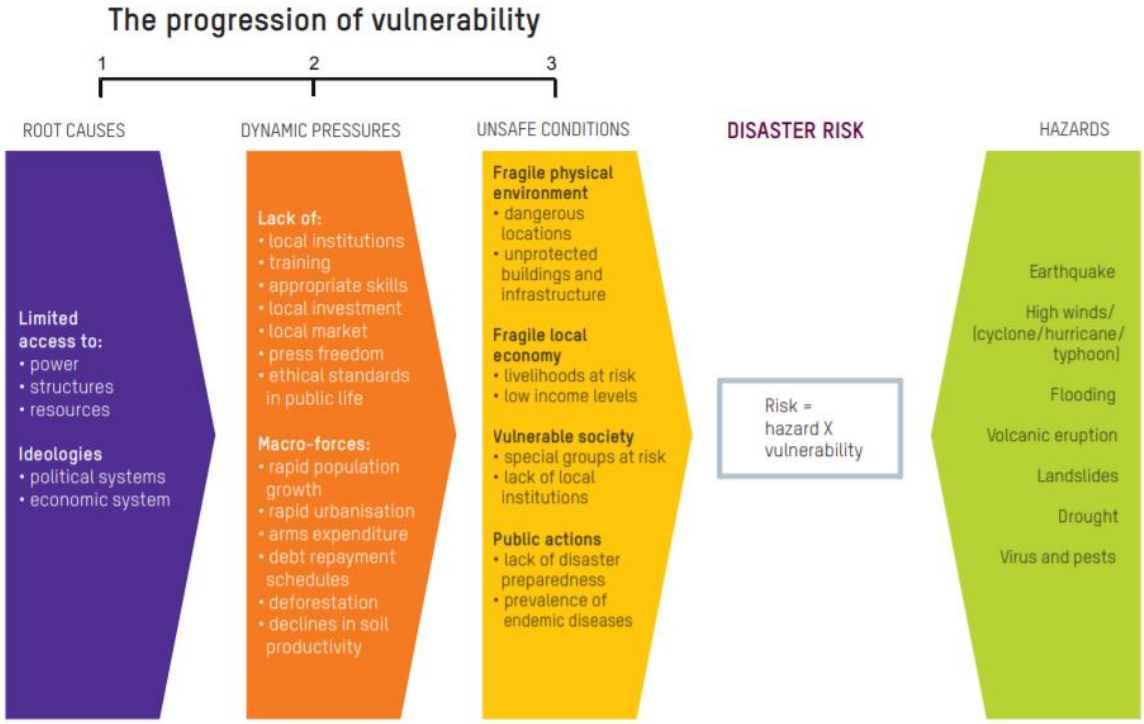


Figure 2.4 Progression of vulnerability (Smyth & Hai, 2012)

It has been largely used to explain the factors contributing to vulnerability (Thinda, 2009) in Zambia; (Hamis, 2018) in Tanzania; (Sandoval, 2017) in Chile. Originally developed by Blaikie et al in 1994, and further modified in 2004, the model assumes risk to be a function of a hazard and vulnerability, as shown in the figure below (*Figure 2.5*).

The absence or presence of a natural phenomenon (floods, earthquakes, volcanic eruptions, droughts, etc) and the level of vulnerability is key: a natural phenomenon, or a trigger event on its own does not result in a disaster, and equally, even though a

population can be vulnerable, without a hazard, there is no disaster (Blaikie et al, 1994).

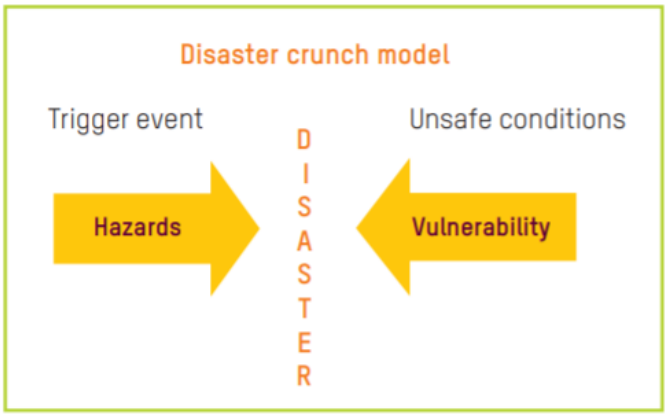


Figure 2.5 Hazards vs. Vulnerability (Smyth & Hai, 2012)

In other words, a disaster is the result of two opposing forces: the natural hazards on one side and the conditions influencing vulnerability on the opposing side (Blaikie et al, 2014).

The following section will briefly explain the relationship between risk, hazard and vulnerability (Risk= hazard x vulnerability). USAID (2011, p.9) briefly summarises their relationship by noting that "disaster **risk** is the product of the possible damage caused by a **hazard** due to the **vulnerability** within a community".

Risk: Disaster risk describes "the combination of the probability of an event and its negative consequences" (United Nations Office for Disaster Risk Reduction, UNISDR, 2009, p.25). Disaster risk alludes to the potential impacts which could occur such as asset losses and livelihoods (also discussed within the SLF above). Authors have added exposure as being a factor affecting risk (discussed within the Model of vulnerability) (Smit and Wandel, 2006; Turner et al, 2003). Coping capacity, or adaptive capacity, is an essential component of reducing risks as it combines the skills, knowledge, resources that individuals or a community possess to better be prepared to face the hazard or disaster (USAID, 2011). All these elements share similarities with the previously discussed models / framework.

Hazards: The UNISDR (2009, p. 17) define a hazard as "a dangerous phenomenon, substance, human activity or condition that may cause loss of life, injury or other health

impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental change". On their own, hazards are not disasters, but they have the potential to be harmful when they meet human vulnerabilities and when they disrupt the human systems (USAID, 2011). Hazards can be pfied into several categories:

- **Natural hazards:** eg, earthquakes, volcanic eruptions, floods, droughts, heat waves, etc
- **Technological hazards:** These are occurrences which are caused by human activities such as technological/industrial accidents. Examples include nuclear activities, explosions, industrial pollution.
- **Human induced environmental hazards:** Occurs as a result of human activities which causes an imbalance of available natural resources and ecosystems. Examples include deforestation, air pollution, climate change, land degradation (USAID, 2011).
- **Biological Hazards:** These refer to biological particles which threated any living organism, especially humans. Examples include medical waste, toxins and viruses.
- **Climatological Hazards:** These are thought of as hazards which have the potential to impact human settlements or the environment. Examples include droughts, extreme heat and cold waves.
- **Hydrological Hazards:** These refer to events which are associated with the movement and distribution of water. Examples include floods, storm surges and hailstorms.

(International Federation of Red Cross and Red Crescent Societies, 2021)

Progression of vulnerability

Vulnerability is at the core of the model, and it states that there are three steps of progression to vulnerability: root causes, dynamic pressures and unsafe conditions. All three elements are interlinked in that root causes lead to dynamic pressures which provide an explanation of the presence of unsafe conditions and why they have and persisted (Smyth & Hai, 2012).

As one progresses from each step, factors from the previous builds on the next which ultimately increases pressure on the system as a whole (Hammer et al, 2019). Rauken and Kelman (2010) explain that dynamic pressures consist of decision-making institutions which transform root causes into unsafe conditions. Root causes describe historical developments in a society over time, and dynamic pressures are the economic, political and social factors at a present time, thus unsafe conditions are a combination of both past and present.

Root causes define deeply engrained factors in a society which have an impact in the distribution and allocation of resources (Hammer et al, 2019) This alludes to the distribution of power people have in a society; the more access to resources and choices a person has, the more power they have to make decisions which can reduce their vulnerability (Rauken & Kelman, 2010). This is similar to the SLF in that the more assets' households possess, the greater their chances of adapting, but this also depends on the ease of accessing structures and institutions. According to Blaikie et al (2004), the most important factors contributing to vulnerability in a society include economic, demographic and political processes as these have an impact on the distribution of resources.

Dynamic pressures act as a bridge between root causes and unsafe conditions, and they describe the "evolving systems that can lead to increasing pressure and subsequently to unsafe conditions" (Hammer et al, 2019, p. 4-5). Dynamic pressures include urbanisation, (lack of) local investments, population change and epidemic diseases; in other words, they refer to the social, economic and political structures which are in place at present.

Unsafe conditions express the "specific forms in which the vulnerability of a population is expressed in time and space in conjunction with a hazard" (Blaikie et al, 2004, p. 55). Particular emphasis is placed on the physical environment, social relations, local economy, and public actions. This includes, for example, people having to settle in flood prone areas, not being able to afford or have access to safe building materials, having limited protection from the state and engaging in dangerous livelihood activities (ibid). It is important to consider that unsafe conditions are primarily a result of the level of well-being of communities and individuals and their access to both tangible (cash, shelter)

and intangible resources (support network, knowledge on how to survive) (Blaikei et al, 2004).

Progression of safety

The 'release' concept of the PAR model is illustrated by the progression of safety, which is the reverse of progression to vulnerability, and describes the process of reducing vulnerability (*Figure 2.6*):

Figure 2.6 Progression of safety (Smyth & Hai, 2012)

Blaikie et al (2014, p. 50) explain that "to relieve pressure, vulnerability has to be reduced". Consequently, the progression of safety finds strategies that address root causes and reduces dynamic pressures with the objective of achieving safer conditions. According to the model, root causes are addressed by ensuring vulnerable groups have access to resources and power structures. This aligns with the SLF discussed previously, in which one of the factors contributing to vulnerability amongst groups is their access or lack of access to assets: the more assets one possesses, the stronger their adaptive capacities. Furthermore, root causes are also addressed when ideological, political and economic systems are

challenges. This is arguably the most challenging aspects of a society to address as factors such as culture and traditions can be so engrained in a society.

One of the benefits of applying this model is that strategies are contextually based. The model assumes that dynamic pressures are reduced through the development of local institutions, training, education, local investments, factors which all play a role in enhancing resilience. Safer conditions are attained by creating safer locations, investing in resilient buildings, strengthening, and diversifying livelihoods, and increasing incomes, which share similarities with the 'livelihood outcomes' component of the SLF. The model also alludes to the temporal aspect of vulnerability as root causes are a result of historical and developmental factors which have changed over time; dynamic pressures refer to present political, social and economic factors and unsafe conditions are a combination of both past and present occurrences (Lundgren and Strandh, 2020).

Although the model has been widely recognised as useful for identifying vulnerability factors, it assumes that vulnerability is a linear process, in other words, in assumes that vulnerability progresses from root causes, dynamic pressures which end in unsafe conditions. It does not consider the occurrence of simultaneous and multiple hazards, which the Model of Vulnerability discusses (Section 2.3.1). One of the practical benefits of applying the PAR model is its potential as a tool for identifying and explaining factors and situations which contribute to vulnerability. Furthermore, it can be used as a practical tool to formulate possible solutions. The framework is also successful in integrating physical and social vulnerabilities (Turner et al, 2003).

One strong justification for using the PAR is that according to Hammer et al (2019, p.1), model is "arguably the best known and most accepted model for conceptualizing risk in the context of disaster and emergency and offers a comprehensive and compelling framework for understanding the role of (social) vulnerability in risk". Rauken and Kelman (2010, p.314) take the same stance and state that the model is "one of the most robust approaches from disaster risk reduction literature in theory and practice". The authors used the model to access the vulnerability to river flooding in Norway and found that the Norwegian political

and economic systems played a major role in how risk reduction was addressed. It found that lack of policy coordination and decision-making enhanced flood vulnerability. It can be argued that the utilisation of the PAR model in this study was successful as it was able to be adapted into the study context and reveal gaps in the way the country tackled flood vulnerability.

2.3.4 Types of Vulnerabilities

Although this thesis focuses on social and physical vulnerabilities, it is important to consider the other different types of vulnerabilities. Thomas et al (2018) classify social vulnerability into four factors:

- Access to resources
- Governance
- Culture
- Knowledge and information.

The table below demonstrates how the above factors link with the models discussed above (*Table 2.4*):

Factor	Brief Description	Link with the Models
Access to resources	Social processes in any society have the potential of determining which resources are accessible to which groups. The authors describe how race and gender can influence representation in government and decision making. Poverty also plays a role as the location of homes and the surrounding build environment tends to be in floodplains with lack of adequate infrastructures.	This factor shares similarities with the Sustainable Livelihood framework, specifically, **livelihood assets** and **transforming structures and processes**. Both elements highlight that the more access to resources a community has, the higher their adaptive capacity and the more likely they are to have access to institutions. The Pressure and Release Model views limited access to resources as a **root cause** of vulnerability.
Governance	Within governance, the authors focus on representation as they believe that the opportunity for people to participate in decision making activities is crucial for the establishment of procedures and hence influence outcomes. Additionally, NGO' have the influence to empower local vulnerable communities as they represent their interests.	The Pressure and Release Model indicate that political and economic systems are **root causes** of vulnerability. Additionally, a lack of local institutions (**dynamic pressure)** can hinder a community's adaptive capacity.

Culture	Cultures influence how people perceive risks and their adaptive behaviours. The authors highlight that if communities don't perceive the risk as harmful, they are less likely to put things in place or change their behaviour. Gender is also a cultural aspect: women are more vulnerable to the impacts of climate change compared to men as they are less likely to be involved in mitigating activities.	With reference to the Sustainable Livelihood Framework, **transforming structures and processes** indicate that culture can play a role and cause a particular group of people to be neglected from decision making due to their position in society.
Knowledge and information	The authors highlight the potential of merging traditional knowledge with that of mainstream science knowledge to creative adaptive measures. A higher regard needs to be places on traditional knowledge as it's based on a collective experience accumulated over the years and a deep understanding of their surrounding environment and their needs.	The Model of Vulnerability views **resilience** as the ability of a system to return to its state better than when it first experienced the hazard. This is possible by applying knowledge and attaining the correct information to make informed decisions.

Table 2.4: Linking Vulnerability Factors with Vulnerability Models (Authors Own)

The section that follows will illustrate how components of each framework / model discussed have been drawn together to form the 'vulnerability' section of the new framework.

2.4 Towards a synthesis of vulnerability models

The Model of Vulnerability (section 2.3.1) state that stresses and forces determine the level of exposure and sensitivity experienced at the local level, however, the occurrences which happen outside a system cannot solely be used to determine vulnerability, but rather, an understanding of the system. Compared with other models, the SLF (section 2.3.2) is more livelihood centred; it focuses on what assets communities already posses or are in possession at the moment of a hazard. Hence, vulnerability is seen as a failure to access and sustain assets. The framework also highlights the role institutions and policies have: the more access they have, the more able to adapt they are. The PAR model (section 2.3.3) highlights the exposure component of the model of vulnerability: if a system is not exposed to a hazard, then it is not vulnerable.

Table 2.5 draws out key vulnerability elements from each model:

Source:	Key principles of vulnerability:
Theory **(Adger and Kelly, 1999)** **(IPCC, 2007)**	• The multi- scale nature of disturbances and their effects on the system • Socio-ecological systems are usually exposed to multiple, interacting disturbances • Poverty is a disturbance which incapacitates an already vulnerable system to adapt- highlighting a clear relationship between poverty levels and disaster risk reduction measures
Model of vulnerability **(Smit and Wandel, 2006)**	• Most important element is 'adaptive capacity' and a creation of resilience • Adaptive capacity needs to be context specific • Adger and Kelly (1999): Adaptive capacity is dependent on individual status and institutional actions within communities
Sustainable Livelihood Framework **(Chambers and Scoones, 1980 & 1998 respectively)**	• Adopts a contextualized approach • Focuses on vulnerability on a community and household context • The more assets individuals posses, the less vulnerable they are • Vulnerability is seen as a failure to access and sustain livelihoods, thereby emphasising the role of assets. • Policies, processes, and institutions can either hinder or facilitate access to capitals.
Pressure and Release Model **(Blaikie et al, 1994)**	• Model assumes vulnerability is expressed through three phases: root causes, dynamic pressures and unsafe conditions • Can be used as a tool to identify and explain factors and situations which contribute to vulnerability. • Strategies are contextually based.

Table 2.5: Key Principles of Vulnerability (Authors own)

Based on the above table, this section illustrates the vulnerability components which were considered for the new framework:

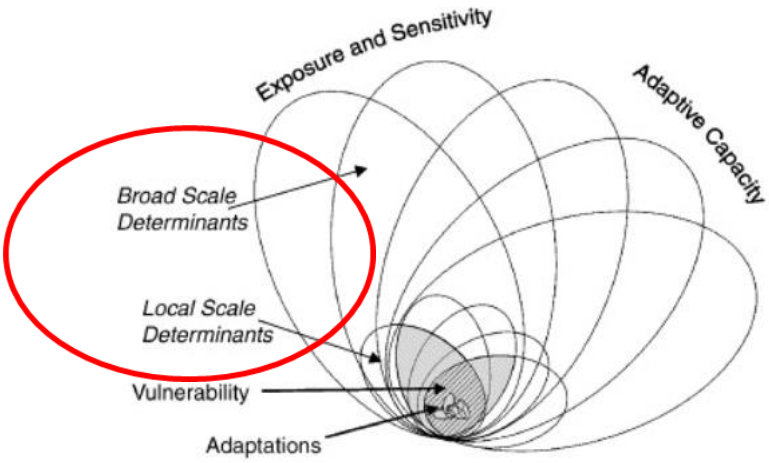


Figure 2.7: Model of Vulnerability (Smit and Wandel, 2006)

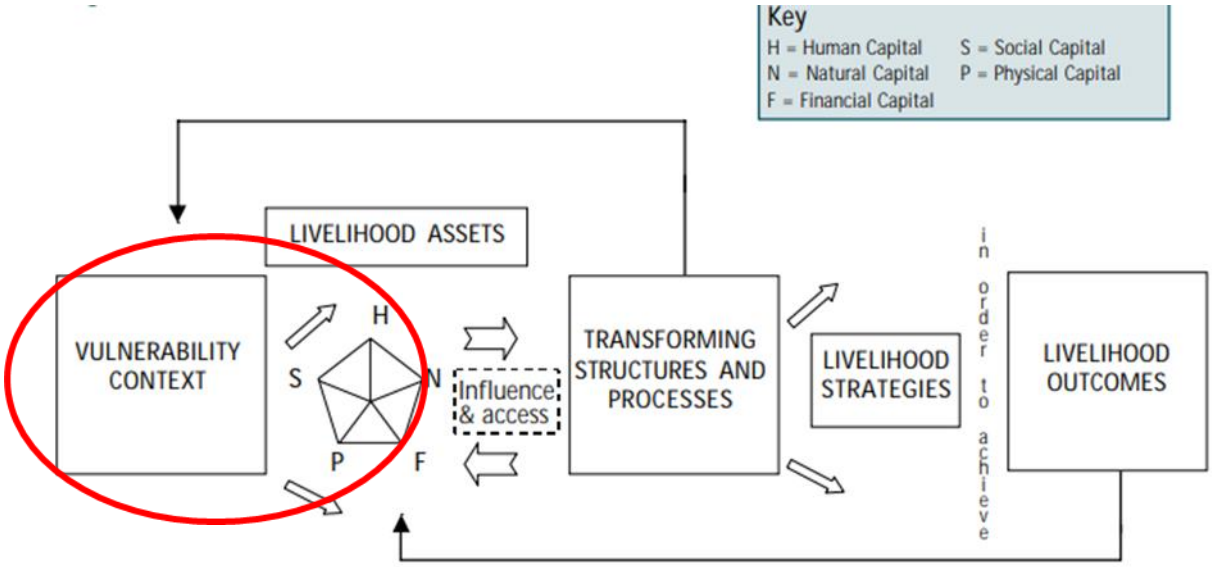


Figure 2.8: Sustainable Livelihood Framework (DFID, 1999)

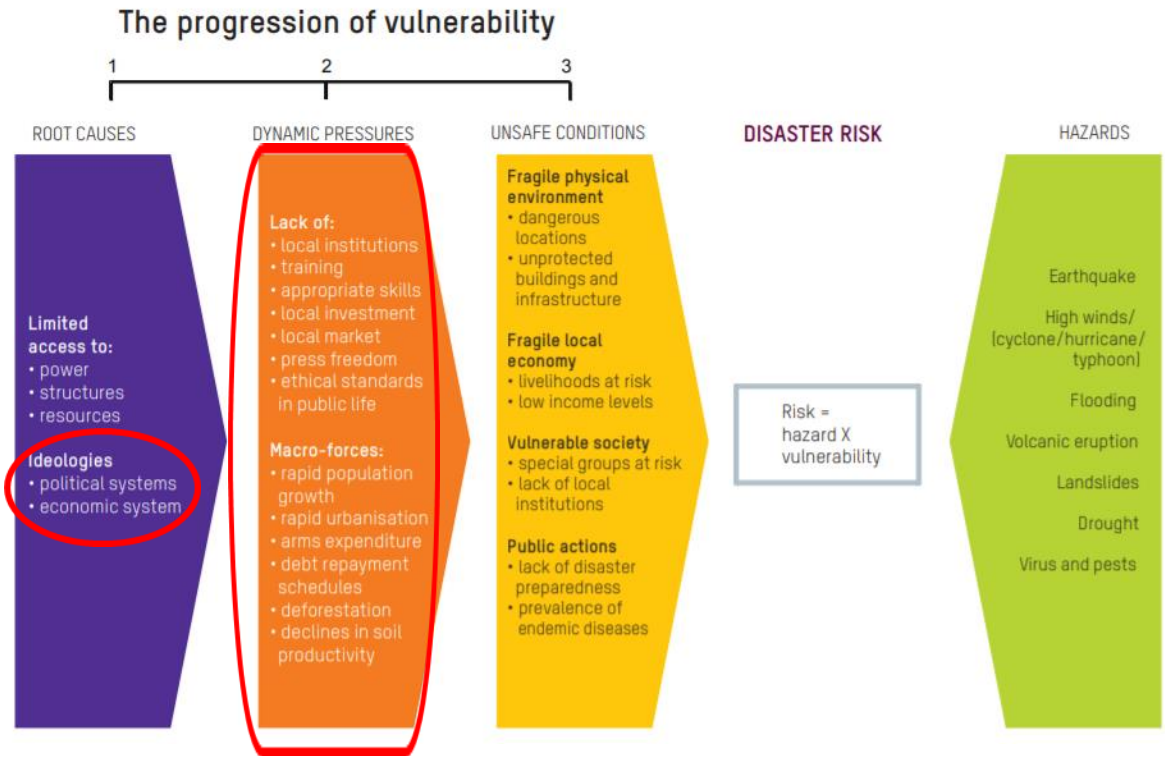


Figure 2.9.: Progression of Vulnerability (Smyth and Hai, 2012)

All models agree that accessing the vulnerability context is key when determining relevant adaptation strategies. The SLF and PAR model share commonalities in terms of their approach. Firstly, both models have been applied to tackling natural hazard-induced disasters. Most importantly, both acknowledge that root causes of vulnerability to natural hazard-induced disasters in a society lies in the lack of access to resources, as well as political and economic ideologies in a society. Secondly, both models assume that vulnerability can either be strengthened or weakened by the level of access groups have to resources and power structures. However, it is not enough to solely have access to their structure, but to also know who to refer to. Lastly, the 'achiever safer conditions' section of the PAR model corresponds to the 'livelihood outcomes' in the SLF, both of which suggest enhanced resilience.

A well-known model which was considered in this study was the SENDAI (2015-2030) framework produced by the UNDRR as global guidelines on prevention, preparedness and mitigation for countries to implement. The model was not used as it was deemed too general and lacked contextuality, which was important to this study. To illustrate its broadness, Mozambique has taken the model and aligned it to its own Master Plan for Disaster Risk Reduction (2017-2030). However, the model was not completely dismissed as it was used as a baseline for thinking about adaptation and risk reduction. Some components such as Build Back Better (Section 5.5.4) and the debate on the inclusion of people with disabilities (Section 5.2.6.1) were components which emerged from the data collection process and hence, explored in the thesis.

Another model which was considered was the Gendered Adaptation to Climate Change (Bryan and Behrman, 2013). This framework observed how rural communities in developing countries collectively organise themselves to adapt to climate change impacts and the degree to which different actors are involved in adaptation strategies. It also explores the aspects which impact the different responses of men and women. One reason why this model was initially considered was because of its contextual approach in exploring the pathway of climate impacts in affecting the well-being of individuals, households and communities, which shares similarities with the Sustainable Livelihood Framework. Moreover, it also

acknowledges the important dynamics between individuals and institutions. This model was not used in this study due to its emphasis on different gender adaptation strategies, which would not aligned with the aims and objectives of this thesis.

Based on the above discussion, below is the part of the conceptual framework concerned with vulnerability (*Figure 2.10*):

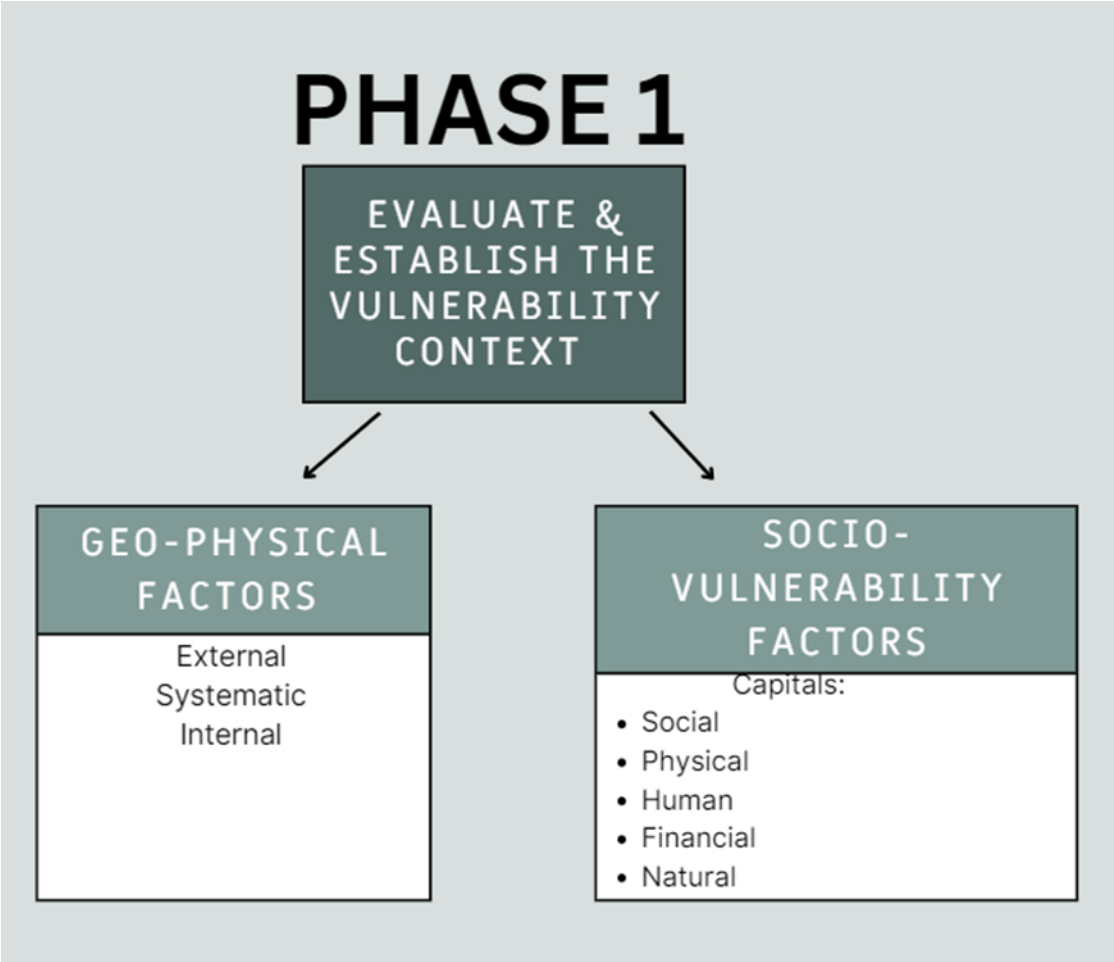


Figure 2.10: Conceptual Framework: Vulnerability section, Authors own

This section of the Community Adaptation Practices framework represents the first step communities take in the adaptation to a disaster. Establishing a communities' vulnerability context is the duty of both the community and their respective authorities such as municipalities and community leaders. The Vulnerability context comprises of factors and occurrences which are outside of peoples control such as climate change, pandemics, droughts and floods, political conflicts, etc. Despite being outside the control of people, an enhanced awareness of these

factors better prepares people. From a household perspective, it is important to acknowledge that different households will have different economic and adaptive powers. Therefore, while a collective adaptive approach is important, a household adaptive capacity is equally important. The framework suggests that an assessment should be conducted both within households and the community as a whole to determine the vulnerability context.

Having established key aspects of vulnerability and considering that the thesis is concerned with the role communities play, this next section turns to the question of adaptation. Literature on sustainable adaptation is explored (section 2.5.1), followed by a review of different types of adaptation strategies (Section 2.5.2) and an in-depth exploration of community-based adaptation (Section 2.5.3). The chapter ends with the integration of community-based adaptation into the new framework (Section 2.6).

2.5 Adaptation and Communities

2.5.1 Sustainable Adaptation

The concept of 'sustainable adaptation' is one that is widely used yet highly contested. Brown (2011, p.21) gathered views from various sources and found that the concept varied in perspectives; authors described it as "deliberately vague and slippery…fosters hypocrisy…impossible theorem…delusional, in distracting attention from meaningful, more profound change…". These views suggest that authors believe sustainable adaptation to be a sugar-coated term and almost unachievable. A widely acceptable definition is the following: adaptation that promotes the development of strategies which as socially and environmentally beneficial, and which incorporate environmental integrity and social justice (Eriksen & Brown, 2011).

Given the nature of sustainability and the challenge of reaching a universally accepted understanding in terms of how it is applied, it is no surprise that agreeing on what would constitute 'sustainable adaptation' has been widely argued. A review of literature (Eriksen & Brown, 2011; Bueb et al, 2021; Hritonenko, Yatsenko, 2022; Eriksen & O'Brien, 2007) indicates that there are a few crossovers in terms of key principles and what authors believe should be considered as 'sustainable adaptation':

- Appreciate the context of vulnerability
- Acknowledge that values and interests affect outcomes
- Incorporate local knowledge
- Consider interrelations between local and global processes.

The table *(Table 2.6)* below considers how the above principles are incorporated in an urban setting:

Principle	Urban Setting Incorporation
Appreciate the context of vulnerability	Within the urban setting, the vulnerability context comprises of both geo-physical and social factors. These include the urban space such as road construction, pavement placements, availability of green spaces, political stability and influence, the presence of local institutions, etc. By understanding the vulnerability context, it provides households and communities with the mechanisms necessary to adopt relevant adaptation strategies.
Acknowledge that values and interests affect outcomes	Within the urban setting, one of the most prioritised interests is the creation of job opportunities (USAID, 2021). This is also supported by the pattern of rural to urban migration in search of better living conditions. Another interest in the urban setting is the reduction of poverty which is needed in order to capacitate urban dwellers to deal with the impacts of nature induced hazards. Hence, adaptation strategies being implemented need to be in line with the development priorities (Broto et al, 2014)
Incorporate local knowledge	It can be argued that local knowledge applies to both urban and rural settings in similar ways. As Steynor and Pasquini (2019) explain, the more a household or a community experience flooding, the more they would be willing to explore adaptive strategies to lessen the impact of future occurrences. In the urban setting, local knowledge will include evacuation strategies and routes of previous floods, locations of homes most likely to flood, the importance of emptying drainage systems of solid waste, etc.
Consider interrelations between local and global processes.	As mentioned above, the Government of Mozambique has taken the SENDAI (global framework) and incorporated it into their Master Plan for Disaster Risk Reduction (2017-2030) (national / local strategy) which is one example of interrelations between local and global processes. Additionally, urban dwellers have been involved in pilot projects implemented by international agencies such as the Nordic Development Fund – adoption of GIS system tools for urban adaptation to climate change and flood risk (NDF, 2013); UN HABITAT – offered technical support for the construction of resilient schools.

Table 2.6: Sustainable Adaptation Principles in Urban Setting (Author's Own)

One of the two key principles of sustainability is firstly to ensure that current actions and decisions do not negatively impact future generations and secondly, that a balance is struck between social, economic and environmental factors. Within the context of climate vulnerability in developing countries, poverty reduction is central: Brown (2011) is of the opinion that there is a strong linkage between sustainable adaptation and poverty alleviation and this view is shared by Eriksen and O'Brien (2007). The complexities presented by sustainability are not limited to its nature as a concept, but it transcends to how its applied. This echoes what was discussed in relation to the SLF (Section 2.3.2), explaining that a positive outcome for one household may be detrimental for the other. It is important to consider all parties are benefitted in order for the strategy to be deemed as sustainable. Whilst 'full' sustainability may never be achieved, the constant goal of attainment is imperative as it means that progress is being made towards poverty reduction, which in the long run is sustainable.

2.5.2 Types of adaptation

The IPCC differentiated between three types of adaptation: anticipatory, autonomous, and planned. Planned and anticipatory adaptations are considered opposites to autonomous adaptation in that autonomous adaptations are described as reactive and spontaneous, whereas planned adaptations are deliberate actions (Rahman & Hickey, 2019). Malik and Smith (2010) state that planned adaptations strategies are usually initiated and led by governments whereas autonomous strategies are led by private actors. However, Forsyth and Evans (2013) state that a few authors have argued that for autonomous adaptation to be effective, governments need to be involved in providing public incentives. They explain that behavioural economists view adaptation as requiring behavioural change because climate change protection is a public good, so private actors will need market incentives. Malik and Smith (2010) take the same stance and argue there are instances when governments must provide the right incentives for people to adapt; for example, if governments chose to heavily subsidise crops, and farmers aren't affected by impacts of climate change, then they won't have any reason to think they need to adapt.

Thorn et al (2015) explored autonomous adaptation strategies in Mathare, a slum community in Kenya and found that autonomous adaptation strategies ranged from individual to community level adaptation. On an individual level, for residents whose livelihoods were too affected by flooding, strategies included diversification of incomes and venture into businesses which could still operate during extreme weather events. On a household level, residents based their decisions on past experiences of floods. Their strategies included moving to higher grounds or distributing their goods to family and friends to avoid losing them; residents also improved their homes by insulating roofs and elevating homes using sandbags. On a collective level, the youths of the community took charge by forming committees such as Mathare Safety Committee, which was aimed at improving infrastructure and services in the community, raising flood awareness, conduct drills, amongst other initiatives.

Thornton and Manasfi (2010) questions whether in a world full of climate unpredictability's, is it viable to treat the concept of adaptation as something that can 'managed or engineered'? Udellsmann (2019) and Thorn et al (2015) take the same stance and concede that adaption, especially in the urban poor communities, change over time, and hence, benefit better from adopting an autonomous adaptation approach. The time component is also something Pelling (2010) agrees with: the author states that a difficulty in understanding adaptation comes with the challenge of following adaptive processes over time. Pelling (2010) distinguishes between 'forward and backward' looking adaptation. As a backwards looking approach, adaptation is shown through the ability to cope when a system is hit by shocks or stresses and forward looking adaptation' relies on "theoretically identified components associated with adaptive capacity" (Pelling, 2010, p.7). The focus should be on forward looking adaptation because it allows governments to address development policies and practices, while local past experiences contribute to the locals understanding of pressures with future adaptation.

2.5.3 Community Based Adaptation

The term 'community' remains a contested topic both due to its theory, practical and multidisciplinary applications. Cobigo et al (2016) conducted a literature review

of 40 articles which contained the term ‘community’ and came up with several characteristics such as ‘physical proximity’, ‘shared’, ‘group’, ‘bounded’, ‘interaction’, ‘belonging’, with physical proximity and shared being the most common characteristics. Hence, the authors derived the following definition of community: “a group of people that interact and support each other, and are bounded by shared experiences or characteristics, a sense of belonging, and often by their physical proximity” (Cobigo et al, 2016, p.192).

This definition makes various assumptions; it implies that communities form relationships with one another, and that through experiences, they form a connection with each other. The most common assumption that it makes is that they are physically found in one geographic location. The concept of connectedness is one which is fundamental in community studies. Cohen (2013) describes that with communities, people learn friendship through social experiences because, according to him, it is the closest relationship people have in society outside the home. Larsen et al (2005) contest to this view and apply a more contemporary approach. They argue that community research has overemphasised those geographical proximities equates connectedness, which is not always the case.

In 2015, the United Nations introduced the Sustainable Development Goals (SDG’s), which are a set of 17 interlinked goals with the purpose of eradicating poverty, protecting the environment and ensuring global peace and prosperity by the year 2030 (UNDP, 2020). To date, 103 countries, including Mozambique, have pledged to incorporate the SDG’s into their national development strategy (UNDP, 2020). While all goals can be linked to climate change and disaster management, within the context of this study, SDG number 11 is the most relevant: ‘Make cities and human settlements inclusive, safe, resilient and sustainable’ (UNDP, 2020). One of the major challenges which cities and urban communities must confront, including Maputo, is the unplanned and rapid rate of urbanisation, which places pressure on the environment, consequently, exacerbating the impacts of natural hazard-induced disasters. Communities play an integral role in minimising these impacts.

2.5.3.1 The emergence of CBA

During the late 1980's, development practitioners and researchers began to acknowledge that the past 40 years dedicated to improving the livelihoods and lives of the most vulnerable had significantly failed (Dodman & Mitlin, 2013). One reason for this was the implementation of top-down strategies instead of applying contextuality and local knowledge (Clarke et al, 2019; Dodman & Mitlin, 2013; Dorman, 2002). Clarke et al (2019) argue that top-down adaptation approaches are inefficient due to their negligence of localised needs of communities. Likewise, Dodman & Mitlin (2013) explain that the failure of this approach was due to countries adopting global climate change modeling into their national adaptation plan without considering local needs and knowledge.

Developers as well as researchers started recognising the importance of applying climate change adaptation strategy which focused on encouraging locals to be at the forefront of their own development. The need to understand and appreciate local perceptions, and the importance of involving locals in climate change adaptation initiatives gave rise to the concept of community-based adaptation (CBA). Clarke et al (2019, p.60) define the approach as "a holistic, multi-dimensional, transdisciplinary and place-based approach that focuses on the interrelations between socio-economic, cultural, political and environmental stressors to which communities are exposed".

This definition highlights at least three aspects:

- CBA is a multi-sectoral effort: the impacts of natural hazard-induced disasters in a society are diverse as they affect several sectors such as education, health, transport, infrastructure, etc, therefore, the response needs to be collaborative.
- CBA is based on locality: this supports Dodman and Mitlin's (2013) point that natural hazard-induced disasters cannot be addressed using global models, but instead, need to consider the context in which it happens.

- External forces are relevant: similar to the vulnerability context, it is important to acknowledge the factors which contribute to vulnerability but are out of the control of communities.

2.5.3.2 Principles of CBA

CBA is based on the principle that communities possess the necessary abilities, knowledge, and experiences to develop initiatives with the aim of reducing vulnerability and enhancing resilience to climate change (Dodman and Mitlin, 2013). Even though there was a strong emphasis by Dodman and Mitilin (2013) on the nature of locality of the approach, Clarke et al (2019) highlight that external factors (ie, socio-economic, cultural, etc.) are just as important. For instance, Artur and Hillhorst (2012) found that culture influenced what a community in Mozambique believed about climate change with findings suggesting that locals associated events such as floods with the will of God, which further had an impact in their adaptation choices.

Although the CBA concept is relatively new, Clarke et al (2019) highlight that it is instrumental towards building sustainable adaptation because it ensures the full involvement of communities and is embedded in local contexts. It is also based on the assumption that when a community feels empowered, heard, acknowledged and part of the decision-making process, projects and initiatives that are put in place are more likely to succeed (Dodman and Mitlin, 2013).

According to Ayers and Forsyth (2009), there are four key CBA principles within the climate change context:

i. It operates in a local context where communities are vulnerable to climate change.
ii. It helps to identify and implement community-led activities in an attempt to strengthen the capabilities of locals to adapt to climate change impacts.
iii. It involves local stakeholders through participatory processes in order to come up with adaptive strategies.
iv. It considers cultural norms and aims to tackle people's development concerns.

Kirkby et al (2015) liken CBA to an attempt to move away from ‘top-down’ strategies discussion of climate change, and instead, open up the opportunity for locals to be more involved in adaptation agendas.

In regard to the first principle, Clarke et al (2019) are in accordance, explaining that understanding local contexts optimises communities’ efforts. Additionally, the authors challenge the ‘one size first all’ narrative that international approaches use and state that CBA must acknowledge the evolving patterns of communities. The authors argue that the application of traditional knowledge is present in all phases of CBA.

The second principle explores the different activities communities engage with to enhance their resilience. Some of these activities include income diversification, capacity building, and resource management (Haque et al, 2022). This is an important phase as it gives communities the opportunity to apply their contextual knowledge and understanding into practise. Clarke et al (2019, p.74) emphasise the importance of creating an environment in which locals can “experiment, learn, reflect on and communicate ideas”. Creating such an environment also encourages communities to be more confident in their abilities and fosters this mentality for the future.

The third principle of CBA appreciates the participation of local stakeholders.
Haque et al (2019) highlights an interesting point regarding low-income countries; that due to their limited capabilities, they rely on ‘outside’ help to support them with knowledge and resources. This questions the extent to which vulnerable communities can be self-sufficient in building their own resilience. In support of this, Piggott-McKellar et al (2019) explored the barriers to implementing community projects and highlighted that the lack of coordination between non-government, government and communities was poor. This therefore highlights that there is an assumption that CBA will incorporate to some extent the involvement or external stakeholders.

The final principle deals with the element of culture and development. The cultural norms and beliefs in a society have the potential to determine the extent to which

communities are willing to take measures to adapt, and moreover, they will dictate which adaptation activities communities engage with. For example, Piggott-McKellar et al (2019) stated that in Papua New Guinea, the pig population had impacted the local environment, however, communities resisted the attempt to control the pig population due to their role in traditional ceremonies. This highlights the impact culture and religion can have in communities' readiness and willingness to implement adaptation measures.

Below are some examples of CBA projects managed by the UNDP and how they link to the principles of CBA (*Table 2.7*):

Overview of the project	Community Involvement	CBA Principle
Protection and preservation of Kenya's Kakamega rain forest. Forest was being depleted for charcoal consumption and production	Communities formed the 'Muliru Farmers' Cooperative Group and began planting Camphor tree. Community made use of both their traditional knowledge and modern technology to utilize the tree for cold and flu treatments, insect repellant and muscular reliefs. With the tree growing at a fast pace, the community could diversify their income (element of the SLF).	*'It helps to identify and implement community-led activities in an attempt to strengthen the capabilities of locals to adapt to climate change impacts'.* *''It considers cultural norms and aims to tackle people's development concerns'*
Conservation of the Pequi tree in the indigenous Kisedje community of Brazil. Due to deforestation by neighbouring farmers, the community was forced to be displaced and start over.	The community planted the Pequi tree, which not only is medicinal, but also used for cooking, ritual paintings and moisturiser. In 2011, the community formed the Pequi Oil Project, which annually extracted over 300l of oil per year to be sold to US cosmetics company, as well as restaurants around Brazil though online platforms, with the income benefitting members of the community.	*'It helps to identify and implement community-led activities in an attempt to strengthen the capabilities of locals to adapt to climate change impacts'.* *'It involves local stakeholders through participatory processes in order to come up with adaptive strategies'*

Table 2.7: Examples of applied CBA, (UNDP, 2022)

However, one aspect to consider is the fact that in poor communities, adaptation to climate change is just one of the many priorities locals have. Ayers and Forsyth (2009) explain that matters such as adequate infrastructure, healthcare, source of income and livelihood options are their main priorities. Therefore, CBA needs to start with "communities' expressed needs and perceptions" and ensure that "poverty reduction…livelihood benefits… reducing vulnerability to climate change and disasters" are the main priorities (Ayers and Forsyth, 2009, p.13). Gender can also play a role in community adaptation; Clarke et al (2019) argues that to ensure the success of future adaptation sustainability and resilience, gender should be incorporated into the CBA framework. In practice, Reid et al (2009) explain that adaptation to climate change programs, particularly in developing nations, will rarely have gender as its own component, but instead will be part of a larger national development strategy.

Leary et al (2008) explains that when climate change is seen as a distance threat, or if its effects are unknown, adaptation tends to take a 'back seat' and poverty eradication placed at the forefront. Instead, the authors propose that development and adaptation should be complementary in that if a country is resilient to climate change, it becomes less threatened by climate impacts and hence considered more sustainable. In the context of natural hazard-induced disasters, sustainable development describes the ability of a system, i.e., a community, to recover using its own resources. Sustainable development can also measure the extent to which a system is vulnerable to natural hazard-induced disasters. The generally accepted use of the term 'sustainable development' refers to meeting "the needs of the present without compromising the ability of the future generations to meet their own needs" (Brundtland Report, 1987, p. 16). Even though this definition is widely accepted, Kreisel (2018) argues that it poses many unanswered questions such as sustainability for whom; even if we were to assume that sustainability is referring to humans, then questions such as how many humans, and which standard of needs need to be met arise.

