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PROMOTING SCIENCE FOR HUMAN DEVELOPMENT

MASTER OF SCIENCE IN CLIMATE CHANGE AND SUSTAINABLE DEVELOPMENT

DISSERTATION

Community-Based Disaster Risk Reduction Approaches for The Agriculture Sector: A Case Of Chirumanzu

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This dissertation is submitted to the Bindura University of Science Education in partial fulfilment of the requirements for the Master of Science in Climate Change and Sustainable Development Degree.

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APPROVAL FORM

BINDURA UNIVERSITY OF SCIENCE EDUCATION

The undersigned faculty member certifies that she has supervised the student, Takunda Mvuwu (student number B226358B), in the completion of their dissertation titled: "Community Based Disaster Risk Reduction Approaches for the Agriculture Sector: A Case of Chirumanzu District, Zimbabwe".

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14 October 2024

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DECLARATION

I affirm that the dissertation titled '**Community-based Disaster Risk Reduction Approaches for the Agriculture Sector: A Case of Chirumanzu**' is my original work. All sources used or quoted in this dissertation have been properly acknowledged with complete references.

Signature

Takunda M Mvuwu

Date

05 June 2024

DEDICATION

I dedicate this piece of work to my wife, Itai Rufasha, to whom I feel indebted. She has been supportive, and I wish her to achieve greater academic success.

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Abstract

The utilization of Community-Based Disaster Risk Reduction (CBDRR) approaches has emerged as a critical strategy in enhancing the resilience of vulnerable communities to the adverse impacts of natural disasters, particularly within the agricultural sector. This research study examines the application of CBDRR approaches in strengthening the resilience of smallholder farmers in Chirumanzu district, Zimbabwe. The investigation employed a qualitative method research design, and data collection techniques. A survey was conducted with 120 smallholder farmers to assess their awareness, perceptions, and adoption of CBDRR practices. Additionally, focus group discussions and key informant interviews were carried out with local community members, extension workers, and district-level officials to gain deeper insights into the implementation and challenges of CBDRR initiatives. The findings reveal that while smallholder farmers in Chirumanzu district exhibit a general understanding of CBDRR, the actual adoption and integration of these approaches into agricultural practices remain limited. Factors such as inadequate access to information, financial constraints, and weak institutional linkages were identified as key barriers to the effective implementation of CBDRR in the local agricultural context. The study further highlights the need for a more holistic and collaborative approach to CBDRR, involving the active participation of farmers, local authorities, and relevant stakeholders. Strengthening extension services, improving access to financial and technological resources, and fostering multi-stakeholder partnerships are recommended as crucial steps to enhance the integration of CBDRR into the agriculture sector in Chirumanzu district. The research contributes to the growing body of knowledge on the application of CBDRR in the context of smallholder farming, providing valuable insights for policymakers, development practitioners, and local communities in their efforts to build the resilience of the agricultural sector to natural disasters.

ACRONYMS

CBDRM	Community-Based Disaster Risk Management
CBDRR	Community-Based Disaster Risk Reduction
CCA	Climate Change Adaptation
DDC	District Development Coordinator
DRR	Disaster Risk Reduction
IK	Indigenous Knowledge
IPCC	Intergovernmental Panel on Climate Change
ISAL	Internal Savings and Lending
MWACSMED	Ministry of Women Affairs Community Small to Medium Enterprises Development
NGO	Non-Governmental Organization
PVA	Participatory Vulnerability Analysis
SDG	Sustainable Development Goals
UNISDR	United Nations Office for Disaster Risk Reduction
UNDP	United Nations Development Program
UNDRR	United Nations Office for Disaster Risk Reduction
WFP	World Food Program
ZIMVAC	Zimbabwe Vulnerability Assessment Committee

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CHAPTER 1: INTRODUCTION

1.1 Introduction

The idea of community engagement is at the heart of community-based disaster risk reduction, or CBDRR. Through community engagement in identifying and planning for potential hazards and dangers related to natural disasters, Community-Based Disaster Risk Reduction (CBDR) techniques foster cooperation and a sense of shared responsibility. In the event of a crisis, communities can reduce losses and increase savings, according to Pandey (2019). The interactive procedure enables community members to participate and share ideas for inclusive problem-solving and decision-making.

Disaster risk reduction primarily focuses on reducing underlying risks and promoting preventative measures to avoid disasters. On the other hand, CBDRR places greater emphasis on pre-disaster interventions such as prevention, mitigation, and preparedness. Communities are actively involved in the identification, assessment, treatment, and planning for a variety of risks and vulnerabilities as part of the collaborative CBDRR process. Seddiky et al. (2020) argue that communities are at the centre of this strategy, and the objective is to address local issues, difficulties, and problems from the viewpoints of those who live with them daily. By empowering communities to take the lead, CBDRR allows for the utilization of local knowledge while working with external partners, ultimately enabling more effective management of risks and vulnerabilities.

The CBDRR approach marks a significant shift away from traditional emergency management methods that have been reactive towards a more proactive approach to risk reduction. Even though these strategies have greatly lowered the likelihood of disasters and encouraged sustainable community development, they are still regarded as reactive framework elements. According to Graveline and Germain (2022), risk reduction requires a more proactive and progressive strategy, and the risk paradigm should now include resilience building in addition to vulnerability reduction.

According to Kori et al, (2021), the region of Chirumanzu is particularly susceptible to agricultural risks such as droughts, floods, and other potential hazards. Given the limited resources and capacity available to most farmers in the Chirumanzu District in Zimbabwe, adapting to such climate variability can be a costly endeavour. Disaster resilience can be

significantly increased by creating community-based disaster risk reduction (CBDRR) plans tailored to the region's agriculture sector.

Gaining a thorough understanding of the agricultural practices, vulnerabilities, and disaster response strategies specific to the Chirumanzu region was the study's main goal. The investigation assessed the readiness and adaptability of the community, while also analysing the efficacy of current CBDRR programs. Ultimately, the study offered customized suggestions to promote sustainable reduction of disaster risk within the local area.

1.2 Background of the Research

The importance of communities as first responders in the event of disasters cannot be overstated. Their extensive knowledge of the local area and ability to adapt to difficult circumstances are fundamental. Disaster and natural hazard literature alike have highlighted the growing significance of community involvement in these situations. In essence, such involvement is essential to comprehend the intricacies of the local social landscape, including how natural hazards are best handled (Gunhild Setten and Haakon Lein, 2019). The implementation of local peoples' customs and expertise during disaster situations is crucial to this intricacy. But the nature of local knowledge is opaque and contentious, in part because it is the kind of knowledge that frequently manifests itself only when applied.

CBDRR focuses on taking proactive measures, prevention, mitigation, and preparedness to reduce the risk of disasters. It evolved as a change from the reactive approach of emergency management to risk reduction as indicated by Niekerk et al, (2018). The goal of the comprehensive, people- and development-oriented, participatory, and ecosystem-focused CBDRR strategy is to lessen the losses in human life, property, community resources, and the environment because of natural and man-made hazards. The people and communities, their vulnerabilities, and their ability to deal with the aftermath of catastrophes and change the systems that have made them disaster-prone are at the centre of the CBDRR strategy. According to Tan (2022), the development of people's and communities' capacities in four areas—disaster prevention and mitigation, disaster preparedness, emergency response, and recovery and rehabilitation—is highly valued by CBDRR.

In the past, communities helped one another out in times of need. According to Chowdhooree (2019), traditional cultures typically rely on nature for their sustenance. They don't aim to change the natural world; instead, they make do with indigenous, traditional, or local

knowledge that is specific to their environment. According to Ali et al. (2021), indigenous peoples have throughout time developed complex ecological knowledge and practices to use their deep, personal relationships with their nation to forecast, prepare for, cope with, and survive natural events.

The concept of CBDRR emphasizes the importance of incorporating indigenous knowledge and community practices. In this regard, the management of natural hazards presents a compelling framework to explore how local knowledge is applied in times of crisis, including how it empowers individuals to act and make decisions (Gunhild and Lein, 2019). Understanding how people rationalize and validate their actions is a crucial aspect of this investigation.