Rose (2011) reports that evidence has shown that the occurrences of natural hazard-induced disasters, such as hurricanes and floods, are also associated with settlement

systems; in other words, the location of a settlement and how it interacts with nature can exacerbate its impacts. Climate hazards can impact a country unexpectedly, but if the country is resilient, it will use less of its already limited resources to get the country back on track.

As discussed earlier, locals are at the centre of CBA initiatives, however, Dodman and Mitlin (2013, p.647) believe that “cross-scale interactions” are deemed necessary when discussing global occurrences which have impacts on a local scale, which challenges the core principles of CBA mentioned above. While there has been a wide acknowledgement that the participation of local residents and stakeholders are the core of successful CBA initiatives, Mohan and Stokke (2000, p.249) highlight the dangers of adopting such a focused lens on locals. The authors argue that focusing solely on the locals neglects the potentials of “national and translational economic and political factors” meaning that CBA must acknowledge the external forces, such as socio-political and cultural stressors, which could impact its ability to adapt (Clarke et al, 2019). Similarly, Burton (2008, p.1-2) is a firm believer that the “ ‘adaptation is local’ mantra is no longer valid” and further encourages a rethinking of adaptation strategies which involves “planning and cooperation at national, regional and global levels”.

In practice, Adger et al (2005, p.77) believe that “levels of actions take place within hierarchical structures such that levels interact with each other” which can be seen as adopting a top-down approach to adaptation, however, they acknowledge that to adopt sustainable adaptation strategies, local engagement alone is not sufficient. In support of this, Dodman and Mitlin (2013) argue that while local’s past experience of climate change is a valuable source of information, it is not a sufficient source in which to make future plans, hence, the knowledge and expertise of agencies and donors offer a better insight. Examples of agencies that offer expertise knowledge and resources are NGO’s.

NGO’s have an established long-term presence in a country, regardless of the presence of a disaster. This not only fosters a closer relationship with the community, but it also means that NGO’s are better equipped to deal with a disaster when it strikes as they are

familiar with the specific needs of the community as well as their culture, language and social structures (Coppola, 2015). A study based in Asia found that through NGO's working with local groups, they were able to ensure accountability from the government on matters such as environmental management and urban services. Likewise, in Vietnamese cities, collaborations between NGO's and communities have enhanced debates and arrangements around development decisions (Reed et al, 2015). NGO's also play a major role in assisting locals to implement strategies. Dodman and Mitlin (2013) state that they act as voices to the locals at higher levels, by communicating their concerns and priorities. Furthermore, agents and NGO's act as a facilitator between locals and government, ensuring that the money the government gets from global initiatives, reach the most vulnerable. (Ayers and Forsyth, 2009). This brings out the element of trust that needs to be established between the locals and agents; trust that they will be held accountable for their actions and that they will act in the best interest of the locals. By establishing this trust, Clarke et al (2019) and Dodman & Mitlin (2013) agree that it aids locals to embrace uncertainties and not blame agents when the outcomes are not as expected.

One of the contested debates that has risen due to the increased presence of NGO's in developing countries is whether they provide a form of sustainable development in the countries they operate it. The solutions they offer to impacted communities might be what they need then, but for development to be sustainable, solutions need to be thought of long term. Izumi and Shaw (2012) argue that for communities to be resilient, the strategies and activities implemented by the NGO's must have continuity even when NGO's leave the field. For this to happen, the authors believe that local governments should be involved in policy and decision making as well as having institutions which will carry on and monitor the activities in communities (ibid). Izumi and Shaw (2012) state that for NGO's to effectively contribute to sustainable community development, they have to build on communities' capacity for preparedness, which includes using a participatory approach. NGO's tend to analyse a community's vulnerability and thereafter, implement strategies based on that analysis. By allowing communities to take charge by being involved in decision-making of policies, they are more likely to ensure the continuity of

their own development (Izumi and Shaw, 2012). Izumi and Shaw (2012) note that governments dependency on NGO's to effectively and promptly provide emergency services has increased, especially those countries with less economic resources. Makoba (2002) believes that the presence of NGO's in African countries alludes to the failure of governments and markets to ensure economic development. In this case, because African governments are so reliant on NGO's, they are at their 'mercy' to accept any of their policies, giving NGO's dominance.

While the participatory process of agents and other stakeholders have been appreciated in CBA, a few authors have criticised their involvement (Sachs, 1992; Dorman, 2002). Dodman and Mitlin (2013, p.644) argue that the participative process can be seen as "manipulation and tokenism" instead of a genuine "citizen engagement". Dorman (2001) refer to local participation as a 'new tyranny'; their use of the word tyranny was used to highlight the power external participators can have in regards to which decisions are made, how they are made, who is involved, which groups are more benefitted and which actions are prioritised?

2.5.3.3 Critiques of CBA

Theoretically, the approach appears to offer many benefits, however, Clarke et al (2019) along with Dodman and Mitlin (2013) agree that there is little practical evidence to demonstrate its efficacy and long-term benefits. One of the main reasons for this, apart from it not being a priority for locals as discussed earlier, is its lack of replicability and scaling out to communities due to its contextual nature; and the question that rises is how can localised perceptions and adopted policies be transferred to another context? Dodman and Mitlin (2013) further state that this challenges the relevance of the conceptual adaptation framework, which Forsyth (2013, p.442) asserts should be "mainstreamed in more formal policy approaches". The aim of implementing participatory development processes is to encourage those who are less socially and economically well off to take change of their own lives by being involved in decision-making (Dorman, 2002).

In connection with the downfalls of participatory processes associated with CBA is the danger of treating communities as a homogenous group. Robinson and Green (2011) dispute the accredited notion that a community is formed of people who share common sets of values and norms, which is in line with Larsen's et al (2005) argument discussed earlier. The authors argue that this assumption ignores characteristics such as race, gender and class which may have different values and interests. Robinson and Green's (2011) perspective of community take a more practical approach: it presupposes there are problems which are common to people living in the same area which will result in collective action. With this perspective, the authors view community as "when residents in a specific geographic place are mobilized to act on locality-oriented collective interest" (ibid, p.2). Clarke et al (2019, p.62) argue in accordance to this and state that "in reality, communities are diverse and multi-faceted in their individual priorities, needs, vulnerabilities and capacities…" Hence, to effectively engage communities, there needs to be a thorough knowledge of power relations, power dynamics, community priorities, values and norms. It is also important to consider that different groups within the community will have various degrees of capacity to adapt (Reid et al, 2009).

Thus, based on the above discussion, it can be determined that the participation and full involvement of communities and locals is at the forefront of successful CBA. It is important to acknowledge that communities' posses the necessary abilities, experiences and abilities to develop initiatives. Cultural factors also need to be taken into account as it can determine the adaptive measures a community chose to adopt. CBA also encourages the full involvement of communities, that consequently creates a sense of empowerment, ownership and sustainability of projects.

The table below (*Table 2.8*) summarises the key principles of CBA and uses it to construct the adaptation component of the new framework:

Source:	Principle of CBA:
Clarke et al (2019)	CBA is instrumental in building sustainable adaptation as it ensures full involvement of communities
Eriksen & O'Brien (2007); Brown (2011)	There is a strong link between poverty alleviation and sustainable adaptation
Rahman & Hickey (2019)	Planned adaptation are deliberate actions
Dodman & Mitlin (2013)	Communities have acquired the necessary knowledge, experience, and abilities to develop vulnerability reducing and resilience enhancing initiatives
Ayers & Forsyth (2019)	The involvement of local stakeholders through participatory process is important in order to establish adaptive strategies
Rose (2011)	For adaptation to be successful, it needs to align with poverty reducing strategies.

Table 2.8 Key Principles of CBA (Authors own)

2.5.4 Indigenous Knowledge in Mozambique

In a country that highly esteems its elders and senior citizens, it is worth appreciating the role indigenous knowledge has in a modern world. Mawere (2014) describes indigenous knowledge as “a set of ideas and practices of indigenous people of a specific locale that has been used by its people to interact with their environment and other people over a long period of time”. This definition assumes that each ‘specific locale’ has accumulated, through time, a set of ways of thinking and practices which is different in another region / area. This aligns with the principle of CBA that considers the local context within which communities operate. A similar definition if offered by Kelman et al (2012): “a body of information passed down through generations in a given locality and acquired through the accumulation of experiences, relationships with the surrounding environments, and traditional rituals, practices and institutions”. What both definitions have in common is that they highlight the uniqueness of local knowledge and how it won’t always be applicable in other communities. The element of time is also evident from both definitions which implies that knowledge is passed down and learnt from one generation to the next. Other phrases and words used to describe the term include “traditional knowledge, indigenous technical knowledge, folk knowledge” (Kelman et al, 2012, p.13). In this thesis, the phases ‘traditional knowledge’ and ‘indigenous knowledge’ will be used interchangeably.

As explored in Section 2.3.2, a study by Perez (2002) found that a negligence to incorporate traditional strategies resulted in a community’s livelihood remaining vulnerable. Additionally, incorporating indigenous knowledge ensures the inclusion of the whole community, thereby adhering to the principles of CBA (Clarke et al, 2019). Ali et al (2021, p.2) praises the role and practices indigenous communities in Australia have played in addressing climate risks and criticises colonizers for treating their practices as “primitive or irrelevant”.

Ali et al (2021) believe that a western approach should not be all together treated as not applicable, but rather, that it should attempt to create a cohesive method which combines the two approaches. This stance agrees with Broto et al (2015) discussed in Section 2.2 where global frameworks such as SENDAI cannot be implemented as they need to consider local developmental priorities in order to succeed. Castiano and Mkabela (2014, p.28) explored the integration of local and official knowledge in the school curriculum in Mozambique and described it as potential "space for negotiation, evaluation and validation of both". Reyes et al (2020) argues for a rethinking of disaster risk models and encourages practitioners to create integrative frameworks with a participatory approach.

Salite (2019) conducted a study exploring the traditional prediction methods of farmers in a region in Mozambique. Findings indicated that farmers viewed the absence of clouds or clear skies as a way of predicting droughts; other indicators included wind direction, appearance and the position of the moon, and the air temperature throughout the year. It was interesting to note that many of the indicators used by farmers were nature driven. The author explained that this was not only due to the farmers being illiterate, but also because farmers held a strong belief that their cultural knowledge and inheritance should be passed down to future generations (Salite, 2019). Similarly, a study conducted by Reyes et al (2020) into the indigenous practices of Philippine communities also found that they used the observation of natural phenomena as predictions for natural hazard-induced disasters. This included the movements and height of waves, patterns of clouds, intensity of winds, and the behaviour of certain sea animals.

In Mozambique, the use of traditional knowledge is mostly seen is areas such as agricultural production and forestry (Shaffer, 2010; MDG Fund, 2020; Salite, 2019); this is due to Mozambique being a highly agricultural driven country as discussed in Section 1.2.

2.5.5 Early Warning Systems

Early warning systems are a crucial part of addressing disaster risk reduction (World Meteorological Organization, 2019). The UNDRR (2020, p.1) describe early warning systems as "an integrated system of hazard monitoring, forecasting and prediction, disaster risk assessment, communication and preparedness activities systems and process that enables individuals, communities, governments, businesses, and others to take timely action to reduce disaster risks in advance of hazardous events". This definition highlights three important aspects:

a) the processes of the system: monitoring, forecasting, predictions, preparedness activities.
b) the stakeholders involved: individuals, communities, governments, etc. which highlight the collaborative response.
c) Timely action: early warning systems are only effective if it people can make timely and effective actions in advance,

Salite (2019) explains that due to past efforts for independence, civil war and poverty, the country has limited functioning meteorological stations. To address this issue, the government launched the 'One district, one weather station' programme in 2022 in which the aim is build 54 weather station by 2024 in order to improve early warning systems in the most vulnerable communities (360 Mozambique, 2022). Another initiative adopted by the government is the 'Early Warnings for All' initiative which was launch in 2022 by the UN Secretary General. This programme encourages the accessibility of a multi-hazard early warning system for all people affected. Together, these initiatives highlight the importance of establishing an effective early warning system in the country.

While the improvement of early warning systems is essential, for communities to efficiently take advantage of the information, they need to have the adaptive means such as being able to relocate or strengthen their homes.

An initiative to enhance early warning systems was introduced by the Mozambican Red Cross Society in collaboration with the Danish Red Cross in eighteen vulnerable communities in the provinces of Inhambane and Zambezia (Red Cross, 2007). This

project included forming community committees, training and equipping them to respond to early warnings of approaching disasters. To enhance the effectiveness of the project, the Red Cross ensured community leaders and well-respected members of the community were members of the committee. The initiative was a partnership with the community helping to “map local resources and identify real and perceived risks and traditional coping mechanisms’ (Red Cross, 2007, p.2). Each community was given a radio to ensure residents got reliable access to government warnings; community members were also taught how to make sense of the three colour coding scheme used by the government to reveal how close the cyclone was; blue=24-48 hours; yellow=24 hours, red=6 hours. Community leaders were also in charge is safekeeping emergency materials such as megaphones, whistles and life-jackets (ibid).

2.5.6 Community Based Adaptation in Maputo Urban Setting

This section explores a few of the practices which are being adopted by urban residents. Udelsmann (2019) explored the effects of flooding and rising sea levels in poor neighbourhoods in Luanda (Angola) and Maputo (Mozambique) and how residents have taken in upon themselves to create initiatives to adapt to climate change impacts. In his study, the adaptation of houses among poor urban dwellers was found to be the most prevalent adaptation strategy. This included residents “building protections, drainage ditches and outlets, securing roofs with stronger fixes and heavy weights” (Udelsmann, 2019, p.328). An interesting finding was that many of the slum dwellers living in floodplains had at some point been relocated to higher grounds by government officials but chosen to later move back; one reason for this was the strategic location they lived and their lack of trust in authorities.

A further strategy communities employ is to modify their homes by developing effective construction techniques to ensure their houses can withstand strong winds and rain (*Figure 2.11*). Residents made modifications in and around their houses. One respondent in Udelsmann’s study, a block coordinator reported that to secure their roofs, residents used strong nails and placed heavy rocks and cement blocks on top, which was replicated

by neighbouring residents. Collective action in communities were formed to mitigate climate impacts.

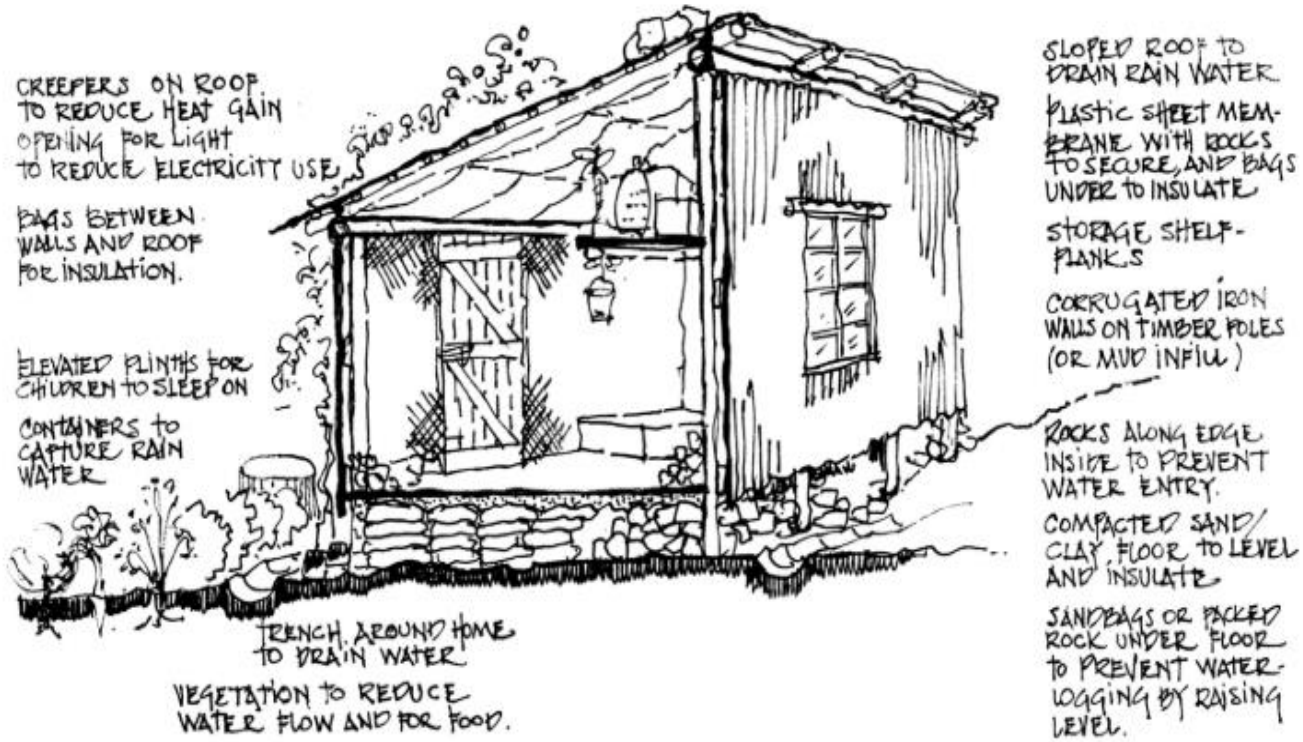


Figure 2.11: Physical and Built Environment Adaptation. Thorn et al (2015)

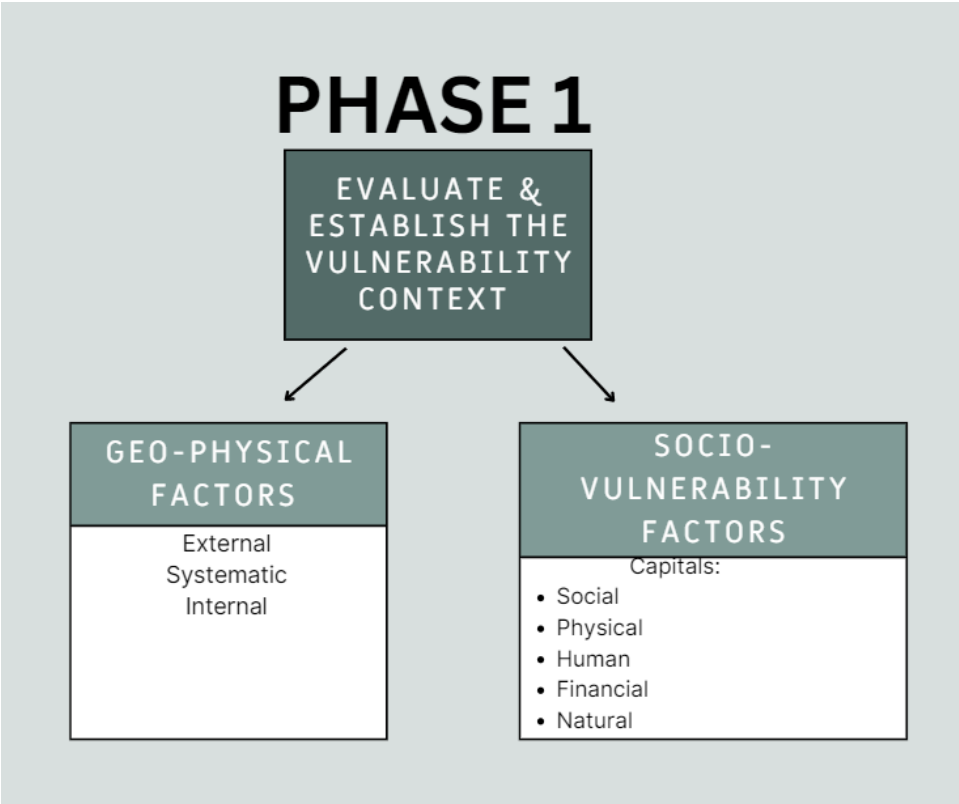
Another example was the creation of specific committees, for instance one to dig ditches, and the other to maintain and improve roads and passages (Udelsmann, 2019). This is an interesting approach as creating specific committees could arguably be more effective as they are more task focused. Moreover, it ensures that practical measures are undertaken on a regular basis, and not when the floods happen. It shows a proactive approach to adaptation, as opposed to a reactive approach.

Broto et al (2015) reported that in Chamanculu C, residents proposed that a way to tackle the issue of waste management and poor drainage systems was for the community to repair the drainage system and install recycling centres in the communities. This again shows an acknowledgement and a willingness that residents have in addressing factors which exacerbate their vulnerability to floods.

Another strategy used by communities is the identification of evacuation routes and the setting up of emergency centres before the rainy season. These evacuation routes and emergency centres are set up in collaboration with the local communities, NGO's and relevant emergency services. Several factors have to be considered before a strategy is approved, such as the safe transfer of residents, any form of transport which may be needed, decide whether some residents are safer in the homes of family and friends, ensure that the evacuation centres have appropriate sanitation systems, portable water and food (The New Humanitarian, 2019). In order for this strategy to be effective, considerable amount of planning need to be done before the rainy season. Additionally, the community need to be informed about the safest routes and the locations of evacuation centres.

2.6 Integrating vulnerability and community-based sustainable adaptation

This section synthesises the vulnerability models with the principles of CBA reviewed above into the new conceptual framework:



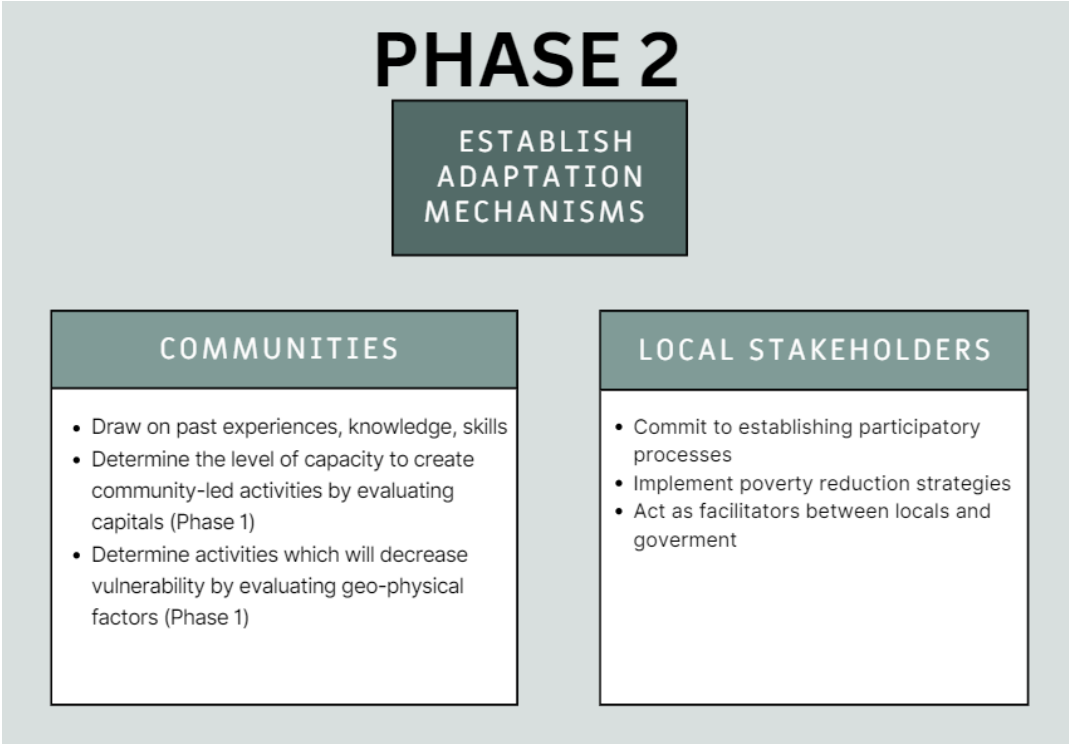


Figure 2.12: Conceptual Framework, Authors own

Thus far the thesis has discussed vulnerability and adaptation, and based on this discussion, key principles were drawn out and used to formulate a new conceptual framework intended to be used as a best practice approach in order to strengthen the disaster response strategy in communities succeptible to floods.

Phase 1 (Establishing the vulnerability context) is the first step in evaluating the level of vulnerability. This incorporates geophysical factors which are those outside the control of the community, and socio-vulnerability factors are capitals which households possess. This was deemed to be an important stage using the understanding that the more aware communities are regarding what makes them vulnerable, the more pro-active they can be. Morevoer, it highights which areas of their livelihoods they can improve.

Phase 2 (Establish adaptation mechanisms) is concerned with highlighting adaptation mechanisms communities and local stakeholders can engage with. According to the Ayers and Forsyth (2019), even though CBA is primarily community focused, the involvement of stakeholders is important to establish adaptation strategies. This is particularly relevant to Maputo where vulnerable communities have limited resources available.

The other sections of the framework will be further elaborated in Section 5.4.

2.7 Chapter Summary

This chapter has discussed the concept of climate change, vulnerability and models of vulnerability and community-based adaptation. The concept of climate change was introduced, and various definitions were given; it was established that climate change is a process, and hence, the notion of time is an important factor. Effects of climate change are experienced on a global scale, and impacts include natural hazard-induced disasters such as droughts, hurricanes, cyclones and floods. Following this, the chapter explored vulnerability using three models: According to Smit and Wandel (2006) vulnerability is made up of three elements: sensitivity, exposure and adaptative capacity. The Sustainable Livelihood Framework views vulnerability as households having a lack of assets, and the Pressure and Release Model assumes vulnerability is composed of root causes, dynamic pressures and unsafe conditions. All models have been used in the context of natural hazard-induced disasters and all agree that to reduce vulnerability, political and economic ideologies must be addressed. Where the models short fall is that they fail offer practical strategies which communities can adopt, and hence, that is where community-based adaptation plays a role. Community based adaptation is based on the understanding that communities have acquired the abilities, knowledge and experiences necessary to reduce vulnerability and enhance resilience. These models / frameworks (Model of Vulnerability, Sustainable Livelihood Framework, Pressure and Release Model & Community Based Adaptation), along with the literature, were discussed and integrated to create the new conceptual framework (Community Adaptation Practices' Framework) for a best practice approach to enhance community resilience to the impacts of floods in urban communities (objective three).

CHAPTER 3: METHODOLOGY

3.1 Introduction to the chapter

This chapter discusses the methodological approaches adopted in the study. In order to attain the objectives set, a mixed method approach was deemed most appropriate. Combining quantitative and qualitative techniques allowed the researcher to acquire a robust data set. The chapter begins with a brief reminder of the research objectives (Section 3.2) followed by an exploration of the different philosophical underpinnings (Section 3.3), concluding that a pragmatic paradigm with an interpretivist approach is the most suitable. It then goes on to discuss the research strategies which were adopted, namely semi-structured interviews (Section 3.7) and questionnaires (Section 3.9). The chapter closes by discussing validity and reliability in terms of triangulation (3.10.2) and reflexivity (Section 3.10.3), and by exploring ethical consideration (3.11).

3.2 Research aim and objectives

To recap, the main aim of the study is to explore and evaluate adaptation strategies being applied in urban communities vulnerable to flooding in Maputo. To achieve this, the study intends to address the following objectives:

Objective 1: Identify CBA strategies being implemented by urban communities vulnerable to floods in Maputo.

Objective 2: Appraise the role of stakeholders in aiding residents to adapt to the impacts of floods.

Objective 3: Construct/develop a best practice approach to enhance community resilience to the impacts of floods in Maputo urban communities.

3.3 Philosophical Underpinnings

The way we experience the world is largely determined by our experiences, knowledge, and perceptions. Our assumptions about the world influences the approach we adopt in research, which is known as a paradigm. A paradigm describes one's interpretation of worldviews based on culture, beliefs, and experiences, which in turn, guide the approach the researcher adopts (Collis & Hussey, 2021). Saunders et al (2019, p.124) describe research philosophy as "a system of beliefs and assumptions about the development of knowledge". These three assumptions include epistemology, ontology, and axiology.

Epistemology looks at the nature of knowledge and asks the question 'What is knowledge?' (Saunders et al, 2019). For some, reality or truth can be constructed using numerical and scientific data, without interacting with the phenomenon being research; this is known as a positivism. For others, there is not a single reality or truth, and knowledge is obtained through interacting with the phenomenon being investigated by collecting various interpretations and life stories, which are then considered legitimate truths; this is known as interpretivism or constructionism (Collis and Hussey, 2021).

Ontology looks at the nature of reality and asks the question 'What is reality?' (Saunders et al, 2019). There are two possible ways to approach this question: to some, there is one single universally accepted reality which remains consistent, whereas to others, reality is relative and there are various subjective truths. Researchers who believe that there is a single universal truth are known as objectivists, and sometimes referred to as realists, whereas researchers who believe truth is relative are known as constructivists (Neuman & Robson, 2014).

And finally, axiology looks at the researcher's ethics and values in relation to their research; it asks the question of 'what value is placed upon the subject?'. Positivists are detached from their subjects and treat them as 'objects', thereby placing little value on their subjects, whereas interpretivists value their research 'subjects' and are attached to them, to the point of risking being subjective (Collis & Hussey, 2021).

3.3.1 Positivism

Positivism, also sometimes referred to as objectivism, has its roots in the field of natural science and was introduced by Comte (1798-1857), Mill (1806-1873) and Durkheim (1859-1917) (Collis and Hussey, 2021). Comte argued that society could be studied solely by empirical observations (Ryan, 2018) and the aim of positivism was to create and develop theories based on observations and experiments; or in other words, positivist researchers believe that by observing social phenomenon's, it is possible to generate law-like generalisation (Saunders et al, 2019). From an epistemological stance, positivists believe that the world and the researcher are distinct, and ontologically, they believe that reality can be attained through testing hypothesis using logical reasoning (Ryan, 2018). Researchers adopting a positivist approach believe that the attainment of knowledge is purely scientific and mathematically logical and hence conduct their study using quantitative measures such as questionnaires, observations and experiments (Collis and Hussey, 2021). One of the main criticisms for using this approach, which can also be taken as a strength, is the assumption that the researcher can completely separate their perceptions and influences from what they are observing/exploring and efficiently remain objective; Collis and Hussey (2021, p.45) explain that "researchers are not objective, but part of that they observe", therefore, the effectiveness of adopting a positivist approach can be questionable, but also largely dependent on what is being researched.

3.3.2 Interpretivism

Positivism was challenged by Kant (1754-1804) and Popper (1902-1994), and this led to the contrasting concept of interpretivism, which states that reality is created in our minds, hence, reality is subjective and include multiple interpretations (Collis & Hussey, 2021). Advocates for interpretivism argue that the complexities of human beings cannot be studied through a mathematical or physical lens, but rather, require a deeper interpretation (Saunders et al, 2009). Kant believed that human thoughts and perceptions created reality. Unlike positivism, interpretivism does not separate the researcher from the phenomenon, because according to Collis and Hussey (2021), what exists in the social world is inseparable from what exists in the researcher's mind. The goal of

interpretivism is to make meaning of people's actions and behaviors in society and more specifically, within cultures (Chowdhury, 2014). Researchers adopting this approach are more subjective and will generally collect their data qualitatively; their intention is to appreciate in-depth data gathered and attempt to attain a deeper understanding of their subjects' perceptions and experience, which positivism lacks. On the other hand, researchers need to ensure they remain objective throughout the process as it can be tempting to manipulate data or use their own interpretations. One of the arguments against this approach is that data produced is not value free because researchers, already having their own preconceptions, interact with their participants, which unintentionally can cause a transfer of perceptions from researcher to participant and vice versa (Chowdhury, 2014).

3.3.3 Critical Realism & Pragmatism

Some authors believe that positivism and interpretivism can be viewed as a continuum with each approach on opposite sides (*Table 3.1*) (Morgan & Smircich, 1980; Sekaran & Bougie, 2013; Saunders et al, 2016; Collis and Hussey, 2021). Over the years, researchers have applied principles of both paradigms in their research, thereby creating new paradigms, one of which is critical realism which was developed by Bhaskar. Sekaran and Bougie (2016) describe critical realists as believing that there is an objective truth, but that this truth cannot be achieved objectively or measured. This makes the search for truth impossible to attain because on one hand, phenomenon such as culture and motivations are hard to measure, and on the other hand, research will always be bias and subjective by the researchers' own preconceptions and beliefs. However, rather than searching for the truth, the researcher investigates how groups 'construct' their own reality. Cruickshank (2003) believes that the researcher's version of reality can 'clash' with the narratives of the groups they are studying and hence encourages researchers to study groups which are similar to their own social origin. However, this still does not make the researcher immune from using their own perceptions and feelings. Moreover, it could result in them being even more passionate.

	Positivism ←					→ Interpretivism
Ontological assumption	Reality as a concrete structure	Reality as a concrete process	Reality as a contextual field of information	Reality as a realm of symbolic discourse	Reality as a social construction	Reality as a projection of human imagination
Epistemo-logical stance	To construct a positivist science	To construct systems, process, change	To map contexts	To understand patterns of symbolic discourse	To understand how social reality is created	To obtain phenomeno-logical insight, revelation
Research methods	Experiments, surveys	Historical analysis	Interpretive contextual analysis	Symbolic analysis	Hermeneutics	Exploration of pure subjectivity

Table 3.1 A continuum of paradigms (Collis and Hussey, 2021)

Like critical realism, pragmatism also falls in the middle of a continuum. Pragmatism steps away from the concepts of reality and truth, and instead, accepts that there can be multiple realities that can be investigated empirically (Kaushik and Walsh, 2019). These multiple realities are a result of pragmatist believing that knowledge is socially constructed. Both Easton (2010) and Kaushik and Walsh (2019) argue that pragmatists consider truth to be anything that is 'beneficial' to a certain point; for instance, the authors state that "reality is true as far as it helps us get into satisfactory relations with other parts of our experiences" (Kaushik and Walsh, 2019, p.4), likewise, Easton (2010, p.119) argues that "truth is what is useful to people researching in a field". However, Kaushik and Walsh (2019) explain that pragmatist don't simply ignore the philosophical arguments, but instead, they conclude that one cannot separate meaning from human experience, and these different experiences from various researchers mean that knowledge will continue to be constructed. For Collis and Hussey (2021), pragmatists chose their research methods based on how effectively they will address the research aims, hence, allowing the researcher to mix methods.

Based on the above discussion, the current study found pragmatism with an interpretive approach to be the most appropriate approach. Pragmatism is suitable because the study adopted a mixed method approach which permitted the use of techniques most well

suited to attain the aims and objectives of the research: both quantitative (questionnaires) and qualitative (interviews) methods.

A pragmatic approach is one of the most practical and flexible ways of deriving information from various sources in order to better understand a phenomenon and address the research objectives. This was done through both the research method and sample- the research methods allowed flexibility of data collection which would best address the research objectives, and with regards to the sample, a range of interviewees and questionnaire participants. A key characteristic of pragmatism is the notion that truth is tentative and changes with time, and this holds true for climate change and community adaptation. The way climate change and natural hazard-induced disasters are understood today is different to how they were viewed a few decades ago. For instance, the Intergovernmental Panel on Climate Change (IPCC) who produce accredited climate change reports was solely focusing on mitigating climate change before 2001, however, after that, the organisation realised that adaptation to climate change needed to be the priority. The notion of truth being tentative and evolving with time can also be used as a rationale for adopting this approach to the context of Maputo in that the reality of climate change is differently understood and constructed depending on people's backgrounds and past experiences, and moreover, the understanding of climate change increases with time (Climate Communication, 2015).

Additionally, pragmatism appreciates complex real-life issues and attempts to solve them using different perspectives. This is seen in the complexities that different groups experience in dealing with the impacts of hazards (communities, academics and civil society organisations). Moreover, this flexibility allowed the researcher to utilise various methods of collecting data. Combining pragmatism with an interpretive approach allowed the researcher to value both a practical and conceptual understanding of the participants involved. In this instance, it was beneficial to understand how the cultural background of the communities influenced their behaviours and actions.

As a social researcher, the researcher believes that the phenomenon being researched is as important as the participants involved. The researcher acknowledges the value of numerical data as a significant contribution to knowledge, however, disagrees that a complete representation can be made solely based on numerical results. In this present research, where a social phenomenon is being investigated, the involvement of social actors is essential in building knowledge. In support of this, Karrouchi (2016, p.iv) states that “in order to understand what is going on in the social world, it is important to study the underlying social structures which have given rise to the phenomena under consideration”. Owing of its exploratory nature, a subjective approach could prove to be more appropriate because it allows the researcher to freely interpret the data, hereby addressing objective three.

A solely positivist approach would arguably be inadequate in this research due to its objectiveness and deductive outlook of knowledge, that is, that knowledge is logical and explanations are derived from ‘casual laws’ generalisations. But instead, by conducting interviews along with questionnaires, knowledge is obtained through interactions with participants. Henn et al (2009, p.16) describe the importance of language in knowledge creation: “Language is considered a tool with which we make meanings, so in order to empathise with participants, it is important to allow their meanings to be expressed in the way they normally would be through their language”. Critical realists believe or assume that “there is a real world out there” (Easton, 2010, p.119) which can’t be proven using only a positivist or interpretivist approach.

As stated above, this study applied a mixed methods approach, therefore, the subsequent section will outline the data collection process (Section 3.4), introduce the principles of mixed methods and justify why this approach was used and what are the implications are (Section 3.5). Then the section explores quantitative and qualitative studies by discussing key elements which differentiates them, followed by an explanation of how they were applied to this study.

3.4 Data collection process

Before the Covid pandemic, the plan was to conduct questionnaires in communities to gather residents' perceptions and understanding of community adaptation to floods. The pandemic also meant that the research objectives had to be revised. The following were the **original** objectives:

Objective 1: Identify mechanisms to encourage autonomous adaptation in urban communities
Objective 2: Identify community members' perceptions of climate change risks
Objective 3: Understand what is being done by local stakeholders to aid residents in adapting to impacts of climate change.

Objective two aimed at exploring community members perceptions which would prove to be challenging without interacting with the community. It could be argued that this could have been done through an online questionnaire, however, getting access to people and ensuring they have internet access would prove challenging. The following are the revised and final objectives and their respective data collection methods:

Objective	Method
Objective 1: Identify CBA strategies being implemented by urban communities vulnerable to floods in Maputo	Interviews; Literature Review
Objective 2: Appraise the role of stakeholders in aiding residents to adapt to the impacts of floods	Interviews
Objective 3: Construct/develop a best practice approach to enhance community resilience to the impacts of floods in urban communities	Questionnaire & follow up interviews

Table 3.2 Objectives and data collection methods (Authors Own)

3.4.1 Research Strategy and Justification

The Covid pandemic presented itself with various limitations such as not being able to travel abroad due to lockdowns. Moreover, Mozambique was placed on the 'Red list' which meant that travellers returning from Mozambique would have to be placed in compulsory hotel quarantine (GOV.UK, 2023).The pandemic impacted the methodological processes of the study in various ways, hence, it was primarily this 'freedom to combine elements' in order to address the aims and objectives of the study that drove the adoption mixed method with a pragmatic approach.

Before the pandemic, the data collection process involved travelling to Maputo and was divided into two phases: Phase one involved conducting questionnaires with the local communities in order to get an understanding of their views, beliefs and experiences of natural hazard-induced disasters and identify adaptation strategies that they were implementing (addressing objective one). By applying components of the Sustainable Livelihood framework, the questionnaires aimed to create a comparison between the importance of particular assets and their availability by accessing the importance assets play in the livelihoods of participants versus if the participant are able to benefit from them. The results of the questionnaires would then be used to structure the interviews in terms of the questions asked. By analysing community members perceptions and needs, these would be presented to the stakeholders during the interviews to enlighten and present them with what community members think and to implement adaptation strategies which are contextually based and not a top-down approach.

Phase two of the data collection process involved conducting in depth interviews with local stakeholders that were experts in terms of responding to flood risks in communities in order to appreciate the role they play (addressing objective two). After gathering and analysing data from local communities, results were to be presented to local stakeholder,

with the purpose of combining the views of both groups and creating a best practice approach framework (addressing objective three).
Instead of the above process, the study adapted to the circumstances and implemented a new strategy. The data collection process was consequently divided into three stages.

Stage one involved conducting in depth interviews with experts involved in responding to flooding in urban communities in Maputo. This was done to address objective two (Appraise the role of stakeholders in aiding residents to adapt to the impacts of floods). In depth interviews were the dominant method. Phase two were questionnaires which aimed at identifying factors participants believed contributed to vulnerability in Maputo and adaptive actions they thought should address vulnerability. Phase three involved follow up interviews with participants experts in their fields. Two of the participants had previously had also been involved in stages one and two. Phase three was primarily conducted with the aim of 'closing the loop' and validating the data. It involved presenting the questionnaire findings to the participants and asking them to comment on them, challenge if necessary or simply agree. It was important for the researcher not to compromise on the quality of the data due to the pandemic, but instead, to create ways of attaining the information, which also reflects the pragmatic approach. These changes are reflected in the following table *(Table 3.3)*:

	Approach before the pandemic	Approach which was applied
Research objectives	• Objective 1: Identify mechanisms to encourage autonomous adaptation in urban communities. • Objective 2: Identify community members' perceptions of climate change risks. • Objective 3: Understand what is being done by local stakeholders to aid residents in adapting to impacts of climate change.	• Objective 1: Identify CBA strategies being implemented by urban communities vulnerable to floods in Maputo. • Objective 2: Appraise the role of stakeholders in aiding residents to adapt to the impacts of floods. • Objective 3: Construct/develop a best practice approach to enhance community resilience to the impacts of floods in urban communities
Methods to be used:	To address: Objective 1: Questionnaires with local communities Objective 2: Interviews with local stakeholders Objective 3: Collating results to create a best practice approach.	To address: Objective 1: Literature review and questionnaires Objective 2: Interviews with local stakeholders Objective 3: Collate results from questionnaires, interviews and follow up interviews.

Table 3.3: Approach before the pandemic vs. approach which was applied (Authors Own)

In order to enhance the quality of the data and to validate findings, follow up interviews were conducted with three participants. These participants were presented with the results of the questionnaire findings and asked to comment upon them. Due to the Covid pandemic, getting access to participants proved challenging, therefore, the researcher had to re-evaluate data collection techniques so as not to compromise the quality and validity of the study. Initially, the plan was to conduct Delphi questionnaires as discussed in Section 3.9, however, in order to comply with the principles of the technique, two or three rounds of questionnaires would have to be conducted (Cere, 2019; Ezeji, 2019). After piloting the questionnaires, it was clear that completing at least two rounds and ensuring participants remained willing to do so would prove challenging, therefore, it was decided to send out a 'traditional' questionnaire. The researcher appreciated the value of the Delphi technique, and as a result, some principles of the Delphi were used, such as

ensuring that participants are experts and that a consensus was reached. In order to address the absence of a second round, follow up interviews were conducted with three experts. These interviews were completed in three weeks.

3.5 Mixed Method Approach

As stated above, this study employs a mixture of quantitative (questionnaires) and qualitative (interviews) methods. Johnson and Onwuegbuzie (2004, p.17) define mixed method approach as “research where the researcher mixes or combines quantitative and qualitative research techniques, methods, approaches, concepts or language into a single study or set of related studies”. This definition alludes to the fact that a mixed method approach is not solely constrained to data collection, but it encompasses all stages of research. In support of this, Creamer (2018) and Ostlund et al (2011) explain that the mere fact of combining quantitative and qualitative research methods is not sufficient when labelling research as mixed method approach. Creamer (2018) state that quantitative and qualitative principles should be evident at all stages of the project.

Similar research also supports to use of mixed method approach. Almutairi (2019) explored resilience in coastal communities in Saudi Arabia and adopted a pragmatic approach in their research with the justification that it was the most compatible with mixed methods. Similarly, Ezeji (2019) investigated resilience to extreme weather events and adopted a pragmatic approach with the reasoning that a mixed method allows for a more robust comprehension on the data. Thinda et al (2020) conducted a risk assessment to evaluate community-based hazard and vulnerability risk in an informal town in South Africa and adopted a mixed method approach as it allowed the researcher to triangulate the data and enhance its analytical power. Lastly, Salami et al (2017) developed a framework for analysing flood risks in urban settlements in Africa and also adopted a mixed method research approach. Conclusively, it can be seen that flood risk adaptation studies are largely characterised by adopting a pragmatic approach and using mixed methods.

McKim (2017) states that one benefit of adopting a mixed method approach is the integration of data which offer researchers more confidence about the results. However, many arguments have risen against using a mixed method approach. These include the additional time needed, additional resources, funding and supplies along with the requirement for the researcher to understand both quantitative and qualitative data collection and analysis skills (McKim, 2017).

As discussed above, pragmatism advocates that rather than the research paradigm be used to determine research methods, instead, research questions, aims and objectives should influence the methods to adopt, and that these can be from more than one paradigm, as long as it addresses the research question. Similarly, rather than conforming to a single research design, a mixed method research approach allows the researcher the freedom and flexibility to combine elements of different paradigm which will best address the research aims and objectives. Another reason why the pragmatism was appropriate was due to its constructivism nature. In the context of climate change, and addressing its impacts, it was important to understand how it is constructed within different groups (local communities and stakeholders) as well as the context (Maputo). As discussed in section 2.3.2, how these concepts are constructed and understood in people's minds has a direct impact on their adaptive behaviours.

The next session explores the principles of qualitative and quantitative approaches (3.6) and then outlines how interviews were conducted (Section 3.7.1), and links the objectives, interview questions and conceptual framework (Section 3.8). The chapter follows with an overview of how questionnaires were administered (Section 3.9).

3.6 Quantitative vs Qualitative Research

Having described the problem, its need to be explored, and the different research paradigms, the next phase is to outline *how* it will be done. The two main schools of inquiry are quantitative and qualitative approaches; the choice as to which one to apply is largely dependent on the chosen research paradigm; positivism is generally associated with quantitative methods whereas interpretivism is largely associated with qualitative methods (Collis & Hussey, 2021). The table below (*Table 3.4*) (although not exhaustive) differentiates between the methodologies which can be applied in both paradigms:

Positivism ←	→ Interpretivism
Experimental studies	Hermeneutics
Surveys	Ethnography
Cross-sectional studies	Participative enquiry
Longitudinal studies	Action research
	Case studies
	Grounded theory
	Diversity and equality studies

Table 3.4 Methodologies associated with the main paradigms. (Collis & Hussey, 2021)

In quantitative research, the intention tends to be to collect high levels of specific numerical data and can arguably be said to be more reliable because of its objectiveness. In qualitative research, while there is an emphasis on the depth and quality of data, the analysis is more subjective. Qualitative and quantitative research is also differentiated when it comes to their usage of theories and theoretical frameworks; quantitative studies derive their variables from theories and the results are then used to refine that theory, whereas qualitative research stems from theory and asks general questions with the aim of broadening knowledge (Court et al, 2018).

As discussed above, qualitative approaches are associated with an interpretivist view and is interested in searching for 'why' answers, providing a more in depth understanding of a phenomenon. It aims to get an understanding of people's opinions, behaviors and

attitudes. Contrastingly, quantitative studies are associated with a positivist view; researchers in this field believe that knowledge is objective and rational, and it can be attained through numerical means and statistical analysis. Collis and Hussey (2021, p. 40) state that explanations are formed by "establishing casual relationships between variables by establishing casual laws and linking them to a deductive or integrated theory", fully contrasting the interpretivism view which relies on social constructs. The essence of a quantitative approach is that researchers construct theory-guided questions and hypotheses to test and measure variables (Creswell & Creswell, 2018). Methods associated with this methodology include questionnaires, experiments, longitudinal studies & cross-sectional studies.

3.7 Qualitative Method: Interviews

Interviews in social research are described as a conversation between two or more people with the purpose of gathering opinions, feelings, and thoughts about a certain phenomenon (Saunders et al (2012). They are a valuable source of information for various reasons: misunderstandings and ambiguous language, which can be present in questionnaires, can be clarified during interviews (Appleton, 1995); they also allow for a deeper level of information by permitting the respondent to elaborate or explain certain statements. Interviews also allow the interviewer the opportunity to gauge reactions to certain questions, pauses, and comfortability; although these are 'unspoken', they can be used to interpret the feelings of the respondents. On the downside, interviews tend to be time consuming, labour intensive and costly (Appleton, 1995).
Saunders et al (2012) differentiate between three types of interviews: structured, semi-structured and unstructured. These range from following a strict structure to a simple informal conversation.

Structured interviews, which can be seen as a quantitative tool, involves the researcher asking the same questions to all participants with little intention of exploring the responses any further (Court et al, 2018). **Unstructured interviews** are characterised by the researcher using an "aide memoire" (Bryman, 2016, p. 468) as a guide, and allow the

interviewee free range to respond as they wish and only ask follow up questions based on what they say. In a **semi-structured interview**, the researcher has a set of questions to be asked but is not constrained to follow a certain pattern. Semi-structured interviews offer the researcher the flexibility to formulate questions based on the responses and to prompt deeper explanations from the interviewee (Denscombe, 2014). Conducting semi-structured interviews requires the research to have the skill of ensuring that the questions asked are answered but also being aware of any new or interesting topics which should be followed up with (Court et al, 2018).

Unstructured interviews could be preferred over semi structed because they allow the respondent to freely speak their mind, which could be hindered if they understand that a certain structure must be followed. They may be less encouraged to speak on a topic which may seem irrelevant and off topic to the researcher but not to them, due to time and relevance.

This study made use of a semi-structured interview. It allowed the researcher the flexibility to ask a set of questions and follow up upon interesting comments which arose during the interview. One of the challenges which arose during the interviews was when participants who had previously been briefed on the research background and aims or sent a preview of questions (upon request) started the interview with an unstructured approach: by 'pouring out' all they knew and thought was relevant to the study. While this was appreciated, it caused some disorientation as it meant that the researcher lost some control over the structure and had to pay closer attention to what was being said; this caused a disruption to the flow of the interview and also meant that the researcher had to make a mental note of which questions were already being answered so as not to repeat any. On all occasions, valuable data was extracted from these narratives. The researcher was able to gain control and ensure all questions were answered. Bryman (2016) encourages this dynamic and highlight that "it gives insight into what the interviewee sees as relevant and important" Bryman (2016, p. 466-467). Therefore, it not only offers a wider range of data, but it also offers an insight into how the person being interviewed thinks and feels. Despite causing some disruptions, the structure may have been to the benefit of the interviewee for two reasons: firstly, it allowed them to freely express their

experiences and opinions without feeling constrained by a structure, and secondly, it meant that they were more likely to be sharing information which might not have been uncovered with the set of questions asked yet still highly valuable.

Potential interview participants were first contacted beginning of June 2020 by email (Appendix A). Organisations included NGO's, civil society organisations and international agencies that work in responding to natural hazard-induced disasters in Maputo, provide financial aid to the government or assist in equipping the national institute for disaster management. These contact details of these organisations were found online. Initially, response rates were slow, with a few organisations explaining that they had limited resources. By then end of June, thirty-nine organisations had been contacted, with six positively responding. Interviews began to be conducted towards the end of July, out of which four further contacts emerged through snowballing sampling. From the beginning of August, until the end of September, a further twenty-two organisations were contacted, out of which eight responded positively. In total, sixty-one organisations were contacted. The researcher believes that response rates were affected by Covid at the time as many organisations were not operating as normal and therefore reporting limited resources.

All interviews were conducted online using Skype, WhatsApp & Zoom. Initially, the plan was to travel to Mozambique to conduct face to face interviews, however, due to Covid, this was not possible. Online interviews still offered the interviewee the chance to see the participant and vise versa which made the conversation flow much easier. Another advantage was that conducting interviews online allowed both the researcher and the participant to agree on a time which was most convenient for both.

Before conducting the interviews, a pilot study was completed with the aim of ensuring the feasibility of the study; this included testing the structure, format and instructions of the interview, testing to see if the questions were comprehensive, and finally, to identify the length of interviews. The pilot study was conducted with three participants who each had different functions:

- Local stakeholder: to ensure that the structure was appropriate and that the questions were clear.
- International agency: to ensure that the questions formulated could be applicable in a different context and still remain relevant.
- Resident in Maputo: Given the context of the study and that Portuguese is the official language in Maputo, the interview questions had to be translated. Therefore, another purpose of piloting the interviews was to ensure that translated versions of the interview questions were comprehensible. Also, to ensure connectivity was reliable and that the interviews could be conducted using Zoom, Teams and WhatsApp in Maputo.

Piloting the interviews presented ways in which to improve the process. Feedback from the pilot interviews included a clarification of the study context; the local stakeholder differentiated between Maputo city and Maputo province and suggested that this needs to be clearly stated. Regarding the translated version, the questions were first translated by the researcher, then by a bilingual person. Feedback from the piloting phase included simplifying the language of some questions to ensure clarity. All these recommendations were applied to the final version (Appendix B)

3.7.1 Guidelines followed when conducting interviews

1. The interview started with the researcher introducing themselves and thanking the participant for their time and agreeing to participate in the research.
2. A brief explanation of the project was given.
3. Permission to record the interview was requested (this was included in the consent form), along with a reassurance that all data shared would remain confidential. A mobile device was used to record the interviews. As the sound quality was an essential consideration to enable an accurate transcription of the interviews, a test run was conducted. The application used to record the interviews had the functions of controlling the speed, fasting backwards and forwards 15 seconds which

facilitated the process transcription. Additionally, participants were reminded that their participation was voluntary, and they could decide to withdraw at any time should they chose to.

4. Followed by this, pre-set questions were asked, along with any clarifications when necessary. All questions asked were open questions to get comprehensive and developed answers.
5. To complete the interview, participants were asked whether they wished to add anything.
6. Participants were finally thanked for their time.

Please refer to Appendix B for interview questions.

Selection criteria's:

Interview participants were selected based on the following:

- Their experience with supporting Maputo with floods,
- Experience and knowledge in flood management (in Maputo and similar cities),
- Local stakeholders and industry players with their mission being to enhance community resilience to floods and provide support in times of crisis.
- Researchers who had published journal articles with the following key words: 'climate change', 'Mozambique', 'Maputo', 'flood adaptation', 'communities', 'drainage', and 'urban poor'. Participants contacted via Research Gate were identified by their skills and expertise tags such as 'climate change', 'flood risk', 'climate vulnerability', 'disaster reduction', 'climate adaptation' and 'cyclones'.

Contact details of potential interview participants were found on their websites and journal articles. All interview participants were initially contacted a month before the beginning of the interviews process with the intention to reach out and establish a connection. The email (Appendix A) included its purpose (which was to secure interviews), a brief overview of the research study, why the potential participant was in a position to provide valuable information, potential duration of the interview and the email address should they wish to contact the researcher. Those who accepted the request were contacted at a later stage

to schedule the interview at their convenience along with an information sheet and a consent form which had to be signed before the interview.

3.7.2 Analysing Qualitative Data

Qualitative research has the potential of producing large volumes of data such as field notes, jotted notes, recordings of interviews, focus groups and researchers' reflective notes (Pope et al, 2000). There are mainly two ways to approach qualitative data analysis: deductive and inductive approach (Gill et al, 2008). The difference between the two is determined by whether the researcher uses a structure, framework or theory to analyse the data. Deductive approaches make use of a predetermined framework of theory to analyse the data; in essence, the researcher 'enforces' a structure or framework upon the data and uses these to analyse it (Gill et al, 2008). This approach is mostly used when the researcher can predict the responses of participants. Contrary to this approach, is the inductive approach which makes no use of a framework or theory but uses the data itself to develop the structure for data analysis. This approach is used when little is known about the phenomenon being investigated, hence, its very time consuming (ibid). The following section discusses three ways of analysing qualitative data: discourse analysis (Section 3.7.2.1), content analysis (3.7.2.2) and thematic analysis (3.7.2.3).

3.7.2.1 Discourse Analysis

Discourse analysis examines the way language and communication is used in social interactions within the contexts in which they happen (Collis and Hussey, 2021). From a philosophical perspective, it explores the use of language in creating and reflecting reality, which does not always reflect knowledge or reality, but instead, it formulates and maintains them (Shanka et al, 2013). In other words, it assumes that truth and reality is relative, and that peoples' experiences and cultures shape how they view the world. Language is an important element in discourse analysis as it is through this medium that researchers can delve into their participants construction of the social world, and thereby, begin to make meaning of it (Clarke et al, 2021).

Discourse analysis is flexible in its use as it does not solely rely on analysing transcripts; it can also be used to analyse news articles, debates, YouTube videos, books, films, etc (Clarke et al, 2021). The process of conducting a discourse analysis involves assessing word and grammar choices made by participants are trying to understand the deeper meanings of those language patterns.

One aspect of discourse analysis relevant to this study is that it is interested in understanding how the concept of vulnerability and adaptation is constructed within the context of Maputo. This is important as how people view these concepts has an impact in the adaptive strategies, they are ready and willing to implement (Grothmann & Patt, 2005; Azadi et al, 2019). Despite this benefit, this study is not concerned with understanding peoples' construction of reality and truth.

3.7.2.2 Content Analysis

Another way of analysing qualitative data is through content analysis. A simple and well-known definition for this technique is given by Berelson (1952, p.18; cited in Clarke et al, 2021): "content analysis is a research technique for the objective, systematic and quantitative description of the manifest content of communication". It may seem unusual to have the words' objective and communication in the same sentence in the context of conducting research.

Content analysis can be used in both qualitative and quantitative methods such as interviews and open-ended questions is questionnaires. According to Krippendorff (2018; cited in Clarke et al, 2021), this technique is used to examine "data, printed matter, images or sounds-text-in order to understand what they mean to people, what they enable or prevent, and what the information conveyed by them does".

As mentioned above, content analysis can be conducted both quantitatively and qualitatively. When using a quantitative content analysis, the aim is to answer 'how many' by drawing out facts from texts and reporting on their frequency (that is, how many times a fact emerges from the texts being studied) (Bengtsson, 2016). When doing a qualitative content analysis, the researcher analyses the data through themes and words, and the

researcher can then decide on how to further use that data depending on the level of depth wanted. According to Bengtsoon (2016), the analysis can either be manifest or latent. A manifest approach is superficial and uses the specific words used by participants whereas a latent approach attempts to make meaning of the data by interpreting it.

Content analysis shares similarities with discourse analysis discussed above as it uses data to construct meaning. An interesting aspect of this approach relevant to this study is that the approach can be used for both quantitative and qualitative data, which this study adopted. One could argue that a single data analysis approach could have been used to analyse the interviews and the questionnaires. However, the purpose of this study was not to construct meaning by quantifying the data, but rather to get a deeper understanding of how natural hazard-induced disasters are dealt with. That is because the technique uses a quantitative approach to make meaning of texts and documents by using systematic and replicable allocated codes or categories (Clarke et al, 2021).

3.7.2.3 Thematic Analysis

One of the most common ways of analysing qualitative data is by using thematic analysis. Cameron and Price (2009, p. 437) define the approach as “a process by which you take each of the key words or themes identified in the content coding manual and search for manifestations of them in each of the texts”. This approach ensures that the researcher reduces biasness and analyses the data in an objective manner. In essence, the process of thematic analysis requires the researcher to analyse transcripts, identify key themes within the transcripts and group them together. Gill et al (2008) offer a structure to conduct thematic analysis made up of four stages (this is further discussed in Section 5.2):

1. Read the transcribed interviews and make notes of any theories, words or phrases which summarise what is being said in the text.
2. Gather all words, theories and phrases from stage one; eliminate repetitions and look for overlapping categories/themes. Further refine categories.
3. Allocate a colour to each category/theme and colour code the interview transcripts according to each corresponding category.

4. Assemble all texts which correspond to the same colour code in one page; then the researcher can start to interpret the text.

With reference to Gill et al's (2008) structure, the first stage describes what is known as open coding and begins with the researcher familiarising themselves with the data by transcribing the interviews. Transcribing the interviews allowed the researcher to be fully immersed in the data and allowed the opportunity to begin to notice emerging themes. While this is a time-consuming activity, it enables the researcher to collectively analyse the data and identify differences and similarities among interviewees, and most importantly, produce conclusive results (Cameron and Price, 2009). Clarke and Braun (2017, p. 297) describe codes as "the smallest units of analysis that capture interesting features of the data (potentially) relevant to the research question". Lazar et al (2017) suggests that codes can be identified through frameworks, new ideas and concepts identified by the participants, and researchers own interpretations.

Following open coding, the next step in the coding process is axial coding, which Lazar et al, (2017, p. 307) describe as "the identification and definition of relationships between these concepts", which corresponds to stage two. Saunders, Thornhill and Lewis (2019) describe this stage as when the researcher begins to make sense of the data and explaining the phenomenon by taking into consideration the environmental factors such as cultural, social, economic and political aspects. Section 4.3 provides more details about the process of how the themes were determined.

Thematic analysis in this thesis proved to be the most appropriate method of analysing the data as it allowed the researcher to capture meanings and explanations from the perspectives of its participants. By collating key words and phrases from various participants, it was possible to create a picture of their overall thoughts – which not only enhances the quality of the data, but also validates it. Although the method proved to be time consuming, it allowed the researcher to become immersed in the data content.
The researcher found it beneficial to print out all the transcripts and complete the analysis manually (all transcripts were inputted on Nvivo to facilitate searching for words / phrases,

and have all interviews stored in one database). Manually, the process involved allocating each theme a colour and underlying words and phrases corresponding to that theme. By conducting the process manually, it provided several benefits such as being able to make notes, transcripts being easily accessible, using sticky notes and being able to seamlessly move from one transcript to another. This process is further explained in section 4.3.

3.8 Linking objectives, interview questions, and Conceptual Framework

OBJECTIVE ONE: Identify CBA strategies being implemented by urban communities vulnerable to floods in Maputo	Interview Question	Link to Conceptual Framework	Explanation
	In your opinion, what are the main disaster related threats faced by communities in Maputo	Phase 1: Evaluate and establish the vulnerability context	This was the first question raised after asking participants to introduce themselves and explain their roles. Although this thesis focuses on floods and participants were informed of this beforehand when sent the information sheet, it was important to have the participants acknowledge themselves that floods are one of the significant natural hazard-induced disasters in Maputo. Apart from confirming the relevance of the study, it also set the tone for the rest of the interview.
	What would enhance resident's ability to deal with floods?	Phase 1: Evaluate and establish the vulnerability context Phase 2: Establish adaptation mechanisms	This question addresses both phases in the conceptual framework. In phase one, it aimed at exploring factors which contributed to communities' vulnerability to floods. In addition, this was an opportunity to explore which socio-vulnerability factors participants thought communities lacked, and in turn, which would need to be acquired to enhance resilience. With regards to phase two, the question aimed at exploring which adaptation strategies communities could implement to address the impacts of floods. As these

			participants are experts, it was expected that their suggestions would feasible.
	In your opinion / from your experience are residents aware of the causes of climate change?	Phase 1: Phase 1: Evaluate and establish the vulnerability context	This questions was based on the understanding that an increased awareness of the causes and impacts of floods results in a greater willingness to implement adaptive strategies (Pelling, 2010; Clarke et al, 2019). The question also aimed at learning whether communities could identify any geo-physical or socio-vulnerability factors which contributed to their state of vulnerability.
	Are there any community initiatives (or committees) that deal with flooding adaptation in areas you have worked in?	Phase 2: Establish adaptation mechanisms	As discussed in the introduction (Section 1.3.4), since 2005 Mozambique has formed community committees in vulnerable communities around the country which is linked to the concept of CBA. The purpose of asking the question was to identify how the concept was being applied in Maputo and to understand its practicalities, functions and challenges.

Table 3.5: Linking objective one to CF (Authors own)

OBJECTIVE TWO: Appraise the role of stakeholders in aiding residents to adapt to impacts of floods	Interview Question	Link to Conceptual Framework	Explanation
	What are your main priorities when you are called to respond to floods?	Phase 2: Establish adaptation mechanisms	This question was aimed at understanding the role of local stakeholders in responding to floods and to identify what they deemed as priorities.
	What are the challenges / barriers you face as an organisation when working in vulnerable communities	Phase 2: Establish adaptation mechanisms	This question was asked to highlight what improvements could be made to the current response strategy, and thereby addresses objective three (Construct/develop a best practice approach to enhance community resilience to the impacts of floods in urban communities).
	From your experience / in your opinion are residents' priorities in line with other stakeholders when it comes to adaptation measures?	Phase 2: Establish adaptation mechanisms	Several authors (van Niekerk et al, 2020; Broto et al, 2015; Barros et al, 2014) have stated that development, poverty, governance and lack of financial resources are significant hinderances to urban dwellers, and that adaptation measures should be aligned with these priorities; therefore this question was designed to assess whether this was a factor stakeholders took into consideration.

Table 3.6: Linking objective two to CF (Authors own)

3.9 Quantitative Method: Questionnaires

One of the most popular quantitative methods of data collection are questionnaires. Collis and Hussey (2021, p. 190) define questionnaires as a “method for collecting primary data in which a sample of respondents are asked a list of carefully structured questions chosen after considerable testing…” with the aim of exploring what they think, feel and their attitudes towards what is being investigated.

Questionnaires can be administered in several ways, such as by post, telephone, face to face and online. This study adopted online questionnaires as it allowed the researcher to distribute it to a large sample of respondents, eliminating any geographical constraints. One of the benefits of using online questionnaires is the opportunity it allows the researcher to use a variety of layouts and formats which can be customised to fit the purpose of the study. This feature also allowed respondents to return to the questionnaire at their convenience if needed and not allow them to move on to the next question until the previous question has been answered.

Collis and Hussey (2021) suggest the following structure when designing a questionnaire (*Figure 3.1*) and some aspects of it were applied to this study.

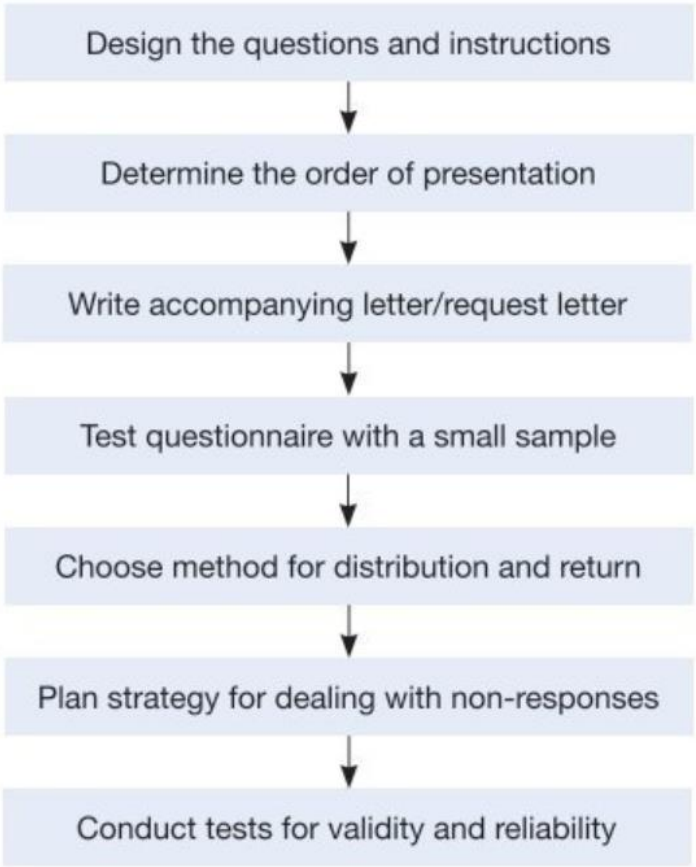


Figure 3.1 Designing a questionnaire. (Collis & Hussey, 2021)

3.9.1 Design the questions and instructions

As discussed in Section 3.4, Covid meant that the researcher had to adapt to the changing circumstances. This was reflected in the methodological process that the study followed. The initial plan was to conduct questionnaires with local communities with the aim of gathering their thoughts and views of natural hazard-induced disasters and identify adaptation strategies they believed to be necessary. Thereafter, in depth interviews were to be conducted with local stakeholders with the purpose of combining the views of both groups. As explained, interviews were conducted first, then questionnaires. The questionnaire designed aimed to be formatted and structured using the Delphi technique which will be explained next.

<u>The Delphi Technique</u>

In its most basic form, the Delphi method is a multi-round use of surveys distributed to participants who are deemed to be experts within a field with the aim of building consensus. The multi round of surveys are used to gather information or find solutions on complex topics or phenomena which lack sufficient evidence and reach consensus about them. Dalkey and Helmer, who originally developed the technique, define it as follows: “a method used to obtain the most reliable consensus of opinion of a group of experts by a series of intensive questionnaires interspersed with controlled feedback” (Dalkey and Helmer, 1963, p.458; cited in Keeney et al, 2010, p.4).

The classical Delphi, or its original version, involves two or multiple rounds of questionnaires. It begins with panellist being sent out a questionnaire in which they are asked their opinion about a certain topic or provided with an initial opinion in a set of statements or questions. The results from the first round are then summarised and analysed and sent back to the experts in the form of a new questionnaire. In the second round, panelists are asked to review the responses from the other experts, (anonymously) against their own and are given the option of either sticking to their original response or revising their response. During the third round, they are then given a set of statements which are based on the previous questionnaire and asked to rate/rank them. In all the rounds, panelists are presented with a summary of their own and other expert opinions

(anonymous) from previous rounds. This process is repeated until a consensus is reached. Several authors who conducted research related to disaster management adaptation, reducing vulnerability and enhancing resilience also made use of the Delphi Technique (Cere, 2019; Alshehri et al, 2015; Almutairim 2019; Ezeji, 2019).

When piloting the questionnaires, it was observed that response rates were low; only half of the participants who were asked to fill in the questionnaire responded. It was observed that if more than one round was completed, there was a potential risk of response rates dropping by the second round. Due to these factors, it was decided to implement a simplified questionnaire which still used the following Delphi principles:

- Participants are considered experts
- A consensus among participants had to be reached.

Given the nature of the Delphi technique, questions asked included classification questions, open questions, ranking and rating scales. (Appendix C)

Classification questions:

Classification questions aim to collect data which characterise the sample, such as job title, age, geographical local, education level, etc, (Collis & Hussey, 2021). In the context of this study, the classification questions, based on the Delphi principle of participants being 'experts' in their field, were asked at the beginning of the questionnaire:

- Organisation
- Role/occupation
- Country
- Highest level of education.

One of the reasons these questions were asked was to enable the researcher to make comparisons between the respondents: in this instance, to compare responses from academics, industry and community residents. Another reason was to access whether the geographical location had any impact on responses. Role/occupation gave the researcher an insight into the experiences and knowledge that the respondents might have had and also understand the context under which the response was being given.

Open questions:

Questionnaires can make use of open or close questions. Close questions are closely associated with a positivist approach and entails either a short answer or 'yes' or 'no' response. While this makes analysis easier, it does not allow the respondent to expand or explain their response. Contrastingly, an open question requires the respondent to give a more detailed answer and offers the researcher a deeper understanding of the response. Participants were asked an open question at the end of each rating question: if they thought that any of the statements made were 'not applicable', they were asked to justify their answer. One of the drawbacks of asking participants to justify their answer is that they may chose not to do so because of time constraints; similarly, if they know that they will be required to justify a 'not applicable' response, they may be reluctant to select that response. In this instance, if the participant did respond 'non-applicable', they were not 'forced' to respond or hindered from proceeding to the next question.

Rating and ranking scales:

To measure the extent to which a respondent felt towards a concept, a rating scale can be used. Rating scales can measure "level of agreement, importance, usefulness" (Collis & Hussey, 2021, p. 200). Participants were asked to measure statements in order of importance; they were given five options (extremely important, very important, moderately important, slightly important and not applicable). Participants were also asked to rate the top three strategies to decrease vulnerability in order of priority. These were all done in order to condense the Delphi questionnaire.

3.9.2 Determine the order of presentation

The order which the questionnaire followed was one based on the Pressure and Release Model shown below *(Figure 3.2)*. The model was chosen as it outlines vulnerability factors as well as strategies which can be implemented to reduce vulnerability strategies.

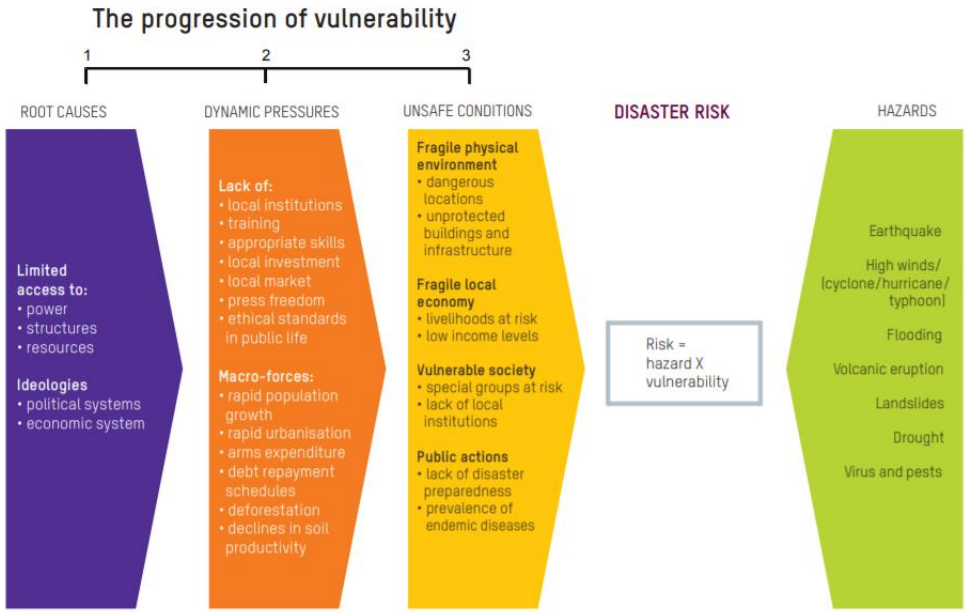


Figure 3.2: Progression of vulnerability (Smyth & Hai, 2012)

The first part of the questionnaire explored 'Progression of Vulnerability' factors, sub dividing them into 'root causes', 'dynamic pressures' and 'unsafe conditions'; a brief explanation of the three dimensions was provided. Participants were asked the level of importance statements related to the dimensions had in contributing to vulnerability in Maputo. The figures below illustrate how this was conducted:

Please indicate the level of importance each statement has in contributing to Maputo's vulnerability to floods:

- Lack of project continuity
- Lack of a consolidates institutional framework for dealing with disaster risk management
- Rapid urbanization leading to expansion of informal settlements
- Lack of local investment in drainage systems, sanitation and housing quality
- Relocating people to areas with no jobs
- Degradation of fertile land due to soil erosion
- Lack of access to local markets
- Lack of a culture of paying tax resulting in the absence of Municipality providing quality services
- Lack of data collection and technical knowledge in institutions
- Lack of mainstreaming and communication between stakeholders.

Please indicate the level of importance each statement has in contributing to Maputo's vulnerability to floods:

- Lack of project continuity
- Lack of a consolidates institutional framework for dealing with disaster

Please indicate the level of importance each statement has in contributing to Maputo's vulnerability to floods:

- Poor solid waste management systems
- Poor drainage systems which cause soil erosion leading to obstruction of roads
- Disappearance of mangrove forests making the city vulnerable to tidal surges
- Residents lack of responsibility to correctly dispose of solid waste
- Residents construct homes in flood plains
- Inadequate building material is used in urban settlements
- Maputo has nine hydraulic basins
- Destruction of coastal dunes
- Exposure to waterborne diseases such as cholera and malaria
- Rising sea levels have resulted in salt intrusion, affecting agricultural activities
- Natural flow of water is disrupted by pavements and roads

Please indicate the level of importance each statement has in contributing to Maputo's

Similarly, the second part of the questionnaire explored 'Progression of Safety' (*Figure 3.3*) factors which were sub divided into 'Address root causes', 'reduce pressures' and 'achieve safer conditions'. Participants were asked the importance that each strategy had in decreasing flood vulnerability in Maputo. Furthermore, they were asked to rank the top three strategies in order of importance from the list they had just rated.

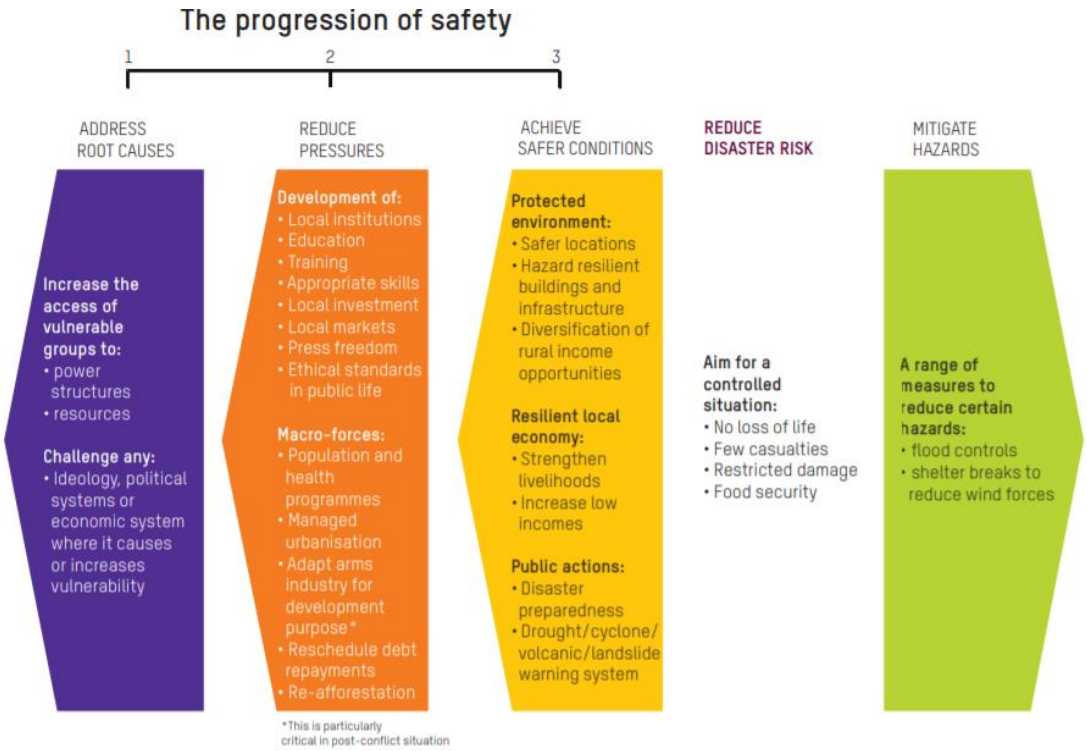


Figure 3.3: Progression of safety. (Smyth & Hai, 2012)

3.9.3 Write accompanying letter/request letter

Many participants who were invited to participate in the questionnaire were also interview participants, therefore, a line of communication had already been established which facilitated their participation. Participants were first contacted via email along with an information sheet which provided details about the project. The email sent thanked them for their previous participation, explained that the research methodology had to change due to Covid and asked them to fill the questionnaire. On the first page of the questionnaire, a brief introduction was given along with the request to tick the informed consent box- this was a requirement before allowing participants to complete the questionnaire. (Appendix C.)

Contacting Participants

Participants, or panel members, were contacted via email, WhatsApp and ResearchGate, an online journal platform. The researcher had the contact of a local resident, and consequently had access to further local participants through a snowballing sampling technique. In total, ten participants were identified using the snowballing technique. Several participants who had initially been previously invited for interviews were contacted, and five accepted to fill in the questionnaire. Further participants were contacted using ResearchGate by identifying published papers or books which aligned with the objectives of the study.

3.9.4 Test the questionnaire with a small sample

Piloting the questionnaires

The questionnaire was designed using the Qualtrics Software provided by the University of Huddersfield. Piloting participants were contacted via email and explained the purpose of the study and why they were being contacted- in total, twelve people were contacted, out of which six people responded. Apart from testing the questionnaire itself (link), participants were encouraged to comment on the length, appropriateness of words, question sequence and formulation, reliability, validity and whether it addressed the research objectives. In total, fifteen questions were asked based on a Delphi structure,

which included various statements asking participants to rank them from 'extremely important' to 'not applicable'. Additionally, participants were given a blank space and asked to include any statements they believed were missing from the list of given statements. Feedback given include "there is a need to explain the mechanism involved, how things are seen by you as working should be added to the question", "text boxes are usually very discouraging", "respondents feel it best when they use tick boxes and simple short answers". Collis & Hussey (2021) discuss this issue and term it as 'questionnaire fatigue' and it could lead to participants feeling bored or too tired to continue the questionnaire or even provide answers which do not reflect their opinion.

Piloting the questionnaires was a valuable way to evaluate response rates- only 50% of those approached responded, which was taken as an indication of how the 'real' Delphi would proceed. Several authors have pointed out that dropout rates in Delphi is very high due to the several rounds needed. Cere (2019) highlights the relationship between the number of rounds and response rates, that is, the more rounds, the higher the dropout rates. As a result, they deployed two rounds. The table below (*Table 3.7*) shows the dropout rates in different studies:

REFERENCE	SCALE TYPE	INITIAL PANEL SIZE	FINAL RESPONDENTS
Alshehri et al. [94]	5-point Likert	71	40
Labaka et al. [81]	5-point Likert	21	15
Elmer et al. [256]	6-point bipolar	55	45
Jordan et al. [248]	5-point scale	12	11

Table 3.7: Dropout rates (Cere, 2019)

When piloting the questionnaire, it was observed that if more than one round was completed, there was a potential risk of response rates dropping by the second round. Therefore, it was decided to conduct a standard questionnaire while still adhering to Delphi principles such as participants having to be experts and a consensus being reached. In addition to this, they were also asked to rank the top three priorities from the list of statements given which is an exercise that is conducted in the second and third round. Based on the feedback provided, the blank spaces were left out because they were seen as discouraging for participants. Instead, there was a space for participants to

share their thoughts if they believed that a statement was not applicable, which still gave participants a space to share their thoughts.

Piloting the translated versions

Given the context of the research and the nationality of participants, a Portuguese version of the questionnaire was produced. The participants had the options of an English and Portuguese version. This was to mainly accommodate local residents who may not have a strong English understanding, but the option was also offered to the local stakeholders. The questionnaires were first translated by the researcher, then second translated by a bilingual person who had some background to the study and ensured it was translated in a correct context and with accuracy. Because the translated versions were only going to be used by Mozambicans, it was important to test it with people in the country. Two participants were contacted to test the questionnaire- whether the questions were clear and in the correct context and the internet connection.

After the modifications were made based on the feedback, the final version was distributed (Appendix C). The majority of potential participants were contacted via email with the link attached, and for potential participants based in Mozambique, the link was sent through text message.

3.9.5 Choose method for distribution & return

As mentioned earlier, Qualtrics was used as a software to design the questionnaires. Compared to other software's such as SurveyMonkey, Qualtrics offer advanced features when it comes to design and reporting results. The software has a 'distribution' function which allows the user to distribute the questionnaire using various methods such as 'anonymous link', 'emails', 'social media', and 'QR codes'. All participants were invited to participate in the questionnaire via email with a link attached. Although the questionnaires could have been distributed directly through Qualtrics which would still have allowed the researcher to keep track of all participants who were invited to participate, a connection had previously been established through email, and furthermore, if participants had any queries or issues with the questionnaire, they were encouraged to contact the researcher via email. All responses were collected by Qualtrics, which allowed the researcher to track

the responses and prompt any participants who had not completed the questionnaire to do so. A notification was sent to the researcher whenever a questionnaire was completed.

3.9.6 Plan strategy for dealing with non-responses

There were a few responses which were incomplete/ not usable. In these instances, participants were contacted and asked via email to complete/fill in the questionnaire.

3.9.7 Expert selection process

One of the central considerations that a researcher employing a Delphi technique has to consider is the definition and identification of the panel members which is made up of 'experts'. Keeney et al (2010, p.7) define expert as "a group of informed individuals and as specialists in their field or someone who has knowledge about a specific subject", nevertheless, it can be argued that just because an individual has a deep understanding of a particular subject, does not equate them to an expert. Rowe and Wright (2001) are of the opinion that expertise shouldn't be decided based on role, seniority or power and in a similar vein, Hussler et al, (2011, p.1646) expressed that "the label 'expert' does not systematically indicate that an individual is capable of making judgements of greater validity". When selecting a participans to create a framework for community resilience, Alshehri et al (2015) included criteria such as participants years of experience in the field, number of publications published and other qualifications; when investigating definitions for climate change adaptation, Doria et al (2009, p. 812), used "academic publications databases, participation in scientific conferences, and professional networks" as criteria, and Almutairi (2019, p.103) used "international experts, professionals and highly informed local experts from the world of academic, government and non-governments", with a minimum of five years of experience in the field and a relevant degree.

The criteria used in this study were similar to the criteria's used when selecting interview participants:

- Their experience with supporting Maputo with floods,
- Experience and knowledge in flood management (in Maputo and similar cities),

- Local stakeholders and industry players with their mission being to enhance community resilience to floods and provide support in times of crisis.
- Researchers who had published journal articles with the following key words: ‘climate change’, ‘Mozambique’, ‘Maputo’, ‘flood adaptation’, ‘communities’, ‘drainage’, and ‘urban poor’. Participants contacted via Research Gate were identified by their skills and expertise tags such as ‘climate change’, ‘flood risk’, ‘climate vulnerability’, ‘disaster reduction’, ‘climate adaptation’ and ‘cyclones’.

Following on what makes an expert, another important aspect is the process of selecting a panel of experts. There is an agreement among researchers that employing a heterogenous panel is preferable (Doria et al, 2009; Rowe & Wright, 2011; Hussler et al, 2011). As this ensures participants of various backgrounds and geographical locations are involved. Alsheheri et al (2015, pg.2227) takes the same stance and explains that by employing a diverse panel, both in terms of background and geographic location ensures “non-context specific issues that may be overlooked by local participants” are explored and thus “ensure a more holistic, objective and positivist grounding of the resulting framework”. This study adopted the same stance and agrees that employing participants from different countries and backgrounds provided different views and perspectives. In total, six different geographical locations took part in the questionnaire.

There has been no agreement when it comes to the number of acceptable panel members. Hang et al (2019) consider 10-15 participants enough; Alshehri et al (2015) believe an acceptable number is between 20-50 experts; Doria et al (2009) agree that 15-60 is considered acceptable; on the extreme end, Wild (2000); cited in Keeney et al (2010) suggested that a panel of 300-500 best presents information which is representative. The most common recommended and agreed upon size according to Endacott cited in Alshheri et al (2015) is between 15-30 people. Despite the vast range, Alsheri et al (2015) suggests that instead of drawing too much attention on the number of experts, researchers should focus on acquiring a variety of experts in order to get as many perspectives as possible, which is what this study attempted. The diversity of the

participants was not only reflected in the geographical distribution of the participants, but also in their roles and organisation (discussed in greater detail in section 4.2).

To identify participants, this study adopted a purposive sampling technique and snowballing. In a purposive technique, the intension is to seek out participants with experiences of the phenomenon being investigated and the potential to provide rich in-depth knowledge (as discussed previously). A snowballing sampling technique is conducted by initially identifying relevant participants, and consequently asking those participants to identify "other participants who have had the same experience or characteristics relevant to the research" (Bryman, 2016, p. 15). The two techniques differ in that with purposive sampling, the researcher explicitly decides on the criteria for choosing participants before beginning data collection and does not consider any potential participant who may come up from a contact.

How to obtain consensus?

Obtaining consensus is one of the main objectives when conducting a Delphi questionnaire. Graham et al (2003, p. 1152-1153) defined consensus as a "condition of homogeneity or consistency of opinion among the panelists".

While the concept of achieving consensus within a group may be simple, the question of how best to measure it has been less evident. Various statistical methods have been applied to determine consensus such as standard deviation, chi-square, average, median and interquartile range, however, even among these statistical tools there are variations: Cited in Keeney et al (2010), William and Web (1994) believed 100% agreement meant consensus; Stewart et al (1999) thought 95%; Putman et al (1995) thought 80%; Keeney et al (2006) 75% and Loughlin & Moore (1979) 51%. Crisp et al (cited in Hasson et al, 2000) has criticised the use of statistical analysis and suggested that the consistency of responses across each round should in itself be an indicator of consensus. Both Labaka et al (2016) and Alshehri et al (2015) used a 5-point Likert scale but calculated consensus differently. Hong et al (2019) considered consensus to have been reached with a 0.80 or

more agreement index, whereas Alshehri et al (2015) believed that the interquartile range was a stronger determiner of consensus and therefore considered an interquartile range of 20% to be acceptable. Furthermore, Alshehri et al (2015) also used standard deviation: a SD close to 0 meant that the panel had a strong consensus, whereas if the SD was 1.5 or greater equated to a weak level of consensus. In the context of this research, 50% was considered to have reached consensus due to the diversity of roles and geographical locations. These factors meant that their experiences and perceptions would be different, so therefore, the level of consensus had to baselined.

Critiques of the method

While the anonymity nature of the technique is seen as a bonus, for others this has been a point of dispute. Graham et al (2003) points out that the lack of interaction between the panelists is seen as a downfall as the consensus which is reached will have been derived solely from the information given by the researcher and not as a result of a discussion with other panelists. On the other hand, however, anonymity, as Keeney et al (2010) state, allows panelist to freely express their opinion without the fear or intimidation from more influential panel members, which is a factor in focus groups, but instead, panelists have the opportunity and the freedom to be truthful and open regarding their opinions.