To improve disaster management, plans must be incorporated at different levels, including international, national, and sub-national. Efforts should be made to increase both individual and community coping capacities during the risk reduction phase. Government and civic organizations should collaborate effectively to develop the community's disaster-response capacity as indicated by Cvetkovic et al, (2021). To enhance the effectiveness of disaster management, it is crucial to integrate plans at various tiers, such as international, national, and subnational levels. Shah et al, (2020) emphasize the need for collective efforts to achieve this goal.

UNDP (2020) highlighted that the evolution of state governance led to the formalization of CBDRR approaches where local governments and civil society organizations (NGOs) are essential players. Shaw (2016) argues that while the private sector and academic/research institutions play a crucial role and research has focused on scientifically validating Indigenous Knowledge (IK), it’s essential to integrate this accumulated knowledge into government early warning systems and disaster risk reduction approaches.

1.3 Statement of the Problem

Crop production characterizes small-scale farming in Chirumanzu district; according to Shoko and Kori (2022), maize is the most widely planted crop. Nevertheless, the region is subject to harsh winters, prolonged dry spells in the middle of the growing season, and recurrent droughts. Most small-scale farmers rely mostly on rain-fed agriculture for their income, and the increased frequency and severity of climate-related disasters are having an impact on these communities'

standard of living. Marambanyika et al. (2021) claim that while people have turned to wetlands as safety nets, there are no sustainable utilization strategies in place, which has resulted in significant deterioration of the natural resources. Wetlands' significance was highlighted by the Ramsar Convention Secretariat (2018) through their ecosystem services.

Formalized community-based disaster risk reduction is necessary for the enhancement of community resilience, addressing power and resource imbalances, and increasing its capacity. However, Chirumanzu which is subject to harsh winters, prolonged dry spells in the middle of the growing season, and recurrent droughts is currently without documented Community-based Disaster Risk Reduction initiatives. Initiatives seem ad hoc as they are typically implemented by various sectors under their respective requirements, such as Agritex and the Veterinary Department. However, there has been little scholarly attention on the extent of community-based disaster risk reduction (CBDRR) strategies in the field of agriculture.

1.4 Aims of the Research

The purpose of this study was to investigate the efficacy of community-based disaster risk reduction (CBDRR) strategies in the field of agriculture. In order to improve the sustainability and adaptability of agricultural practices in the face of growing climate-related risks, the research focused on understanding the disasters that affect the agricultural sector and how CBDRR strategies can strengthen the resilience of smallholder farming communities and mitigate the impacts of natural disasters.

1.5 Objectives of the Research

The primary objectives to be achieved by the study were:

1. To establish factors causing climate-induced disasters among smallholder farmers in Chirumanzu district, Zimbabwe
2. To determine the CBDRR strategies adopted by smallholder farmers to mitigate and adapt to climate change.
3. To assess the effectiveness of CBDRR strategies implemented by Chirumanzu smallholder farmers in mitigating and adapting to the effects of climate change.
4. To develop a CBDRR model to promote the resilience of smallholder farmers to climate change.

1.6 Research Questions

The research questions which guided the study were:

1. What are the factors causing climate-induced disasters among smallholder farmers in Chirumanzu district, Zimbabwe?
2. What are the CBDRR strategies adopted by smallholder farmers to mitigate and adapt against climate change?
3. To what extent are CBDRR strategies implemented by Chirumanzu smallholder farmers effective in climate change mitigation and adaptation?
4. Which is the best CBDRR model to promote the resilience of smallholder farmers to climate change?

1.7 Significance and Research Rationale for Chirumanzu

Community-based disaster risk reduction (CBDRR) as noted by ADPC, (2020) is a way of involving communities in the risks and impacts of disasters, especially those related to climate change. With CBDRR, smallholder farmers can protect their livelihoods and attain food security. Various parties, including government agencies, non-governmental organizations, community-based organizations, and local leaders, have implemented CBDRR initiatives in the Chirumanzu district.

Studying CBDRR can improve the ability of the local agriculture sector to withstand disasters. This research has the potential to promote sustainable methods and enhance the welfare of the smallholder farming community of Chirumanzu district whose agricultural livelihood is affected by hydro-meteorological hazards.

Community resilience was described by Imperiale and Vanclay (2016) as the social survival mechanisms that local communities use to mitigate the detrimental social and economic effects that crises bring about. The report also lists some of the difficulties and chances that CBDRR in Chirumanzu district faces, including inadequate resources, low community knowledge and involvement, inadequate capability, and poor coordination.

To the best of the researcher's knowledge, this is the first investigation into community-based approaches to disaster risk reduction in Zimbabwe's Chirumanzu district's agricultural sector. The study aimed to identify gaps in the approach, assess the efficacy of current CBDRR techniques, and suggest practical improvements in addition to providing insight into the vulnerabilities of smallholder farmers in the area caused by climate change. The study looked at ways to improve community resilience, support evidence-based practices, minimize losses and human suffering during hard seasons, use local knowledge and participation, and practice sustainable agriculture. This study improved our knowledge of how CBDRR may strengthen

the agricultural sector's resilience, helping the Chirumanzu district and smallholder farmers' productivity even in the face of climate-related risks.

1.8 Trustworthiness and reflexivity

Content validity, construct validity, and criterion validity were among the several metrics used by the researcher to evaluate the validity of research findings on CBDRR approaches in Chirumanzu agriculture sector. The research instrument's content validity guaranteed that it sufficiently addressed the pertinent aspects of CBDRR techniques in agriculture. The degree to which the instrument captures the intended theoretical constructs—such as risk perception, community participation, or disaster management knowledge—is known as construct validity. The assessment of criterion validity involves evaluating the correlation between the scores obtained from the instrument and external criteria, including the efficacy of CBDRR interventions (DeVellis, 2016). Combining these metrics contributes to proving the validity of study findings.

The researcher employed pilot studies and test-retest analysis to guarantee the validity of the research findings. To evaluate the stability of responses over time, test-retest analyses entail giving the same measurement or survey instrument to the same group of participants at various intervals (Kurtz, 2020). By using this technique, researchers can assess how consistently individuals responded, which speaks to the validity of the results. Greater dependability is indicated by a higher degree of consistency between the test and retest administrations.

However, to find and fix any potential flaws in the research design and data collection methods, a pilot study was carried out prior to the primary study (Polit & Beck, 2010). Through the implementation of a pilot project, the investigator can refine the research concept, data collection tools, and protocols considering first findings. This procedure assists in improving the validity of the study results by anticipating and resolving any potential drawbacks or difficulties.

1.9 Assumptions

According to Manyena et al. (2011) and Béné et al. (2012), this study assumed that active community engagement is essential for the success of disaster risk reduction activities in the agricultural sector. To improve efficacy and sustainability, these studies highlight the significance of incorporating local populations in decision-making and implementation processes. Furthermore, it is believed that developing effective risk reduction methods requires

acknowledging the importance of local knowledge and comprehension of Chirumanzu farming practices, vulnerabilities, and coping mechanisms, as stressed by O'Brien et al. (2007). Through training on disaster preparedness and sustainable agricultural techniques, capacity-building initiatives are thought to increase the resilience and adaptive capacity of farmers and communities, as shown by Manyena (2006) and Nhemachena et al. (2017).

The assumption of multi-stakeholder collaboration, supported by UNISDR (2015), suggests that effective risk reduction requires coordination among government agencies, NGOs, research institutions, and community-based organizations to leverage expertise and resources. It is also assumed that supportive policies and institutional frameworks, as emphasized by the Sendai Framework (UNISDR, 2015) and Mechler et al. (2014), are crucial for implementing community-based risk reduction approaches in the agriculture sector. Finally, addressing socio-economic factors, as highlighted by IPCC (2014) and Adger et al. (2018), is assumed to be necessary for effective risk reduction, including poverty alleviation, resource access, and consideration of social and gender dynamics.

1.10 The Study's Scope and Delimitations

The study was conducted in Zimbabwe's Midlands Province in the Chirumanzu district. The province is divided into eight districts, one of which being Chirumanzu. The area is a perfect place for the study since it has seen an increase in hydrometeorological hazards that have had a detrimental effect on rural farming communities and prompted the development of various disaster risk reduction strategies.