Another criticism that the technique has faced is the researchers bias, both with regards to the scope of the topic (Graham et al, 2003) and the sampling approach (Hasson et al, 2000). Graham et al (2003) explain that as the researcher decides on the scope of the issue being explored, they greatly influence the degree to which the panelist can explore the topic. This limitation can be overcome by allowing panelist to input their own opinions and views in round one. Another bias from the researcher can emerge when selecting the panel members. In most instances, purposive or criterion sampling is deployed to identify panelists as they must be ‘experts’ in their field, meaning they are not randomly selected which implies a non-representative sample.

One of the main issues encountered while administering the online questionnaire was the lack of completion of all the questions. It is unclear whether this was due to not

understanding the questions or technical difficulties. Brace (2013) outlines that there are several problems caused by the writer which can be encountered when administering questionnaires online such as: question ambiguity, inappropriate codes, and also those encountered by the respondents such as not understanding the question and boredom.

3.10 Validity and Reliability

The validity and verification of qualitative data has been widely debated (Gill et al, 2008; Lazar et al, 2017; Appleton, 1995). Analysing qualitative data is more subjective compared to quantitative analysis due to its interpretative nature and the belief of social scientists that reality is created in people's mind, hence, a universal truth is unattainable. However, Lazar et al (2017) points out that this shouldn't be seen as a drawback, but instead, that social researchers should embrace the subjectiveness which is associated with interpreting qualitative data and attempt to present data which is a representation of diverse viewpoints.

Reliability of data is a key attribute of social research. It is defined by Appleton (1995, p. 996) as "the degree of consistency or dependability with which an instrument measures the attribute it is designed to measure". In the context of this study, the reliability can be attributed to the how it detailed its methods and hence, its replicability for further research. Additionally, the novel conceptual framework (discussed in further detail in Section 5.7) can be replicated and applied in other similar settings such as Zambia and Zimbabwe, which are also affected by flooding in urban communities (UNICEF, 2019).

3.10.1 Data Validation:

To validate the reliability of the current study, the research made use of different data collection methods as discussed above.
Visually, the process followed the following sequence *(Figure 3.4):*

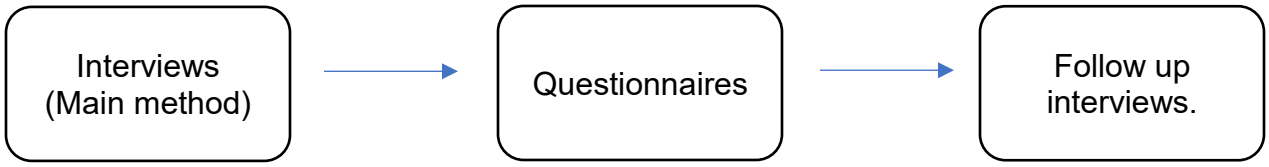


Figure 3.4: Data collection phases (Authors Own)

The purpose of engaging with the three methods was, firstly, to interact with different participants, which was done by interviewing both academics and professionals in the field. Additionally, the questionnaire allowed community members to engage with the research. Secondly, it was to ensure that the data was reliable, hence, reaching data saturation. Faulkner et al (2017) describe data saturation as “the point in the research process when no new information is discovered in data analysis, and this redundancy signals to researchers that data collection may cease.” This is an important consideration in any research as it not only ensures the validity of the study, but also its credibility.

The design and structure of the questions in each phase was also intended to validate the data *(Table 3.8):*

	Phase 1: Interview	Phase 2: Questionnaire	Phase 3: Follow up interviews
Question:	What are your main priorities when you are called to respond to floods?	Please rank the three strategies you believe should take priority from the list above.	From the results gathered, to what extent do you agree that these actions should take priority?
Question:	What would enhance resident's ability to deal with floods?	Indicate the level of importance: strengthen the role of communities by training community committees and providing appropriate tools.	From the results gathered, how important are community responses?

Table 3.8: Questions asked and data validity.

Data gathered through the above process ensured that any discrepancies were addressed.

3.10.2 Triangulation:

The term 'triangulation' is often associated with mixed methods approach. Sage Research Methods (2010, p.1) define it as "the practice of using multiple sources of data or multiple approaches to analysing data to enhance the credibility of the research study". This shows that triangulation spills from just involving different data collection methods, to also including different samples and the way data is analysed, synonymous to the principles of mixed methods. Collis and Hussey (2021) note that triangulation involves collecting data both at different times and from different sources.

Sage Research Methods (2010) note that there are different purposes of using triangulation; while some researchers view it as essential in establishing reliable data, others use it to gather multiple perspectives and interpretations which enrich the data.

Bryman (2016) highlights that one of the objectives of this is so that findings are cross-checked.

Triangulation in this research was used by conducting follow up interviews with experts. The Covid pandemic affected the data collection process as potential participants were reluctant to participate due to limited availability and resources. In order not to compromise on the quality of data, follow up interviews were conducted after completing questionnaires and in-depth interviews. The aim was to present the results and ask the participants to comment upon them. Doing this meant that it verified the previously collected data and 'closed the loop'. Scott (2010) agrees with this stance and points out a link between epistemology and triangulation; the author demonstrates that if the two methods reach the same conclusion, the author can resolve that their accounts are its truest version of truth. Scott (2010) further concludes that when elements of qualitative and quantitative research are combined to address a research question and produce supporting results, it increases the credibility and reliability of the study.

3.10.3 Reflexivity

Critiques of qualitative methods state that it is highly subjective in its approach as past experiences, culture can influence how the research interprets data. Barnham (2015, p.840) concurs and states that interpretation is "essentially a construction in the mind of the researcher", which can be addressed using reflexivity.

One way to increase validity is through what Bernard et al (2008, p.431) refer to as 'constant comparison'. This involves the researcher continually reading and re-visiting emerging themes and constantly questioning their meaning. Another way for the researcher to ensure validity is by using reflexivity. Reflexivity involves "critical reflection of how the researcher constructs knowledge from the research process" (Guillemin & Gillam, 2004, p. 275); this can be done if the researcher is aware of their own personal experiences and perception and ensure that these don't have an influence on how the research is planned, or how data is collected and analysed; essentially, it involves the researcher constantly taking a step back from their research. Lazar et al (2017) encourage researchers to instead of fixating to explain the phenomenon by using their

chosen theory, they should keep an open mind about explaining the data using alternative frameworks or theories. Although this may discredit the initial framework, it will allow the researcher to explore new frameworks and have a discussion about which one fits better which produces a compelling argument. Lazar et al (2017) believe that validity can be ensured through using third parties to verify the analysis. However, due to the subjective nature of qualitative analysis, this might not be very effective as different researchers may interpret the same raw data differently with each interpretation being equally valid.

3.11 Ethical Considerations

Knowing to anticipate potential ethical issues is important when conducting social research as it involves collecting information from people, and as Creswell and Creswell (2018) point out, ethics needs to be considered at all stages of the research process. Prior to contacting participants, this research underwent a review which was later approved by the University Research Ethics Committee. (Appendix D) This involved stating the overview research methodology, any permissions for the study, access to participants, recording and storing data, informed consent, any harm, confidentiality, and anonymity, as well as right to withdraw. Although different institutions have their own set of policies, there is a consensus that the following principles should be adhered to (Collis & Hussey, 2021; Creswell & Creswell, 2018):

- Privacy
- Anonymity & Confidentiality
- Informed consent
- Publications
- Dignity

Anonymity refers to “the assurance given to participants and organisations that they will not be names in the research” (Collis and Hussey, 2021, p.29). This means reassuring participants that nothing they share will be traced back to them. For some, this is an important reassurance as they may feel more comfortable sharing sensitive information, whereas for others, they may want to be identified for status reasons. Although

maintaining anonymity and confidentiality in research is imperative, it is important to consider the research context.

Due to the nature of participants being 'experts', they were asked about their role, organisations they work in and highest level of education. Although the names of the participants were not divulged, their role & organisations were important factors in order to meet the criteria of the questionnaire. A further reason why their role and organisations was an important factor was that some may argue that the number of participants was low; however, it can be argued that the quality of participants surpasses the number of participants.

Informed consent is one of the most important elements in ethical research in which participants are informed of the research and agree to freely participate. Court et al (2018) allude to the implication of signing a consent form; the authors state that participants need to be fully *informed* of their involvement in the research as well as any future implications. Therefore, upon acceptance of an interview request, all interview participants were sent an information sheet along with a consent form. Participants were invited to read the information sheet and only after agreeing to the terms were they requested to sign the consent form. The information sheet had the purpose of explaining to the participant the following (Appendix E):

- What the research is about
- What their involvement would be
- How, if they chose to, could they withdraw from the study and who to contact
- What the information will be used for
- How the data would be kept confidential and anonymised
- Who had reviewed the study.

Only when they had read and understood the terms were they invited to sign the consent form. The consent form ensured that they (Appendix F):

- Had been informed of the nature and aims of the study
- Understood that they had the right to withdraw from the study at any point
- Understood that the interview would be recorded

- Understood that no one else had access to the information provided
- Understood that their identity would be protected.

With reference to this research, ethical considerations concerning cultural differences had to be addressed. In some cultures, as is the case in Mozambique, as a token of appreciation, participants may expect grants or gifts, which in western cultures, could be seen as unacceptable or even as a bribe (Silverman, 2007). This was addressed and avoided by clearly communicating to participants that their agreement to participate in the research was entirely voluntary. This issue did not arise with any participants; they were all more than happy to participate and most of them were kind enough to send additional resources such as links and reports following the interview.

An ethical issue which arose with the interviewees was that some didn't sign the consent form before the interview. In most instances, they had read the information sheet and consent form and just hadn't had a chance to sign and send it back. With the questionnaires, participants were given a brief overview of the project and the aims of the questionnaire; they were reassured that information gathered would remain confidential, participation in the questionnaire was entirely voluntary, contact information of the researcher and approximate completion time of the questionnaire. Finally, participants were asked to tick a consent box if they were happy to proceed.

3.12 Chapter summary

This chapter has discussed the methodological considerations which the research has undertaken. Firstly, a recap of the aims and objectives was given (Section 3.2) and this was followed by a discussion of the different philosophical approaches and explored why pragmatism with a constructionist approach is the most suitable (Section 3.3.3). Due to Covid, the data collection process had to be revised (Section 3.4). Consequently, the reasons why a mixed method approach was adopted were discussed with reference to the philosophical approach chosen. The chapter then discussed interviews and questionnaires and explored different processes on conducting each. Section 3.8 demonstrates the link between the research objectives, questions and conceptual framework. Consequently, Section 3.10 discussed factors which contributed to the validity and reliability of the study. The chapter then closes by exploring the ethical considerations (Section 3.11).

CHAPTER 4: PRESENTING THE FINDINGS

PART A: INTERVIEWS

4.1 Introduction to the chapter

As discussed in section 3.5, the current study adopted a mixed method approach to collect data. Due to Covid, the methodology was revised which resulted in the study being divided into three phases: in phase one, in depth interviews were conducted with experts in the field of flood response in Maputo. The way the findings are presented in this chapter reflect the order in which they were done. The interviews, which were the dominant method, were conducted with twelve participants who had experience and/or were involved in responding to floods in Maputo and were designed to address objectives one and two:

1. Identify CBA strategies being implemented by urban community residents.
2. Appraise the role of stakeholders in aiding residents to adapt to the impacts of floods.

In phase two, questionnaires were completed by experts as well as local community members. The structure of the questionnaire was designed based on the Pressure and Release Model, ie, the questionnaire followed the principles of 'Progression of Vulnerability' and 'Progression of Safety'. These two principles were important as they capture both what the participants thought were the causes of vulnerability and how they thought this could be addressed. However, the content of the statements was guided by all models (Model of Vulnerability, Sustainable Livelihood Framework & Pressure and Release Model'). The aim of the questionnaire was to capture with the aim of determining what respondents believed to be the causes of.

While the questionnaires and the follow up interviews offered valuable data, the in-depth interviews were the dominant method. The aim of conducting questionnaires and follow up interviews was primarily to support the findings of the in-depth interview, enhance the quality of the study, gather thoughts and opinions from community members (questionnaire), and consolidate and triangulate the data initially obtained. In phase three, follow up interviews were conducted with three participants, two of whom had previously completed the questionnaire and taken part in the in-depth interviews.

This chapter is divided into two sections. Part A presents the findings from the in-depth interviews which were conducted with 'experts' in the field. It starts by giving an overview of the interview participants (Section 4.2), followed by explaining the process of identifying emerging themes using Gill's et al (2008) four stages (Section 4.3). Part B presents the findings from the questionnaire and the second round of in-depth interviews.

4.2 Interview Participants

One of the objectives set out in this study was to understand the role various stakeholders play in responding to climate crisis in Maputo. To this effect, a purposive sampling strategy was used to achieve the following:

- Identify organisations based in Maputo.
- Contact local stakeholders who had previously been involved in providing flood relief or had collaborations with agencies responsible for flood management.
- Communicate with researchers who had published papers and reports about floods in Mozambique.

In total, twelve interviews were conducted with NGO's, civil society organisations and international organisations. Out of the twelve, eight participants had been involved in responding to Cyclone Idai which hit Mozambique in 2019, affecting approximately 50,000, and hundreds of deaths (IPCC, 2022). The interviews were conducted between September and October 2020 (one month). The duration of the interviews ranged from thirty to ninety mins. Three interviews were conducted in Portuguese and translated to English. To protect their identity, each participant was given a pseudonym, while their occupation/position was disclosed. Although this research focuses on flood adaptation in urban communities in Maputo, it acknowledges the importance of appreciating global perspectives on the topic. This was shown in the level of expertise foreign participants had on the research context. The figure below *(Figure 4.1)* shows the geographical distribution of participants:

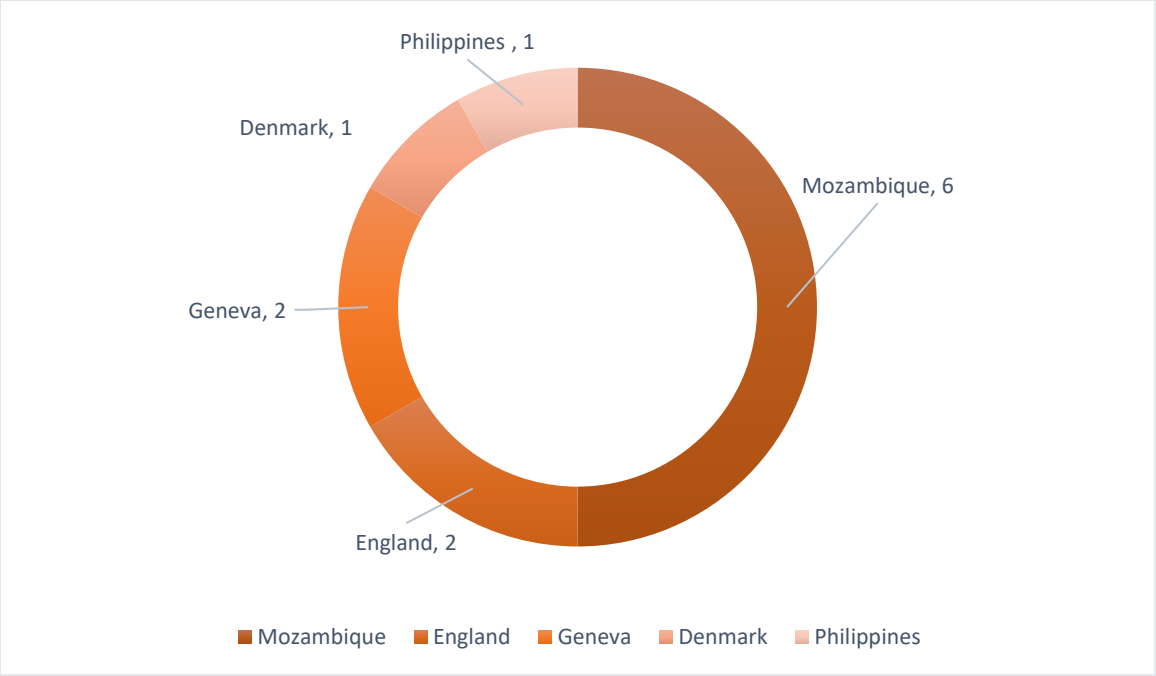


Figure 4.1 Geographical distribution of participants (Authors own)

Furthermore, it was also beneficial to learn and become familiar with strategies countries with similar geographic location and physical vulnerabilities to Mozambique are implementing, which was the case of Philippines. The country is highly susceptible to natural hazard-induced disasters such as earthquakes and tropical cyclones. According to Statista (2023), it is the country with the highest global disaster risk index.

The table below *(Table 4.1)* outlines the interview participants along with how they are involved with flood response:

Pseudonym	Organisation	Based In	Job description	Degree of involvement in flood response
1. **Aaron**	Nordic Development Fund	Denmark	Provides climate finances on a grant basis to the government.	Collaborates with local meteorological station to strengthen data collection, processing and dissemination of information.
2. **Antoine**	SIDA: Swedish Embassy	Mozambique	Liaisons between Swedish Embassy, Mozambique partners & other organisations.	Supports and manages national disaster management programmes.
3. **Ben**	UN HABITAT	Mozambique	Head of Programme: Liaisons between UN & humanitarian & development partners.	Provides technical assistance during emergencies. Risk mitigation of disasters, urban resilience & planning.
4. **Cindy**	ActionAid Mozambique	Mozambique	Emergency Project Manager	Provides emergency relief aid to communities. Responded to the 2019 cyclones (Idai & Kenneth).
5. **Deborah**	United Nations	Philippines	Focal point for Disaster Risk Reduction, humanitarian & emergency affairs.	Involved in setting up the United Nations SENDAI framework.
6. **Daniella**	UNICEF Mozambique	Mozambique	Child Protection Specialist: Coordinator for Child Protection Working Group.	Respond to humanitarian emergencies. Coordinate & lead coordination mechanism together with government counterparts.
7. **Fay**	Irish Aid	Mozambique	Vulnerability advisor: focal point of climate change Disaster Risk Reduction.	Liaisons with government and INGC to train local committees. Provides financial assistance.

8. **Gregg**	UNDRR	Geneva	Head of Communication for the UNDRR. Advocacy, writing opinion pieces, speeches & press releases.	Reports on disaster occurrences and provides expertise knowledge to Mozambican technical staff.
9. **Jasmine**	RE-ACT	England	Operations Manager	Provided emergency support to IDAI victims in the first 24-48hrs.
10. **Jack**	UNDRR	Geneva	Liaison between Japan and Geneva in UNDRR affairs	Provides expert knowledge regarding Japan's vulnerability to climate change.
11. **Natasha**	Sheffield University	England	Professor in climatology. Research on how to respond to climate change.	Conducted in depth research on communities' vulnerability to floods in Mozambique
12. **Pablo**	National Institute of Disaster Management	Mozambique	Coordinated programmes for disaster risk management & resilience	Strengthen local committees for disaster risk management; contributes for policy reformulation.

Table 4.1 Profile of participants (Authors Own)

4.3 Identifying Emerging Themes

As stated in section 3.7.2.3 the present study utilises thematic analysis as a method of analysing the data. This approach involved the process of becoming familiar with the data by identifying common key words and meanings and grouping them under themes (Cameron and Price, 2009). This approach was chosen for two reasons. Firstly, it aligns with the philosophical lens adopted in this study, that is, pragmatism with an interpretive approach, therefore, using thematic analysis allows the researcher to investigate the social phenomenon by interpreting the interview transcripts and attempting to making meaning from them. Secondly, it's an analysis approach by which objectives one and two of the study can be explored by constructing and forming an understanding of the roles of community members and local stakeholders.

To develop the four themes, the study implemented Gill et al's (2008) four stages as mentioned above:

1. Read the transcribed interviews and make notes of any theories, words or phrases which summarise what is being said in the text.
2. Gather all words, theories and phrases from stage one; eliminate repetitions and look for overlapping categories/themes. Further refine categories.
3. Allocate a colour to each category/theme and colour code the interview transcripts according to each corresponding category.
4. Assemble all texts which correspond to the same colour code in one page; then the researcher can start to interpret the text.

The table below *(Table 4.2)* highlights the similarities between Gill et al's (2008) process of theme identification with that of other authors.

	Phase 1	Phase 2	Phase 3	Phase 4
Gill et al's (2008)	Read the transcribed interviews and make notes of any theories, words or phrases which summarise what is being said in the text.	Gather all words, theories and phrases from stage one; eliminate repetitions and look for overlapping categories/themes. Further refine categories.	Allocate a colour to each category/theme and colour code the interview transcripts according to each corresponding category	Assemble all texts which correspond to the same colour code in one page; then the researcher can start to interpret the text.
Alhojailan (2012)	Data must be read at least twice. Researcher to analyse the data word-by-word, identifying any significant patterns.	Highlight sentences that could be used to answer the research question.	Use sentences which were previously highlighted to break down the data further. "We highly recommend pawing through texts and marking them up with different coloured highlighter pens" (Alhojailan, 2012, p.16)	Data is prepared for identifying themes.
Cohen et al (2017)	'Immersion' in the data.	Dividing the data: filtering,	Categorising and classifying	Synthesizing and recombining the data

Table 4.2: Similarities between Gill et al's model and other authors (Authors Own)

One of the reasons why this model was used was because of its simplistic structure.
In order to develop the themes, the study implemented Gill et al's (2008) four stages. For demonstration purposes, extracts of transcripts were copied here and the emergence of the theme 'Culture' is explained. The same steps were followed for all four themes.

Stage 1: Read the transcribed interviews and make notes of any theories, words or phrases which summarise what is being said in the text.

The first stage involved becoming familiar with the transcript. In reality, this stage initially began while transcribing the transcripts. During this process, the researcher started identifying common words and themes. The notes made on the margins are notes which summarise what is being said by the participants. The following are extracts from four interviews:

the government isn' t always able to because there are generations after generations of people who have been living in the same regions; that is where they have their loved ones buried, that is where their spirits are.

Because those generational practices; that when the sun was like this and when the rain was like this- it' s a time to plant. All this is altered. So the communities are very conscious that the climate has changed

There is a cultural pra
homes for generations
attachment to the hom
the government strugg
safer areas. People us
understand climate ch

Because they say 'no, I cant leave this place because my grandfather lived here, my father lived here, and this has never happened, then why will it happen today'. People don't want to understand that we live in different times compared to when our grandfathers lived. Its indeed the change of behaviour that makes them more vulnerable

what makes them more vulnerable is the matter of resisting to change their mentality, their behaviour

This echoes what the p
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what contributes to the

Particularly, the older generations who had been in the community and had farming in the community for years were very well aware and could tell you that 10 years ago this is what happened and this is how we used to be able to do things and now we are having to modify and do it this way. So yes, very aware.

Flooding in the past was from generation to generation, but now we experience in one same year 2 floods, every two years we can experience floods. There is more understanding. they know that during the season when x son was born, the river was this height. See how they rationalize their knowledge. When this grandfather died, we experienced such drought. The proper limits of the affected regions, the communities and leaders are able to say that it reached the border with X, so they have that knowledge

Communities are unders
and natural disasters th
their farming practices.

One thing which is clear and evident is the change when each season starts. The rainy season varies a lot. We have noticed times when we have intense rains even in January which was strange in previous years but now its happening.

Participants explain th
significant past exper
flooding.

Figure 4.2: Stage 1: Identifying key words, phrases summarising what is being said

Stage 2: Gather all words, theories and phrases from stage one; eliminate repetitions and look for overlapping categories/themes. Further refine categories:

The second stage was an extension of the first as it involved collating all the key words and phrases from stage one.

the government isn' t always able to because there are generations after generations of people who have been living in the same regions; that is where they have their loved ones buried, that is where their spirits are.

Because those generational practices; that when the sun was like this and when the rain was like this- it' s a time to plant. All this is altered. So the communities are very conscious that the climate has changed

Because they say 'no, I cant leave this place because my grandfather lived here, my father lived here, and this has never happened, then why will it happen today'. People don't want to understand that we live in different times compared to when our grandfathers lived. Its indeed the change of behaviour that makes them more vulnerable

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One thing which is clear and evident is the change when each season starts. The rainy season varies a lot. We have noticed times when we have intense rains even in January which was strange in previous years but now its happening.

- Generations after generations
- Generational practices
- All is altered
- Communities are very conscious that the climate has changes
- Grandfather lived here, my father lived here
- People don't want to understand that we live in difference times
- The change of behaviour makes them more vulnerable
- What makes them more vulnerable is the matter is resisting to change their mentality, their behavious
- Older generations
- Generation to generation
- 10 years ago that is what happened and this is how we used to be able to do things and now we have to modify and do it this way
- They know that during the rainy season when x son was born, the river was this height.

Figure 4.3: Stage two: gather key words and phrases.

Stage 3: Allocate a colour to each category/theme and colour code the interview transcripts according to each corresponding category:

the government isn' t always able to because there are generations after generations of people who have been living in the same regions; that is where they have their loved ones buried, that is where their spirits are.

Because those generational practices; that when the sun was like this and when the rain was like this- it' s a time to plant. All this is altered. So the communities are very conscious that the climate has changed

Because they say 'no, I cant leave this place because my grandfather lived here, my father lived here, and this has never happened, then why will it happen today'. People don't want to understand that we live in different times compared to when our grandfathers lived. Its indeed the change of behaviour that makes them more vulnerable

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they know that during the season when x son was born, the river was this height. See how they rationalize their knowledge. When this grandfather died, we experienced such drought. The proper limits of the affected regions, the communities and leaders are able to say that it reached the border with X, so they have that knowledge

Figure 4.4: Stage three: colour code categories / themes

Key:

Generational Differences

Behaviour and Practices

Lived Experiences

Stage 4: Assemble all texts which correspond to the same colour code in one page; then the researcher can start to interpret the text:

the government isn' t always able to because there are generations after generations of people who have been living in the same regions; that is where they have their loved ones buried, that is where their spirits are.

Because those generational practices; that when the sun was like this and when the rain was like this- it' s a time to plant. All this is altered. So the communities are very conscious that the climate has changed

Because they say 'no, I cant leave this place because my grandfather lived here, my father lived here, and this has never happened, then why will it happen today'. People don't want to understand that we live in different times compared to when our grandfathers lived. Its indeed the change of behaviour that makes them more vulnerable

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Flooding in the past was from generation to generation, but now we experience in one same year 2 floods, every two years we can experience floods. There is more understanding. they know that during the season when x son was born, the river was this height. See how they rationalize their knowledge. When this grandfather died, we experienced such drought. The proper limits of the affected regions, the communities and leaders are able to say that it reached the border with X, so they have that knowledge

Figure 4.5: Stage four: Collate corresponding colours

Generational Differences:

- Generations after generations
- People who had been living in the same regions
- That is where their spirits are
- Generational Practices

Behaviour and practices

- The government isn't always able to
- People don't want to understand that we live in different times compared to when our grandfathers lived
- The change of behaviour makes them more vulnerable

Lived Experiences

- When the sun was like this and when the rain was like that
- All is altered Could tell you that 10 years ago that is what happened
- See how they rationalize their knowledge.

From the above process, four themes were identified: Infrastructure, intersectoral dynamics, community involvement and culture. These themes were further divided into sub themes as shown in *Figure 4.6*. As interviews were the dominant method, this chapter explores the themes derived from the interview findings, and supports it with questionnaire findings, and consolidates it with the follow up interviews.

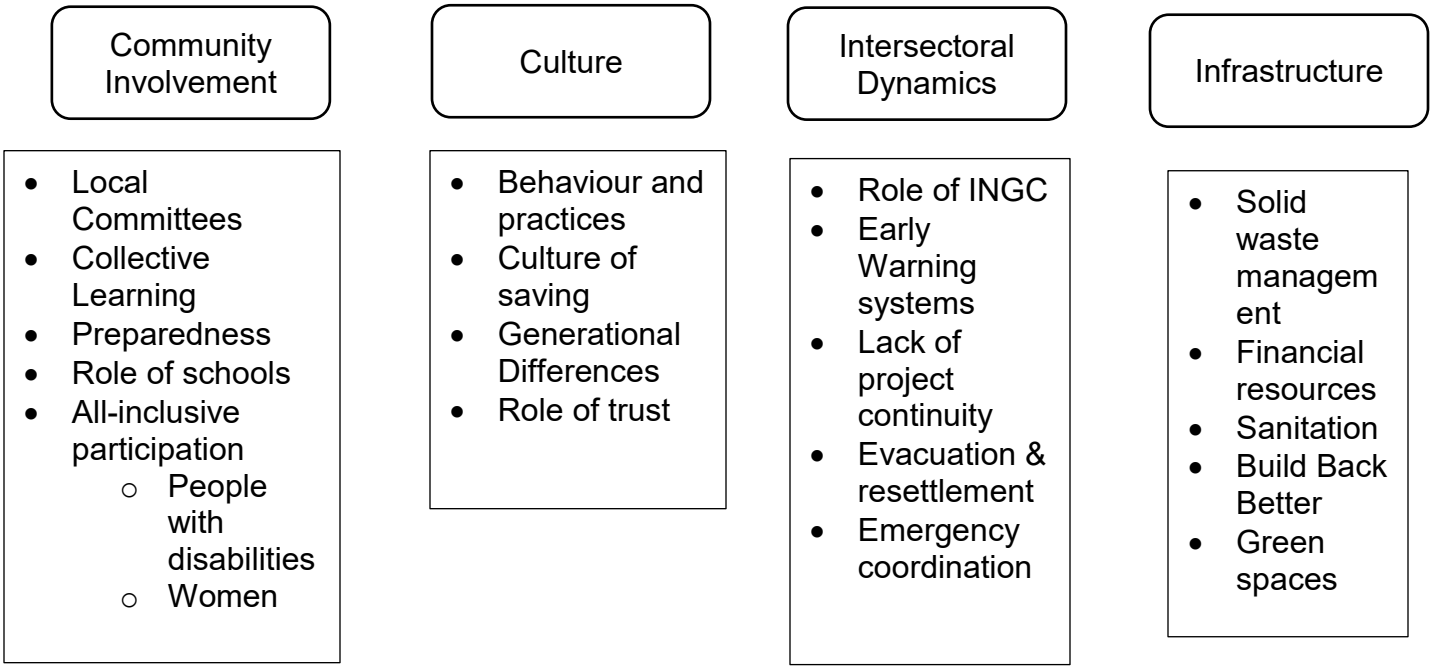

Figure 4.6 Summary of themes (Authors Own)

The table below shows different statements made by the participants regarding each theme:

Theme	Quotation	Brief Ana
Community Involvement	*"activity that the community approved was to open the road of formal segment because the road was a problem for evacuation"* "*we work directly with the community when it comes to DRR because the community is the one that has to go there and implement the actions".* "*It's the committees who work to try and save people and the protection of communities".*	Local community committees trained in areas most vulnera Committee members act as f event of a disaster, thereby,
Culture	"*what makes them more vulnerable is the matter of resisting to change their mentality, their behaviour".* *They say 'no, I cant leave this place because my grandfather lived here, my father lived here, and this has never happened, why then will it happen today?'"* *"there are generations after generations of people who have been living in the same regions; that's where their loved ones are buried, that is where their spirits are. Its challenging"*.	Culture and risk perceptions the extent to which communi to respond to climate risks. T perception, the more likely th adaptive strategies.
Intersectoral Dynamics	"*trying to put a system together like not working in isolation-like community by themselves, INGC by themselves… but how can we connect and work at local and central level".* *"you need the whole society engaged for a successful DRM plan to work; it has to be across all sectors…you need a multi-sectorial approach and you need a governmental approach to successfully manage and prevent disasters"*	There are several key player responding to natural hazard crucial that they all respond i supportive manner. This ther act together.
Infrastructure	*"There are certain technical criteria within civil engineering which have to be complied to. But the risk continues"*. *"water management infrastructures are very poor…road systems obstructed… poor land use management…".* *"infrastructure is very limited in terms of communication".*	Rapid urbanisation has led to number of residents in Mapu the city being overpopulated, natural flow of water which c surface runoff.

Table 4.3 Brief analysis of themes. Authors own

PART B:

QUESTIONNAIRES & FOLLOW UP INTERVIEWS

4.4 Questionnaire Participants

4.4.1 Number of Responses

In total (*Figure 4.7*), 80 participants attempted the questionnaire, but only 34 of the results could be used for analysis. One reason for this gap could be due to the length of the questionnaire. Participants could have experienced what Collis and Hussey (2021) refer to as 'questionnaire fatigue' in which the questionnaire could be too long and result in participants feeling tired or discouraged to proceed. Although it could be argued that the questionnaire was lengthy, the researcher did not want to compromise on the quality of responses that the questionnaire provided. The questionnaires were completed between September 2020 and October 2020 (one month), and on average, participants took 15-20 minutes to complete it.

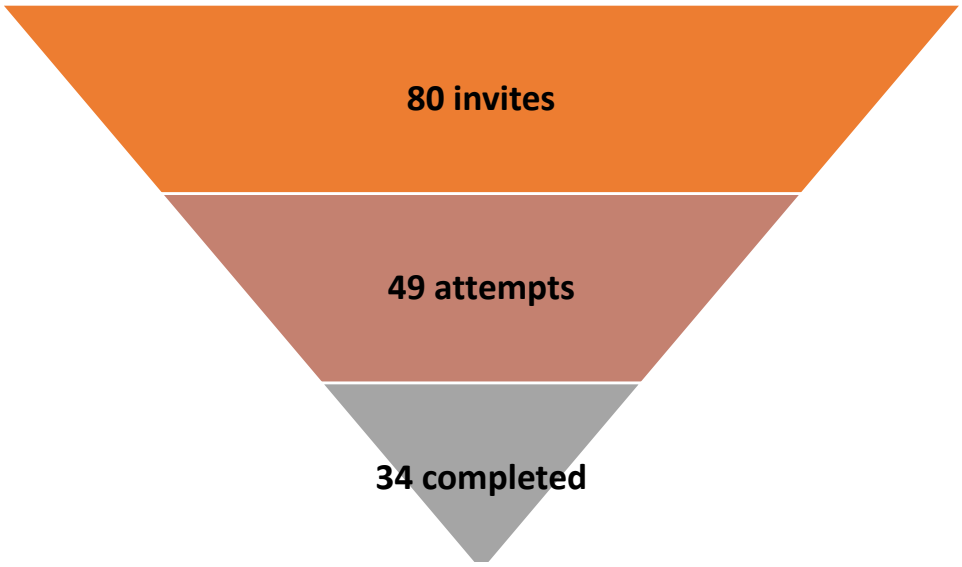

Figure 4.7 Summary of questionnaire participants (Authors own)

Although more participants, especially community residents, would have been preferred, the researcher must contend with the fact that challenges associated with Covid were addressed where possible. Due to travel restrictions, it was challenging getting access to community members. To complete the questionnaire, participants needed access to the internet, therefore, this also hindered community participation due to their limited internet access.

4.4.2 Geographical Distribution

As natural hazard-induced disasters are experienced on a global scale, it was important to invite participants from different countries to get their views and perspectives. The figure below (*Figure 4.8)* shows the geographical distribution of participants. In total, 6 countries were represented, with almost three quarters being from Mozambique (n=25). The UK represented a quarter of the participants (n=5), as the other countries (Philippines, Denmark, South Africa and Italy) had one participant each.

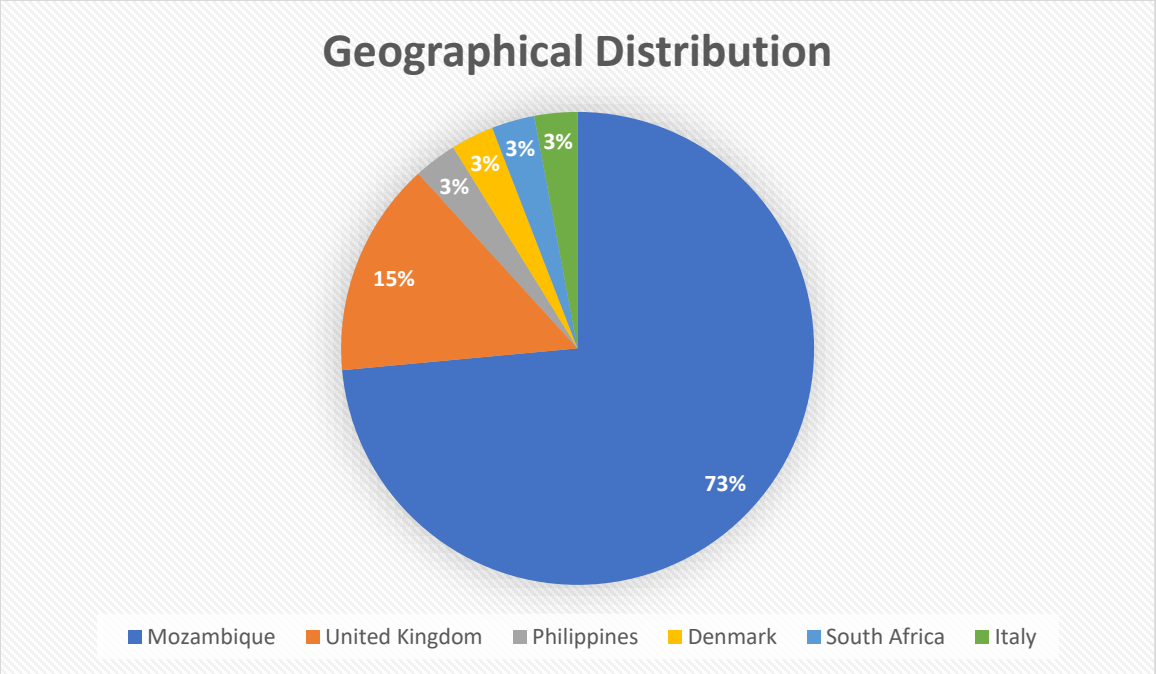

Figure 4.8: Geographical distribution of participants (Authors own)

4.4.3 Profile of Participants

As discussed in section 3.9.1, participants that were invited to participate in the questionnaire were considered experts in their fields and this was reflected in their professions and roles. To get a community perspective, community members were also invited to participate. *Table 4.4* classifies the professional participants by academia and industry and states the organisation they represent.

Expert	Organisation
Industry/consultancy (International)	• WaterAid • Nordic Development Fund • eThekwini Municipality • Philippines Permanent Mission to the United Nations (Foreign Ministry Philippines) •
Industry / consultancy (National)	• National Institute of Disaster and risk reduction Management (x5) • Provincial Service of Economic Activities in Maputo Province. • United Nations Human Settlement Programme (UN-Habitat) • United Nations Development Programme (UNDP) • ActionAid Mozambique • Mozambique Red Cross • Swedish Embassy • Urban development consultant
Academia (International)	• Natural Resources Institute, University of Greenwich (UK) • University of Huddersfield (x2) (UK) • Politecncio of Turin (Italy) • University of Sheffield (UK)
Academia (National)	• University Eduardo Mondlane (x3)

Table 4.4: Profile of participants (Authors own)

An inspection of the data in *Table 4.4* reveals the two groups of experts represented: academics (n=7) and industry (n=14). Academic representation involved participants who had previously conducted flood related studies in communities. They offered a valuable perspective as, due to their research, some had previously been able to travel to the country and therefore were familiar with the setting and the realistic practicalities which came with addressing flood risks. Equally as important, the participation of industry participants offered a practical perspective.

The profile of participants was an important consideration as it reflected the quality of data generated. The diversity of the participants was not only reflected in the geographic distribution, but also in their roles. For example, United Nations agencies such as the UNHABITAT and the UNDP offered valuable and significant insight into how the cluster system functions in Mozambique.

Apart from the involvement of academics and industry related participants, this study considered community residents as experts with the justification that they possess a significant amount of knowledge and understanding of their communities and surroundings (Dewa et al, 2022; Clarke et al, 2019; Dgedge and Chemana, 2018). *Figure 4.9* shows the distribution participants of each group:

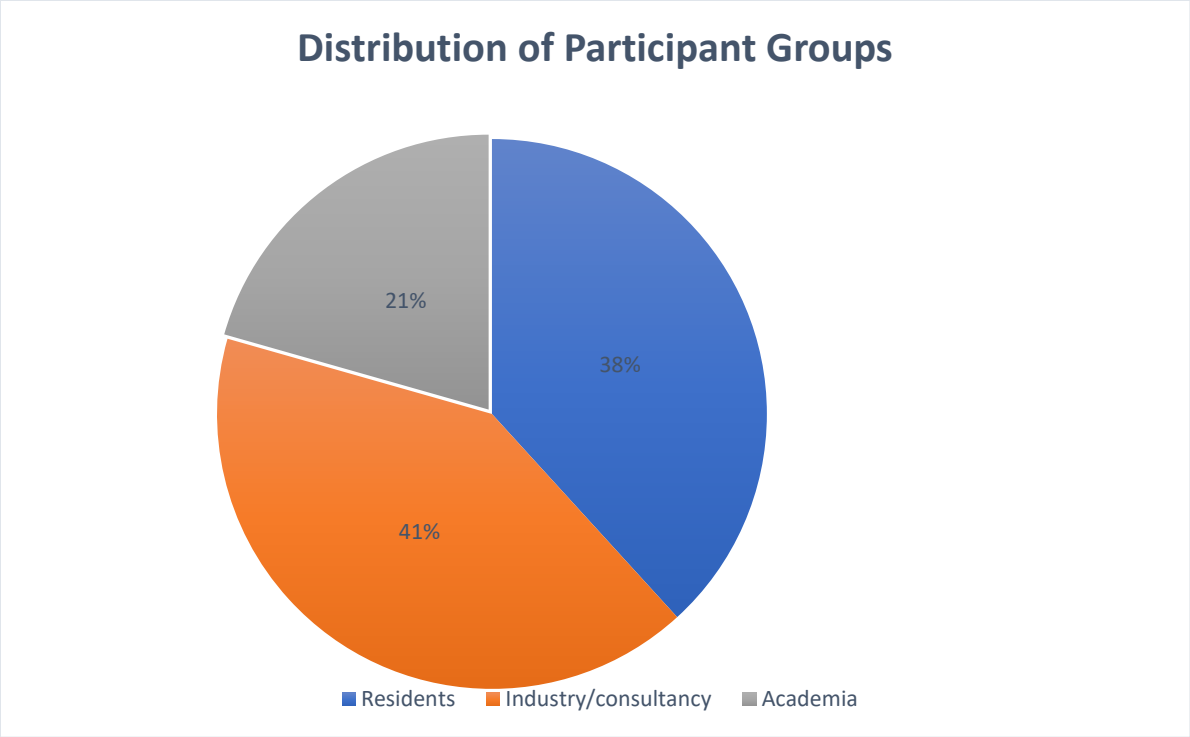

Figure 4.9: Distribution of Participant groups (Authors own)

Most questionnaire participants were industry related participants (n=14), followed by residents (n=13), and finally academia (n=7).

4.4.4 Questionnaire Findings

As discussed in the methodology chapter, questionnaires were conducted with the aim of supporting interview results. Most of the participants also took part in the interviews. In total, thirty-four responses were completed and reliable enough to use.

This section will present the results of the questionnaires, It follows the structure of the PAR model. This was due to two reasons. Firstly, the PAR model is a widely used framework used to outline the factors which contribute to vulnerability and factors which could potentially address vulnerability and enhance resilience. This was applicable in this study as it allowed the questionnaire participants to be presented with a wide range of factors to choose from. Secondly, by presenting the participants with potential strategies to tackle vulnerability, it addresses objective three. Therefore, from the results gathered, it was possible to determine which strategies were deemed most applicable. Therefore,

the questionnaire began with the ‘Progression of Vulnerability’ and its three components. The first section included statements which described the ‘Progression of Vulnerability’, which involved exploring ‘root causes’, ‘dynamic pressures’, and ‘unsafe conditions’. The reverse, ‘Progression of Safety’, aimed at addressing root causes, reducing dynamic pressures and achieving safer conditions. During the questionnaires, participants were asked to rank several statements on a 5-point Likert scale ranging from ‘extremely important’ to ‘not applicable’. They were also asked to rank the top three disaster risk reduction strategies they believed should be prioritised.

The questionnaire designed was aimed at addressing objective three: construct/develop a best practice approach to enhance community resilience to the impacts of floods in urban communities and although three models were used in this study, only the PAR model was used to structure the questionnaire. This was primarily because the PAR outlines specific strategies which can be used to enhance resilience. The SLF offers a blueprint in which to think about household / community vulnerability and describes how by using skills, knowledge and capacities, vulnerability can be reduced. While valuable, it would not have provided best practice approaches like the PAR model does. With the model of vulnerability, one of the most important components is the adaptive capacity; if the adaptive capacity of a household or a community is strong, then it is able to build resilience which links to the ‘progression of safety’ element in the PAR model. Although the SLF and Model of Vulnerability were not directly used in the building of the questionnaire, it can be argued that both models have elements which are featured in the PAR model. For instance, all three models that in order to consider adaptation strategies, there needs to be a thorough understanding of the vulnerability context. The models also agree that lack of access to resources and political ideologies are factor which hinder progression.

4.4.5 Progression of Vulnerability

4.4.5.1 Root causes

The first section of the questionnaire explored 'Root causes' of vulnerability in Maputo. Participants were given the following description of root causes: "Root causes describe underlying situations and power dynamics that are ingrained in a society; these include economic, demographic and political processes, which affect the way resources are located and distributed among the social groups of people".

Figure 4.10 displays the four root causes participants believed to contribute to flood vulnerability in Maputo; the selected statements are those which achieved 50% consensus. Over half of those surveyed (59.38%) believed that the most important cause root to vulnerability in Maputo were both 'Weak law enforcement when building houses' and 'Rural to urban migration has increased vulnerability, increasing land pressure and forcing people to settle in floodplains'.

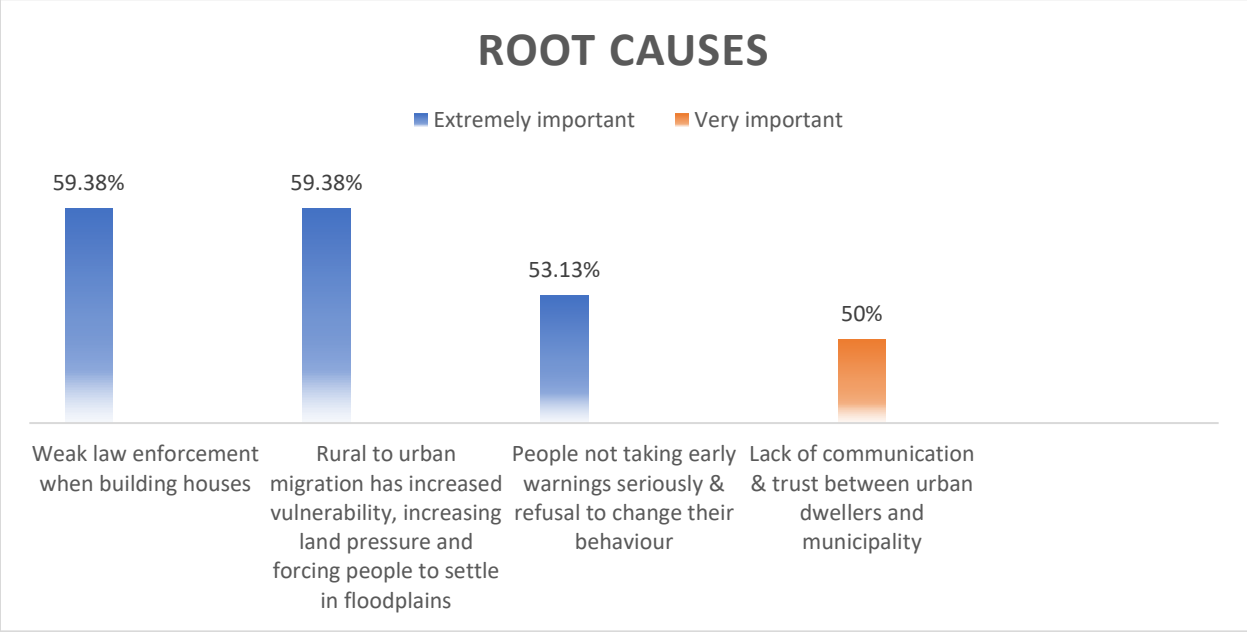

Figure 4.10: Root causes (Authors own)

According to UNHABITAT (2020) 'rural to urban migration' is a dominant factor contributing to vulnerability in Maputo as people are forced to settle in the peripheries of

the city with limited resources available to them. This is an interesting root cause because it can be traced back to the colonial period when residents from neighbouring provinces and districts migrated to Maputo in search for better employment opportunities. During that time, the government saw these unplanned communities as temporary which was reflected in the materials, they used for construction such as reeds and iron sheets. Consequently, the areas were neglected and not provided with adequate resources and infrastructure. The results can still be seen today. The 1977 civil war exacerbated an already fragile environment and resulted in more migrants.

Five respondents believed that 'civil war has affected governments ability to deal with the impacts of climate change' was not applicable as a root cause. When giving a not applicable answer, participants were asked to justify their choice. For this statement, one participant justified that:

"*The civil war did not impact directly on the Government as climate change issues are a recent threat, thus there is a global trend on investing in more trained/skilled people with knowledge in those matters".*

This is interesting reasoning as the respondent did not associate the civil war with climate change as climate change is seen as a recent threat. Although the impacts of climate change have become more frequent, intense and harder to predict (IPCC, 2022), it should not be overshadowed by past events. The civil war left the country without adequate infrastructure (Lundgren, 2020), which meant that the country was significantly impacted by the 2000 floods (Section 1.2).

53.13% thought that 'people not taking early warnings seriously & refusal to change their behaviour' was extremely important, whereas half thought 'lack of communication and trust between urban dwellers and municipality'.
Refusal to heed to early warnings can be linked to a lack of communication and trust between urban dwellers and the municipality as its the municipality that communicates early warning to the community. This links to the fundamentals of early warning systems

presented by UNDRR (2020) discussed in section 2.5.5. Firstly, there needs to be an effective system of monitoring early warning systems and preparedness activities. Secondly, there needs to be a collaborative relationship between communities and the municipality in order for early warning systems to be effective. Thirdly, to enhance effectiveness, early warning systems need to be communicated both in a timely fashion and in a way which can be easily deciphered by communities to enable them to take action.

A study conducted by Lundgren (2020) revealed that residents in a flood prone community in Mozambique felt frustrated and let down by the lack of adequate communication from the municipality. In support of this, a study conducted by Tvedten and Candiracci (2018) exploring waste management in Maputo highlighted that a lack of trust had risen due to misunderstandings of the responsibilities of the municipality, residents and community leaders.

4.4.5.2 Dynamic Pressures

After inquiring about root causes, the next stage of vulnerability is dynamic pressures. Participants were given the following description of dynamic pressure and asked to rank them in order of importance from extremely important to not applicable:
"Dynamic pressures describe the evolving systems that can lead to increasing pressure and subsequently to unsafe conditions."

Below are the statements included in the questionnaire:

- Lack of project continuity
- Lack of a consolidates institutional framework for dealing with disaster risk management
- Rapid urbanization leading to expansion of informal settlements
- Lack of local investment in drainage systems, sanitation and housing quality
- Relocating people to areas with no jobs
- Degradation of fertile land due to soil erosion
- Lack of access to local markets

- Lack of a culture of paying tax resulting in the absence of Municipality providing quality services
- Lack of data collection and technical knowledge in institutions
- Lack of mainstreaming and communication between stakeholders.
-

Figure 4.11 summarises the dynamic pressures and highlights which factors/statements participants believed to be 'extremely important' and 'very important'. Like the root causes, these are statements which achieved a consensus of above 50%.

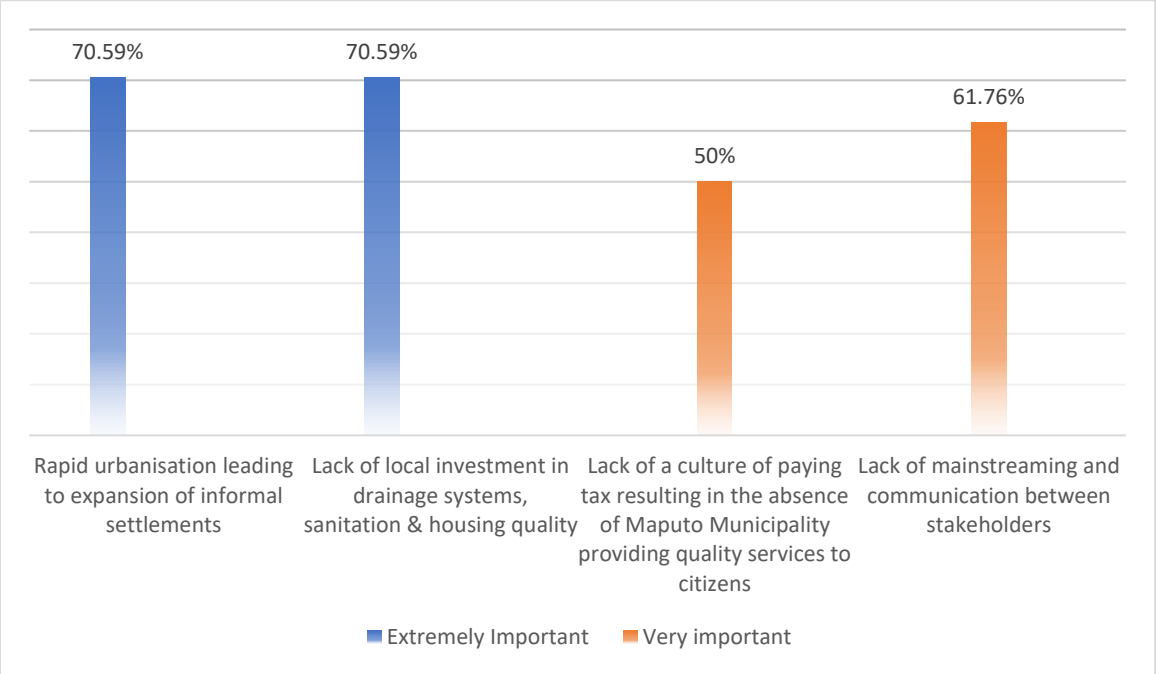

Figure 4.11: Dynamic Pressures (Authors own)

The two dynamic pressures which participants most believed contribute to Maputo's vulnerability to floods include 'Rapid urbanization leading to expansion of informal settlements' (70.59%) and 'Lack of local investment in drainage systems, sanitation & housing quality' (70.59%). These two factors do not come as a surprise as it was discussed in the introduction (Section 1.2 & 1.3.3) that rapid urbanization and poor drainage systems are causes of vulnerability in Maputo.

Three participants felt that 'lack of consolidated institutional framework for dealing with disaster risk management' were not applicable. One participant suggested that:

"*The country is making a lot of progress in terms of developing legal instruments to deal with disaster risk management, but challenges can be mentioned when it comes to coordination and enforcement as this issue calls for all line ministries to mainstream DRR (Disaster Risk Reduction) & CCCA (Centre for Climate Change Adaptation) into their plans and activities*".

This statement justifies and highlights the importance of this study as its aim is 'to explore and assess the disaster response strategies being applied in urban communities vulnerable to flooding in Maputo, Mozambique'. It demonstrates that there is a gap and need to revise the structure of the flood response system in urban communities. Objective three (Construct/develop a best practice approach to enhance community resilience to the impacts of floods in urban communities) addresses this gap.

4.4.5.3 Unsafe Conditions

Following an inquiry about dynamic pressures, participants were asked to rank unsafe conditions they believed contributed to vulnerability. They were given the following description of unsafe conditions:
"Unsafe conditions express how a population is vulnerable to hazards. This is the vulnerability context where people and property are exposed to the risk of disaster. It includes the physical environment, the local economy, social relations and public actions"
Below are the statements included in the questionnaire:

- Poor solid waste management systems
- Poor drainage systems which cause soil erosion leading to obstruction of roads
- Disappearance of mangrove forests making the city vulnerable to tidal surges
- Residents lack of responsibility to correctly dispose of solid waste
- Residents construct homes in flood plains
- Inadequate building material is used in urban settlements
- Maputo has nine hydraulic basins

- Destruction of coastal dunes
- Exposure to waterborne diseases such as cholera and malaria
- Rising sea levels have resulted in salt intrusion, affecting agricultural activities
- Natural flow of water is disrupted by pavements and roads

Figure 4.12 summarises the unsafe conditions participants believed contribute to Maputo's vulnerability to floods. Participants were given the following description:

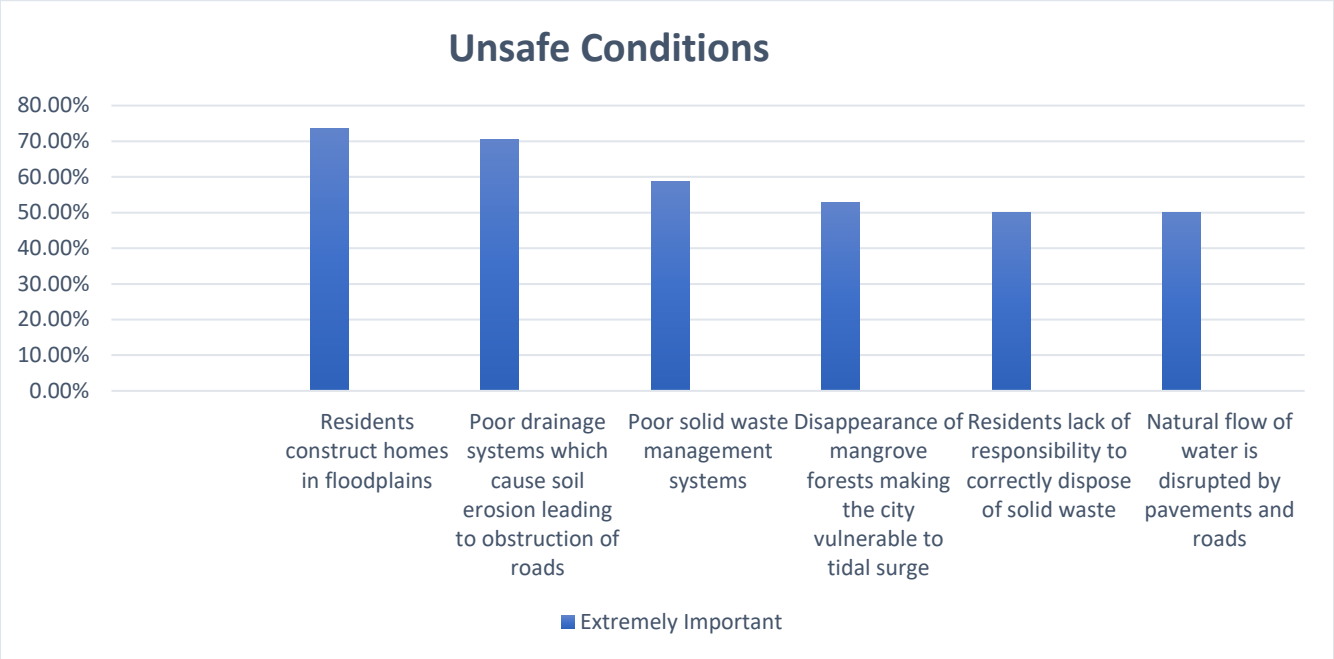

Figure 4.12: Unsafe Conditions (Authors own)

The majority (73.53%) attributed the most important unsafe condition to 'urban residents was that they continue to construct their homes in floodplains', and 70.59% agreed that 'poor drainage systems which cause soil erosion leading to obstruction of roads' led to unsafe conditions. It was interesting to note that 'poor solid waste management' did not receive a higher percentage as several studies conducted in Maputo (Zehra et al, 2019; Lundgren. 2020; Tvedten & Candiracci, 2018) attributed this as a major contributor to flooding.

4.4.6 Progression of safety

The rest of the questionnaire addressed the ‘Progression of Safety’ element of the PAR model, which was divided into two sections. First, participants were asked to rate statements they believed to be a measure or strategy to address flood risks and reduce vulnerability on a 5 Likert scale; they were then asked to rank each statement (those they believed would address vulnerability) in order of which should take priority. The results which reached consensus are presented in the form of a populated ‘Progression of Safety’ (*Figure 4.13*):

Address Root causes	Reduce Pressures	Acheive Safer Condition
•Improve drainage systems, water and sanitation **(85.29%)** •Establish a dedicated unit in the Maputo Municipal Council to deal with climate change **(61.76%)** •Reformulate building codes for transport, infrastructure, telecommunications, energy distribution to make it more climate resilient **(52.94%)**	•Encourage collective learning in communities: Educate communities on the risks of floods **(70.59%)** •Communities should be involved in handling risk reductions **(67.65%)** •Reinforce the role of the National Institute for Disaster Management in coordinating operations, evacuations, relief, reconstruction and support to victims through more resources **(64.71%)** •Ensure all groups are included: women, people with disabilities, youth, elders, the sick **(61.76%)** •Introduce disaster management in primary school curriculum **(52.94%)** •Strengthen preparedness and response: ensure evacuation centres are ready and with enough supplies **(52.94%)** •Strengthen the national information system including early warning systems, and cross-sector information sharing and knowledge management for disaster risk reduction **(52.94%)** •Increase trust between communities and local authorities by creating better communication channels **(50%)** •Regulate urban expansion: Keep demographic growth within the limits of socio-economic and sustainable development **(50%)** •Strengthen institutions with technical capacities required for urban planning, development of infrastructure, waste management, sanitation services **(50%)**	•Infrastructure which is resilient: Have standard building codes; teach communities building techniques and materials to use. Use local builders **(72.73%)** •Preservation of green areas, wetlands and coastal mangroves. **(67.65%)** •Construct homes which are elevated **(63.64%)** •Improve solid waste management: collect garbage before rainy season **(55.88%)** •Train school teachers to educate students, offer psychophysical support, distribute school material **(51.52%)** •Relocate flood victims to areas that correspond to their livelihood activities so they can continue earning a living **(50%)**

Figure 4.13: Summary of strategies to reduce vulnerability (Authors own)

4.5 Community Findings

13 community members completed the questionnaire; therefore, this section presents the questionnaire results which this group completed. Ideally, the researcher would have wanted a larger community representation, but due to travel restrictions and difficulty in getting access to community members this was not possible.

When asked which 'root causes' they believed increased Maputo's vulnerability to floods, community members rated the following. The results presented are those which achieved more than 50% consensus.

Root causes	Dynamic Pressures	Unsafe Conditions
Lack of employment especially for the youth **(75%)**	Rapid urbanisation leading to expansion of informal settlements **(79%)**	Residents lack of responsibility to correctly dispose of solid waste **(83%)**
Lack of government financial funds **(67%)**	Lack of local investment in drainage systems, sanitation & housing quality **(71%)**	Inadequate building material is used in poor urban settlements **(83%)**

Table 4.5 Progression of vulnerability Findings

'Lack of employment especially for the youth' was a root cause which was only selected amongst community members; this could have been because more of the community respondents were youth and of working age. According to the International Labour Organisation (ILO) (2022) the country's national development has been impacted by the financial crisis couples with the impacts of natural hazard-induced disasters. The youth face hindrances entering the employment market and self-employment due to the lack of jobs available, as well as lack of connection and finance (USAID, 2021).

It was interesting that 83% of community respondents took ownership and said that it was 'residents lack of responsibility to correctly dispose of solid waste' that contributed to unsafe conditions. This shows that residents are becoming more environmentally aware of the impacts that their actions are having. An initiative created by BioFund with the purpose of increasing environmental education and awareness saw 2,270 students attending lectures on the importance of conserving the environment. The lecture also equipped students with some practical steps they could take such as "good waste management, planting trees, avoiding water pollution and uncontrolled fires" (BioFund, 2022, p.3). Initiatives such as these have the potential of creating a better environment in the future and encourage community residents to be aware of the small steps they can implement in order to reduce the impacts of floods in their communities.

When addressing dynamic pressures, there was an agreement among all respondents that 'rapid urbanisation leading to expansion of informal settlements' and 'lack of local investment in drainage systems, sanitation & housing quality' has increased Maputo's vulnerability to flooding. These two factors are interrelated as rapid expansion naturally results in the deterioration of drainage system, sanitation and housing quality (Zehra et al, 2019).

When asked to rank vulnerability reducing strategies, community residents reported the following:

Addressing Root causes	Reducing Dynamic Pressures	Achieving Safer Conditions
Improve drainage systems, water and sanitation	Encourage collective learning in communities: Educate communities on the risks of floods	(a)Infrastructure which is resilient: Have standard building codes; teach communities building techniques and materials to use. Use local builders (b)Increase containers and trucks for solid waste collection (c) Building environmentally sustainable social housing

Table 4.6: Progression of safety findings

All participants agreed that to address root causes, a focus had to be placed on improving drainage systems, water and sanitation. Community members would have had experience of seeing blocked drainage systems during the rainy period. Zehra et al (2019) report that in a neighbourhood in Maputo after the raining period, rainwater had remained stagnant which was a result of malfunctioning drainage systems. Another risk which malfunctioning drainage systems can cause are waterborne diseases such as malaria and cholera.

Overall, there seemed to be more of a community centred approach to natural hazard-induced disasters, as opposed to playing the 'blame' game and placing the responsibility on the Municipality (DW, 2017; Tvedten & Candiracci, 2018). This is an encouraging finding as it indicates that communities are willing to take more ownership and initiative to protect their communities. What could be hindering them is the lack of investments and financial resources, which was a dynamic pressure believed to enhance vulnerability.

The following section presents the data gathered from the follow up interviews. These interviews were conducted after the questionnaires and in-depth interviews with the purpose of validating the data and enhancing its quality. Section 4.6.1 provides the profile of those who were interviewed including the organisation they work for and their roles. This was an important consideration as its purpose it to demonstrate their levels of expertise and thus their valuable contribution to the study. Section 4.6.2 comments on the findings and describes what the implications are, this is followed by the summary of the chapter (Section 4.7)

FOLLOW UP INTERVIEWS

4.6 Interview Participants

4.6.1 Profile of experts:

Follow up interview participants were contacted by email and explained that due to the pandemic, the methodology of the study had to be revised. A communication channel had already been established with two of the participants (Participant one and two), as they had previously been involved during the in-depth interviews and had completed the questionnaire, therefore, they were familiar with the research aims and objectives. *Table 4.7* overviews their roles. During the interview process, they had displayed a genuine interest in the study, and provided valuable information as they are both highly involved in disaster management and risk prevention in their respective countries. Participant three emerged through a combination of a snowballing and purposive sampling technique.

Participant	Organisation	Role / occupation	Country
1	United Nations	Focal point for Disaster Risk Reduction, humanitarian & emergency affairs	Philippines
2	National Institute of Disaster Management	Coordinated programmes for disaster risk management & resilience	Mozambique
3	United Nations Development Programme	Works in disaster risk management and climate change adaptation	Mozambique

Table 4.7: Summary of participants. Authors own

The follow up interviews took 2 weeks to complete, and on average lasted 45 mins.
To highlight their involvement in disaster management and to justify their value, the below section provides a brief overview of the work they have done:

Participant one:

Although this participant is from the Philippines, they were valuable as they brought in a different perspective on handling disaster management. Philippines is considered one of the countries most affected by natural hazard-induced disasters (The World Bank, 2022), therefore, through time, they have learnt how the effectively implement adaptive strategies. This participant had previously worked in the United Nations Disaster Management agency and been one of the negotiators in the drawing up of the SENDAI framework (Discussed in Section 2.2), therefore, they had a deep understanding of drawing up sustainable strategies with the aim of reducing vulnerability and enhancing resilience. The participant also had experience with working with local communities and relevant stakeholders in the Philippines in order to establish a multilateral and multiagency coordination mechanism addressing the impacts of climate change. Therefore, this participant was valuable in providing best practice approaches and also highlight areas which could be implemented in the context of this study.

Participant two:

This participant currently works in the National Institute of Disaster Management (INGC), briefly discussed in Section 1.4. The institute is the governmental body responsible for coordinating disaster response strategies, therefore, this participant offered valuable information about how the institute functions, its challenges and future projects. Another reason why this participant was valuable is they had been involved in designing the Disaster Management course at one of the Universities in Maputo, therefore, they had a deep understanding of the disaster management strategies in the country.

Participant three:

This participant is a Programme Specialist and had over 10 years of experience working in the United Nations; working with the UNHABITAT first them moving to the UNDP (United Nations Development Programme). Their area of expertise is in the field of

disaster risk management and climate change adaptation; therefore, they were valuable to the study. This participant is involved in the process of establishing community committees in areas most vulnerable to flooding, adhering to the principles of community-based adaptation, which is one of the focal points of this study.

In all, these participants are considered experts in their fields with a rich understanding of natural hazard-induced disaster management. Their contribution to the study was used to validate the findings gathered from the in-depth interviews and questionnaires. It was also beneficial to have a representative from a country that shares the same vulnerabilities as Maputo and how they have resulted to dealing with the impacts.

4.6.2 Interview Findings

Participants were presented with the results of the questionnaire and asked to comment upon them. The results they were presented with were the top three priorities questionnaire participants believed should be implemented to address vulnerability factors in Maputo (*Table 4.8)* Participants were asked to rank them in order of priority. This was done with a two-fold purpose. Firstly, ranking the top priorities would highlight elements which needed to be included in the new conceptual framework, thereby addressing objective three (Construct/develop a best practice approach to enhance community resilience to the impacts of floods in urban communities). Secondly, with regards to the Delphi technique, performing this exercise was seen as completing round two of the questionnaires as the second round is done by presenting the findings and asking participants whether or not they agree and why (Keeney et al, 2010).

Progression of Safety	Key priorities	Comments of experts in follow up interview	Implications
Addressing root causes	1. Improve drainage systems, water and sanitation 2. Increase access to technologies: irrigation systems, solar panels, effective early warning systems. 3. Reformulate building codes for transport, infrastructure, telecommunications, energy distribution to make it more climate resilient	**Participant one:** *"I would say slightly important. The reason is that the most important thing is to have people understanding the risks that they are facing… I think that the side of reformulating building codes is need for improve the way people understand the risk".* Participant one discussed that they understood why "improve drainage systems, water and sanitation" has been seen as a top priority, but they argued that the government did not have enough resources to implement this, and instead, strategies should be diverted to increasing the understanding or risks. **Participant three:** "*The structures need to be reviewed; but the other thing is the law enforcement. How is that monitored?... I don't know if the need is to reformulate- for me it's looking at how effective it is before proposing reformulation."*	According to **Participant one**, there is a need to enhance climate related knowledge, which related to the concept of community-based adaptation. Initiatives need to start with the communities; therefore, efforts should be diverted to educating communities on risks and how to adapt. This implies that apart from showing how communities should react in times of floods, the INGC must also provide communities with a theoretical understanding of causes of natural hazard-induced disasters. **Participant three** highlighted that before a reformulation takes place, an assessment of the current building codes needs to be conducted. This would entail exploring and assessing the building codes for all infrastructure. While this would highlight areas needing improvement, conducting such as exercise would be time consuming and costly.
Reducing dynamic pressures	1. Regulate urban expansion: Keep demographic growth within the limits of socio-economic and sustainable development 2. Strengthen institutions with technical capacities required for	When asked to comment upon priority one, **participant three** said the following: *"I think its more to do with enforcement law, and not regulation- because the regulation exists. One thing for example is 'SONEC', those people were removed from there. But if you have a look at the urban structure plan, it mentions that that [certain] zone is not for dwelling, but those*	With reference to priority one**, Participants three** comment regarding residents occupying land which is prohibited to build on could imply two things. Firstly, as discussed in Section (1.3.3), a cause of unregulated urbanisation is due to a lack of financial resources. And secondly, it implies that law enforcement is not strong enough as people continue to occupy vulnerable land. With regards to priority two, **Participant one** highlighted valuable practices which are applied in the Philippines.

	urban planning, development of infrastructure, waste management, sanitation services 3. Strengthen preparedness and response:	*people are there. So it's not a lack of regulation or posture, it's a lot more inspection"* When asked to comment upon priority two: *"There is a limited amount of qualified personnel"* When asked about strengthening institutions, **Participant one** (Philippines) commented that: "*Aside from the civil society organisations that is very strong, our private sector and businesses are also very strong in terms of coordination. And why? Because they know that if they don't also coordinate, their businesses will be affected"* *"There are regular once or twice a year that they do meetings, the government meets with the private sector, with the heads of different organisations and civil society and this is being done to talk about what is being done in different parts of the country, especially floods. Not only floods, but floods is really a big thing"* When questioned about early warning systems, **Participant two** said the following: *"I think there is a big gap on that: to make sure that the early warning information is reaching the last mile, that its reaching the right people, people that need this information, information to act. And the way the information is*	Firstly, a cohesive multisectoral structure was credited to the successful response mechanisms. There was an acknowledgement that all key players had a role and a responsibility, and that they could rely on each other. This cohesiveness is achieved through time and regular meetings. This implies that s strong communication system has to be established. In Mozambique, **participant two** explained that there are gaps in the way early warning systems are communicated. Not only is it important for the community to obtain this information, it is equally important that the information reaches the community in time for them to respond, and also that the information is in a layout they can understand. When asked about incorporating disaster related content in schools in Mozambique, **participant two** highlighted an important factor: that children are inundated with societal issues. The participant highlighted that implementing natural hazard-induced disaster content is important, but that the standard of what is already being taught should not be compromised. This is an interesting point as one could argue that its imperative to teach young children about the impacts their actions have on the environment and to ensure a sustainable world in the future.

		communicated, should be something actionable." Under 'Strengthen preparedness and response', participants were asked about the role of schools in disaster risk. **Participant one** said that: *"the curriculum is from as early as kindergarten until college… the basic education at least for the Philippines is kindergarten, elementary and high school-But definitely, its integrated into the curriculum, its trying to be mainstreamed, its not yet perfect but its there"* **Participant two:** *"Of course, putting this on curriculum is also good, I am not saying no. But there is a lot of discussion- we are flooding the children- whatever issue comes on society we say 'lets put it in the curriculum' –'Disaster risk reduction- put in the curriculum, climate change, put in the curriculum, now covid, put in curriculum, HIV, put in the curriculum. So is that what we want? So there is also that kind of discussion that I should respect because theoretically, okay, lets put everything on the curriculum for children but maybe we are losing the standards of what we are supposed to teach children."*	
Achieving safer conditions	1. Infrastructure which is resilient: Have standard building codes; teach	With regards to priority three, **Participant two** was asked about the feasibility of creating green spaces:	When asked about creating green spaces, both participant one and two agreed that it was a useful strategy. In the Philippines this is already being done. However, in

	communities building techniques and materials to use & use local builders 2. Improve the way land is used 3. Preservation of green areas, wetlands and coastal mangroves	*"Yes, for sure! For sure that is one way towards solution, but unfortunately, here [Maputo] it comes to enforcement, because of the law. Even disaster management law: it will tell you don't put infrastructure in flood prone areas, but at the end, no space is left behind. When people see a piece of land, especially in the urban areas, they think about money"* **Participant one** noted the following: *"That is very interesting. I think its happening. For example, in metro Manila we are doing that already. Many building now are trying to do this-sometimes vertical green spaces. Its actually happening now. I think its going to be very useful and good"*	Mozambique, this strategy, although useful, could prove to be challenging to implement. One reason is that there is a lack of urban space left in the city due to the rapid urbanisation rate. Secondly, according to participant two, available land is seen as an opportunity to make a profit.

Table 4.8: Experts opinions on key priorities (Authors own)

4.7 Chapter Summary

This chapter was divided into two sections and presented and analysed the data from the interviews, questionnaires and follow up interviews. Obtaining participants from different geographical locations was important as they provided different perspectives and approaches. 25 were from Mozambique, United Kingdom had five participants and the rest had one (Philippines, Denmark, South Africa and Italy). Following this, the profile of the participants was outlined (Section 4.2); this was also an important factor as it justifies why the sample was chosen and their value to the study. Part B presented the findings of the questionnaires and follow up interviews. Section 4.4.1 outlined the number of respondents, which were 35 in total. It then moved on to describe the geographical distribution of the participants (Section 4.4.2).

The second section of the chapter presented the findings from the follow up interviews. These were conducted with three participants, two of which had completed the questionnaire and taken part in the in-depth interviews. The main purpose of conducting the follow up interviews was to enhance the quality of the data. Section 4.6.1 commented on the profile of the participants which justified their relevance and section 4.6.2 presented the findings.

CHAPTER 5: DISCUSSION

5.1 Introduction to the chapter

This chapter discusses the findings in relation to the themes which were identified. The process of how the themes were identified is described in Section 4.3.

From the above process, four themes were identified: Infrastructure, intersectoral dynamics, community involvement and culture. These themes were further divided into sub themes. As interviews were the dominant method, this chapter explores the themes derived from the interview findings, and supports it with questionnaire findings, and consolidates it with the follow up interviews. As a recap, below are the themes and sub themes which emerged:

Community Involvement

- Local Committees
- Collective Learning
- Preparedness
- Role of schools
- All-inclusive participation
  - People with disabilities
  - Women

Culture

- Behaviour and practices
- Culture of saving
- Generational Differences
- Role of trust

Intersectoral Dynamics

- Role of INGC
- Early Warning systems
- Lack of project continuity
- Evacuation & resettlement
- Emergency coordination

Infrastructure

- Solid waste management
- Financial resources
- Sanitation
- Build Back Better
- Green spaces

5.2 Theme 1: Community Involvement

5.2.1 Introduction to the Theme

Community involvement explores the significant role community committees play in responding to flooding in vulnerable neighbourhoods. Since the 2000 floods, the country has advanced in terms of responding to natural hazard-induced disasters. The Mozambican Master Plan for Disaster Risk Reduction (2017-2030) highlight how they have acknowledged the significant value of placing communities at the forefront of disaster response, which has resulted in the creation of local community committees. Respondents highlighted the importance of creating and training locals to be first respondents in the occurrence of a disaster (Section 5.6.2), enhancing preparedness (Section 5.6.4), the role of schools (5.6.5) and adopting an all-inclusive approach (Section 5.6.6). An important issue which emerged was the lack of involvement and consideration for people with disabilities (Section 5.6.6); at the moment, there aren't schemes in place which consider the challenges faced by people with disabilities in the occurrence of floods.

5.2.2 Creating Local Community Committees

As discussed in the literature review (Section 2.5), the Hyogo Framework for Action (2005-2015) along with its successor, SENDAI framework (2015-2030) are internationally recognised frameworks formulated by the UNDRR to address disaster risk. Mozambique set in place a Master Plan for Disaster Risk Reduction (2017-2030) which is aligned with the SENDAI framework earlier explored. Its main aim is to 'Reduce the risk of disasters, the loss of human lives and vital infrastructure, as well as prevent the emergence of new risks to disasters'. The programme has five strategic objectives, which are aligned with the priorities within the SENDAI (*Table 5.1*):

MASTER PLAN OBJECTIVE:	CORRESPONDING SENDAI PRIORITY	WHAT IT ENTAILS:	PROGRESS SO FAR:	CHALLENGES
Strategic objective 1: Improving the understanding of disaster risk at all levels.	Priority 1: Understanding disaster risk.	Ensuring the components and principles of disaster risk is understood at all levels.	Government purchased high resolution spatial and topographical data, as well as hazard and exposure maps.	Data remains spread across different institutions and databases causing a lack of informed decisions.
Objective 2: Strengthening governance & public and private participation in DRR	Priority 2: Strengthening disaster risk governance to manage disaster risk	Ensuring that all stakeholders know their roles and responsibilities and create a stronger intersectoral harmonization.	Creation of local community committees in disaster prone regions to act as first responders. Government trains and equips the committees.	Ensuring all flood prone communities have fully equipped and functional committee. In 2017, only 698 out of 1,218 committees were equipped.
Objective 3: Mainstreaming DRR in public investment & territorial planning, and consolidating financial protection against disaster.	Priority 3: Investing in disaster risk reduction for resilience	Disaster management fund was created in 2017 in order to increase available resources for emergency response. Government approved a decree ensuring public	The education sector is the most advanced in terms of resilient infrastructure and mainstreaming. They have building codes which ensure schools are constructed to withstand cyclones and earthquakes.	Existing school buildings have not been rehabilitated using the new building codes.

		buildings comply with certain standards.		
Objective 4: Strengthening capacity for disaster preparedness, response, and rapid recovery.	Priority 4: Enhancing disaster preparedness for effective response, and to "Build Back Better" in recovery, rehabilitation and reconstruction.	Improvement of early warning systems, disaster preparedness, effective recovery.	The role of various institutions were strengthened: National Civil Protection Unit: responsible for search & rescue Communities: formation of committees from volunteers. Communities were recognised as first responders.	The concept of "Build Back Better" has not yet been widely applied in all sectors. Building codes will need to be adhered to.
Objective 5: Building partnerships and international cooperation	n/a	Building stronger cooperative relationships with members of the African Union and SADC, as well as the World Bank	The WB has been involved in several development projects. The African Union has developed a more African focused version of the SENDAI.	Mozambique has already implemented the UN 'cluster system' which creates partnerships with several UN agencies.

Table 5.1 SENDAI vs. Master Plan (Authors own)

As a country, Mozambique has committed to implement components of both framework into its National Master Plan as a strategy to tackle the cyclic climate risks it faces. One of the priorities is to strengthen disaster risk governance to manage risk; in support of this priority, almost two thirds of the questionnaire participants believe that it is extremely important to involve communities in handling disaster risks and events. Accordingly, since 2005, the country has invested in creating local community committees in regions most vulnerable to climate events. These committees have been formed, trained and equipped by the Institute for Disaster Management (INGC) to act as first responders in the event of a disaster. The INGC equips communities to develop prevention and mitigation action plans against natural hazard-induced disasters, including floods. The main priority of the committee is to ensure minimum loss of life, animals, and destruction of houses, schools, hospitals, and crops (Dgedge and Chemana, 2018).

The notion of applying a localised focus is not new to Mozambique (Section 2.2); both the Hyogo Framework for Action (2005-2015) and the SENDAI Framework (2015-2030) are global frameworks aimed at addressing climate change. As a country, Mozambique has incorporated them in their national strategy by creating a Master Plan for Disaster Risk Reduction (2017-2030). The figure below shows how a proposed way of thinking about how to apply a local focus.

Figure 5.1: Applying a localised approach (Authors own)

A community committee is generally made up of 15-18 people who are nominated by their respective community and are seen as respectable and capable residents. Training lasts in average two hours. One interviewee explains that:
"it's a consultive process and it's the members of the community who identify who they think is better positioned and who they trust in the community to execute those roles".
Some of the criteria include:

- People willing to work as volunteers.
- People who are respected by the community authorities.
- People who are dynamic, creative, motivated and proactive

- People who have a strong decision-making capacity
- People who are passionate about creating a strong community.

Their roles range from:

- Coordinator
- Responsible for the kit
- Radio listener
- Early warner
- Evacuation
- Search and rescue
- Relocation/ shelter
- Information management, assessment of damages and needs.

One interviewee described that currently the country has only reached 30% of the populations which require a committee due to their vulnerability. This implies that as a whole, the country remains susceptible to floods, and with the increasing threat that climate change has on natural hazard-induced disasters, more committees need to be formed and trained.

While the community is involved, the extent of their involvement and participation is unclear, therefore, it could be reasoned that there needs to be more participation from the community in terms of how training is conducted, which contents are discussed and shared, and the best adaptation strategies to be included. On a surface level, it can seem that the process is inclusive, however, the extent of that inclusivity is undetermined. Residents might feel obliged to comply with whatever is said by the INGC, without having a say because they feel intimidated or think their opinion does not matter. One interviewee stressed that it is important for residents to feel as included as possible in strategies which are implemented as that creates ownership and a sense of empowerment which can lead to the sustainability of the community. If communities feel that something is being forced upon them, they are less likely to follow through. One interviewee described the level of community involvement in the Philippines:

"…it really comes from the community; what they want to do, because of these experiences, what they have learnt, what they want to do to protect their community".

Another point to consider is the number of committee members that averages around 15-18 which brings to question the effectiveness and impact that 18 people can have in a single community. One article describes the work which the committee members perform around the community and this includes, educating the community about the risks of floods. This is done through talks, simulations and door-to-door education. This results in the bulk of the awareness campaigns resting on the committee (Dgedge & Chemana, 2018). Moreover, it also brings to question whether 15-18 people can meet the various needs of varying community sizes.

The above arguments question the extent to which community members are involved with the training of local committees (Section 5.6.2). The interviews lacked evidence to demonstrate that community members are involved in the training content or that they can give suggestions, thereby indicating that the 'formal' training provided by the INGC adopts a 'top-down' approach.

As discussed in section 2.5.3.2, 'top-down' approaches are inefficient as they fail to appreciate the needs of the communities, whereas 'bottom- up' approaches allow communities to develop autonomous responses. In fact, due to the nature of natural hazard-induced disasters and the ever-changing environment, it could be argued that communities in Maputo would benefit better from applying an autonomous approach to adaptation rather than a 'top-down' one size fits all. It is important to acknowledge that each community is different in terms of sizes, location, demographics, skills and past experiences; therefore, each community should have the autonomy to determine how it tackles risks. The results gathered indicated that the INGC applies the same training in all communities. Despite the importance of involving local communities, Troglic et al (2017) along with Dewa et al (2022) contend that there isn't enough community participation in policy making and a negligence to address underlying factors of vulnerability. Troglic et al (2017, p.8) explain that "community approaches are very often done 'at' community levels rather than 'with' community or local ownership".

Despite the challenges, since the creation of local committees, there has been a significant improvement in the preparedness of vulnerable communities that are regularly affected by floods. As an example, during the 2000 floods, the province of

Gaza suffered immensely both in terms of material and human loss due to a lack of early warnings and preparedness. However, after the establishment of local committees and during the 2013 floods, which were more intense, the province was much more prepared as it allowed the community to receive the early warnings in time and for them to take preventative actions (Save the Children, 2019).

However, it was still demonstrated that community members had taken their own initiatives in creating other forms of committees such as one attributed to 'digging ditches, maintaining and improving roads and passages' when they saw the need arise. This sense of community is reflected in the Sustainable Livelihood Framework under the 'social capital', where it represents relationships and connectedness. Otto-Zimmermann (2011, p.46) found that social capital was essential as it demonstrated "social cohesion, as well as robust forms of self-organisation, self-regulation and self-reliance".

5.2.3 Encourage collective learning in communities: educate communities on the risks of floods.

As previously discussed, communities are viewed as 'first responders', therefore, the INGC has been in charge for forming and training community-based committees which are responsible for "avoiding the deaths of people and animals and the destruction of houses, schools, hospitals, areas of agriculture and other assets, in the case of a calamity" (translated) (Dgedge & Chemana, 2018, p.126).

More than two thirds of the interview participants believed that it is extremely important to 'encourage collective learning in communities. Encouraging collective learning is already being done in the most high-risk communities with the INGC creating and training local community committees to in the event of floods. Despite their accomplishments of establishing more than 1,200 local committees nationwide, one interviewee reports that that is only 30% of coverage and that:

"We are way below of what is required".

By 2024, the INGC plans to create an additional 1,500 committees.
While collective learning is vital, the results of the interview highlighted the issue of a lack of housing regulation which cause residents to build their homes on flood plains: *"I mentioned Mozambique just have the legislation of disaster…but they don't have regulation- they are missing a lot of regulation- how the community can be structured in the context of disaster. How the city can be integrated in all this process: which can kind of tools and principles must be respected before, during and after disaster".*

The lack of efficient law enforcements in vulnerable urban settlements triggers residents to build their houses without adhering to any regulations. The INGC and the local newspaper (Jornal Noticias) both blame the municipal and district authorities for being negligent in prohibiting residents to construct their homes in areas of high risk, and for allowing the delivery of electricity and water in these areas, claiming that they fear not being re-elected (DW, 2017). The delivery of water and electricity in areas of substantial risk alludes to residents that its 'okay' to settle in these areas. One interviewee expressed this as a dilemma:

"And then the electricity company go there and they install energy. When you put energy there [community] you are saying that those people should stay there; the water company go and install water because they are looking at it from a human rights perspective"."

In accordance with the Disaster Management Law in Mozambique, provincial, district and municipal governments, with the coordination of the INGC, have the responsibility to places signs to let the residents know that the area is a floodplain and therefore construction if prohibited. Despite these warnings, one participant indicates that construction and expansion of public infrastructure continue to take place. One participant explained that:

"A new neighbourhood has grown that is called 'Xihango'. Its a neighbourhood that is growing with elite buildings and with people with a certain economic power. But its being on top of an area that, according to the Maputo structural urban planning, shouldn't be the case because it's a swampy area with mangroves… it's a formal settlement but its not adhering to the environmental criteria".

This goes to show that even the expansion of formal settlements are not adhering to the law. Moreover, this still doesn't hinder people from building their homes and at times, residents remove the sign. According to a jurist, these signs should be unmovable, and besides, there should be a law which penalises anyone who does remove the sign.