The District Development Coordinator, Agritex, Rural District Council, Veterinary Services, Forestry Commission, Ministry of Women Affairs, Ward Councillor, extension workers, and smallholder farmers were among the department heads in Ward 1-Mapiravana that were the subject of the study. The agriculture sector was the study's focus of attention.

The study concentrated on the CBDRR advancements of the past decade, with research being carried out in English. This approach may restrict access to the valuable indigenous knowledge that is expressed in other languages. Due to funding, time, and staffing constraints, data collection and analysis may be limited in scope. It's also crucial to remember that each region has distinct contextual elements, which could limit how broadly applicable the findings are.

1.1.11 Definition of terms

Disasters: Disasters refer to sudden, severe events resulting from natural phenomena or human-made hazards that cause significant damage, loss of life, and disruption to societies and ecosystems (UNDRR, 2017).

Climate-induced disasters: Climate-related phenomena, such as variations in temperature, precipitation patterns, sea level rise, and extreme weather events, can either cause or worsen disasters. (IPCC, 2012). Climate change and its effects on natural systems and human vulnerabilities have an impact on these disasters, which include floods, droughts, and storms.

Drought: A lengthy period of unusually low rainfall or precipitation, known as a drought, causes soil moisture deficits and water scarcity. Reduced crop yields, animal losses, and food insecurity can result from its detrimental effects on agriculture, water resources, and ecosystems (WMO, 2012).

Floods: Floods arise from the spilling of water into ordinarily dry ground, submerging areas that are not normally flooded. These can be brought on by excessive rain, overflowing rivers, or storm surges, which can destroy infrastructure, uproot communities, and result in fatalities (UNDRR, 2017).

Resilience: According to the UNDR (2017), resilience is the capacity of people, groups, systems, or ecosystems to tolerate shocks, pressures, or disturbances and then bounce back while preserving key components and functions. It entails having the ability to take hits, get back up, and change in the face of difficulty to create long-term sustainability and well-being.

Mid-season dry spells: Mid-season dry spells are periods of reduced or inadequate rainfall occurring within the growing season of crops. These spells can disrupt agricultural activities, hinder crop growth and development, and negatively impact yields (FAO, 2016).

Risk reduction: Risk reduction encompasses the actions and strategies implemented to minimize the impacts of hazards and disasters on communities, societies, and ecosystems. It involves measures to prevent, mitigate, and prepare for potential risks, as well as enhance resilience and adaptive capacity (UNDRR, 2017).

CBDRR: The term "CBDRR" describes a methodology that actively incorporates neighbourhood communities in the conception, execution, and assessment of disaster risk reduction programs. It acknowledges the value of local expertise, capabilities, and ownership in lowering risks and boosting community resilience (IFRC, 2009).

Summary

In this respect, the main goal and contribution of this chapter are to present a fully-fledged contextual framework and rationale for the study. Particularly, it conceptually introduces the phenomenon and the problem in question, enabling the reader to understand the underpinning background and importance of the subject matter. It also elaborately delves into the identification of the issue to be addressed in the research and the research question this study should answer. Lastly, by determining the boundaries and the need for this research, it spells out the rationale for the study and defines its potential in informing the design of policies, interventions, and academic discourses. This chapter essentially provides an overview for understanding the overarching purpose and goals of the entire study effort.

CHAPTER 2: REVIEW OF LITERATURE

2.1 Overview of Disasters Caused by Climate Change for Smallholder Farmers

Das and Ansari (2021) have underlined that climate change is a worldwide phenomenon that is rapidly intensifying and has significant ramifications for many industries, including agriculture. According to Komba and Muchapondwa (2018), smallholder farmers are particularly susceptible to its effects because they primarily depend on rain-fed agriculture and have few resources available to them for climate adaptation. Catastrophes, which result from extreme weather events produced by climate change, pose significant challenges to smallholder farmers' livelihoods and food security. The purpose of this review of the literature is to give a thorough overview of how climate change is affecting agriculture, stress the need of understanding the factors that lead to smallholder farmers experiencing these types of disasters, and emphasize the importance of community-based disaster risk reduction in reducing the effects of climate change and helping farmers adapt to them. The evaluation also evaluates how well community-based methods to disaster risk reduction work in tackling the issues brought on by climate-related disasters.

2.2 Theoretical and Conceptual Framework of the Research

According to the United Nations Office for Disaster Risk Reduction (UNDRR, 2024), the Sendai Framework for Disaster Risk Reduction 2015–2030 is an internationally ratified agreement that attempts to lower the risk of disasters and lessen losses in terms of lives lost, livelihoods, and economic, physical, social, cultural, and environmental assets. This is accomplished, by putting integrated and inclusive strategies that boost community resilience into practice (Zimmermann and Keiler, 2015).

Understanding disaster risk, bolstering disaster risk governance, investing in disaster risk reduction, and improving disaster readiness are the four key areas for action identified in the Sendai Framework (UNDRR, 2024). Disaster preparedness is affected by several elements, according to Akpi's (2020) Theory of Planned Behaviour, emphasizing the critical role that behavioural methods play in this area. This hypothesis does, however, have several drawbacks because it does not take into consideration every factor that influences preparedness behaviour. Thus, to effectively promote catastrophe preparedness, a more comprehensive effort is required.

To successfully intervene and enhance disaster preparedness, it is crucial to have a deep understanding of the factors that influence preparedness behaviour (Akpi, 2020). In the agricultural sector of Chirumanzu, the conceptual framework for community-based disaster risk reduction (CBDRR) approaches integrates important concepts and elements that guide the research process. This framework includes vulnerability assessment, CBDRR strategies, and resilience building. It acknowledges the influence of the local context, such as socio-cultural factors, institutions, and governance structures, on the implementation and effectiveness of CBDRR strategies. Moreover, the framework emphasizes the importance of collaboration, policy support, and knowledge exchange for the successful adoption and scaling-up of CBDRR approaches in the agricultural sector (see the illustration in the figure 1 below).