5.2.4 Enhancing Preparedness

Performing drills or simulations is one of the common methods used to prepare communities and societies in the event of a natural hazard-induced disaster. To better prepare the communities, different emergency simulations are conducted by the INGC, with the participation of the community committee members as well as the larger community. In Mozambique, simulation exercises started being practiced in 2006 with the aim of increasing the level of preparedness of communities in areas of high risk. These aim to demonstrate how communities should react when faced with natural hazard-induced disasters. One interviewee describes the simulations as a 'multisectoral preparation' as it:

"*brings together social action, health, education; the different sectors- depending on the forecast that is predicted for that region in the country".*

Dgedge & Chemana (2018, p. 130) (translated) quoted a community resident who described the benefits drills have in their community:

"We learn to save lives and the rest of the things that may occur during a disaster. Its not just learning for the sake of it, there are rules to follow to start acting in the right time. The simulation teaches us well. For example, they teach us that we shouldn't walk without a walking stick as a guide because there are areas we can fall; they teach us that we should walk hand in hand".

The statements above indicate that there is great value in performing drills, however, according to the table below *(Table 5.2),* one could argue that they are not conducted enough.

Province	Type of simulation	Number of committees involved
Maputo	Floods & cyclones	10
Zambezia	Floods	12
Sofala	Floods & Cyclones	8
Gaza	Floods	15
Inhambane	Cyclones	7

Table 5.2: Simulations conducted. Retrieved from INGC (2020)

One of the challenges that committees face and which hinders preparedness is the lack of available resources. The definition of vulnerability incorporates the concept of adaptive capacity, which describes "a system's ability to adjust to disturbance, moderate potential damage, take advantage of opportunities, and cope with the consequences of the transformation that occurs" (Gallopin, 2006, p.296). This definition considers adaptive capacity to be linear and dynamic as the risk changes with time, which indicates the higher the level of preparedness, the less negative impacts will occur. Interestingly, the word 'capacity' was mentioned seventy-four times throughout all interviews; this included phrases such as 'capacity building', 'adaptive capacity', 'institutional capacity', etc. However, a willingness to adapt does not merely involve acknowledging the seriousness of a disaster, but it goes a step further and asks whether locals have sufficient resources and the capacity to effectively adapt. There was unanimity among interviewees that for adaptation to be successful, residents need to acquire the necessary resources and capabilities.

Below are a few statements made by interviewees regarding adaptive capacity:

"Communities have experience: they know very well that this area is flooded…but at the same time, most of them don't have capacity or initiative to cope… the people of

the community are not aware of the processes between disaster to the recovery; their awareness in this process is not good".

"And then we do lots of community level strengthening because lots of times the public services, where it was already quite limited prior to the disaster, it becomes even more weaker post disaster. So we try to kind of empower and provide capacity building for the community members".

"certainly, in the last 10 years, there has been much more of a shift to building local capacity…But the aim is to build their resilience and their capacity".

"There are several NGO's that don't work like that; they get there and don't leave any capacity in the community. So the communities continue to depend on outside help".

"I think is an important point that needs to be improved. But what also needs improving is the level of enablement in communities; ; to be sustainable in the long term".

Figure 5.2 shows that the ratio between number of members and equipment available is very low; for example, there were 40 committees formed in Maputo city, but only twenty-two of those were fully equipped (batteries, torches, axes, etc). Similarly, in Tete province, out of the seventy-one committees formed, only twenty-one were adequately equipped to respond to a disaster.

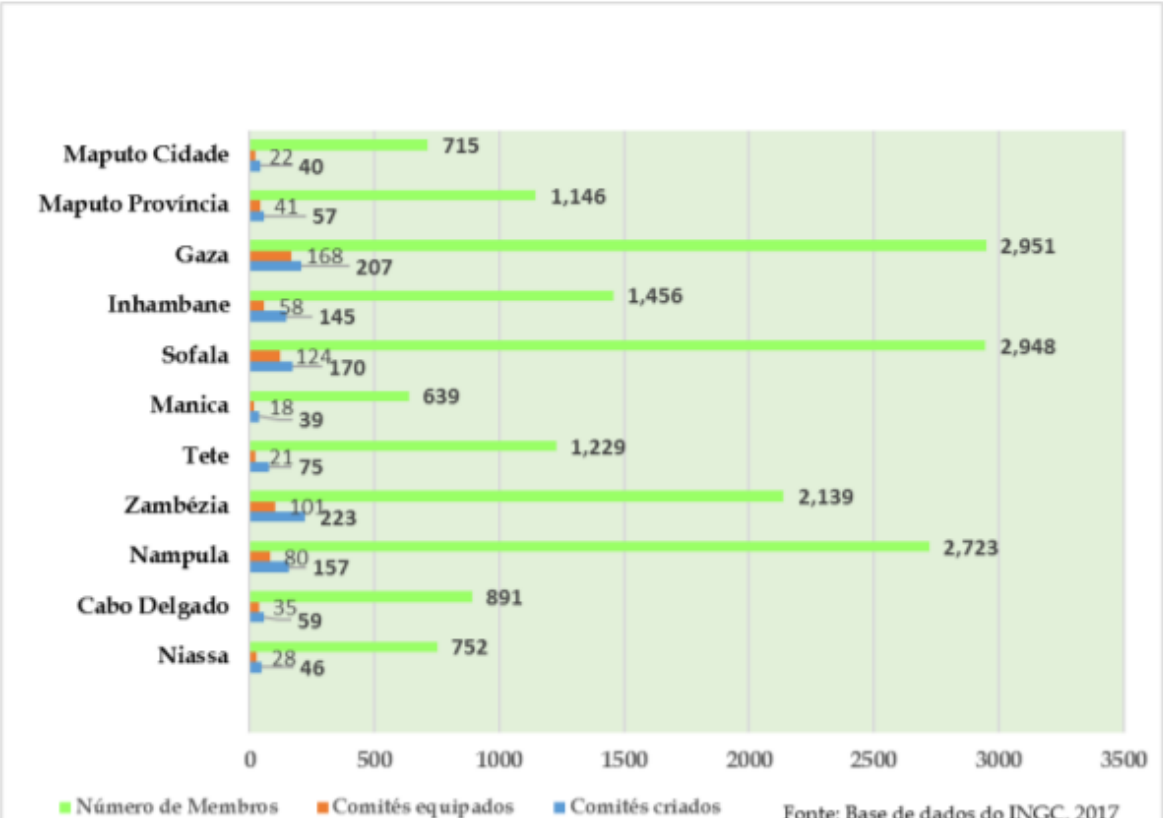

Figure 5.2: Number of committees in each Province. INGC (2019)

This emphasises the weaknesses and vulnerabilities of these communities. The comment below highlights the weaknesses communities face due to a lack of governmental resources:

"…the government doesn't have the capacity- after a flood- to again give batteries, or if the aces break- to provide another one- they don't have the capacity to maintain the emergency regions. And because they are volunteers, they wont be putting in their own money to do that, but they sometimes end up putting money in- which is not what should be done".

To emphasise the need of international support to developing countries, Mozambique's NDS's stated the following: "The implementation of any proposed reduction is conditional on the provision of financial, technological and capacity building support from the international community" (Mozambique NDC, 2021, p. 20).

5.2.5 The role of schools

A report by UN's International Strategy for Disaster Reduction states that incorporating disaster risk education in primary and secondary curriculums creates an environment of understanding and enhances awareness (UNISDR, 2009). Therefore, an important factor to consider is how implementing climate change and disaster related content in school curriculums could enhance future preparedness. The UNHABITAT in Mozambique works closely with schools to provide support in three different ways:

- **Infrastructure**: Ensuring the schools are built following the correct building codes (Discussed further in section 5.10.3)
- **Community preparedness:** Forming school committees using a participatory approach that aid residents in the event of a disaster.
- **School curriculum**: Integrating DRR and resilience in the school curriculum.

Community preparedness includes students, teachers and directors, with different responsibilities: information management, maintenance of infrastructure, first aid. It also involves sensibilisation and training students how to evacuate to safer grounds in the occurrence of a disaster. One interviewee mentioned that:

"*they have flags in schools which they can raise; when they see the red flag, they know that the hazard is imminent".*

UNHABITAT Mozambique also forms school committees, like the committees formed in communities, using a participatory approach. School committee has links with the district committee, showing a share of information and that residents can evacuate quicker if needed. Volunteers are selected and they range from students of all grades, teachers, directors as well as community members. Volunteers are then given several 'tasks and responsibilities' such as

"information management, maintenance of infrastructure, first aid".

It could be argued that this committee is more proactive compared to the community committees because during the 'normal' period they:

"work in the sensibilization, training schools on how to evacuate, they imitate the evacuation roads in the school…they identify the refuge area".

Performing drills is an important activity in disaster preparedness:

"we have a lot of drills- not only at village level, but national level, city level also. I am talking about hundreds and thousands of people involved in a drill to be able to address this kind of thing".

UNHABITAT's work with the school committee is very participatory in that the organisation offers the school committee a blueprint of responses before, during and after the emergency, and the committee, using that blueprint, collectively decide which actions should be prioritised and put in place all necessary measures.

On a national level, the National Strategic Educational Plan (NSEP) (2020-2029), natural hazard-induced disasters are mentioned only with reference to ensuring that schools are resiliently built, that they provide a place of refuge in times of crisis and that they do not suffer loss in terms of manuals, books and equipment's. With regards to its inclusion in the curriculum, like UNHABITAT, it also states that it should be included in the teachers training content, so they are equipped to reduce the risks and offer psychosocial support to students (Government of Mozambique, 2020).

According to a progress report of the HYOGO implementation in Mozambique, disaster risk reduction is offered at primary, secondary and tertiary levels. In the Curricular Plan for Primary Education produced by the Ministry of Education and Human Development, the profile of a primary graduate includes ‘to promote actions which protect the environment’ as well as ‘adopt responsible attitudes in the face of natural hazard-induced disasters’. While the plan does not explicitly mention the contents students are taught, it does acknowledge the importance of teaching young students about natural hazard-induced disasters. With regards to primary and secondary level, DRR is addressed in subjects such as geography, physics, and natural sciences. The curriculum states that and DRR should involve the: “inclusion in the teacher training curriculum competencies for disaster risk reduction and to offer psycho-social support for children in emergency cases”. While this is beneficial, it takes a reactive approach to prevention, rather than proactive. In other words, it fails to offer strategies students and schools could implement in order to reduce the impacts of natural hazard-induced disasters before it hits.

The importance of involving schools in disaster preparedness was reinforced by participants from the follow up interviews. Apart from forming school committees, Macorreira (2020) expresses that environmental education should be promoted in classrooms on all school levels, by demonstrating to students its importance to the environment.Organisations around Maputo have created initiatives with the aim of creating awareness in schools. In 2018. BioFund, which is an environmental organisation, ran three days of environmental education for children between the ages of 9-12. Activities included whale watching, cleaning the beach, teaching them about solid waste management, and to equip them with the necessary knowledge and practices about marine preservation (BioFund, 2018). Another initiative is by Verde Azul (Green Blue), which is an organisation with the aim of mitigating the impacts of maritime pollution and enhancing the potential of marine resources. Since 2018 the organisation has run various projects focused on the development and management of the environment. One of those projects was ‘Ecological School- Seeds for The Future’, which saw the participation of six schools. Verde Azul created awareness campaigns about the importance of conserving biodiversity through lectures, cleaning the beach, and provision of materials with the aim of encouraging the students to learn

more about the environment (Verde Azul, 2021).

5.2.6 All-inclusive Participation

5.2.6.1 Persons with Disabilities

The inclusion of people with disabilities in disaster management is an area which is under investigated in Mozambique. According to Radio Accao (2019), there are around 727,620 in Mozambique with a 'visible' disability, representing 2.6% of the population. As discussed in the literature review (Section 2.5), Mozambique has adopted the SENDAI framework in its disaster management policy. Under priority four of the framework, the importance of including vulnerable groups is highlighted: "Women and persons with disabilities should publicly lead and promote gender-equitable and universally accessible approaches during the response and construction phase" (United Nations, 2015, p.36). Two participants highlighted the importance of involving people with disabilities in communities because they are arguably the most neglected group:

"it was very evident from the survey that we did that people living with disabilities are often overlooked".

"the persons with disabilities were also involved in this area; there are actually organisations of PWD at the local level…".

When considering forming community committees, it is important to ensure that it is a fair and equal representation of all community members. In the case of Maputo, volunteers are elected by the community based on their respectability and capabilities. There is a consensus among interviewees that committees formed need to have an all-inclusive nature. One interviewee explained that:

"make sure you don't overlook the most vulnerable; older people, women and children, people living with disabilities, and groups that might be marginalised because of their religion or their ethic group".

With reference to the recent cyclone which hit the province of Beira, Light for the World (2019) highlights that the event negatively impacted persons with disabilities as they faced economic restraints and social marginalization.

While the importance of involving PWD, one interviewee shared the practicality of this:

"its difficult to have a disabled person within the committee because you need some time- in terms of response- you need people evacuating others, running all over and so on. But they are trained to give high priority for those people".

This shows that they are not involved in the committee, but they are given priority during responses. However, this brings to question whether without directly involving them in the committee, how can their needs be listened to and understood. questions which could be asked include 'how can they be best helped', 'what are their immediate needs in times of crisis?'

The lack of inclusivity of people with disabilities was a major finding in this study. Under the SENDAI Framework, people with disabilities are encouraged to be included in the disaster management framework, however, one interviewee from the follow up interview reported that:

"its difficult to have disabled person within the committee because you need some time- in terms of response- you need people evacuating people, running all over and so on. But they are trained to give high priority for those people".

The latest population census which took place in 2017 showed that 2.6% of the population has some sort of disability (AICS, 2022) Although this figure isn't high, the country has struggled to accommodate them in society; as an illustration, 46,200 jobs were created between 2013 and 2015, but only 1,576 were allocated to people with disabilities (AICS, 2022). The implication this has in addressing adaptation strategies is that there needs to be more understanding of the needs of people with disabilities. Again, this can be done by applying a participatory approach.

5.6.6.2 All-inclusive participation: Women

Women play a crucial role in communities in the event of floods. Two participants alluded to the idea of the nurturing nature of mothers and how that plays a role of adaption:

"Women themselves shared with us many different strategies they implement, especially during the flooding season that you would say 'wow, so creative".

"…she is the person that suffers for the children, she has to guarantee food for her children, she has to guarantee water for her children, she has to guarantee clothes for her children, security for her children, and everything depends on her".

Gender relations add to the complexities of community engagement and authors have agreed that climate change has the potential to exacerbate gender inequality (Clarke at al, 2019; Dodman and Mitlin, 2013; Mersha and Learhoven, 2016). This is supported by the following statement made by one participant:

"When you look at the numbers, women are much more vulnerable to disaster situations and they are the ones that are really impacted. So certainly, all interventions need to be really gender responsive. You see it with the hurricane IDAI in Sofala province again, those that drowned were women and children.. So again, they are fundamental players when it comes to climate change adaptation and building resilience. So you need to have all interventions being more gender responsive".

One factor which can hinder women participation in communities is culture and customs. Despite there being the acknowledgement of the importance of involving women in the climate change adaptation, little had been done to address the current marginalisation they face (Moyo, 2012; Mersha and Laerhoven, 2016;). Historically in Mozambique, due to climate change impacts, men have migrated to South Africa and other surrounding countries in search for employment, leaving women as head of their households and, making it even harder for women to make ends meet. Thus, as an adaptive strategy against climate change impacts, they might favour strategies which do not demand migration, and allows them to remain nearby. Hence, in this instance it is important to involve women in decision making since they are the ones who will remain and become the main benefactors. This is also supported by one interviewee who states that:

"So what we do is that we try to do an advocacy to INGC to give priority to the issue of women".

A common association which women in communities become a part of is 'xitique'. Xitique is described as "a form of community association in which the members of the group, usually made up of friends, co-workers or family members, periodically

contribute a monetary value so that each person receives, on a rotating basis, a total of all contributions" (Priberam, 2021, p1). In the academic literature, its known as Rotating Savings and Credit Associations. This form of saving ensures that women are regularly receiving income and creates a stronger union between them, as every month they get together and socialise; it becomes more than just a source of income, but of trust, union and solidarity. Xitique is largely based on trust and commitment amongst members; trust as the person contributing the money is delaying their personal investments and the person receiving the contribution is given the financial power to purchase goods or investments which they would otherwise not be able to afford. Commitment is important as any new member which joins the association must guarantee that they will be able to make payments on time so as not to impact others.

It could be argued that this is a form of empowerment as women can take their own initiative as to how to use the amount. Another advantage is that there is no interest placed on loans, no bureaucracy, no paperwork, and no external debt. Trinidade (2017) explains that in some instances the contributions made are deposited in a bank account to be used either for funerals, weddings or in emergency situations. In a study involving smallholder farmers, 11% stated that they had a plan to manage unexpected expenses due to flooding, and 11% reported to be a part of xitique or a savings and credit group (Ayani, 2016). Panman et al (2021) conducted a study on the effects that a savings group had in a flood prone community and concluded that households who were members of a savings group recuperated much faster than households who did not have a member as part of a savings group.

5.2.7 Summary

The theme of community involvement has explored the various ways in which communities have been at the forefront of flood responses. Primarily and most significantly, it was established that community committees play a significant role as first responders. Created and trained by the institute of disaster management, committee members have various roles which range from coordinator, search and rescue and helping people to relocate, however, there was indication that only 30% of communities in the country which are susceptible to flooding has a committee. While their importance was made clear, the extent of their involvement and participation in decision making was uncertain. It was established that for adaptation to be sustainable, and to abide by the principles of community-based adaptation, it should integrate the experiences and opinions of locals. The study found that in some instances, residents resorted to making their own home modifications, such as, using stronger nails, placing heavy rocks on roofs, digging ditches and improving water flow. A rather unfortunate finding was the lack of inclusivity of people with disabilities in both the committee and general community engagement. To some extent, women were also marginalized owing to cultural norms.

5.3 Theme 2: Culture

5.3.1 Introduction to the theme

Cultural aspects were an interesting theme to explore as according to literature it is one area within the climate adaptation field which is understudied (Grothmann and Patt, 2005; McNeeley and Lazrus, 2014; Azadi et al, 2019). This theme explored cultural aspects in society which acted as hinderances in flood adaptation such as the belief that natural hazard-induced disasters are caused by supernatural forces and the resistance to change their behaviour.

Stavenhagen (1998, p.5) conceptualises culture as a way of life: “the sum total of the material and spiritual activities and products of a given social group… as well as a set of practices that a specific group produces over time”. A more contemporary definition of culture is presented by McNeeley and Lazrus (2014, p. 506) as “the full range of learned ideas and behaviour patterns that are acquired, shared, and modified by people as members of a society”. Both definitions allude to culture encompassing ideas that are learnt by society, and are dynamic throughout time. McNeeley and Lazrus (2014) state that culture dictates perceptions and decisions societies adopt when tacking climate adaptation. Embedding cultural norms and community practices within adaptation and allowing that to be at the forefront allows for a more flexible way to move forward, as opposed to forcing communities to behave or think a certain way.

One important factor which emerged from the interviews was the emotional attachment communities had to their homes; it was found that residents who had occupied a piece of land for generations were less likely to relocate. To ensure the success of adaptation strategies, it is important to understand the context in which a society exists, therefore, this theme explores cultural elements which had an impact in the way communities perceived climate risks and their willingness to adapt or change their behaviour.

5.3.2 Behaviour and Practices

Although vulnerability is largely influenced by external factors, it can be argued that people's beliefs and understanding of the matter impact their approach towards it; how one perceives risk, and its seriousness will determine how they respond to it (Walawalker et al, 2022; Steynor and Pasquini, 2019). One interviewee explained that:

"What makes them more vulnerable is resisting to change their mentality and their behaviour. Its indeed the change of behaviour that makes them more vulnerable".

The same participant also described the attitudes of committees after participating in training and drills:

"some communities don't take the information seriously. That's the challenge we face".

Interviews suggested that the 'older generation' displayed higher resistance to change their behaviour in relation to responding to floods, such as refusing to leave their homes:

"Because they say 'no, I can't leave this place because my grandfather lived here, my father lived here, and this has never happened, then why will it happen today'. People don't want to understand that we live in different times compared to when our grandfathers lived. Its indeed the change of behaviour that makes them more vulnerable".

The above statement is significant in at least two aspects: Firstly, that the 'older generation' who have experienced flood events growing up have built up resilience to the impacts of floods, and secondly, that they have an emotional attachment to their family homes, which results in their refusal to relocate to safer grounds. These two aspects are important considerations to the INGC in addressing flood adaptation in communities. Through education and creating awareness, it is possible to encourage a change in behaviour, however, it is more challenging to deal with people's emotional attachments and past experiences.

Supporting this, questionnaire participants also believed that a resistance to change behaviour and not taking early warnings seriously enhanced their vulnerability (53.13%). This is what Leary et al (2008) and Steynor and Pasquini (2019) describe as a 'distant threat' and 'psychological distance' respectively, which is described as "a

person's personal perception of something as either close or far away" (Steynor and Pasquini, 2019, p.2). It's the notion that a behavioural or perceptual change will be determined by how close or far the person associates with the risk or how urgent they deem their response needs to be. In other words, if a flood is seen as psychologically close, it enables one to closely relate to the event, especially if they have had past experiences with it. On the other hand, if the event is psychologically distant, it can be harder to relate and more of an effort is needed to mentally construct the risks involved. Due to climate change being seen as an 'abstract phenomenon', it has resulted in a lack of action in many developed countries (ibid). Moreover, Loubser et al, (2018, p.3) assert that "perception is an important link between beliefs and adaptation".

In contrast to the concept of 'psychological distance' presented by there is lived experiences. There is a difference between hearing about an event and living through it. Adger et al (2009) explain that while some communities may be resistant to change, others may adopt a flexible approach to it due to the changes they have experienced. A repeated lived experience of flooding is more likely to result in a willingness to implement adaptive strategies to avoid future disasters and this was a concept which resonated among several interviewees:

"The communities would say that these were events that they would experience every ten years. But during these last times, we experience floods every single year".

"…because of those experiences, we developed some sort of expertise…".

"In fact, many countries, such as Mozambique, also have a certain kind of DRR country champion perception from other countries because of their experience".

"It was through a lot of experience with handling disasters that the Philippines was able to develop a more proactive approach".

"So even before that, we already had some of these plans in place because of experience".

All the above quotes allude to the fact that past experiences of floods act as a learning curve to produce future resilience and pro-action initiatives. Steynor and Pasquini (2019) along with Albright and Crow (2019) explain that personal past experiences of natural hazard-induced disasters have the potential of triggering strong responses to avoid future negative impacts. This is consistent with Udelsmann (2019) study into adaptation strategies of urban dwellers in which participants reported that accumulated knowledge of past experiences had shaped their current adaptive strategies. The findings also supported the adoption by city planners and municipal government of a 'citizen perspective' which involves an ongoing discussion among citizens and the municipality in order to get a resolve on the best strategy to adopt (Otto-Zimmermann, 2011).

Clayton et al (2015) indicate that by addressing the psychology of people, and understanding their behaviour and motivations, policymakers can ensure they implement effective policies. Literature has suggested that how individuals understand climate change is important in shaping their responses, including their understanding of and support for policies that aim to address the problem and their willingness to adapt (Grothmann & Patt, 2005; Wolf and Moser, 2011; O'Connor et al, 1999; Arbuckle et al, 2013; Borquez et al, 2017; Azadi et al, 2019). Consequently, this may also determine how receptive residents are to governmental initiatives. As Clarke et al (2019) advise, adaptation strategies should not be in contradiction to communities' culture.

An aspect which neither the SLF and PAR model consider when discussing vulnerability is the role of perceptions and behaviour. Walawalkar et al (2022) concede that behavioural changes, as well as cognitive, affective, and cultural factors all have the potential to either hinder or stimulate adaptive behaviours. As discussed by Campos et al (2015), practices such as throwing waste in drainages and blocking them, along with poor management of waste were factors which contributed to enhanced flood risks in the Maputo neighbourhood of Maxaquene A.

People's perceptions of risk or adaptive capacity are largely influenced by what they hear about climate change in the media, through friends and neighbours or public agencies.

Grothmann and Patt (2005) conducted a study in Germany and rural Zimbabwe and explored risk perception and perceived adaptive capacity to determine why some people show adaptive behaviours while others don't. Risk perception was expressed as "the perceived probability of being exposed to climate change impacts and to the appraisal of how harmful these impacts would be to things an actor values" (Grothmann and Patt, 2005, p. 202. The results indicated that better future predictions are possible by incorporating socio-cognitive indicators. With regards to perceived adaptive capacity, the authors found that in addition to effectively communicating risks to people, they also need information on possible, effective and affordable adaptation options. A critical consideration policymakers should address regarding implementing adaptation strategies is that climate change will drive households and communities to change their livelihoods and behaviour, which may contradict with their cultural beliefs. Local social forms are beliefs and norms which define communities. For instance, in Nepal, Hinduism and Buddhism, which are both deeply rooted in nature, inform and define households' lifestyles. Therefore, when deciding adaptation strategies, policy makers ensure they suggest strategies which protect the environment as locals are more likely to respond positively to strategies which are in line with their values and beliefs (Clarke et al, 2019).

Patt and Schroter (2008) conducted a similar study and explored farmers and policy maker's perceptions of climate change and their effects on adaptive strategies in Mozambique. The results, shown in *Figure 5.3*, indicated that farmers believed that non-climate events, such as "a women becomes the President of Mozambique… an African country wins the football World Cup" (Patt and Schroter, 2008, p. 463) were more likely to occur compared to climate events such as "the Limpopo River valley experiences foods more severe than those in 2000"; "two major cyclones hit the coast of Mozambique near Beira in a single year", whereas policy makers believed climate events are more likely to occur. This demonstrates the different perceptions these two groups have. The farmers in this study seemed more concerned about the issues they have continued to face as a result of policy decisions compared to the possibility of a future flood. This difference of attitude and thinking can be attributed to the policy makers involved in the study; these included program managers, technicians from the Meteorological department and Mozambique Red Cross. Due to their readily access

to climate information and ability to disseminate that information, they could arguably be making decisions based on future predictions and the knowledge they already possess.

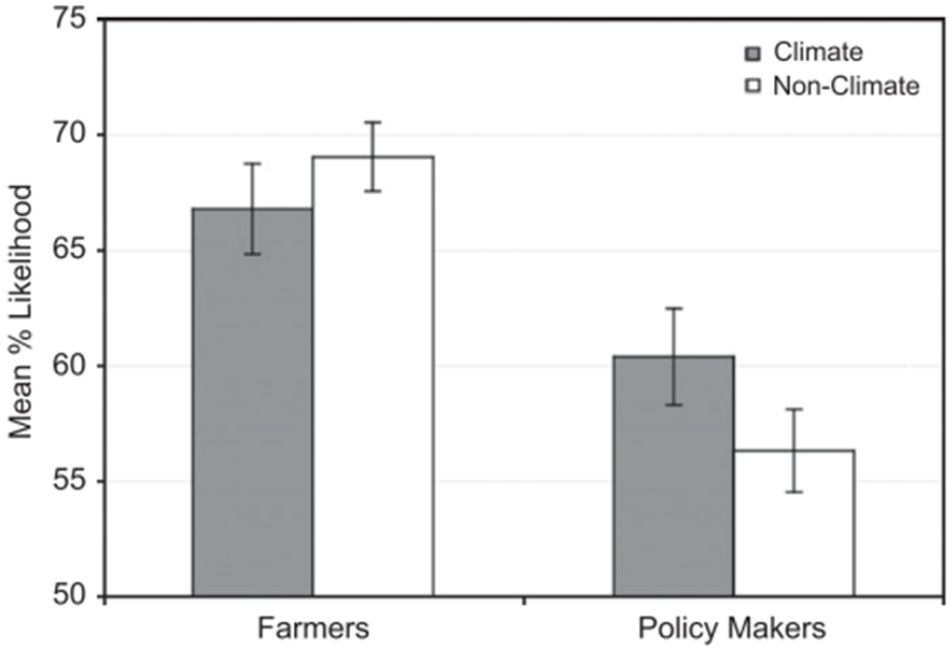

Figure 5.3 Likelihood of climate and non-climate event amongst farmers & policy makers. Patt & Schroter (2008)

To further demonstrate community perceptions, Patt and Schroter (2008) conducted a study which showed the extent to which religious beliefs have an influence in people's perception of climate change, as shown in *Figure 5.4:*

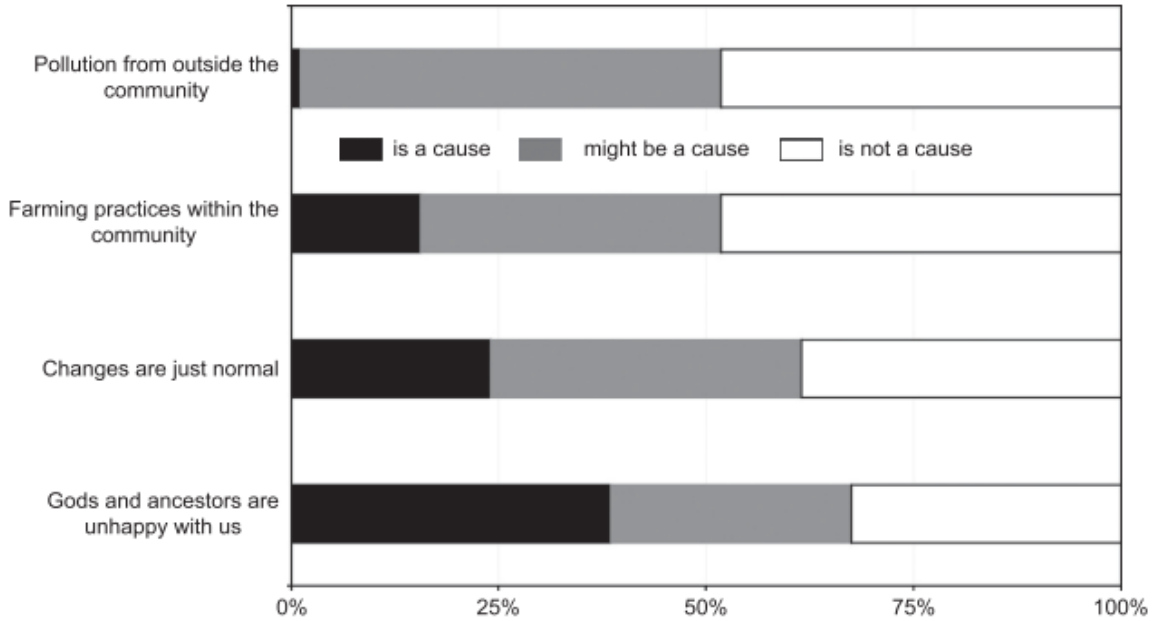

Figure 5.4: Beliefs about climate change. Patt & Schroter (2008)

When asked what they thought were the causes of climate change were, around 31% strongly believed that it was caused supernaturally. Prior to answering this question, the farmers had taken part in a workshop which explained to them the causes of climate change, in this case, it was pollution from outside the community. Patt and Schroter (2008) explain that informing or educating the farmers on the causes of climate change will not automatically change their behaviour or result in adaptive changes. They state that farmers will adopt something referred to as 'confirmation bias': instead of accepting new information, they will use it to confirm their own pre-existing beliefs.

To further support the relevance of perception and adaptation in Mozambique, Artur and Hillhorst (2012) investigated climate change adaptation in rural provinces by adopting a multi-sited ethnographic approach with the aim of exploring the importance of the socio-political and cultural dimensions of adaptation to climate change, and how the interpretations and responses of different actors' impact adaption.
Findings suggested that the scientific explanation of climate change is not widely known, hence, people find alternative explanations for extreme weather events:

a) **Will of God:** A popular explanation propagated by church leaders was: ""Nobody can claim droughts and floods. Only God can decide when to send rain or not!"" In 16 sermons, priests were found talking about floods and comforting those affected. Sermons had 3 important social roles: i) comfort for survivors, ii) helped them make peace with the situation, iii) enhanced solidarity with victims.

b) **Ancestors**: Ancestors play a large role in the lifeworlds of Mozambicans. When there is lack of rainfall, traditional leaders perform rituals to ask for forgiveness from ancestors. This reinforces and strengthens traditional leadership.

c) **Wrongdoing of witchcraft**: Some people associated droughts and flooding with the influence of witches. In June 2003, newspapers in Mozambique reported about alleged witches who were thought to 'put off rainfall' which led to lynching by local people to seek 'justice'. This led to a campaign by the National Institute of Meteorology to send teams to explain to locals the causes of droughts and flooding.

These three narratives demonstrate how engraved religion and supernatural beliefs are in the society. It is therefore important to dispel these beliefs by creating more awareness of the causes and consequences of natural hazard-induced disaster. Most importantly, it is essential to educate communities on how their actions can propagate or mitigate the impacts of climate change and natural hazard-induced disasters.

Communication also plays a role in how communities respond to climatic threats. The way a message is communicated will determine how people respond to it. Theatre, soap operas and music play a significant role in Mozambican society. Theatres are used to tackle taboos, encourage debates and change mentalities. One benefit of using theatre to communicate a message is that it is a true reflection of the society it is portraying and transcends any illiteracy boundaries. As Calisto (2022) puts it (translated): “Theatre in Mozambique has always been, since the armed struggle of national liberation (1964-1974) and to this day, one of the main means of education, culture and participation of the people in the socio-political life of the country”. A theatre

piece aimed at creating community awareness about the impacts of climate change and offering concreate adaptive actions was titled (translated) 'Fighting Pollution Through the Arts'. This piece was presented by theatre students of Eduardo Mondlane University and it re-enacted the main behaviours which exacerbate climate change, such as water pollution, cutting down on mangroves, devastation of marine ecosystems and forest deforestation (O Pais, 2022). One of the positive outcomes from this initiative was that it allowed the audience to interact with the actors and created a forum for discussion. One of the principal benefits of engaging in this kind of initiative is that it is relatable and contextually based.

The Mozambican ministry of Land and Environment created a campaign with local prominent musician and climate change activist, Stewart Sukuma, with the aim of communicating the importance of addressing climate change and increasing environmental conscience. This campaign saw various artists, climate activists and musicians coming together in a song. Some extracts of the lyrics include (translated):
"we are here together waiting for you; we bring the world in our arms"
Along with the lyrics, the music video highlights that responding to climatic threats is a collective action, and it 'invites' the viewers to join them. What the above two examples have in common is they both invite the listen / viewer to 'join' them in tackling climate issues. This form of 'invitation' creates a sense that they are all have an important part to play.

5.3.3 The Culture of saving

A cultural aspect which arose from the data gathered was the lack of the active practice of saving money for the use in emergencies. Due to high levels of poverty, people do not have the financial power to acquire insurance or loans; one interviewee states that

"the insurance companies focus more on life insurance… not disaster insurance. This is a work that is being done to access whether the insurance companies start introducing this package. This will take its time- people are already reluctant to take on life insurance, how much more…"

The National Institute for Social Security (INSS) is the board responsible for Mozambique's social security scheme. While it offers several benefits such as maternity leave, medical allowance, retirement plans, it only covers those employed in the formal private sector (Cenfri, 2012), thereby excluding those who live in urban poor areas. Therefore, it is not surprising that only 12.9 % of questionnaire participants believed that a lack of social security schemes contributed to flood vulnerability. One interviewee described the challenge of obtaining insurance:

"the insurance companies focus more on life insurance… not disaster insurance. There is a work that is being done to access whether the insurance companies can start introducing this package. This will take its time- people are already reluctant to take on life insurance, how much more…".

In contrast to the Western culture of obtaining loans and credits from the bank, the average Mozambican does not have that opportunity. When an individual or a family lose their livelihood assets which they depend on to sustain themselves, they are faced with the challenge of rebuilding their lives, which isn't always easy with lack access to credit or capital. Below are statements which demonstrate that a lack of practicing saving money makes communities more vulnerable as they do not have the resources to rebuild their lives:

"They are very dependent on the assistance of NGO's because they are poor and they don't have access to markets".

"Because Mozambique is very vulnerable to natural disasters and floods happen on a regular basis…you have to have some amount of saving. Either though money or food storage, or planning."

One interviewee believed that practicing saving would enhance preparedness:

"monetary savings is a huge huge thing, but those kind of preparedness, I think definitely helps".

"if communities are given access to that kind of environment they may create a lot social enterprise initiatives locally. This may be very beneficial to the community and they can create certain livelihood".

As an alternative to having a bank account, Batista and Vicente (2021) describe how people hide money 'under the mattress', inside buried cans, keep money with a local trader or sign up for a rotating savings and credit association (locally known as xitique) (section 5.6.6.2). Similarly, BBC (2011, p.12) reported that a journalist describing how people store money in several places other than the bank: "in their homes, some people bury their money in the ground…they keep money in pots; they keep money under pillows and so forth".

Since 2011, the introduction of mobile financial services (MFS) has grown in the urban cities and consequently changed the way money circulates in the economy. In Maputo alone, more than 70% of the population have access to a mobile financial account (UK International Development Agency, 2018). The Alliance for Financial Inclusion (2012, p.3) defines MFS as "the use of a mobile phone to access financial services and execute financial transactions. This includes both transactional and non-transactional services, such as viewing financial information on a user's mobile phone".

In Mozambique, M-Pesa and M-Kesh are the two MFS founded by mobile network providers VodaPhone and TMCel respectively. This service allows customers to pay bills, deposit and withdraw money, receive loans, purchase airtime, pay employees, all without needed to have a bank account. This has meant that the number of people opting to use mobile financial services as opposed to a conventional bank is increasing as shown in *Figure 5.5*. The World Bank (2019) strategy reports that by 2018, the population with access to a bank account fell to 33%, whereas 51% were using MFS's.

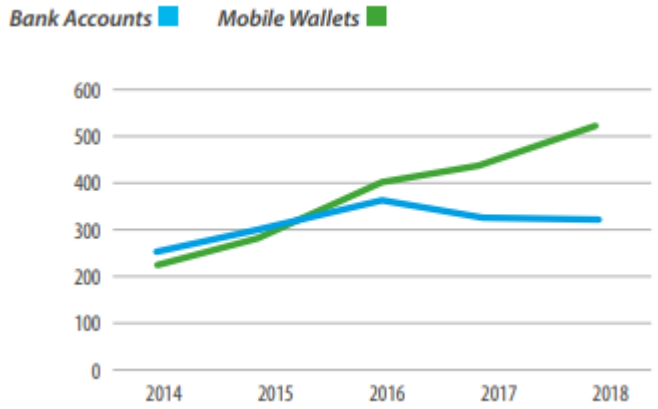

Figure 5.5: Bank account users vs. mobile money users. World Bank (2019)

Taking into consideration the rapid expansion of mobile financial services, it is worth considering what role it could play with regards to offering financial assistance in times

of floods. As almost half the population does not make use of formal banking services, it's less likely that victims will get financial assistance from the bank. M-Pesa offers a credit service called 'Txuna M-Pesa' which allows its customers to borrow and receive money instantly without having to have a bank account. To be eligible for the loan, clients must meet the following three criteria:

- Be a registered member with an active account for the last three months,
- Not be owing any previous 'Txuna M-Pesa' loads
- Not be declared bankrupt by a Mozambican court.

Clients can borrow any amount from 70MTS (£0.9) up to 3,500MTS (£45) (VodaCom, 2022). Interest rates are applied depending on when the client chooses to pay back the amount, as shown in *Table 5.3* (ibid).

7 days	10% tax
14 days	12% tax
30 days	15% tax

Table 5.3 Interest Rates Returns, (VodaCom, 2022)

This form of borrowing money is beneficial as money is instantly made available and can thus be used to relocate families to safer grounds, transportation, food, and medical supplies. A drawback, however, is that it can be tempting to borrow money but not be able to pay it back immediately.

On a global scale, the impact of natural hazard-induced disasters causes an average loss of approximately $300 billion, and most importantly, the risks of floods are the major threats to livelihoods and development (Rentschler et al, 2022), which further emphasises the importance of addressing floods. According to Surminski and Oramas-Dorta (2014), regions such as the Caribbean and Latin America possess high levels of flood insurance cover schemes, whereas in the Sub-Saharan, this isn't the case. There is a significant difference to the support provided by Western countries compared to those less economically developed; for instance, in Japan and Canada, flood victims are granted readily government support immediately after a disaster,

whereas countries such as Malawi and Bangladesh people are left to deal with the impacts for prolonged periods of time (Rentschler et al, 2022).

5.3.4 Generational Differences

In the Mozambican society, the elderlies make a fundamental contribution though their experiences, efforts to keep family units stable, and teaching new generations about the importance of work ethics and respect for others. Mozambican President Nyusi states that there is a need to "recognize that the elderly not only demonstrate their capacity for adaptation and resilience to adverse phenomena, but also play an important role in the fight against these evils…," (Club of Mozambique, 2022, p. 9) therefore, there is a need to ensure that their voices are heard and respected. However, there seems to be an agreement among interviewees that the 'older generation' are much more reluctant to change their behaviour and comply with government requirements. This is consistent with a study conducted by the University of Oxford in which 10% less of over sixty's believed climate change to be a global emergency, compared to respondents under eighteen (University of Oxford, 2021).
For instance, one interviewee reported that:

"the government isn't always able to because there are generations after generations of people who have been living in the same regions; that is where they have their loved ones buried, that is where their spirits are".

Another participant stated that:

"Because they say 'no, I can't leave this place because my grandfather lived here, my father lived here, and this has never happened, then why will it happen today'. People don't want to understand that we live in different times compared to when our grandfathers lived. Its indeed the change of behaviour that makes them more vulnerable".

A study conducted by Zehra et al (2019) revealed that residents have grown so accustomed to having their homes flooded that it is treated as a 'normal occurrence', resulting in residents taking a reactionary rather an initiative-taking approach, as shown by the below statements:

“And we still unfortunately live based on beliefs. Most of the times the communities don’t believe until they see it. But their understanding is increasing”.

“There is the traditional knowledge. For a while now, our communities have been adapting in their own way”.

“Particularly, the older generations who had been in the community and have been farming in the community for years were very well aware and could tell you that 10 years ago this is what happened and this is how we used to be able to do things and now we are having to modify and do it this way”.

In support of this, Bang (2022) encourages the use and value of traditional knowledge from local communities in enhancing their resilience to disasters. The different generational perspectives and beliefs are intertwined when it comes to educating the community. Dgedge and Chemana (2018) discuss the importance of the involvement of persons older than sixty in community committees as they would have had previous experiences of floods, such as the 2000 floods in Maputo. The authors argue that their experiences are communicated to the younger generations in the form of stories, and in turn, the younger generation take advantage of the technological advancements to make more informed decisions.

5.3.5 The role of trust

The success of climate adaptation is dependent on collective action, however, for collective action to be effective, there needs to be an element of trust present. Half of the questionnaire participants believed that one way to reduce dynamic pressures is to increase trust between communities and local authorities by creating better communication channels. Literature has indicated that social and institutional trust lead to a change in behaviour and an individual willingness adapt (Bodor et al, 2020; Smith and Mayer, 2018; Cologna and Siegrist, 2020). Smith and Mayer (2018, p.141) express trust as “assuming that other people, or institutions, are acting in a mutually beneficial manner informed by broadly shared social norms”. This definition, however, disconnects the individual and places responsibility on other entities; nonetheless, it acknowledges that trust appreciates local social norms. Within the context of climate

adaptation, both Bodor et al (2020) and Smith & Mayer (2018) express trust as a 'social dilemma': they agree that while an individual may be reluctant to mitigate their impacts of climate change, as a collective society they will recognise that it's in their interest to act. The authors agree that countries with higher levels of trust are more likely to engage in adaptation activities. One interviewee stated that trust is:

"Extremely important, because if you have a good communication channel, you minimize a lot of non-understanding and so on".

This is supported by Schmidt et al (2014) who warn that residents' lack of trust in authorities and other stakeholders can influence adaptation, as it creates communication barriers, project financing restraints and resistance to comply with government regulations. Supporting this, a study conducted by Thorn et al (2015) found that one adaptation barrier to urban dwellers was their lack of trust in government officials. Authorised officials were not considered reliable sources to deliver early flood warnings to residents. This was mainly due to community leaders and chiefs not being democratically elected, combined with various "informal governance structures" which resulted in fragmentations within the community (Thorn et al, 2015, p.128). Correspondingly to this argument, trust was also discussed in the context of forming community committees:

"it's a consultive process and it's the members of the community who identify who they think is better positioned and who they trust in the community to execute those role".

"Because there is an ownership and trust with committee members, because otherwise, it can create social tensions".

A study conducted by Udelsmann in Maputo reported one resident stating that "government have very beautiful policies and have done very little about it [flooding]. The very people that are supposed to benefit from these things don't benefit" (Thorn et al, 2015, p.127).

In past situations when residents have been encouraged to relocate to grounds promised by the municipality, residents have found that the government has not committed to what they promised or that the land provided was not adequate. After Cyclone Idai hit Mozambique, The New Humanitarian (2019, p.1) describe the

following situation "[Jose Antonio] hoped to receive a new house and a job in the neighbourhood. Instead, he found a tent in a forest".

Trust is also an important element in the work of NGO's. Different from governmental organisations, NGO's work on establishing a relationship and build trust with community members. Due to the prolonged presence of NGO's in communities, they are able to gain the trust of members (Coppola, 2015) which facilitates their work in accessing what the community needs, and it also establishes a confidence and willingness of community members to open up about their needs. One interviewee stated that:

"Well, they do trust the organisations that have provided support to them [communities]. More so that whenever there is a situation they search for the focal point to present the challenges they are facing to see if they [NGO's] can find a solution".

5.3.6 Summary

In summary, this theme explored how cultural elements, such as perceptions and behaviour, influence adaptation. Perhaps the most interesting finding is that residents have an emotional attachment to their homes; either because that was their family home for generations, their livelihoods depended on remaining there (if they were farmers), or because their loved ones had been laid to rest there. This however, meant that they were reluctant to relocate to safer grounds in the event of flooding; or even if they did relocate to higher and safer grounds, they would return once waters subsided. Another aspect which arose was what Leary et al (2008) and Steynor and Pasquini (2019) termed as 'distant threat' and 'psychological distance' respectively; which was described as the idea that residents' response any disaster is determined by the level of threat or risk they perceive it to have. Religious beliefs also had an influence on adaptation responses. The theme also found that the government has not put in place a scheme which financially protects communities in the event of floods, equally, it was also argued whether such a scheme or insurance policy would be effective in Maputo with the majority of people using mobile financial services as opposed to banking services. While trying to take advantage of the growing number of people using mobile financial services, it was suggested in the event of a flood, customers could borrow

money from mobile wallets. The role of trust between local authorities and communities was found to be imperative for establishing reliable communication channels. This study found that culture plays a valuable role in influencing adaptation strategies adopted by communities, as it influenced how people perceive climate risks and in turn, their willingness to adopt adaptation strategies.

5.4 Theme 3: Intersectoral Dynamics

5.4.1 Introduction to the theme

Intersectoral dynamics explores dynamics among sections and evaluates their effectiveness in the event of a disaster. Interviewees highlighted that effective adaptation can only happen when all key players are involved, therefore, it is important that stakeholders are able to cohesively collaborate and share their information so they can make informed decisions. While the INGC is responsible for forming and training the local committees, it was evident from the interviews that several other institutions also get involved in training the communities; this includes UNHABITAT, Embassy of Ireland and Sweden and Save the Children.

5.4.2 The role of the National Institute for Disaster Management

The National Institute for Disaster Management (INGC) is the agency responsible for managing floods in Mozambique (Section 5.2.1), as well as in charge of planning and implementing disaster risk reduction measures in Mozambique through improved communication systems, policies, mitigation, and relief (Devex, 2020). Formed in 1999, the institute originally dealt with the impacts of Mozambique's civil war, however, after the 2000 floods, it began focusing on natural hazard-induced disaster prevention, recovery, and reconstruction (Zehra et al, 2019). They also work on coordinating emergencies, mobilising the population to prevent disasters and strengthening multi-sectorial coordination (Devex, 2020). Their multi-sectorial coordination was expressed as such:

"when you have disasters, you also have INGC and other partners like Red Cross is a strong partner in emergency operations. You have also what they called Humanitarian clusters which is formed with different organisations; you can find the UN organisation, different UN organisation you can find World Vision. You can find other organisation, but all of them they work under the INGC"

"We also offer social protection with various partners, not just INGC. We work with UN agencies, we work with UNICEF because of the child it their social protection; we work with World Food Programme because of assistance of survival food during the emergency. We work with IOM (Organisation for International Migration"

Additionally, the INGC is the main governmental body responsible for forming and training community committees. While their efforts to create local community committees have been vital, their internal structure arguably needs reforming. Firstly, since its formation, they have been accountable to various departments: Ministry of Foreign Affairs, Ministry of Environment and Land, Ministry of State administration of Public Services and most recently, it has been accountable to the Prime Minister. These transfers may have arguably created inconsistencies in communication, priorities and rate project completion. Interview participants also mentioned the impacts these changes had on their efforts to conducting research in flood prone communities. Participants shared the challenges of getting access to certain communities because they had to go through various channels and ask for several permissions. This included getting permission from the provincial authorities, local authorities and finally community leaders. However, getting permission from these authorities involved substantial costs, resources and time which meant that some projects just reached a study level, instead of an implementation phase. Another participant expressed the same concern stating that organisations work in 'blocks'- in other words, they don't consult with the communities beforehand to access which projects have already been implemented before by other organisations or which skills and knowledge sets do communities already possess. Instead, they start projects from scratch:

"There's not a culture of trying to build up existing knowledge…but we're supposed to build up on the existing practice- what went well and what went wrong … some communities will tell you we are so tired, so many times you guys will come here to ask us what's wrong, but in the end nothing happens".

This emphasises the need local governments and institutions have for a more cohesive and mainstreamed structure.

The INGC is primarily focused on the humanitarian side of disaster coordination and less on the recovery, which links with what is lacking in the communities: they are aware of how to respond in the event of a flood, but they struggle with their recovery efforts. One interviewee explained that:

"INGC is strongest in humanitarian response because they are more focused on preparedness disaster and immediate response. But when you go to the recovery and recover, , oh, there we have a problem".

Additionally,

“the INGC go more after the disaster in immediate response- but when we go to the recover, they said “okay it’s the sectors”- like the publics’ work we do, but they are not fully engaged with that, and also the local authorities are not fully involved ”.

These results raise intriguing questions regarding to effectiveness of the committee training being offered by the INGC. Preparing for a disaster is as equally important as knowing how to recover from one. Hence, there needs to be more focus on the different strategies for recovery, rehabilitation and reconstruction. There already exists a unit charged with responding to climate disasters, however, these strategies and plans need to be communicated to the locals so they are informed about how to recover. When cyclone IDAI hit Beira, the INGC was not prepared with a recovery plan process, and as a result, an emergency cabinet of reconstruction was formed. This will hopefully serve as an example moving forward and result in the creation of a community recovery plan. One interviewee commented that:

“This is why they created for example for IDAI, the cabinet for reconstruction which is an institution to coordinate the reconstruction effort. This is the kind of institutional set-up that needs to be consolidated”.

Another responded stated that:

“INGC have the role of coordinating everything so this kindlegislation need to be clear, and also the roles of the communities and all this process need to be clearly displayed and established”.

Therefore, there needs to be clearer definitions of roles and responsibilities, communication and accountability. Processes and structures, especially levels of government and institutions, play a vital role in how climate change is addressed in Mozambique. The importance of the involvement of local governments and municipal authorities with communities was highlighted as being essential for effective adaptation measures, as well as the importance of establishing multisectoral collaborations.

5.4.3 Improvement of early warning systems

The improvement of early warning systems was highlighted as needing to be more mainstreamed and communicated in a timely manner. Over half of questionnaire participants believed that lack of mainstreaming and communication between stakeholders constrained the country's ability to tackle flooding.

Figure 5.6: Cycle of communication. Authors own (2022)

Leefers (2022) conducted a field study exploring flooding communication and found that even though risks and warnings are issued out, it does not always result in preparedness activities. For instance, during cyclone Idai and Kenneth which hit Mozambique in 2019, despite the fact that warnings were issues, communities failed

to understand the impacts and intensity of the cyclones, hence, thousands of people were affected. But most importantly, the warnings were not communicated with practical actions to minimise the impacts. It was therefore concluded that risk communication was ineffective due to how the information was delivered, a lack of trust in authorities, and a lack of understanding of risks within the communities (Leefers, 2022).

The cycle of communication shown in *Figure 5.6* describes the path communication takes until it reaches the community:

The explanation why early warning systems need to be streamlined is because before the warnings reach communities, they go through several institutions which results in a delay in communication. One participant expressed that:
"The way to reach the community is so long",

whereas another interviewee explained that:

"The early warning systems are not robust and communicative enough, and at times we receive delayed information".

It can be argued that this cycle of communication is too complex. This is due to the elevated levels of bureaucracy in place and the various bodies involved in passing down information. The structure above ensures that information flows in a controlled way and that its accurate, however, a few participants expressed that this cycle is too complex and causes delays in issuing early warnings:

"We have a basin coordination and all the early warning systems which are not robust and communicative enough, and at times we receive delayed information".

5.4.4 Lack of Project Continuity

For a project to be successful, it needs to be sustainable. Lack of project continuity and shortages of qualified personnel were highlighted as hindrances for effective adaptation. There was a lack of project continuity from both the stakeholders and communities. MICAO (2007) state that the personnel responsible for monitoring and

evaluating river levels are not fully qualified to use modern technological methods, hence, there is a need of capacity building in order to reduce the negative impacts caused from rising river levels.

The term 'adaptive capacity' was highlighted by all interviewees as being pivotal to building resilient communities as a high level of adaptive capacity equates to groups being in a better position to reduce their vulnerability to disasters. One interviewee described how there is a constant movement of people who are being trained for specific tasks to different departments, which is detrimental when dealing with recurrent floods:

"One of the challenges that we have is that within the government we have a lack of institutional capacity and continuity of capacity. We train staff and show them how to do the work. However, after their training, they are moved to a completely different department. And after that maybe the guy from the department of health was nominated at the directory divisional level. And you end up having this constant movement of people"

The same observation was made through a study conducted by Broto et al (2015, p. 581) in which one interviewee highlighted that there is a "lack of dedicated personnel within the municipality". Similarly, one participant indicated that:

"We have a weakness in capacity…in terms of professionalism; in terms of operative resources".

In support of this, Bang et al (2019) conducted a study into the disaster management risk in Cameroon and found that flood monitoring and early warning systems were hindered as a result of operational capacity.

Communities also lacked project continuity. One interviewee explained that many times when external organisations come in to help communities, their focus is to implement specific activities and offer short term aid instead of educating the communities on how they can use their knowledge to be better prepared for future events*:*

"But I insist that the best way is to train people by transferring knowledge to the people and with that knowledge people can find alternatives to continue with the aim of the project".

This is an important element as transferring knowledge and empowering locals ensures that in the long run they are able to fend for themselves, particularly in Maputo, where there are cases of re-occurring floods.

"We need to teach the community- we need to train them so that they can do it themselves. This encourages them to be committed and also ensure that for future disasters they can understand how they can proceed…this is the way we believe that we can help build the resilience in the community".

5.4.5 Evacuation & resettlement

One strategy that the government has continuously attempted with residents is evacuation. One may question whether evacuation is a sustainable form of adaptation as arguably there is no adaptation taking place. However, in some instances, evacuation leads to residents being permanently relocated, which may be a long-term sustainable option, especially if one's home is located above floodplains which isn't going to improve but worsen as the intensity and frequency of floods increase. This is supported by Kuhl et al (2014) who agree that while evacuations are temporary in nature, most people who are relocated scarcely return.

An adaptive strategy used by some community members is the possession of two homes; one close to their livelihood activities, which in most instances are located in floodplains, and a house located in higher grounds so they can relocate in the event of a flood. While this can be seen as a solution, it would be challenging for residents with limited financial resources to own two homes. One interviewee explains this process:

"It ends up being the case that residents have two houses: one close to the river and the other one higher up. So when there is a risk, they move higher up; and when its non-risky, they live close to the river; that's how they live".

Another strategy that the government has attempted with communities residing in flood prone areas is resettlement. UNHCR (2014, p.10) describes it as "the process of enabling persons to establish themselves permanently in a new location, with access to habitable housing, resources and services…". Mozambique has had a long history of resettlement processes, which has displaced millions of people. The government

has attempted to make the houses more appealing by emphasising the modern design, infrastructure and services. Implementing the resettlement policy has been hindered for many reasons Resettlement is also often met with resistance because of their livelihood activities. It is often the case that residents will be relocated to areas where they cannot continue to pursue their main income activities and are forced to find new employment. This was explained by one interviewee:

"there is always a first attempt to not relocate people to regions where people have to change their activities, because that is very challenging".

One participant expressed that the country lacks operative means to deal with relocation:

"What is the point of issuing warnings when the operative capacity to relocate the people in time or to protect infrastructure is very limited in terms of communication, operative means and transportation. Relocating people from zones of risk and managing to resettle them in another is all a dynamic process that is challenging to respond to in a short time because of the little resources the country has".

5.4.6 Structure of Emergency Coordination

The emergency coordination structure in Mozambique is made up of two groups: the government and the cooperation partners. At the highest level within the government, there is the Coordinating Council of Disaster Management which is led by the Prime Minister along with Ministers from all relevant sectors. Their main responsibilities include to coordinate the multi-sectorial response such as disaster prevention and first responses, and secondly, to implement the Master Plan for Prevention and Mitigation of Natural hazard-induced disasters.

At the next level is the Technical Council of Disaster Management, led by the General Director of the National Institute of Disaster Management; this group is composed by all the National Directors of relevant sectors (communication, infrastructure, information and planning & social services). Their main responsibility is to coordinate the early warning systems in the event of any imminent disaster. They also ensure the implementation of vulnerability and risk reduction plans. *Figure 5.7* illustrates this composition:

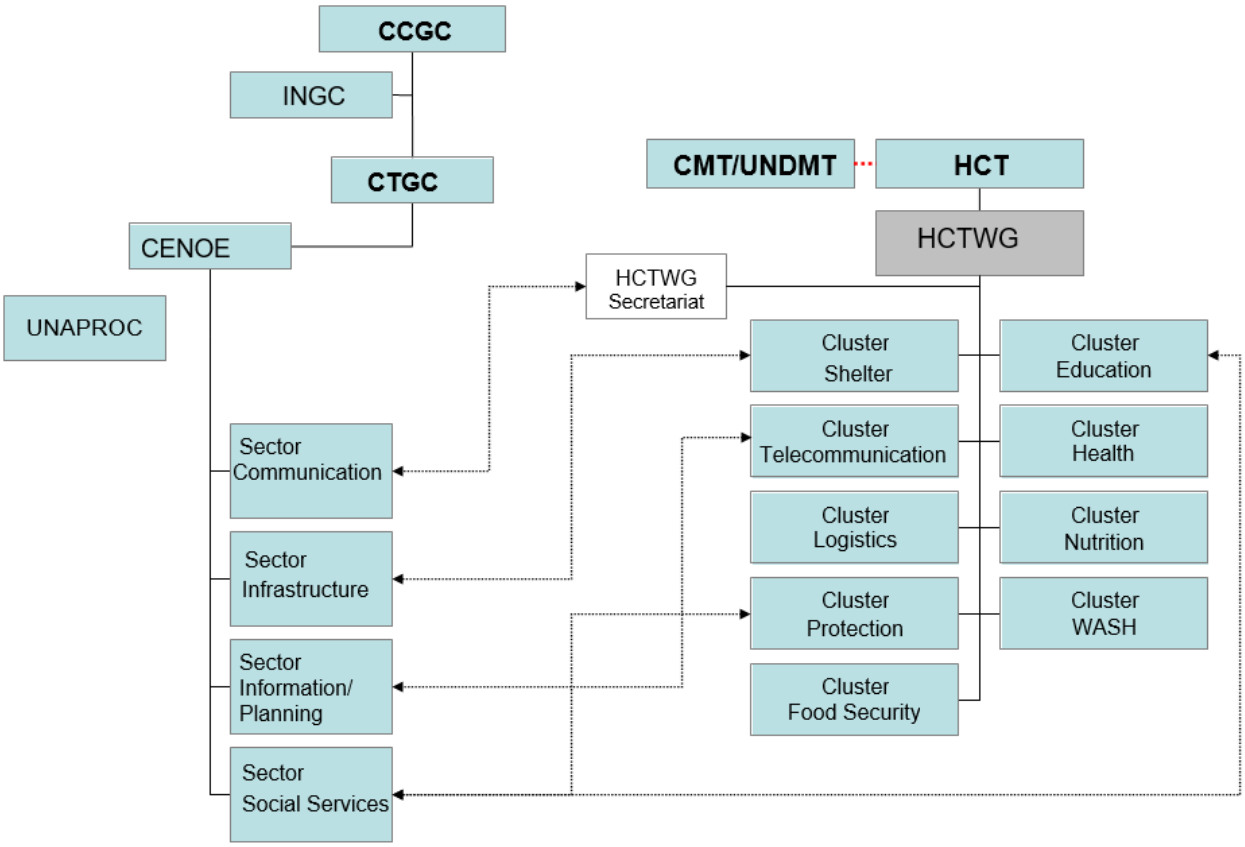

Figure 5.7: Emergency Coordination Mechanisms in Mozambique (INGC, 2019)

Working alongside the government, are various cooperation partners known as Country Management Team. This is comprised of United Nations agencies, social civil organisations, donor agencies, private organisations, NGO's and other partners. This is also reflected in the interview participants:

"I work with the Irish Aid…I am the focal point of climate change and that is why I have with me the responsibility of the disaster risk management portfolios".

"I am now working for the Swedish Embassy in Maputo as the official of programmes of environment and climate change".

"I am the chief of the program UNHABITAT…Besides my managerial role within my work in the UNHABITAT I engage in the technical side of mitigating risks and disasters".

"I am currently sitting now at National Institute for Disaster Management (INGC) where I coordinate programs for disasters".

The Management Team adopts a United Nations cluster system, with nine clusters involved when responding to natural hazard-induced disasters (Shelter, Initial recovery, telecommunication, logistics, education, health, nutrition, (water, sanitation, health), and food safety). The cluster approach is a combination of humanitarian organisations, both non-UN and UN members which are work towards addressing the main sectors within humanitarian action (Humanitarian Response, 2020). These clusters are aligned and work in conjunction with the relevant governmental sectors in a combined effort. By aligning themselves to the relevant sectors, it ensures groups work in a cohesive manner and that there is no duplication or gaps. Additionally, it also ensures that roles and responsibilities are clearly defined and enhances accountability (Humanitarian Response, 2020). Therefore, the cluster system is a good example showing how they are effectively able to collaborate with other organisations when responding to a crisis. One interviewee expressed that:

"that's why we say that disaster risk reduction measures should be a coordinated, well-coordinated action; all institutions should play the same role to reduce the impacts of disasters, sometimes this is a challenging issue".

5.4.7 Summary

In summary, the intersectoral dynamic theme delved into the dynamics of different sectors and their effectiveness. It was established that in order to ensure effective adaptation, there needs to be a coherence in terms of how, what and when information is shared, and ensuring that all players involved have clear and defined roles so as to avoid duplications and gaps. The findings reported here imply that there needs to be an improvement in the way early warnings are communicated; both in terms of early warnings reaching the communities in sufficient time and in a manner which can be easily deciphered. Lack of project continuity was discussed; this was an important finding as it indicated that projects and initiatives aimed at addressing community flooding were not seen to completion. Finally, the theme explored the structure of coordination mechanism in emergencies that the country has in place. In essence, this is divided into two groups: the government and various coordination partners which adopt a United Nations 'cluster' system. Within this structure, various sectors are

represented, such as: education, health, water, nutrition, etc), and these sectors work with their relevant government counterparts.

5.5 Theme 4: Infrastructure

5.5.1 Introduction to the theme

The infrastructure theme examines infrastructural factors which have exacerbated the impacts of flooding in Maputo. An already fragile environment, coupled with high poverty levels, has the potential to weaken a society. Issues such as poor solid management, poor sanitation and the increasing rates of urbanisation were found to exacerbate flooding. From the data gathered from the questionnaires, over half believed that the lack of an effective solid waste management increased the impacts of floods, and consequently, participants concluded that tackling waste management is a high priority in urban communities. One interesting finding which emerged was that flooding is worsen by the fact that residents construct their own homes without adhering to adequate building codes. The concept of Build Back Better (BBB) and the creation of green spaces are explored as potential solutions.

5.5.2 Solid waste management

Poor solid waste management from a lack of investments and rapid urbanisation are leading reasons why Maputo is susceptible to floods. Supporting this, the questionnaire results concluded that addressing this issue is a top priority when tackling floods in urban communities. Urban communities have grown to be characterised by rubbish piles, and due to not having adequate solid disposal services, residents' resort to dumping waste in roads and pathways, which cause the blockage of water channels. One interviewee participant comment that:

"Cleaning, removing solid waste, setting up waste management systems because that is a huge problem in many areas; that waste is not well managed. And waste is often a contributing reason to why you see a lot of flooding".

The issue of solid waste management is one which dates back to the time of civilcivil war in which large numbers of people migrated and were forced to settled on the periphery of Maputo due to their low economic status (discussed in Section 1.2). Residents at that time were not offered land tenure rights and their homes were constructed with precarious materials such as reed and iron sheets. These factors

resulted in Maputo housing 45% of urban migrants, with 50% living below the poverty line (UN HABITAT, 2010). Since then, a lack of effective government interventions in these neighbourhoods has resulted in them being neglected, and this has been reflected in how waste is managed.

When questionnaire participants were asked to indicate whether the civil war had an impact in the governments ability to deal with the impacts of climate change, a minority of participants (16.13%) felt that this was 'not applicable', with the justification being the following:

"*The civil war did not impact directly on the Government as the climate change issues are a recent threat, thus there is a global trend on investing in more trained/skilled people with knowledge in those matters".*

This opinion can be challenged as, according to de Almeida (2018), the civil war had significant impacts on adaptation as already constrained resources were being diverted to tackle the conflicts. The civil war caused large volumes of migrants from the surrounding provinces to settle in the peripheries of Maputo, resulting in Maputo housing 45% of urban dwellers in the country during that period (UNHABITAT, 2010). Subsequently, at least one million civilians lost their lives and approximately four million people were forced to leave their homes (de Almeida, 2018; Lundgren, 2020). The already fragile infrastructure was further affected, with over 60% and 40% of schools and health centres respectively were destroyed.

Because of the civil war, the government has struggled to effectively deal with housing and infrastructure problems that have further arisen due to a growing population, lack of qualified personnel and limited resources (Tvedten & Candiracci, 2018; Gani et al, 2020). As discussed in the introduction (Section 1.2), during the Portuguese colonial period, the city was divided into a dualistic structure: the wealthy settled in what was known as 'cidade cimento' and the urban poor settled into what was known as 'cidade canico'. These two are differentiated from the building material which are used; cimento means 'cement' and canico means 'reed', which also alludes to their temporal state. Even to this day, the city can still be differentiated by the building material used. One of the strategies which could minimise the impact of solid waste is to increase the number of waste collection points around neighbourhoods.

Tvedten and Candiracci (2018) explains that waste containers are located in the outskirts of communities, which poses a logistical challenge. Moreover, due to the waste not being collected regularly, containers are at times overflooded with waste, resulting in residents either throwing in on the pathways or burning the waste in their back gardens. Therefore, they conclude that it is not worth going the distance as there might not be enough space, and instead, chose to dispose of their rubbish closer to home (ibid). *Figure 5.8* shows how irregular waste collection has resulted in an overloaded skip container. Residents have taken initiative by burning the waste in order to create more space.

In support of this, one of the participants from the follow up interviews confirmed that it is "*extremely important"* to ensure waste is properly managed, especially before the rainy season to prevent drainage systems being blocked. Another participant commented that

"you need to desilt and clear all the garbage before the rainy season. Improve waste collection services from low-income communities can reduce flooding…"

Figure 5.8: Overloaded Skip Container

A study conducted by Zehra et al (2019) showed that residents in Maputo attributed the cause of the problem to lack of municipal bins and collection services as well as no guidance on how to best manage waste. To mitigate the issue, residents would use wheelbarrows to collect waste. However, the difficulty they would face was limited

accessibility due to narrow pathways and alleyways, and residents not putting waste in plastic bags.

These results have two implications on how we understand community adaptation in the context of climate change. Firstly, that waste management is the responsibility of both the community and the municipality. Studies conducted by both Tvedten and Candiracci (2018) and Zehra et al (2019) in Maputo indicated that both the community and the municipality were to blame for the lack of effective waste management; the community because they refuse to collectively clean public spaces, and the municipality because they do not collect the waste regularly. These two factors can be credited to a lack of financial resources which is applicable to both the community and municipality. Therefore, referring to the two fundamental models of this thesis: Sustainable Livelihood Framework (Section 2.3.2) and the Pressure and Release Model (Section 2.3.3), the following sections can be used to explain a lack of financial resources. For the Municipality: '**Root Causes'-** Limited access to resources; '**Dynamic Pressures'**- lack of local investment; For the community: **Financial capital**.

People in poor urban area feel like they are treated inferior compared to residents living in the wealthy urban areas. One way in which this is reflected is in the fact that in formal parts of the city, the municipality places dozens of waste containers and collects waste every other day, whereas in the urban poor community of 25 de Junho B, for example, there is only one container for the 23,000 residents living there. In support of this, Tvedten and Candiracci (2018) highlight that most 'recycling stations' are placed in formal settlements because, according to municipal officials, resident in informal settlements "are too disorganized for the companies to work there efficiently", whereas in formal settlements they acknowledge the value of recycling. Furthermore, waste is collected by small businesses within the community twice a week and transported using private companies which should be the municipal's responsibility (Tvedten & Candiracci, 2018).

It is also evident that a sense of community resentment has arisen against the municipality. One resident expressed her frustration at piles of rubbish by saying "imagine the type of life-view that this gives to the children who grow up among these piles of rubbish. They think this is normal" (Tvedten and Candiracci, 2018, p.640).

While the municipality is to some extent to blame for the lack of waste collection services, some responsibility must fall on the residents who at times deliberately throw their solid wastes in public places, as depicted in *Figure 5.8* One community leader reported that residents have refused to collectively clean up public spaces and play the 'blame game' by putting all responsibility of the municipal (Tvedten & Candiracci, 2018).

It is also important to note that most of these neighbourhoods are built in flood prone regions, therefore, during heavy rain periods, the risks are heightened due to the increase in contamination of waterborne diseases such as cholera and malaria.

The Municipality of Maputo has made some attempts to address the issue of solid waste management. A partnership with Recicla, a recycling company, was established with the aim of making commercial deals with locals and plastic waste pickers, who then process the plastic and re-sells it (Tvedten and Candiracci, 2018). This creates employment for local people and indirectly incentivises them to recycle. Africa News (2009) describes how women and young people are seen as crucial to plastic recycling companies as they gather plastic waste from the Hulene dump and sell them to the companies. The Hulene dump, located 10km from the city centre, is in heavily populated neighbourhoods which create dangerous conditions for its residents. In 2018, heavy rainfalls caused a landslide which resulted in sixteen people losing their lives (The Guardian, 2018). The dump is described as "an assault on the senses" with strong smells, stagnant water which attract mosquitos and swampy roads which make access challenging (The Guardian, 2018, p.10). Moreover, between 2007 and 2017, the annual waste in the dump increased from 127,385t to 365,000t respectively (Tvedten and Candiracci, 2018).

Like the above initiative, Valor Plastico (Plastic Value), another recycling company, employs around 800 plastic collectors, and converts plastic back to a state in which it can be reused. AMOR is another recycling company with a similar business model to Valor Plasticos; it employs approximately 350 informal workers, mostly women, who are hired to collect plastic waste. Apart from having several waste collection points, which are referred to Ecopoints- they have a home collection service in which household are charged 150MTS (£1.92) and encouraged to recycle paper, plastics,

metal and glass (AMOR, 2021). AMOR also works with companies and event organisers to recycle waste.

The practice of recycling

Grothmann and Patt (2005) explore the relationship between risk perceptions and adaptive behaviour; the same principles can be applied to this study in that the more aware communities are about their actions (such as recycling and appropriate disposal of waste), the more willing they will be to change and improve their behaviour. The practice of recycling was discussed in Section 5.9.2 where recycling companies such as Recicla, Valor Plastico and AMOR employ people around neighbourhoods to collect waste. While this initiative is beneficial as it reduces waste, it does not directly incentivise households on the importance of recycling and nor does it encourage them to do so. One can argue that households are likely to leave the recycling to companies such as these. This therefore implies that there needs to be a greater educational component in terms of communicating risks involved in the training provided by the INGC. Rather than solely focusing on how communities should react in the event of a flood, educating communities on the impacts their actions have on the environment is equally as important and it encourages them to take a proactive approach to reducing risks. In support of this, Grothmann and Patt (2005) state that effectively communicating risks to people should be complemented with effective and affordable adaptation strategies. With reference to the post-analysis conceptual framework, this links with 'Establishing the vulnerability context'- more specifically, the internal factors.

Municipality vs Community

The approach which the municipality adopts towards waste management is a neo-liberalist one; in that they expect residents to take responsibility for how they manage their own waste, which contrasts the residents' approach as they believe it is the responsibility of the municipality to deal with waste. According to Tvedten and Candiracci (2018, p.7), the municipality believes there is a need to "educate the people and make them produce less waste", making the issue of waste management one which lies with the resident's behaviour. Educating residents and creating an awareness of the various benefits of correctly disposing of waste, and emphasising its health benefits could mitigate the problem, however, this would have to be paralleled

with the municipality providing enough waste collection points around the neighbourhood and regularly collecting waste.

While the municipality must take some responsibility, it cannot be ignored that residents must take some responsibility too. Tvedten and Candiracci (2018) state that residents do not see the value of recycling their waste; this is supported by the World Bank who report that residents mix all kinds of wastes- food, glass, cardboard, making recycling challenging. Aderoju et al (2015; cited in Gani et al, 2020, p. 15) argues that solid waste management is “not only the responsibility of the government, but also requires self-discipline, change in people’s perception and attitude to building a sustainable environment”. On a promising note, the younger educated generation and entrepreneurs in Maputo are beginning to appreciate the value and importance of creating a sustainable society (United Nations, 2022) which has the potential to positively change attitudes towards waste management and consequently improve behaviours.

5.5.2.1 Financial Resources

As discussed in Section 1.2, urban migrants were driven to settle in floodplain communities due to their limited financial resources, which is a fundamental factor contributing to their vulnerability. The Sustainable Livelihood Framework states that in order to reduce vulnerability, communities and individuals need to be able to possess the five capitals (social, physical, natural, human and financial). This is an important factor in understanding how communities behave in relation to adaptation as a deficit in financial capital hinders their adaptative choices and behaviours. Greater financial power, which could be in the form of stable employment, access to financial credit, could be used to implement adaptive strategies such as the construction of flood resistant homes, investments in waste management, or even relocation to higher grounds.

The municipalities lack of financial resources can be linked to limited access to resources (which links to root causes in the PAR) and lack of local investment (which links to dynamic pressures in the PAR). The results of this study revealed the extent to which the government is dependent on external support in times of crisis (Section

5.8.6), such as the establishment of the cluster system. A greater financial power could be used to invest in local communities, such as installing accessible waste collection stations.

Another implication that the results on poor waste management have on how community adaptation is understood in the context of climate change is that it emphasises communities' need to understand the relationship between **waste management and flooding**: ineffective disposal of waste has a direct relationship with flooding in that waste blocks drainage systems, and when it floods, those drainages overflow with water, which can be tackled through educational strategies.

5.5.3 Sanitation

Mozambique's population is rapidly growing and according to a report produced by the World Bank (2017), the urban population is experiencing the highest growth rate, with an annual rate of 3.8%, which by 2025, may make up half the population. This will place further pressures on the already limited infrastructures and service provision. The World Bank (2017, p.7) describes that "only one in three households have access to safe water, one in ten to sanitation, and one in four to electricity", highlighting the degree to which the city is under-serviced.

Inadequate sanitation issues most often arise because of poor management of excreta along with weak "sanitation practices and behaviours" (Campos et al, 2015, p,371). Shiras et al (2018, p.2) state that in Maputo, 86% of residents use "on-site faecal management systems (non-sewered), and only 26% of all faecal waste in the city is safely disposed of, treated or safely managed" which furthermore highlights the extent to which the city is under serviced. A concrete example of a neighbourhood that struggles with sewage management is Maxaquene A. This neighbourhood was formed by migrants who sought employment during colonial times, but due to rapid urbanisation, the area has lacked appropriate infrastructural services, which has exacerbated the impacts of floods (Zehra et al, 2019). For residents who lack latrines in their own homes, they resort to excreting in buckets and end up emptying the buckets in drainage channels (*Figure 5.9)*, which in the event of floods, contaminates the water and creates the threat of waterborne diseases such as malaria and cholera (Zehra et al, 2019). One interviewee explains that this can be addressed by:

“Improving water and sanitation and making it climate resilient. That means that if you are putting latrines, you will make sure they are above the ground so they are not flooded”.

Figure 5.9: Plastic bottles blocking drain (Zehra et al, 2019)

The main challenge residents face is the poor inaccessibility due to houses being so condensed; emptying latrines trucks are not able to get access to the houses, which in turn forces residents to dispose of the waste themselves. Consequently, residents feel like they are being neglected by the municipality and so have expressed their ability to maintain the sanitation systems, nonetheless, they voiced that “a faecal sludge collection service to transport it out of the neighbourhood or networked systems” would be highly beneficial (Zehra et al, 2019, p.9).

ActionAid (2006) believe that urban communities experience regular flooding because of the few drains and a lack of space for the water to run naturally. A large number of questionnaires participants believed the ‘lack of local investment in drainage systems, sanitation and housing quality’ is an extremely important contributor to flooding in

urban communities. Douglas et al (2008, p.188) explain that flooding in urban communities is largely caused by the construction of roads and pavements, which do not soak up rainwater as efficiently as trees and grass. Cement built roads and pavements also interrupt natural channels. UNHABITAT (2009, p. 78) state that "a one-day rain event in Maputo might result in floods that linger for three days" and in some instances, if the rain continues, it takes up to a month for the floodwaters to subside.

5.5.4 Build Back Better

As explored in section 5.8.1, disaster recovery was an element which lacked within the INGC structure, and also in a community disaster recovery plan. The Sendai Framework has a focus on disaster recovery with priority four states the following: "Enhancing disaster preparedness for effective response and to "Build Back Better" in recovery, rehabilitation and reconstruction" (United Nations, 2015, p.8). The concept of 'Build Back Better' (BBB) was mentioned in the interviews participants and all agreed that to ensure sustainable adaptation takes place and to increase climate resilience, Maputo would have to embrace the concept.

According to The World Bank (2018, p.12), the recovery process is made up of three stages *(Figure 5.10)*:

i. "Humanitarian relief, including search and rescue, and medical care
ii. Restoration of basic services, including the supply of clean water, food and sanitation, basic energy, mobility, and health care needs
iii. The reconstruction phase, including infrastructure reconstruction, the repair or replacement of building and production equipment…"

These three phases combined encompass the concept of Build Back Better, defined by the United Nations Office for Disaster Reduction as "the use of the recovery, rehabilitation and reconstruction phases after a disaster to increase the resilience of nations and communities through integrating disaster risk reduction measures into the restoration of physical infrastructure and societal systems, and into the revitalization of livelihoods, economies, and the environment" (UNDRR, 2022, p.1).

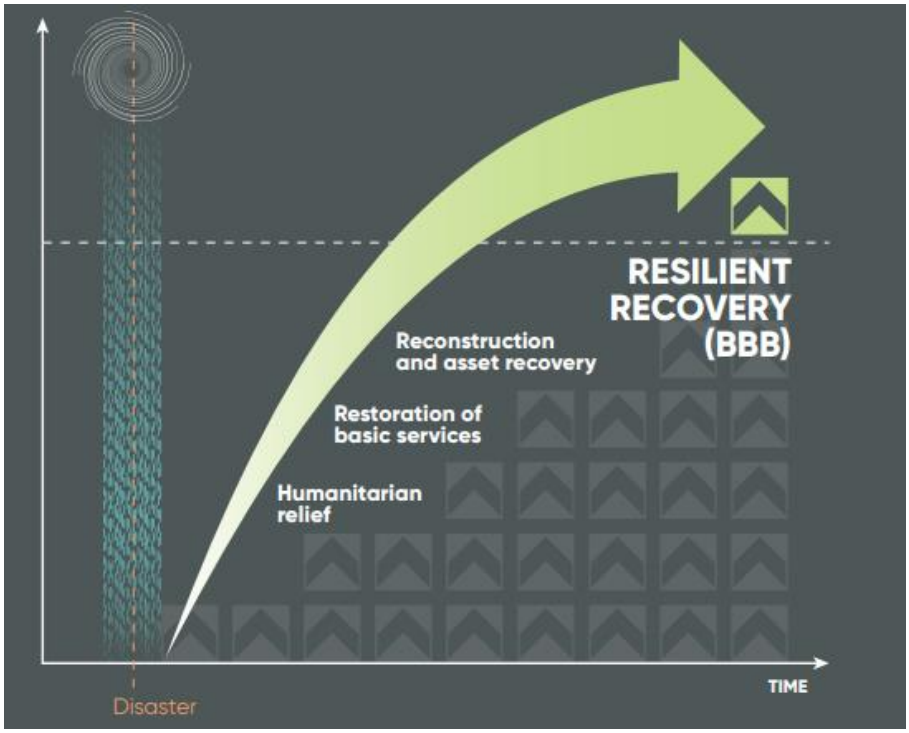

Figure 5.10 Post Disaster recovery (The World Bank, 2018)

BBB is a post disaster recovery approach that focuses on recovery schemes which aim to reduce future shocks by increasing establishing resilient societies. The concept is based on three principles, namely that recovery needs to be **strong, fast** and **inclusive** (The World Bank, 2018).

Building back **stronger** involves reconstructing both a society and infrastructure which will be able to withstand future environmental events. Building back **faster** goes hand in hand with addressing the impacts of disasters as it ensures reduced bureaucracy and quicker reconstruction through contingency plans, already approved contracts and financial availability. **Inclusively** building back ensures that everyone affected by the disaster, especially the poor and most vulnerable, are given the adequate support.

In the case of Maputo, in the last three years, the government has changed how it responds to floods due to its increased intensity and frequency. The country introduced an annual contingency plan- this is significant since before three years, the country only had a contingency plan which covered solely the rainy season, that is, from October to March. The contingency plan is drafted up annually and predicts how weather events are going to affect each region and based on their past experiences and future predictions, the government allocates funds to aid those in need. By having

a contingency plan which covers the entire year, the country places itself in a better financial position to respond to natural hazard-induced disasters. The contingency plan is drawn up by the 'Conselho Técnico de Gestão de Calamidades' (Technical Council for Disaster Management) along with The National Humanitarian Team. In essence, the plan is based upon three hypothetical scenarios which are derived from an assessment of previous rainy season, seasonal weather forecasts and their impact on education, agriculture and roads. Furthermore, the document highlights the following:

- Main threats likely to cause an emergency
- Zones of risks and possible impacts
- Sectorial readiness, response and recovery activities
- Resources available and needed for disaster response.

However, as much as weather events can be forecasted, due to climate change and the increase in frequency and intensity, these are becoming increasingly challenging to predict.

One interviewee challenged the concept of BBB and went one step ahead to suggest 'Build To Last':

"*Don't Build Back Better, Build to Last. Build Back Better implies you made a mess the first time so try and make it a bit better the second time…Make sure you do it once and you do it right. And even if it does cost a little bit extra, you do get a good return on your investment by avoiding future losses."*

The interviewee makes an interesting point in that less developed countries do not have the financial means to invest in long term solutions but are rather focused on providing humanitarian relief. One could be excused into believing that being impacted by a natural hazard-induced disaster can be seen as a 'silver lining'- an opportunity for countries to assess their vulnerability levels and to reconstruct in a manner which will ensure they do not go through the same in the future. This could be done by implementing standard building codes in essential buildings such as homes, schools and hospitals.

When establishing building codes, it is important to consider the contexts in which they will be implemented. In the case of Maputo, two main components need to be

addressed; namely **building materials** and the fact that many residents **construct their own houses**. A further consideration proposed by one participant is **culture.** He gives the following example:

"*in the north… the father cannot share the toilet with the wife of the son, so in the house it is mandatory that they build two houses…but it is different for example in the south".*

UNHABITAT Mozambique has invested high amounts of money in building resilient school buildings; they are strong advocates for constructing resilient schools using local materials and local builders. The materials that are used and the building codes which are adopt ensures that they are resilient in the event of a natural hazard-induced disaster. One UNHABITAT representative stated that:

"Mozambique also is a success case in terms of surface school approach and school reconstruction-like the safest schoolat a world level".

Another participant added that:

"Mozambique also is a success case in terms of surface school approach, school reconstruction-like the safest school-the school safety at the world level…we work with the building code".

In the aftermath of Cyclone IDAI in Mozambique, schools which adhered to the appropriate building codes withstood the impacts. One interviewee observes the following:

"The other thing that impressed me with Beira is that we visited a school where they had classrooms that were built according to the standards required to withstand cyclones and those classrooms survived OK compared to others that weren't".

A concrete example of efforts being directed towards preparedness is the Safer School Project by UNHABITAT. The project originated after cyclone Funso as an attempt to address the schools which had been damaged during the cyclones. What resulted

from the project was a comprehensive and collaborative approach to school construction which “developed hazard maps to guide risk assessments, disaster-resilient school building codes and guidelines on school safety, and produced recommendations for their effective implementation” (International Federation of Red Cross and Red Crescent Societies, 2007, p.2).

House construction

A further factor which contributes to Maputo’s vulnerability to flooding is that locals build their own homes without following adequate building codes. Due to their low financial power, they are compelled to use precarious building materials, such as reed, wood and metal sheets. In keeping with the principles of community-based adaptation (Section 2.5.3), *Figure 5.7* described some of the house modification strategies that residents implemented. These included using heavy rocks and cement blocks on roofs in order to ensure they could withstand strong winds and rain. The attempt to construct resilient homes can be linked to the concept of Build Back Better (BBB) (Section 5.9.4) presented under the SENDAI Framework. All interview participants agreed that in order for Maputo to undergo sustainable adaptation, the concept would need to be implemented. As previously discussed, BBB is a post disaster recovery approach aimed at mitigating future shocks by implementing strategies which are strong, fast and inclusive (World Bank, 2018). Linking it to the post analysis conceptual framework, these concepts fall under ‘Post Disaster Strategies’. This section of the framework is largely focused on implementing strategies which enhancing resilience so that in the event of another disaster, the system is in a much stronger position. This is in agreement with Adger et al (2005) who state that through time and with each hazard, a systems’ resilience increases, making it less vulnerable.

5.5.5 Green spaces

As already discussed, one of the key reasons why Maputo is prone to flooding is due to its uncontrolled urbanisation rate which has disrupted the natural flow of rainwater and increased surface runoff. The creation of **green spaces** was pointed out as a strategy to tackle the impacts of floods. One interview participant stated that

"This type of green planning is certainly needed for Maputo".

UN Environment (2021) highlights that 70% of today's existing urban infrastructure will not exist by 2050, which offers urban planners the opportunity to ensure that future infrastructure is low-emission and resilient. By creating parks and green spaces, cities will become more sustainable and resilient to natural hazard-induced disasters (Sustainable Cities and communities) (ibid).

The concept of green spaces was introduced in 2014 by Chinese researchers and it describes "a nature-based solution which uses the landscape to retain water as its source, slow down water flow and clean it through the process" (EuroNews, 2022, p.8). Techniques used to attain this include creating green grounds on rooftops, planting trees and plants which are highly absorbent, constructing roads and pavements which absorb rainwater and building artificial lakes and ponds to collect excess rainwater (Chapman Taylor, 2020). Not only do sponge cities reduce the risk of floods, but they also allow for the storage of rainwater which can be reused during droughts.
Considering the practicality and applicability of this strategy in Maputo city, land usage and current availability need to be considered. Despite its value, some interviewee believed that Maputo's infrastructure is too far gone to reverse its impacts:

"Maputo used to have those green spaces but currently no green space left".
"… with the build-up of Maputo, you get more flooding because often you take over green spaces that used to be natural drainage"

Due to the rapid urbanisation which has led to less land availability, one option could be to create rooftop gardens with highly absorbent plants. Muva is a programme based in Maputo which focuses on equipping young people, especially women, for economic development. Within Muva, there is the Muva Green Project, which focuses on employing youth to construct green spaces. In Maputo, 90% of green spaces are in the city centre, whereas in the most vulnerable areas there is scarce any green space. Muva, in partnership with Maputo Municipality, created a project in the densely populated neighbourhood of Chamanculu aimed at rehabilitating green spaces. The project was driven by community participation from creation, design and construction,

and most importantly, it ensured that the project had long term benefits by charging the community with maintenance.

5.5.6 Summary

In conclusion, this theme examined infrastructural elements which has exacerbated flooding in Maputo. This includes poor solid waste management, poor sanitation, rapid urbanisation and housing construction to name a few. Poor solid waste management was found to be a recurring factor plaguing the urban communities, and in support of this, other authors have made the same conclusions (Zehra et al, 2019; Tvedten and Candiracci, 2018). Moreover, questionnaire participants noted this as a top priority to tackle flooding in Maputo. Poor solid waste management was found to be traced back to civil war times when people were forced to migrate, which resulted in less financial resourced migrants having to build homes with poor building materials and having to settle in areas with lack of adequate infrastructure. Sanitation was also found to be a major contributor to flooding in Maputo. The potential of adopting green spaces in Maputo was explored, however, some participants felt that Maputo has reached a point where it’s too built up with no more space left for green infrastructure.