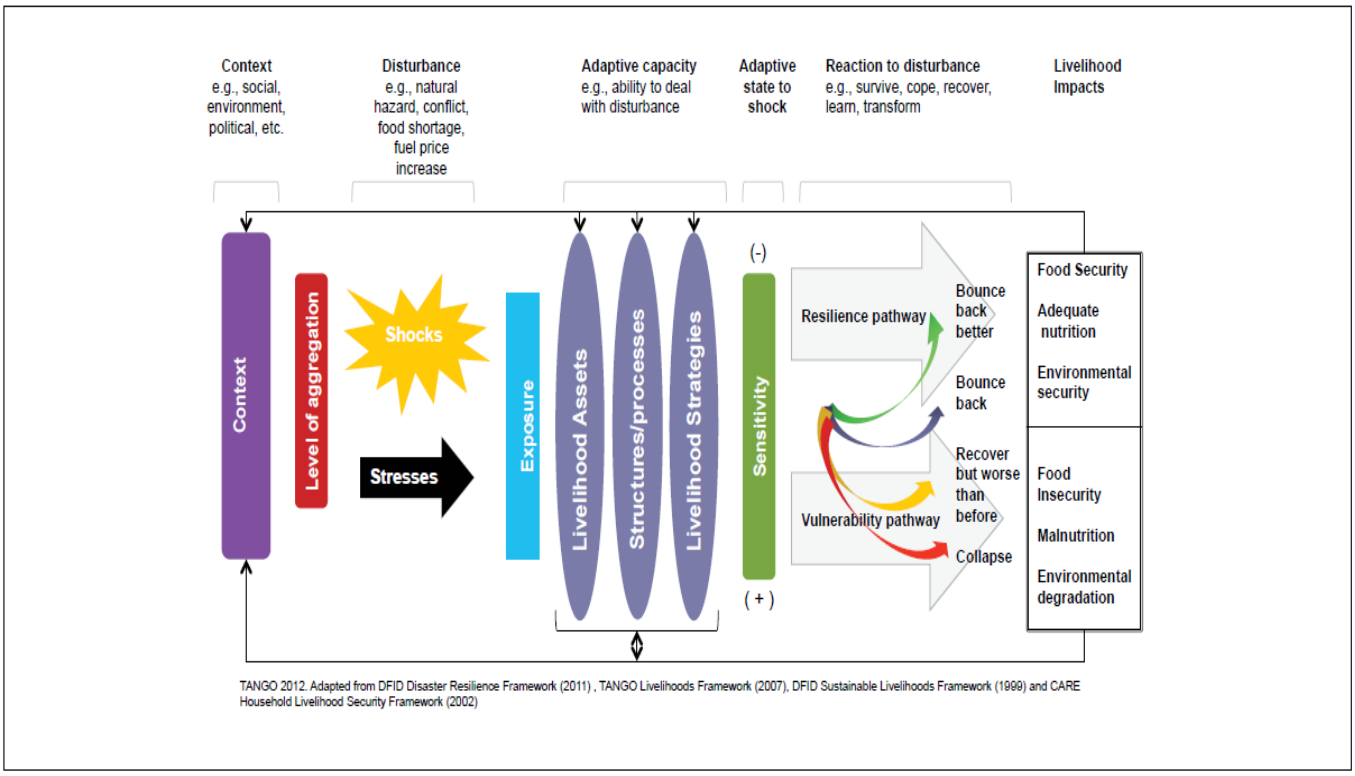

Figure 2.1: Conceptual Framework Adopted from UNDP CoBRA Conceptual Framework, (2016)
Source: UNDP 2016

2.3 An outline of how agriculture is affected by climate change

According to Naz et al. (2022), human activities including the burning of fossil fuels and deforestation are the main causes of long-term changes in temperature, precipitation, and climatic conditions. Portia et al. (2018), these modifications have a big impact on agricultural systems around the world. Rising temperatures changed rainfall patterns, a rise in the frequency and severity of extreme weather events, and modifications to the dynamics of pests and diseases are some of the main effects. According to Bibi and Rahman (2023), climate variability puts

agricultural production at risk since it causes significant drops in crop yields due to rising temperatures, increased carbon levels, and changing rainfall patterns. Soil microorganisms can also be impacted by variations in temperature, moisture content, wet-dry cycles, and freeze-thaw cycles.

According to Sultan and Gaetani (2016), the climate has a significant impact on agriculture, which is extremely weather-dependent and affects food security. Global food pricing, food production availability, food supply stability, food consumption, and access are all impacted by climate variability and change. Warmer and more humid climates are more likely to have insect pests and diseases, which reduce crop yields. Crop yield losses, according to Malhi et al. (2021), may raise food costs and have a major impact on the well-being of farmers worldwide. Agroforestry production is also threatened by unfavourable effects of climate change, such as loss of resources, increased occurrence of pests, illnesses, and undesired species, harm to agriculture and forests, and increased food insecurity (Rahman et al., 2022). These effects have been noted throughout Asia, where weather conditions.

Many smallholder farmers around the world are among the agricultural workforce and are particularly exposed to the effects of climate change. These farmers are especially vulnerable to climatic unpredictability because they mostly rely on rain-fed agriculture. According to Ogundeji (2022), smallholders confront a number of difficulties, such as restricted land access, high rates of poverty, poor educational attainment, restricted access to extension training, and a lack of funding for the adoption of adaptive measures. Their lack of access to contemporary technologies, reliance on subsistence farming methods, and financial limitations make it even more difficult for them to adapt to a changing climate. Smallholders thus confront greater risks and uncertainties in the production of crops, the care of livestock, and general farming operations.

Kusangaya et al. (2014), argue that Africa shows little adaptive capability and significant vulnerability to climate change. Due to the effects of climate change, the region is thought to be the most vulnerable, with water resources becoming scarce. It is anticipated that the effects on water resources will increase in size, variety, and severity based on observations made during the previous ten years. The distribution and services provided by ecosystems, which are essential for the production of food for humans, are also altered by climate change (Sintayehu, 2018).

Climate change is having an impact on sub-Saharan Africa's agriculture industry, as seen by increased temperatures, decreased rainfall, and drought. Changes in soil moisture, soil quality, crop resilience, timing and duration of the growing season, crop and animal yields, air temperatures, weed proliferation, flooding, unprecedented droughts, and increasing sea levels are all attributed to climate change, according to Akinnagbe and Irohibe (2014). Adhikari et al. (2015) emphasized that these changes hurt agricultural activities, which are the backbone of the economies of many African nations. This condition is further made worse by several other factors, such as pervasive poverty, a disproportionate reliance on rain-fed agriculture, unequal land distribution, restricted access to capital and technology, inadequate long-term weather forecasts, inadequate research and extension services, and inadequate public infrastructure (such as roads).

Makuvaro et al. (2018), posit that 90% of Zimbabwe's smallholder farmers' farmed land is in agroecological zones III to V, which have irregular rainfall patterns and problems with soil fertility, making smallholder farmers especially vulnerable. It is predicted that climate change would make their situation worse. Zimbabwe is further identified by Rurinda et al. (2014) as a "hotspot" for climate change, with predicted increases in temperature, variable rainfall, and a higher risk of extreme events including flash floods and droughts. Due to several interrelated stressors, such as soil degradation, restricted access to profitable input and output markets, a declining natural resource base made worse by population pressure, and the disintegration of social safety nets associated with extreme poverty, smallholder farmers are particularly vulnerable to the effects of climate change. Variability and change in the climate thus.

Tui et al. (2021) are of the view that more than 70% of Zimbabweans are employed in agriculture; although there is still a lack of information on the effects of climate change, which makes it more difficult to create effective adaptation plans. Furthermore, Muzamhindo et al. (2015) point out that farmers are facing serious production consequences because of climate change effects including unpredictable rainfall and excessive temperatures, especially as 70% of the local population depends on rain-fed agriculture.

2.3.1 The importance of understanding factors causing climate-induced disasters among smallholder farmers.

To effectively create adaptation and mitigation strategies, smallholder farmers must have a thorough understanding of the elements that contribute to climate-induced disasters. Only a few research, mostly in Africa, have evaluated how vulnerable smallholder farming households

are to climate change (Maganga et al., 2021; Zeleke et al., 2021). To meet the particular requirements and challenges faced by smallholder farmers, it is imperative to obtain an understanding of these aspects.

To enable smallholder farmers to create effective countermeasures and coping mechanisms for climate change, vulnerability assessment is essential (Tofu et al., 2022). Interventions can be designed to increase resilience and reduce risks if smallholder farmers' unique vulnerabilities are understood. Furthermore, the negative consequences of climate-induced disaster factors on individuals and the ecosystem can be lessened by implementing sustainable agriculture methods based on awareness of these aspects (Mallappa et al., 2021). Agroforestry, conservation agriculture, water management strategies, and diverse cropping systems are a few examples of these methods.

Furthermore, understanding the factors contributing to climate-induced disasters can inform policy formulation and the development of governance frameworks that prioritize climate resilience in agricultural systems. This may involve investments in climate-smart agriculture, insurance schemes, and early warning systems (Tofu et al., 2022). It is crucial for developing countries to customize their adaptation policies to address the specific impacts they anticipate, as climate change poses significant challenges to agricultural production without effective adaptation measures.

Moreover, smallholder farmers with experience in climate-induced disasters can design and implement support mechanisms that respond to their specific needs (Shinbrot et al., 2019). Farmers who possess a strong awareness of drought and temperature changes are more likely to adapt to these challenges.

In summary, comprehending the factors contributing to climate-induced disasters among smallholder farmers enables the development of targeted interventions, adoption of sustainable agricultural practices, formulation of appropriate policies, and implementation of support mechanisms. These actions are crucial for enhancing resilience, minimizing risks, and promoting climate adaptation in agricultural systems.

2.3.2 Factors Contributing to Climate-Induced Disasters among Smallholder Farmers

The susceptibility of smallholder farmers to the effects of climate change is largely determined by a number of socioeconomic factors. Poverty, a lack of education, inadequate infrastructure, restricted access to credit and financial services, and social inequality are some of these causes.

It has been acknowledged that improving these socioeconomic characteristics is essential to strengthening the resilience of communities who are at risk (FAO, 2020).

Because of climate change, smallholder farmers are particularly vulnerable to climate-related disasters. Matewos (2019) posits that smallholder farmers in sub-Saharan Africa are particularly susceptible to natural disasters because they rely on rainfall, low adoption of contemporary technologies, and poor capacity for adaptation. Furthermore, several other issues, including a lack of infrastructure, political instability, fragile ecological conditions, marginalization, and limited human and material resources, exacerbate the vulnerability in this region. A thorough understanding of these variables is necessary to develop targeted treatments that will increase smallholder farmers' resilience.

2.3.4 Climate change and variability in rural areas

Rising temperatures, altered precipitation patterns, and shifting climate extremes are just a few of the effects of climate change that directly influence rural communities and agricultural systems. According to Thornton et al. (2014), areas with lower levels of development already confront significant obstacles to food security, especially considering the world's growing population.

Smallholder farmers, who mostly rely on rain-fed agriculture, are especially vulnerable to these changes, according to the Intergovernmental Panel on Climate Change (IPCC, 2019). Planning and managing agricultural operations effectively is significantly hampered by the unpredictability and fluctuation of weather patterns. The relationships between climate change and the increased frequency and severity of climate-related disasters, like storms, floods, and droughts, have been clarified by recent studies.

Ochieng et al. (2016) contend that, as is the case in many African nations, a sizable majority of Kenya's population lives in rural areas and depends on agriculture for a living, making climate variability and change a direct threat to agricultural productivity and food security. The fact that most agriculture in these areas is rain-fed exacerbates this susceptibility. Africa's destitute people, especially smallholder farmers, are very vulnerable to environmental and climatic dangers since they have few opportunities to diversify their sources of income and resources.

Due to their limited ability to adjust, smallholder farmers in rural Zimbabwe are more vulnerable to food insecurity because of reduced yields caused by climate variability.

According to Makuvaro et al. (2018), during the previous three decades, droughts have been more frequent and intense. The primary source of income for rural residents in Zimbabwe is agriculture, which has been negatively impacted by climate change and fluctuation. Nhemachena et al. (2014) contend further that rural livelihood, especially those in the agriculture sector, are negatively impacted by climate change and variability. A study by Tirivangasi and Nyahunda (2019) examined the difficulties rural farming communities confront in reducing the effects of climate change. The study identified several difficulties, such as the unpredictable nature of traditional knowledge systems, scarce resources, and lack of support for putting into practice workable mitigation options, lack of access to technoscientific adaptation methodologies, and inadequate knowledge of climate change resilience and adaptive capacity.

2.3.5 The impact of socioeconomic factors on climate change vulnerability.

China's social vulnerability at the county level has been found to have specific features by Zhou et al. (2014). These characteristics include the country's rural character, development (urbanization), and economic standing. Communities' susceptibility to the effects of climate change is significantly influenced by their socioeconomic standing. According to Thomas et al. (2018), vulnerability is a multifaceted process affected by a range of variables at multiple scales, such as social, political, and economic forces. Vulnerability is greatly influenced by government, culture, knowledge, and resource availability.

Dumenu and Obeng (2016) investigated societal vulnerability and climate change adaptation tactics in Ghana. The results showed that high susceptibility is a result of socioeconomic characteristics such high levels of illiteracy, a strong dependence on livelihoods that are vulnerable to climate change, a lack of income diversification, and restricted access to information on climate change. Leichenko and Silva (2014) also point out that poverty can be made worse by climatic unpredictability and change, especially in less developed places like rural areas.

Examining climate change adaptation, Zamasiya et al. (2017) emphasize the need for multidisciplinary interventions that consider gender dynamics and their influence on access to climate information and attitudes towards adaptation. A study conducted in Hwedza, Zimbabwe, indicated that a significant proportion (49%) of smallholder farmers displayed unfavourable behavioural intentions towards climate change adaptation, despite the district's high susceptibility to hydro-meteorological hazards.

According to Mavhura and Manyangadze (2021), 68% of Zimbabwe's smallholder farmers have average to high degrees of social vulnerability. Social vulnerability is largely influenced by variables including poverty, informal employment, features of the household (such as the head of the household), birth rate, and the existence of populations with special needs. Furthermore, Mavhura et al. (2017) contend that a variety of regionally specific institutional, social, and economic factors all have an impact on social vulnerability. The study also noted that smallholder farmers are more vulnerable when risks and calamities recur.

2.3.6 Agricultural practices and land management affecting climate resilience.

A smallholder farmer's ability to withstand climate-related calamities is greatly impacted by the agricultural practices and land management techniques they employ. The effects of climate change can be exacerbated and agricultural systems' susceptibility increased by unsustainable practices such as excessive tillage, monocropping, and inadequate soil and water management (Nelson et al., 2014). However, using climate-smart farming methods like agroforestry, conservation agriculture, and agroecology can increase climate resilience and lower the likelihood of natural disasters. These strategies are crucial for reducing the effects of climate change on smallholder farmers, according to recent research.

According to Altieri and Nicholls (2017), smallholder farmers have successfully prepared for and adapted to climate change by implementing coping mechanisms, such as agroecology. Research carried out in the last twenty years has demonstrated that smallholder farmers who engage in varied crop cultivation within conventional farming systems are more resilient to natural disasters brought on by climate change. As a dependable and workable strategy for boosting production, sustainability, and resilience among smallholder farming communities in the face of climate change and its effects, the authors advise fusing agroecology with indigenous knowledge systems.

Climate change is significantly impacted by land use, especially when it comes to carbon storage. According to Searchinger et al. (2018), the conversion of land for agricultural purposes increases greenhouse gas emissions, accounting for 20–25% of total emissions. The difficulties that the agriculture industry in developing nations faces are highlighted by Mbow et al. (2014). These difficulties include climate change and land pressure, which put productivity at risk. Food shortages are made worse by the rising demand for agricultural land in order to boost productivity and worsen land degradation. Mubaya and Mafongoya (2017) stress the

significance of institutions in the management of natural resources, including biodiversity and land, in order to strengthen smallholder farmers' ability to adapt to climate change.

2.3.7 Access to resources, technology, and infrastructure as determinants of vulnerability

Smallholder farmers are particularly vulnerable to climate-related disasters because they have less access to infrastructure, technology, and basic supplies. Their capacity to adjust to shifting climatic circumstances and deal with extreme events is hampered by a lack of access to loans, information, high-quality seeds, fertilizers, and irrigation infrastructure. Thornton et al. (2018) have highlighted the significance of improving smallholder farmers' resilience by increasing their access to resources and technologies.

Social vulnerability, as defined by Hummell et al. (2016), arises from inequalities that can be influenced by geographical location. The impacts of disasters disproportionately affect different groups depending on their level of development and pre-existing vulnerabilities, with the poor being the most affected. Less developed regions, including rural areas and developing countries, experience greater impacts. Singh et al. (2014) highlights that lack of technology and limited access are key determinants of vulnerability.

Africa-based research by Shiferaw et al. (2014) highlights the need for a multifaceted, all-encompassing strategy to combat drought. The report suggests tactics include integrating technology, fortifying institutions, and putting climate-related legislation into effect. Reducing susceptibility and effectively managing climate variability and extremes require access to risk-reducing and productivity-enhancing technologies as well as enhanced infrastructure. The relationship between institutions, technology, policy, and smallholder farmers' resilience is depicted in the diagram below.

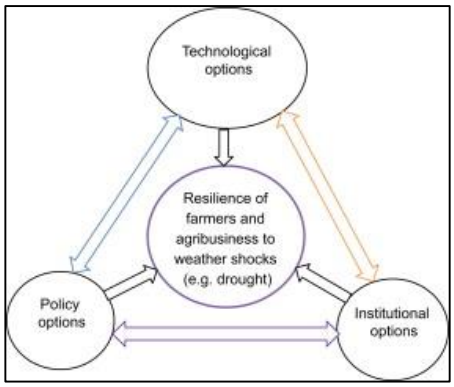

Figure 2.2 Interconnectedness between technology, policy, institutions, and the resilience of smallholder farmers.
Source: Shiferaw et al 2014

Pakistan, like many other developing nations, grapples with issues of food insecurity, poverty, and environmental disasters. The rural areas of Pakistan, like other developing countries, are home to a significant portion of the population whose livelihoods heavily rely on the agricultural sector. Within the rural population, the majority consists of smallholder farming communities who own less than 2 hectares of land and have limited access to resources and services (Ahmed et al., 2017).