5.6 Chapter Summary

This chapter has discussed four themes which emerged from the interviews and questionnaires. These findings suggest that on the whole, Maputo has acknowledged the severity that floods have in their communities, and therefore, various strategies have been put in place such as creating community committees, establishing evacuation centres, sensitising residents, involving schools, etc. However, the findings reported here also suggest that on a national scale, the disaster management institute could improve the way disasters are managed by conducting regular emergency drills, ensuring people with disabilities are more involved, ensuring that communities take accountability for their actions. Furthermore, the lack of financial resources was also highlighted as being a major barrier to adaptation; both from the government perspective in being unable to provide financial assistance in the form of flood insurance, and from an individual level in being unable to afford to construct homes with flood resistant construction materials. The results also shed light on cultural barriers which hinder effective adaptation such as emotional attachments to homes, the lack of willingness to change behaviour, and their perception of floods being a 'distant' threat.

5.7 Building the Conceptual Framework: Framework Representing the Findings

The framework *(Figure 5.11)* was designed and constructed to be used in vulnerable communities in order to enhance flood preparedness and response before and during its occurrence. The framework is largely based on the belief that flood adaptation begins with addressing vulnerability in individual households first, then as a collective community, they can together combine their experiences, knowledge and skills to enhance community resilience. While the INGC is offering valuable guidance in preparing communities to respond to natural hazard-induced disasters, this framework goes a step further in placing communities at the centre and provides a more proactive approach; in other words, the framework offers a basis to consolidate the structure further. The framework also suggests that communities should adopt a contextual approach to disaster management by drawing up local contingency plans. These contingency plans are to include a local vulnerability assessment of each community as it acknowledges that each community is different; their past experiences and their needs will differ. This approach also encourages a more collective approach and creates a sense of empowerment amongst community members.

Having taken the data gathered and combined it with the framework presented in sections 2.4 and 2.6, this section builds a new framework which reflect the empirical findings gathered, which is the main contribution of this study. The section links the four phases of the framework to the four themes of the study.

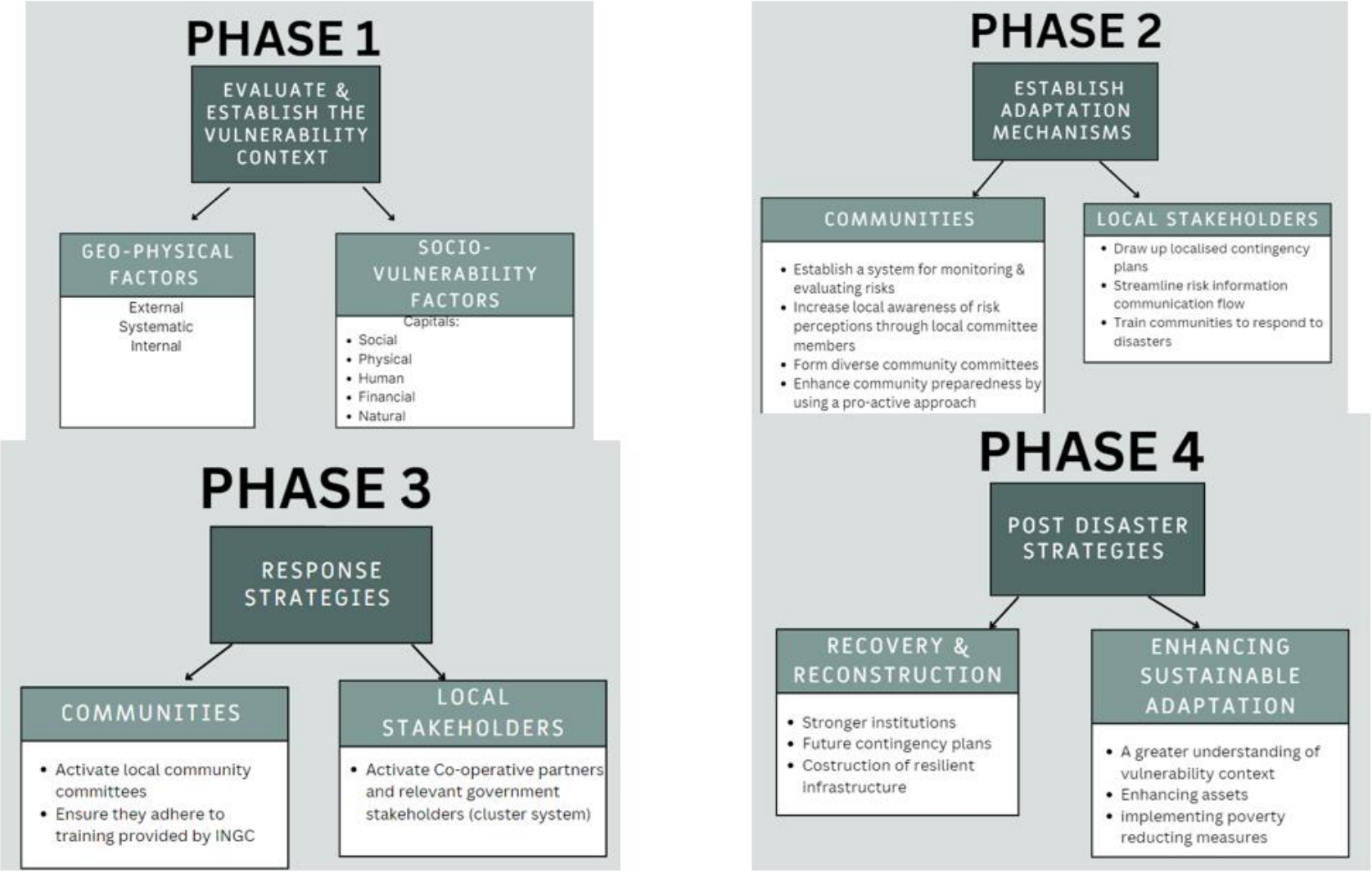

Figure 5.11: Conceptual Framework, (Authors Own)

5.7.1 Phase one: Establishing the vulnerability context

This phase of the framework was created by combining the vulnerability component of the SLF and PAR models, which is explored in the literature review. Both models demonstrated differentiations in terms of how they viewed vulnerability: the SLF was more from a livelihood perspective, and its stance was that vulnerability is determined by evaluating the extent to which individuals and communities have access to the five capitals. On the other hand, the PAR model takes a social view of vulnerability and considers it to incorporate various external and internal factors.

This stage highlights the importance placed on communities acknowledging and being aware of their own vulnerabilities, both from a social and geophysical perspective. When communities are aware of the conditions which make them vulnerable, they are in a better position to determine which actions should be prioritised (Steynor and Pasquini, 2019). The notion of acquiring necessary resources for adaptation associates with both the SLF and PAR's concept that the more assets one possesses, the stronger their adaptive capacity. Referring to the SLF, the framework makes mention of five assets (human, financial, natural, physical & social), which contribute to a sustainable livelihood; Lundgren and Strandh (2022, p.3) state that acknowledging the livelihood assets "captures the different forms of capital that enable people to live meaningful lives". Below is a snapshot of the five capitals, with their respective elements which were captured from the data gathered *(Figure 5.12):*

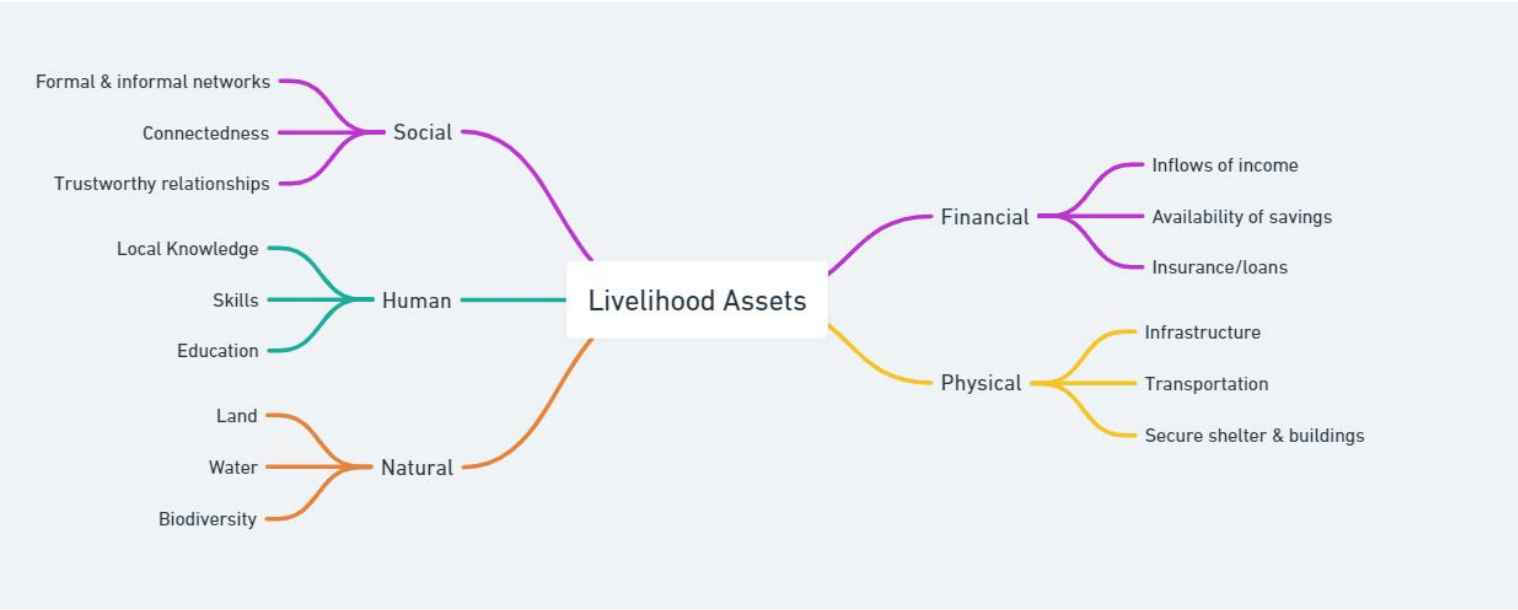

Figure 5.12: Populated Livelihood Assets (Authors Own)

As demonstrated above, there is a high importance placed on establishing the vulnerability context, therefore, this section did not undergo any changes compared to the initial framework presented in section 2.4 (Figure 2.10).

5.7.2 Phase two: Establish adaptation mechanisms

This phase explores how prepared communities and relevant stakeholders are in the face of floods. For communities, it involves creating a system to evaluate and monitor risks and increase the level of awareness of residents. From the discussion (section 5.2), it was established that there is a strong connection between the perceptions and level of awareness possessed and willingness to engage in adaptive activities. For the industry, the focus was on actions which would enhance communities' level of preparedness such as conducting drills, training and equipping communities and ensuring there is a reliable contingency plan in place.

A significant finding was the absence of disaster risk management in the primary curriculum. Section 5.2.1 explored the importance of including disaster related content within primary school curriculum; in countries such as Mexico and Romania, this is a legal requirement.

5.7.3 Phase three: Response Strategies

This phase of the framework addressed response approaches of both communities and relevant stakeholders. From the communities' perspective, it explored the role of the local community committees, and from the stakeholders' perspective, it addressed the 'cluster system'. The combined efforts of these two groups determine the impacts of the aftermath of the disaster. The structure of the cluster system revealed how dependent the government is on external agencies in the response phase.

5.7.4 Phase four: Post disaster strategies

This phase combined the principle of Build Back Better from the SENDAI framework and sustainable adaptation. Depending on the damage, the concept of Build Back Better (BBB) suggests that communities have a 'rare' opportunity to 'start from scratch' in terms of rebuilding. They can ensure that they construct flood resistant buildings; that they evaluate how institutions should function moving forward and that they promote the use of diversified sources of income.

5.7.5 Linking Themes and Conceptual Framework

The following table demonstrates how each phase of the empirical framework links with the themes which emerged from the study:

Phases in the Conceptual Framework	**Findings: Corresponding Themes**
Phase 1: Establishing the vulnerability context	**Theme 1: Community involvement:** It was established that the more involved a community is, the more they are willing to participate in community activities. Phase 1 was made up of two components: geophysical and socio-vulnerability factors. The socio-vulnerability factors are more community oriented as they aim to access capitals which communities possess. By accessing the capitals they possess, they in turn establish their vulnerability context; the more capitals they own, the less vulnerable they will be. **Theme 3: Intersectoral Dynamics:** This theme recognised the importance of a strong governance structure and effective collaborations between the different stakeholders.
Phase 2: Establishing adaptation mechanisms	**Communities (Monitoring and evaluating risks): Theme 3 Intersectoral dynamics:** Section 5.4.3 discussed improving early warning systems; the issue of a complex communication channel and residents receiving information late and not knowing how to decipher information. **Increase local awareness of risk perception through local committee members: Theme 1: Community involvement:** The role of committees in educating other residents and the role of schools in enhancing awareness (section 5.2.5) **Local stakeholders (Streamline risk communication information flow) Theme 1** **Theme 1: Community involvement**: Findings showed that communities play a major role in adaptation. Firstly, the higher their risk perception, the more willing they are to adapt. Secondly, it was shown that communities form community committees which act as first responders in the event of natural disasters. Roles within these committees include: early warner, radio listener, search and rescue, evacuation coordinator, etc. Schools also played a role by being constructed with the appropriate building codes which will withstand future floods.

	Theme 3: Intersectoral dynamics: Findings demonstrated the importance of communication between the different sectors in order to effective respond to and adapt to floods. Under the cluster system, various sectors were shown to be involved. Each of these sectors played an important role both individually, but most importantly, collectively.
Phase 3: Response Strategies	**Theme 2: Culture:** Cultural elements played a significant role in the adaptation strategies communities chose to adopt. Participants reported that due to emotional attachments residents had towards their homes, they were resistant to relocate.
Phase 4: Post disaster strategies	**Theme 4: Infrastructure**: This theme explored the importance of rebuilding back infrastructure which will withstand future hazards by implementing the concept of Build Back Better (BBB). Sanitary issues that arose were poor solid waste management and drainage systems. Addressing these issues will ensure that communities are less impacted.

Table 5.4: Linking Conceptual Framework and Themes (Authors Own)

Chapter 6: Conclusions

6.1 Introduction to the chapter

The present study was designed to explore and assess the disaster response strategy being applied in urban communities in Maputo that are vulnerable to flooding. Using a pragmatic lens with a constructionist approach, the study used interviews and questionnaire to gather data. From the data gathered, four themes emerged: Community Involvement (Section 5.6), Culture (Section 5.7) Intersectoral dynamics (Section 5.8) and Infrastructure (Section 5.9). This chapter concludes all the key findings (Section 6.2) of the research, discusses the extent to which the objectives have been met (Section 6.2.1), makes recommendations (Section 6.3), outlines the limitations of the study (Section 6.4), and discusses areas of future potential research (Section 6.5).

6.2 Key Findings and Objectives

This section will provide a summary of the key findings and link them to the research objectives laid out in section 1.4. Overall, the results indicate that:

- There remain disparities within the national response system.
- Communities need to play more of an essential role in responding to disasters.
- Cultural factors need to be considered in adaptation strategies.
- People with disabilities are not involved in the community committee.
- Early warning communication systems need to be streamlined.

To recap, the main aim of this study was to explore and assess the disaster response strategy being applied in urban communities vulnerable to flooding in Maputo.

One aspect which was concluded in section 5.4.6 was that in order for disaster management to be effective, it needs to have a streamlined information system which is multisectoral and dynamic in nature. The Institute of Disaster Management needs to ensure that vulnerable communities get the correct information. This information needs to be communicated in time for them to act and in a manner which they can easily understand.

Another aspect that the discussion has highlighted is the need to include people with disabilities (Section 5.6.6.1) both within a community response context as well as in the larger national response strategy. It was shown that the exclusion of people with disabilities is not a gap limited to the context of this study alone.

Objective 1: **Identify CBA strategies being implemented by urban communities vulnerable to floods in Maputo**

This objective was formed as an attempt to understand the role communities play in terms of responding to floods. Given that communities are at the forefront of this study, it was important to establish their roles, and equally important to understand what they thought were their responsibilities. Information drawn from literature review, interviews and questionnaires indicate that communities have had to be creative with their adaptive approaches and not always rely on external help. The evidence from this study suggests that while community committees are formed and trained, they are not always supplied with the equipment's they need, such as axe, whistles, and bicycles.

This also questioned the sustainability of these groups to act and react in the long run. Some interviewees mentioned that committee members had to be incentivised to remain part of the committee. Another point to note is that if a community is not frequently affected by floods, then members are less likely to adopt pro-active measures.

The following were found to be strategies adopted by communities:

- Elevating houses
- Relocating to higher grounds; sometimes having two houses: one in the lower region used mainly for agricultural purposes; another in a higher region, used as a place of refuge.
- Placing sandbags to prevent water entering homes.
- Clearing out waste from drainage systems to prevent blockages.
- Diverting drainage water flows
- Use strong nails, heavy rocks, and cement block to ensure roofs are secure.
- Dig up ditches.

While there was an appreciation of the importance of involving Persons with Disabilities (PWD), this research has shown that that generally does not take place. The voices of PWD's are not heard when it relates to their needs during an emergency. The findings have suggested that communities are to an extent to blame for the lack of effective solid waste management which exacerbate the impacts of floods. Section 5.9.2 revealed that residents deliberately throw their solid waste in public spaces, which end up blocking drainage systems, and most importantly, they increase the risk of waterborne diseases such as cholera and malaria. Overall, this objective was met.

Objective 2: Appraise the role of stakeholders in aiding communities to adapt to the impacts of floods.

This objective was aimed at exploring the role stakeholders play in adapting and responding to floods in Maputo. As section 5.8.6 discussed , the disaster management system in Mozambique works under a cluster system, made up of United Nations agencies, social civil organisations, donor agencies, private organisations, NGO's and other partners. These clusters work alongside the relevant governmental sectors in a

combined effort to respond to disasters. This structure highlights the extent to which the government is dependent on external agencies for financial and human resources. 67% of community responders indicated that the lack of government financial funds was a contributing factor for Maputo' vulnerability to flooding.

The interviewees in this study had been involved in different dimensions which ranged from providing technological support, rescue operations, training community committee and providing financial support. One of the reported challenges faced was the lack of project continuity and qualified personnel within the municipality. One reason attributed to this was the constant reshuffling of staff within the different departments, resulting in staff not completing their projects or training before they are moved somewhere else without an adequate handover.

Objective 3: Construct/develop a best practice approach to enhance community resilience to the impacts of floods in urban communities.

This objective forms the basis for the aim of the research as a whole as it laid the foundations for the conceptual framework (Section 5.4). The conceptual framework is pro-active in nature, thereby, it attempts to provide a structure which will minimise the impacts of floods. The theoretical basis of the model was derived from three other frameworks / models: Model of vulnerability, Sustainable Livelihood Framework and Pressure and Release Model. Although useful, what these models fail to address is how communities can be better integrated into the disaster management framework, and hence, that is where this framework makes a contribution. Firstly, by adhering to the principles of Community Based Adaptation, it places communities at the forefront of response by acknowledging that they possess the necessary knowledge and past experience to formulate adaptation strategies. The framework also adopts a highly contextual approach to disaster management as it recognises that each community will have different adaptive capabilities, past experiences and needs, therefore, another contribution it makes it the need to have local contingency plans for each community.

6.2.1 To what extent have objectives been met?

Objectives	Corresponding Section	Brief Analysis
Objective 1: Identify CBA strategies being implemented by urban communities vulnerable to floods in Maputo	• Section 5.6.2 • Section 5.6.3 • Section 5.6.4 • Section 5.7.2	The findings have shed light on various community-based adaptation which communities engage with in times of flooding such as: 1. Setting up community committees 2. Relocating to higher grounds 3. Clearing drainage channels before the rainy season to avoid waste blockages.
Objective 2: Appraise the role of stakeholders in aiding communities to adapt to the impacts of floods	• Section 5.8.6 • Section 5.7.5 • Section 5.6.4 • Section 5.6.2	This thesis has provided a deeper insight into the many stakeholders involved in responding to flooding, primarily owing to the governments low financial and human resources. Stakeholders include academics, NGO's, social society organisations and national institutions. These key players support with implementing building codes to secure resilient homes, evacuation and relocation, training community committees.
Objective 3: Conduct / develop best practise approach	• Section 6.8 • Section 5.4	The findings of this study have a few important implications for future practice, as shown in Section 6.8. This study suggests that to develop a best practice approach, the following should be included: • A thorough understanding of the vulnerability context by communities and relevant key players; both geophysical and socio-vulnerable factors • Determine the roles of communities and key players before the disaster • Conduct drills and simulations in communities, schools, places of work • Create a contingency plan, which accounts for the sustainable recovery and reconstruction of communities and infrastructure.

Table 6.1: To what extent have objectives been met (Authors Own)

6.3 Recommendations

The findings of this study have several important implications for future practice.

Recommendation 1: Strengthen national information systems, including early warning systems among sectors.

As indicated in section 5.8.3, one of the factors which worsen the impacts of floods in communities is the delayed warning systems. Communities do not get the information on time, and in other instances, information is delivered in a manner which is too technical for residents to decipher. One of the reasons why information is delayed is due to the various channels it must go through before reaching the community. As shown in *Figure 5.6,* information goes through five other channels before communities are warned. One way to address the problem and to streamline the communication system is to have a community committee member sit in the provincial or district delegation meetings- this will ensure that they are part of the discussions. Another suggestion would be to directly communicate warnings to communities via text messages. This, of course, poses logistical and technical barriers as it requires residents to have access to mobile phones and for the communicating agency to have a database of contact information.

Recommendation 2: Construct infrastructure which is climate resilient.

A further reason why Maputo is vulnerable to flooding is because residents construct their own homes without adhering to building codes in flood plains and use poor materials. This is a challenge to tackle as many houses in the urban poor neighbourhoods are constructed with poor building materials. To reverse this issue would mean to demolish the homes and construct new ones.

One suggestion to address this challenge could be to provide residents with sandbags which they could use as a barrier against flood waters. Another suggestion would be to invest in creating green spaces around the city. Due to rapid urbanisation which has led to less land availability, one alternative could be rooftop gardens with highly absorbent plants.

Recommendation 3: Install recycle bins in poor urban communities & educate residents on the importance of recycling.

Poor solid waste management was flagged up as exacerbating flooding, especially when drainage systems are clogged up due to waste. There is a scarcity of public bins within urban poor communities due to the challenge pickup trucks have when accessing these communities. Moreover, the practice of recycling is rare. As explained in Section 5.9.2, recycling companies employ local waste pickers who collect waste from the dump and sell it to the recycling company. Even though this generates employment, it does not encourage residents to recycle, if anything, it gives them more reasons not to recycle.

Continued efforts are needed to enhance residents understanding to the importance and benefits of recycling, and most importantly, advise them how this can be practically done. Raising their awareness can be done through leaflets, community talks, theatre groups, etc. A reasonable approach to tackle this issue could be to either place more recycle stations around the community or provide residents with reusable recycle bags / bins.

Recommendation 4: Incorporate DRR in primary curriculum

Educating children from a young age on climate change, natural hazard-induced disasters, and adaptation is key to ensure they are raised up with an understanding of their environment and the role they play in securing a more sustainable world. A key policy priority should therefore be to incorporate disaster related content in the primary curriculum. This will ensure that children are raised with the skills necessary to withstand the impacts of natural hazard-induced disasters. As Section 5.6.5 explored, within the school context, disaster related content is only addressed in terms of building resilient buildings, engaging children in initiatives which educate them on wildlife and preservation.. While this is essential, it does not equip children with the practical skills which are needed. For example, Japan, a country which constantly faces natural hazard-induced disasters, children are given hands-on response and evacuation training using various simulations. They have earthquake simulations, which models the tremors that are felt during a real earthquake. In an urban flooding experience, the challenge of opening car or emergency doors is replicated (Web Japan, 2020).

Recommendation 5: Consolidate the role of community committee.

The important role communities play in disaster management was extensively discussed in this thesis. Overall, this study strengthened the idea that investing in community committees to act as first responders can potentially minimise the negative impacts associated with flooding. Section 5.6.2 discussed the formation and roles of the community committees. The findings, however, provide little insight into the extent to which committees are engaged in the training and decision-making process, and highlight three key areas / questions:

- To what extent can 15-20 people help within one community?
- More inclusion of PWD needed.
- Account for culture in adaptation.

The number of members involved in the committee can raise questions as to the extent of their effectiveness. In times of crisis, it would be challenging for 20 people to lead a whole community.

Under the SENDAI Framework, persons with disabilities are called to be integrated into the disaster management framework. In response to this, the Bulgarian government has created a list of people with disabilities and allocated a member of government responsible of ensuring that disaster planning is inclusive of the needs of the less vulnerable (Yasukawa, 2021). Likewise, in countries like Croatia, Czech Republic and Austria, strategies have been put in place to include children with disabilities by training carers and staff, and creating emergency plans (Yasukawa, 2021). It can be challenging, especial those with mobility difficulties, to relocate to evacuation centres or higher grounds in times of crisis.

In the context of this research, the following recommendations are made:

- Create a database of PWD.
- Conduct drills and training programmes aimed at practically demonstrating how PWD.
- Conduct meeting which discusses their needs in times in emergencies
- Allocate at least one member of the committee in charge of ensuring the needs of PWD are met.
- Ensure that relocation centres / homes meet the needs of PWD.
- Ensure that phycological support is provided in the aftermath of disasters.

Implementing disaster insurance in Mozambique will be a challenging undertaking as poverty reduction and development are major priorities. Nevertheless, an interesting solution which could be considered by policy makers is to explore the potential 'xitique' (saving groups) could have on encouraging communities to take collective initiatives in their respective communities. As discussed in section 5.6.6.2, xitique are informal rotating savings group formed traditionally by women. The suggestion would therefore be to create 'xitique community'. This would be a group which use the funds generated through the meetings to invest in improving conditions in their communities in times of emergencies.

Examples of investments / activities include:

- Cleaning up drainages ahead of the rainy season.
- Using sandbags as barriers.
- Elevating homes.
- Building evacuation centres with first aid supplies.
- Creating awareness in their communities.

A benefit of adopting this strategy is that communit6ies already have strong social bonds, therefore, this would facilitate them working together for the greater good. Alexandra et al (2021) report that savings groups in Uganda had purchased solar lamps as kerosene lamps were seen as a hazard.

Recommendation 6: Use M-Pesa to enable residents to save or borrow money.

As discussed in Section 6.3 Mobile Financial Services (MFS) have grown in popularity, with more than 70% of the population having access to a mobile financial account; this represents a breakthrough with how money circulates in the economy, and it is significant as it opens new opportunities. This avenue allows people to borrow, save and send money, therefore, it has the capability to be used to financially protect locals. A study conducted by White (2012) explored the use of mPesa in a Kenyan neighbourhood; it found that women who had mPesa had used it as a platform to save enough money to construct resilient homes, as opposed to having to repair their homes every time it flooded. Likewise, Riley (2018) investigated the impact floods and

drought had on households using mobile financial services vs households that didn't and found that household with MFS were less impacted as they were able to send and receive money with ease. The results of these two studies highlight the potential mobile financial services have in creating greater financial capabilities among the urban poor.

6.4 Limitations of the research

This study set out to understand the current adaptation strategies being adopted in urban communities and to develop a best practice approach which would enhance adaptation. The findings of this research are subject to at least three limitations:

1. Firstly, the study lacks a comprehensive community perspective. This is largely attributed to the inability to travel to Mozambique due to COVID travel restrictions, as discussed in section 3.4 To overcome this, a number of community residents were invited to participate in the questionnaire. This allowed the researcher to gather community thoughts and opinions. However, to some extent this had an implication on objective one as it was not possible to gather first hand data. To overcome this gap, the researcher explored community-based strategies from a desktop exercise and other similar studies.
2. Secondly, this study has methodological weaknesses. As discussed in section 3.4, due to lack of commitment to complete all three rounds, a modified version, which still abided by the core principles of the method, was applied.
3. Thirdly, it can be argued that this study is limited by the relatively small sample. Although section 3.10 explored arguments supporting the sufficiency and reliability of a smaller sample, it can be argued that a larger sample would have been a more accurate representation of the population.

6.5 Scope for further research

The current study has the potential to instigate further research.

1. A natural progression to this work is to assess and evaluate the effectiveness of applying the conceptual framework suggested in the current research. This would measure the effectiveness of the current and suggested adaptation approaches in reducing the impacts of floods in communities. The conceptual framework also has the potential to be applied with other natural hazard-induced disasters such as droughts and cyclones. An advantage which this conceptual framework has compared to the internationally recognised HYOGO Framework for Action (2005-2015), SENDAI framework (2015-2030) and Pressure and Release Model is that its contextually focused. Consequently, further work could establish its replicability in similar contexts, such as communities in Malawi, Zimbabwe, and Zambia.
2. Further research could usefully explore the potential of Mobile Financial Services, such as MKesh, in securing financial assistance to victims of flooding; similarly, the introduction of flood insurance. This would have to be accessible and affordable; there will also be the need to educate residents on the benefits of acquiring flood insurance.
3. Another possible area of future research would be to investigate how persons with disabilities can be more involved in training and responding to flooding. It is important that the training provided by INGC considers the needs of this group. For instance, for people with reduced mobility, there needs to be accessible relocation methods when transportation is unavailable due to inundation.
4. Considerably more work will need to be done to streamline the early warning systems. It would be interesting to examine the relations between a streamlined early warning system and its impacts of the affected community.

Chapter 7: Reference List

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Appendix A: Interview Request Email

Dear X

My name is Amelia Chissano and I am a PhD student at the University of Huddersfield in the UK. I am currently doing a research project on the impacts of floods in Maputo, Mozambique. One of the objectives is to understand what is being done by local stakeholders to aid residents in adapting to impacts of floods with the aim of identifying sustainable solutions for slum communities to adopt.

I am in the process of securing interviews with people who work to mitigate the impacts of floods in Maputo neighborhoods. I read your climate change journal article about Mozambique and wondered if you would be willing to share your knowledge about climate change adaptation in Maputo. The interview will take between 45mins to 1hr. If you are willing to participate or have any questions, please contact me on amelia.chissano@hud.ac.uk.

Many thanks,

Amelia Chissano

Appendix B: Interview Questions

Interview Questions:

1. Please briefly explain the work you do:
    - How long have you been based in Mozambique?
    - Type of agency / organisation you are? How its structured?
    - The roles that you play?
    - Which areas (communities) do you work in?
    - Types of disasters you have been involved in?
    - Pre-disaster? During? Post-disaster? Long term? Short term?
    - Do you work / collaborate with any local agency: IMAN (Mozambique National Meteorology Institute) or INGC (National Institute of Disaster Management)? Other NGO's?
2. In your opinion, what are the main disaster related threats faced by communities in Maputo (Province)?
    - Literature says droughts, cyclones and floods are the main threats? Do you agree?
    - Has the level and intensity of threats increased? Why do you think this has happened?
    - Which regions suffers from what? North? South?
3. What are your main priorities when you are called to respond to floods?
    - How do you access the damage?
    - Relocation? Food supply? Water?
4. What are the challenges / barriers you face as an organisation when working in vulnerable communities? What do you think would facilitate your work in communities?

- Lack of trust? Access? Resources? Community resistance?

5. In your opinion, why are Mozambican (specially Maputo Province) communities so vulnerable to floods?
    - Location of houses (floodplains)?
    - Construction materials?
    - Refusal to relocate?
    - Coastal region?
    - Drainage systems? Solid waste management?
6. Which challenges do residents face the most when there is flooding? (Access to services? Lack of infrastructure? Lack of government assistance?)
7. Are there any community initiatives (or committees) that deal with flooding adaptation in areas you have worked in? (Sandbags, temporary shelter, relocation?)
8. From your experience / in your opinion are residents' priorities in line with other stakeholders when it comes to adaptation measures? (long term fixes vs quick fixes; survival; food supply).
9. What are the roles of NGO's? How reliant are communities on NGO's?
    - What is their relationship? Partnership?
    - Participative? How is it done?
    - Is their presence permanent? Temporary?
    - If temporary, how do you make sure the communities are reconstructed sustainably?
10. What would enhance resident's ability to deal with floods?
    - Which skills / knowledge / resources / assets would communities need to better adapt to natural disasters?
    - Do they have facilitated access to them? If not, why?
    - Collaborations with municipalities / having a voice in decision making?
    - Community empowerment?
11. In your opinion / from your experience are residents aware of the causes of climate change?

- Knowledge / education about the causes of climate change?
- Their perceptions? Mindsets?

12. Do you have anything else you would like to add?

Appendix C: Questionnaire

INFORMED CONSENT

Title of Research Project: Exploring barriers and opportunities to climate change adaptation in urban communities: A case of Maputo, Mozambique.

Firstly, I would like to express my sincere gratitude for your participation in this research.

- The aim of this questionnaire is to explore vulnerability causes and climate change adaptation strategies in Maputo.
- All the information gathered in this research will be kept confidential & anonymous.
- Your contribution to this research is entirely voluntary and you are not obliged in any way to participate.
- If you require any further details please contact the researcher at amelia.chissano@hud.ac.uk.
- This questionnaire will take approximately 15-20 mins.

If you are satisfied that you understand the information and are happy to take part in this project please confirm by ticking the consent box:

I consent to take part in the research ☑

PROGRESSION OF VULNERABILITY: ROOT CAUSES

This first section will explore root causes. Root causes describe underlying situations and power dynamics that are ingrained in a society; these include economic, demographic and political processes, which affect the way resources are located and distributed among the social groups of people.

Please indicate the level of importance each statement has in contributing to Maputo's vulnerability to floods:

	Extremely important	Very important	Moderately important	Slightly important	Not applicable
High poverty levels in urban communities	○	○	○	○	○
Lack of employment especially for the youth	○	○	○	○	○
Low level of GDP	○	○	○	○	○
Lack of professionalism and operative resources to effectively evacuate vulnerable residents	○	○	○	○	○
High levels of bureaucracy within disaster management, resulting in slow progress	○	○	○	○	○
Lack of effective early warning systems	○	○	○	○	○
People not taking early warnings seriously & refusal to change their behaviour	○	○	○	○	○

PROGRESSION OF VULNERABILITY: DYNAMIC PRESSURES

This section explores dynamic pressures. Dynamic pressures describe the evolving systems that can lead to increasing pressure and subsequently to unsafe conditions

Please indicate the level of importance each statement has in contributing to Maputo's vulnerability to floods:

	Extremely important	Very important	Moderately important	Slightly important	Not applicable
Lack of project continuity which result in failed implementation	○	○	○	○	○
Lack of a consolidated institutional framework for dealing with disaster risk management	○	○	○	○	○
Rapid urbanisation leading to expansion of informal settlements	○	○	○	○	○
Lack of local investment in drainage systems, sanitation & housing quality	○	○	○	○	○
Lack of a culture of paying tax resulting in the absence of Maputo Municipality providing quality services to citizens	○	○	○	○	○
Lack of capacity for data collection and technical knowledge in disaster management institutions	○	○	○	○	○

Please rank the 3 strategies you believe should take priority from the list above (inserting only the number of the strategy)

Priority 1

Priority 2

Priority 3

←

→

PROGRESSION OF VULNERABILITY: UNSAFE CONDITIONS

This section will explore unsafe conditions. Unsafe conditions express how a population is vulnerable to hazards. This is the vulnerability context where people and property are exposed to the risk of disaster. It includes the physical environment, the local economy, social relations and public actions.

Please indicate the level of importance each statement has in contributing to Maputo's vulnerability to floods:

	Extremely important	Very important	Moderately important	Slightly important	Not applicable
Poor solid waste management systems	○	○	○	○	○
Poor drainage systems which cause soil erosion leading to obstruction of roads	○	○	○	○	○
Disappearance of mangrove forests making the city vulnerable to tidal surges	○	○	○	○	○
Residents lack of responsibility to correctly dispose of solid waste	○	○	○	○	○
Residents construct homes in floodplains	○	○	○	○	○
Inadequate building material is used in poor urban settlements	○	○	○	○	○

For access to the complete questionnaire, please following the link: https://hud.eu.qualtrics.com/jfe/form/SV_5o2Pb208LqRpoDI

Appendix D: Ethics Form

APPLICATION FOR ETHICAL REVIEW – E1

- Please complete and return via email to **HBSethics@hud.ac.uk** along with the required documents.
- Before completing this application, please refer to the Huddersfield Business School Research Ethics web pages. Applicants should consult the appropriate ethical guidelines.
- ALL Sections must be completed. You will only be able to start the research when you have been granted permission to use the specified material.
- Please provide sufficient detail to assess strategies used to address ethical issues in the research proposal. Forms with insufficient detail will need to be resubmitted.
- This form should be completed and kept by the principal investigator.
- The final responsibility for ensuring that ethical research practices are followed rests with the principal investigator for staff research projects.

SECTION A: APPLICANT(S) DETAILS

This application is for:

Staff	☐
Student	☐

Name of the Applicant (Principal Investigator/PGR)	
Student number (if applicable)	
Names of the other Researchers in the project	
Names of supervisors (if applicable)	
Title of research	
Proposed project start date	

SECTION B: DECLARATIONS

I confirm that I have read, understood and followed the guidance in the Ethical Review Guidance document: available here	☐
I confirm that I have read and understood the University Research Ethics Policy: available here	☐
I confirm that I have read and understood the University of Huddersfield research data management policy: available here	☐
I confirm that I will respect and adhere to the decision and guidance that result from this application	☐
I confirm that if the circumstances and/or methods of my research change, I will seek further advice/approval from the Huddersfield Business School Research Ethics and Integrity Committee	☐

SECTION C: RESEARCH STUDY DETAILS

Rationale, aims and objectives	Details:
Brief overview of methodology Needs to be explained in sufficient detail to show the approach used (e.g. survey) and explain the research methods to be used during the study.	Details:
Is this a retrospective application? If Yes, please provide details of why it was not possible to obtain ethical approval before the project started.	☐ Yes ☐ No If Yes explain here why this has arisen.
Has this research received funding?	☐ Yes ☐ No If Yes please give details.

SECTION D: DATA COLLECTION AND PARTICIPANT DETAILS

Does the research involve any of the following? • Patients recruited because of their past or present use of the NHS or Social Care • Relatives/carers of patients recruited because of their past or present use of the NHS or Social Care • Access to data, organs or other bodily material of past or present NHS patients • Foetal material and IVF involving NHS patients • NHS Staff • The recently dead in NHS premises • Prisoners or others within the criminal justice system recruited for health- related research • Police, court officials, prisoners or others within the criminal justice system • Participants who are unable to provide informed consent due to their incapacity even if the project is not health related	☐ Yes ☐ No If you have answered yes then you must seek the appropriate external approvals from the NHS, Social Care or the National Offender Management Service (NOMS) under their independent Research Governance schemes. Contact HBSethics@hud.ac.uk for information and support.
Who will be the participants of your research?	Details:

What are the arrangements for selecting/sampling and contacting potential participants?	Details:
Will any of the participants be vulnerable? 'Vulnerable' people include children and young people, people with learning disabilities, people who may be limited by age or sickness or disability, etc.	☐ Yes ☐ No If Yes, describe here how you will implement safeguarding procedures during data collection.
Will the research involve working with/within an organisation, and require their approval (e.g. business, charity, government department, international agency, etc.)?	☐ Yes ☐ No If Yes, do you have granted access to conduct the research? If you do not have permission yet, explain here how you plan to gain approval.
Is there any reasonable and foreseeable risk of physical or emotional harm to any of the participants? Harm may be caused by distressing or intrusive interview questions, uncomfortable procedures involving the participant, invasion of privacy, topics relating to highly personal information, topics relating to illegal activity, etc.	☐ Yes ☐ No If Yes, please explain further here.
Are any of the below questions relevant to the research? • Are drugs, placebos or other substances (e.g. food substances, vitamins) to be administered to the study participants or will the study involve invasive, intrusive or potentially harmful procedures of any kind? • Will tissue samples (including blood) be obtained from participants? • Is pain or more than mild discomfort likely to result from the study? • Will the study involve prolonged or repetitive testing?	☐ Yes ☐ No If Yes, please explain further here.
Are any of the below questions relevant to the research? • Is it covert research? ('Covert research' refers to research that is conducted without the knowledge of participants). Please give details of why this is the only approach possible. • Will anyone be taking part without giving their informed consent? • Will the research output allow identification of any individual who has not given their express consent to be identified?	☐ Yes ☐ No If Yes, please explain further here, and give details of how you plan to carry out the research within the guidelines of the University Research Ethics Policy.
Describe the arrangements for obtaining participants' consent.	Details:

Please explain how you will inform your participants about the study and whether they will be in a position to give informed consent. Please attach the forms you plan to use.	
Describe how participants will be made aware of their right to withdraw from the research. This should also include information about participants' right to withhold information and a reasonable time span (such as a clear point in the research process) for withdrawal should be specified.	Details:
Describe the arrangements for ensuring participant confidentiality. This should include details of: • how the data will be recorded • how data will be stored to ensure compliance with University of Huddersfield data protection procedures and other relevant wider legislation • how results will be presented • exceptional circumstances where confidentiality may not be preserved • how and when confidential data will be disposed of	Details:
Will you offer anonymity to your participants?	☐ Yes ☐ No If Yes explain here how this will be achieved.
Are there any conflicts of interest in you undertaking this research? (E.g. are you undertaking research on work colleagues or in an organisation where you are a consultant?)	☐ Yes ☐ No If Yes explain here how this will be addressed.
Are there any potential risks to researchers' (i.e. your and other investigators') health and wellbeing associated with: a. the venue where the research will take place b. traveling to the research venue and/or c. the research topic itself? d. Time of day research is taking place e. Lone working **IMPORTANT NOTE**: The Research Ethics and Integrity Committee cannot evaluate the changing risks arisen from travelling to other countries. Appropriate Huddersfield Business School risk assessment procedures has to be followed and permission has to be obtained at the time of travel.	☐ No, none that I am aware of ☐ Yes If Yes, outline the risks here, including steps taken to minimise risk.
Please provide a summary of the ethical issues that you envisage and any	Details:

Appendix E: Information Sheet

INFORMATION SHEET

Thank you for considering participating in this research. This information sheet will serve as a guide with the purpose of providing a description of the study as your rights as a participant, should you agree to take part.

1. What is the research about?

The title of the research is "Exploring barriers and opportunities to climate change adaptation in communities: A case of Maputo". The main aim is to identify sustainable solutions for communities to adopt in order to adapt to the impacts of floods.

2. What will my involvement be?

You will be asked to take part in an interview asking about your experiences and knowledge of flood adaptation in communities. This will take between 45mins-1hr.

3. How do I withdraw from the study?

If you decide you no longer wish to participate in the study, you can withdraw at any point until the data analysis is complete. Please note that if you do withdraw from the study, all information provided will not be retrained. If you wish to withdraw, please contact me at: amelia.chissano@hud.ac.uk

4. What will my information be used for?

The information you provide will be used for a PHD research thesis and potentially an academic paper.

5. Will my taking part and my data be kept confidential? Will it be anonymised?

All the information gathered in this research will be kept as confidential as possible. Only the researcher will have access to the files. Your name will not be used in any reports or publications. Data recorded will adhere to the University guidelines by password protecting the files.

6. Who has reviewed this study?

This study has undergone ethics review in accordance with the University of Huddersfield Business School Research Committee.

Appendix F: Consent Form

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CONSENT FORM

Title of Research Project: Exploring barrier and opportunities to climate change adaptation in communities: A case of Mozambique

It is important that you read, understand and sign the consent form. Your contribution to this research is entirely voluntary and you are not obliged in any way to participate. If you require any further details please contact the researcher at **amelia.chissano@hud.ac.uk**.

If you are satisfied that you understand the information and are happy to take part in this project please put a tick in the box aligned to each sentence and print and sign below.

I have been fully informed of the nature and aims of this study as outlined in the information sheet	☐
I consent to taking part in this the study	☐
I understand that I have the right to withdraw from the research to the point before data analysis is complete. I am aware that the information sheet provides guidelines on how to do this	☐
I understand that the interview will be audio and video recorded unless stated otherwise.	☐
I understand that the information collected will be in kept secure conditions for a period of 10 years at the University of Huddersfield	☐
I understand that no person other than the researcher will have access to the information provided	☐
I understand that my identity will be protected in the report and that no written information that could lead to my being identified will be included in any report	☐

Signature of Participant: _____	Signature of Researcher: _____
Print: _____	Print: _____
Date: _____	Date: _____

(one copy to be retained by Participant / one copy to be retained by Researcher)