It was suggested in a Zimbabwean study by Mutombo and Musarandega (2023) that smallholder farmers who grow rainfed crops are especially susceptible to drought because they depend on resources that are sensitive to climate change. As their essential crop, maize is the main emphasis of smallholder farmers in Zimbabwe, despite the country's high climate vulnerability. The inability of these farmers to adapt, including their lack of money, technology, and supported infrastructure, presents serious difficulties for them in dealing with the effects of climate change. In their study, Makate and Makate (2019) hypothesized that smallholder farmers' food security may be improved by implementing climate risk management technology in the face of climate change and variability.

2.4 Community-Based Disaster Risk Reduction (CBDRR) Strategies

The term "community-based disaster risk reduction" (CBDRR) refers to a variety of approaches and strategies used to involve local people in the assessment, management, and identification of disaster hazards. The active participation of community members, acknowledging their local knowledge and skills, and enabling them to reduce vulnerabilities and build resilience are all highly valued components of CBDRR (IFRC, 2009).

In a 2009 report, UNISDR stated that the foundation of CBDRR is community ownership and involvement. This is a clearly recognition that communities should be active participants in disaster risk reduction rather than passive victims. Community members' distinct viewpoints, needs, and goals are considered by CBDRR through incorporating them in the decision-making process. This strategy encourages accountability and ownership, which makes risk reduction programs more successful and long-lasting, hence sustainable.

In rural regions, various CBDRR strategies have been implemented to address specific risks and facilitate adaptation to climate-induced disasters. For example, Mercer et al. (2010) outline the utilization of hazard mapping and response mechanisms in rural areas to mitigate and adapt to climate-related hazards. CBDRR strategies need to be tailored to the specific local contexts and hazards they seek to address to maximize their effectiveness.

Overall, CBDRR seeks to actively engage local communities in the identification, analysis, and management of disaster risks. By promoting community participation, recognizing local knowledge, and empowering community members, CBDRR plays a critical role in reducing vulnerabilities and enhancing resilience. CBDRR strategies must be context-specific and tailored to local circumstances to effectively address the risks at hand.

2.4.1 Definition and Principles of CBDRR

Including communities in disaster risk reduction initiatives is the goal of community-based disaster risk reduction (CBDRR). This is an inclusive and participatory strategy. The cornerstones of CBDRR are empowerment, ownership, integration, and sustainability, (UNISDR,2015). Empowerment entails facilitating communities to assume responsibility for their risk reduction initiatives. Ownership underscores the importance of community involvement and decision-making throughout the entire process. Integration involves incorporating local knowledge and practices into risk-reduction strategies. Sustainability ensures the longevity of CBDRR efforts and their ability to adapt to evolving circumstances.

According to Das Gupta and Shaw's (2017) analysis of the connections between disaster risk reduction and climate change adaptation, CBDRR is essential. They also stress how successful community-based DRR is at attaining the intended results. The pursuit of the Sustainable Development Goals in conjunction with the integration of CCA and DRR highlights the interdependence and common goals of these programs.

2.4.2 Examples of CBDRR strategies adopted in rural areas.

Rural areas with smallholder farming communities have embraced Early Warning and Preparedness Planning, as advocated by Niekerk et al. (2018). This approach involves establishing early warning systems that incorporate local knowledge and technology, recognizing the value of indigenous and scientific knowledge working together. According to Mustofa et al. (2018), these systems give communities fast and reliable information about upcoming calamities, empowering them to take the necessary precautions and respond appropriately.

Community-Based Hazard Mapping is another practice where communities actively participate in mapping exercises to identify and assess local hazards, vulnerabilities, and resources. This information serves as the basis for developing tailored risk management plans. Involving those directly affected is crucial for gaining a deeper understanding of vulnerabilities, hazard

exposure, and resilience. Wambede and Tweheyo (2022) assert that hazard maps are essential tools for enhancing risk awareness, enabling effective disaster mitigation, and informing disaster management efforts.

Community Disaster Management Committees play a vital role in disaster management, as highlighted by Jagirdhar and Sastry (2014). Trained community members serve as first responders and are responsible for mobilizing resources, providing immediate assistance, and coordinating responses during and after disasters. These committees facilitate a participatory approach to preparedness and response, aiming to reduce the impact of natural hazards. Bongo and Manyena (2015) emphasize the shift from command and control to distributed leadership in disaster risk reduction, emphasizing the importance of governance, local knowledge integration, and community-based leadership for addressing sustainable development challenges.

Ecosystem-based approaches are also implemented in rural communities as part of CBDRR strategies. These approaches involve community engagement in the restoration, conservation, and sustainable management of ecosystems. Actions such as protecting watersheds and forests from climate change contribute to nature-based solutions and strengthen community resilience. Amin et al. (2023) argue that these approaches enhance ecological resilience and mitigate the impacts of climate-induced disasters by combining advanced technology, indigenous knowledge, community preparedness and participation, and insurance support.

2.4.3 Role of Community Participation and Local Knowledge in CBDRR

Community-Based Disaster Risk Reduction (CBDRR) techniques rely heavily on local knowledge and community participation. Wang et al. (2019) stress the importance of indigenous knowledge held by communities and their in-depth comprehension of their immediate surroundings, dangers, and coping strategies. Active community member participation in decision-making makes interventions context-specific, culturally sensitive, and long-lasting. According to Adger et al. (2018), community stakeholders' involvement in CBDRR increases social cohesiveness, promotes ownership, and improves the efficacy of risk reduction initiatives.

In their study on Cyclone Idai in Zimbabwe, Saurombe and Shava (2021) emphasize the need of prioritizing community resilience through indigenous responses in the short- and long-term. The Ubuntu ethic of care and humanity, which is firmly anchored in a relational framework that acknowledges people within the larger family and community context, serves as the basis

for these answers. During times of disasters, communities demonstrate a "brother's keeper" attitude, as witnessed during Cyclone Idai, where they provide early assistance and responses to mitigate the impact of the disaster.

2.4.4 Challenges and opportunities in implementing CBDRR strategies for climate change adaptation.

There are potential challenges in implementing CBDRR techniques for climate change adaptation. These challenges encompass limitations in resources, inadequate institutional support, social inequalities, and the integration of traditional and scientific knowledge systems. Conversely, CBDRR brings forth prospects for community resilience, the establishment of social networks, local leadership, adaptive capacity, and co-benefits such as improved livelihoods and sustainable development (Béné et al., 2019). Through the integration of community involvement and indigenous knowledge, CBDRR enables communities to address vulnerabilities and strengthen their resilience. To fully realize the promise of CBDRR, it is imperative to fortify institutional support, allocate resources, exchange information, and cultivate collaborations (Djalante & Thomalla, 2012). Put simply, catastrophe risk reduction actions are implemented in a way that enhances the efficacy of climate change adaptation. The relationship between CBDRR techniques for climate change adaptation that can be used to lessen vulnerabilities and increase resilience is illustrated in the picture below.

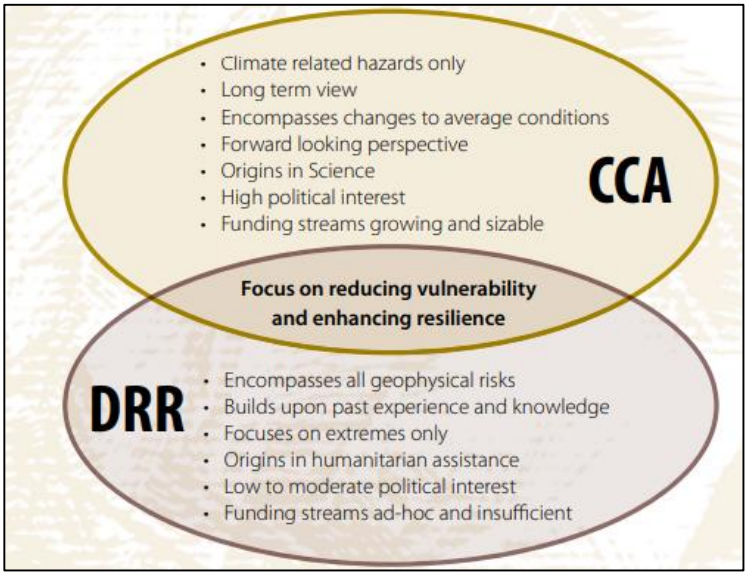

Figure 2.3: CBDRR strategies of CCA Adopted from (Gero, et al, 2010)
Source: Gero 2010

2.5.1 Effectiveness of CBDRR Strategies in Mitigating and Adapting to Climate Change

Community-Based Disaster Risk Reduction (CBDRR) strategies have gained recognition as effective methodologies for mitigating and adapting to the impacts of climate change (Smith et al., 2016). These strategies prioritize community engagement, local knowledge, and capacity building to enhance resilience and reduce vulnerabilities.

According to a study by Chivhenge et al. (2023), the Zimbabwean government implements policies poorly even when there are sound policies in place. This deficiency in policy implementation has failed effective disaster risk reduction measures to address climate change. Notably, policy duplications exist, such as in the Environmental Management Act and Forestry Act, where sections about climate change could be consolidated into the Climate Change Policy to facilitate more effective disaster risk reduction efforts.

Rangarirai et al. (2023), in their examination of community-oriented approaches, indicate that such approaches exert a positive influence on the level of disaster risk reduction among smallholder farmers. They advise that the best way to lessen the consequences of hydro-meteorological hazards in Zimbabwe is for the government to support community-based disaster risk management training. The agricultural sector in Zimbabwe is particularly vulnerable, experiencing shifts in rainfall patterns, rising temperatures, and extreme weather events like floods and droughts. Sustainable Development Goals 1 and 2, targeting poverty eradication and hunger reduction, face significant threats. Therefore, the government must strengthen collaborations and implement projects that support smallholder farmers in vulnerable communities while addressing climate change impacts (Gundu-Jakarasi & Nhidza, 2021). Integrated planning involving the community will facilitate progress in achieving sustainable development goals. Multiple stakeholder engagement is encouraged in developing adaptation and mitigation strategies, providing customized climate information, and establishing robust markets and sustainable value chains.

2.5.2 Evaluation of case studies and empirical research on CBDRR effectiveness

An extensive body of empirical research and case studies has been examined to determine how well Community-Based Disaster Risk Reduction (CBDRR) techniques work to mitigate climate change. These studies offer strong proof of the beneficial effects of CBDRR programs. In Bangladesh, for example, a study by Akter et al. (2017) found that communities participating in CBDRR activities were less vulnerable to hydrometeorological hazards. Early warning

systems, community-based strategies, and the application of creativity and technology were used to accomplish this.

In a similar vein, Karki et al.'s 2019 study in Nepal showed that CBDRR interventions—such as hazard mapping and the creation of Disaster Risk Reduction (DRR) committees—significantly improved disaster preparedness and decreased the negative effects of disasters. These findings underscore the favourable outcomes of CBDRR strategies in decreasing disaster risks and fostering resilience at the community level.

However, Bongo et al. (2019) argued in their study conducted in Zimbabwe that disaster risk reduction policies often neglect the needs of specific social groups. They further emphasized that many measures for disaster risk reduction were formulated without considering the requirements and vulnerabilities of these groups.

Overall, the analysis of numerous case studies and empirical investigations demonstrates how successful CBDRR tactics are at reducing the effects of climate change. Nonetheless, it also emphasizes how important it is for disaster risk reduction policies and initiatives to guarantee inclusion and cater to the unique requirements of many social groups.

2.6.1 Assessment of the impact of CBDRR strategies on smallholder farmers' resilience

Evaluating how Community-Based Disaster Risk Reduction (CBDRR) methods affect the resilience of smallholder farmers is essential to comprehending how effective these strategies are at reducing the risks associated with climate change. Adopting CBDRR techniques, such as better land management, income diversification, and conservation of soil and water, improved smallholder farmers' adaptive capacity and decreased crop failure risks, according to research done in Ethiopia (Asrat et al., 2018). Similarly, in India, engaging smallholder farmers in CBDRR initiatives, including community-based seed banks and climate-resilient agricultural practices, increased their resilience to droughts and improved food security (Bhattacharya et al., 2020). These findings emphasize the positive impact of CBDRR strategies in strengthening smallholder farmers' resilience and mitigating climate-related risks.

Chikodzi et al. (2020) studied the effect of CBDRR techniques on the resilience of smallholder farmers in Zimbabwe. The results showed that farmers' adaptive capacity and resistance to climate-related risks were greatly increased by putting into practice CBDRR interventions, such as farmer field schools and climate-smart agricultural practices. By taking part in CBDRR

programs, participants gained more knowledge and expertise in adapting to climate change, which enhanced crop yields and stabilized income.

Dube et al. (2018) investigated the effectiveness of community-based early warning systems in Zimbabwe and found that establishing such systems, coupled with community training and capacity-building efforts, substantially improved farmers' preparedness and response to climate-induced disasters. Timely and accurate information provided through these systems enabled farmers to take proactive measures, such as adjusting planting schedules and implementing crop diversification strategies, therefore lessening the negative effects of climate variability on their means of subsistence.

Manatsa et al. (2019) investigated the effect of CBDRR techniques on Zimbabwean smallholder farmers' food security in a different study. The study emphasized certain actions, such advocating for conservation agriculture and making drought-tolerant crop varieties more accessible and establishing community seed banks contributed to enhanced food security among smallholder farmers. These CBDRR practices not only increased farmers' resilience to climate-related shocks but also improved agricultural productivity and diversified their sources of food and income.

2.7.1 Analysis of the role of community engagement and capacity building in successful CBDRR

According to Twigg (2015), community engagement and capacity building are vital components of successful CBDRR implementation, ensuring tailored interventions aligned with local needs, values, and knowledge systems, thus promoting ownership and sustainability. It facilitates community participation in decision-making, planning, and implementation processes, fostering social cohesion and collective action. Capacity building empowers communities to identify and address vulnerabilities effectively, encompassing training in disaster risk reduction techniques, early warning systems, and sustainable agricultural practices.

Through community engagement and capacity building, CBDRR strategies leverage local knowledge and resources for efficient risk mitigation and climate change adaption. These elements are crucial in enhancing smallholder farmers' preparedness and overall community resilience (Abenir et al., 2022). Suharini et al. (2020) highlighted that community-engaged DRR initiatives significantly impact knowledge, preparedness, social cohesion, and natural asset management, allowing CBDRR programs to provide grassroots-level disaster risk

reduction guidance. This approach fosters resilience champions within the community who disseminate information and create a sense of belonging, thus preventing disasters and ensuring long-term community sustainability. The analysis underscores the critical role of community engagement and capacity building in successful CBDRR outcomes in Zimbabwe (Chikodzi et al., 2020; Dube et al., 2018).

2.8.1 Developing a CBDRR Plan for Resilience Building

The development of a Community-Based Disaster Risk Reduction (CBDRR) plan is essential to fostering resilience in communities who are at risk, especially smallholder farmers who bear a disproportionate amount of the consequences of climate change. Important elements and factors to consider while creating a CBDRR plan for smallholder farmers include how disaster risk reduction and climate change adaptation are included into the plan, as well as possible implementation issues and suggestions (Chikodzi, et al, 2020). To help vulnerable groups, such as smallholder farmers, become more resilient to the disproportionate consequences of climate change, a CBDRR plan is essential. In its conception and execution, the strategy should take a comprehensive approach to catastrophe risk reduction as well as climate change adaptation.

2.8.2 Frameworks and approaches for developing CBDRR plan.

To assist in the creation of successful community-based disaster risk reduction (CBDRR) strategies, several conceptual frameworks and methodological techniques have been put forth. For example, the Pressure and Release (PAR) model highlights the significance of tackling the "dynamic pressures" that transform these underlying variables into unsafe conditions as well as the "root causes" of vulnerability, such as political, social, and economic processes (Wisner et al., 2004). Pandey and Okazaki (2005) emphasize that the Community-Based Disaster Risk Management (CBDRM) paradigm places significant emphasis on the need to involve local stakeholders at every stage of the disaster risk management cycle. Furthermore, the Participatory Vulnerability Analysis (PVA) approach utilizes participatory tools to enable communities to collectively identify their vulnerabilities and capacities (Twigg, 2007). These and other theoretical frameworks provide valuable guidance for the formulation of locally tailored, community-driven CBDRR plans that account for the multifaceted nature of disaster risk.

2.8.3 Key components and considerations in designing a CBDRR plan for smallholder farmers.

When designing a community-based disaster risk reduction (CBDRR) plan for smallholder farmers, a comprehensive consideration of several key components is essential. Foremost, conducting a thorough vulnerability and capacity assessment is crucial to identify the specific risks faced by the smallholder farming community, such as exposure to extreme weather events, crop failures, and market disruptions (IPCC, 2022). Directly engaging smallholder farmers in this assessment process through participatory methods can help ensure the plan is responsive to their unique needs and capacities (Alam & Collins, 2010).

Furthermore, the CBDRR plan should incorporate strategies aimed at strengthening the adaptive capacities of smallholder farmers. Such strategies may include diversifying livelihood options, improving access to early warning systems, and promoting sustainable agricultural practices (Wisner et al., 2012). The effective coordination and collaboration between local authorities, agricultural extension services, and community-based organizations are equally critical, as this is essential for the the CBDRR plan's effective execution and long-term viability (Delica-Willison & Willison, 2016).

By comprehensively addressing these key components, the implementation of CBDRR plans can significantly increase smallholder farming communities' ability to withstand the effects of natural catastrophes and climate change.

2.8.4 Disaster risk reduction and climate change adaptation integration into CBDRR plan.

To fully address both present and future hazards, smallholder farming groups' community-based disaster risk reduction (CBDRR) plans must integrate disaster risk reduction and climate change adaptation measures in a holistic manner (IPCC, 2022). This integrative approach involves a thorough identification and explicit consideration of climate change impacts within comprehensive risk assessment and planning processes (UNDRR, 2021). Furthermore, it encompasses the seamless integration of climate-smart practices, such as the incorporation of climate information into early warning systems and the promotion of adaptive agricultural techniques, into disaster risk reduction strategies (UNDP, 2021; FAO, 2019).

A complete and sustainable response to the multiple, interrelated threats posed by climate change and natural catastrophes is ensured by this diverse and interconnected strategy (Schipper & Pelling, 2006). Through a more comprehensive and forward-looking strategy, the

CBDRR plan can improve the resilience of smallholder farming communities by strategically connecting frameworks for disaster risk reduction and climate change adaptation (IPCC, 2022; UNDRR, 2015). In the context of a rapidly changing climate, smallholder farmers face increasing difficulties that must be effectively addressed with an integrated viewpoint.

2.8.5 Potential challenges and recommendations for implementing the CBDRR plan.

The literature identifies several obstacles to smallholder farming communities' adoption of community-based disaster risk reduction (CBDRR) programs. According to Peng et al. (2022), the efficacy of these plans may be hampered by insufficient community ownership and participation as well as by a misalignment of CBDRR tactics with local development priorities. Additionally, the COVID-19 epidemic has made socioeconomic vulnerabilities already present even worse, making it more difficult to organize resources and maintain community engagement (Kumar et al., 2021).

To address these challenges, the scholarly discourse advocates for a more inclusive and participatory approach, empowering local communities to actively shape and own the CBDRR process (Roder et al., 2020). Ostadtaghizadeh et al. (2021) suggest that integrating CBDRR strategies with broader development initiatives and aligning them with community needs and aspirations can enhance the plan's relevance and long-term sustainability. Additionally, leveraging digital technologies and innovative financing mechanisms, such as crowdfunding and microinsurance, may help overcome resource constraints and maintain community engagement during disruptive events like the COVID-19 pandemic (Pearson & Pelling, 2021). By addressing these challenges and implementing the recommended strategies, the CBDRR plan can be more effectively and sustainably implemented, ultimately enhancing the ability of smallholder farming groups to withstand.

Within the particular situation of Zimbabwe, the extant literature further illuminates unique challenges in the implementation of CBDRR plans. Gukurume (2020) highlights the limitations posed by inadequate financial resources, weak institutional capacity, and a lack of technical expertise within local communities, which can hinder the effective execution of the plan. Additionally, the effects of climate change, like floods and droughts, have exacerbated existing vulnerabilities, further complicating the mobilization of resources and the sustenance of community engagement (Mavhura, 2017).

Summary

Research shows how smallholder farmers in rural areas are particularly vulnerable to climate-related disasters, which can have a significant negative impact on their means of subsistence. Coordination mechanisms, institutional capability, and resource availability are some of the aspects that affect their ability to adapt. In this context, creating and carrying out a plan for community-based disaster risk reduction (CBDRR) is essential to enhancing resilience against the effects of climate change.

By utilizing models such as Pressure and Release (PAR), Community-Based Disaster Risk Management (CBDRM), and Participatory Vulnerability Assessment (PVA), the CBDRR model may successfully combine disaster risk reduction and climate change adaptation techniques. Important elements like community involvement, risk assessment, and climate-resilient agriculture can increase the plan's applicability and efficacy.

However, challenges related to financing, coordination, and inclusivity must be addressed to ensure the CBDRR model's long-term sustainability and effectiveness. Strengthening stakeholder partnerships, investing in capacity building, ensuring access to climate financing, and promoting gender and social inclusion can help overcome these challenges, thereby enhancing the resilience of smallholder farming communities.

Chapter 3: Research Methodology

3.1 Introduction

This chapter focuses on the design and research technique, and approach as well as data collection tools and techniques employed in this research. As part of data collection and sampling techniques, the study used purposive and non-probability sampling techniques, interviews, observations, and questionnaire administration. The chapter discusses the qualitative design and the philosophy underpinning this approach that the study employed. This chapter discusses the features and justifications of qualitative research design and technique. The chapter also covers population, sampling, and data display and analysis techniques.

3.1.1 Philosophical Positionality

The epistemological positioning of the researcher was central to this study on Community-Based Disaster Risk Reduction (CBDRR). Epistemology, as defined by Goldman (2003), is the branch of philosophy concerned with the study of knowledge - specifically, how we come to trust the sources used to acquire knowledge, such as our senses, memory, the testimony of others, and our own reasoning.

The researcher's epistemological stance determined whether knowledge was conceived as a web, where beliefs interconnect to form a broader set of knowledge, or as a foundation of certain beliefs that do not require connections to other beliefs (Crotty, 1998). This epistemological framing, in turn, shaped the researcher's positionality, which impacted research bias, ethical considerations, and the overall research design (Creswell, 2013).

In the context of this CBDRR study, the researcher's epistemological positioning was crucial, as it informed whether a positivist or an interpretivist approach was to be adopted (Bryman, 2012). Given that this study is qualitative in nature, the interpretivist approach was chosen, aligning with the belief that knowledge is socially constructed and requires an understanding of the subjective experiences of research participants (Creswell & Poth, 2016). This paradigm emphasizes the importance of context and meaning, allowing for a deeper exploration of community perspectives on disaster risk reduction.

The researcher's epistemological stance, therefore, had significant implications for the methodological choices, data collection techniques, and analytical strategies employed in this CBDRR study (Flick, 2014). The rigor, validity, and ethical integrity of the research process and its results depended heavily on the researcher's epistemological stance (Yin, 2017).

3.2.1 Research Design

Given the nature of this study, the researcher appropriately selected a qualitative research design. Using this method, the researcher was able to evaluate community-based disaster risk reduction strategies in the agriculture industry while also delving deeply into the perspectives of research participants (Creswell, 2013).

With an emphasis on the Community-Based Disaster Risk Management (CBDRM) strategies used in Chirumanzu District, the study used a qualitative case study technique. This qualitative research methodology facilitated the gathering of in-depth, rich data to gain a comprehensive understanding of the topic.

Qualitative research methods are well-suited for exploring complex phenomena, capturing contextual information, and generating detailed insights from the perspectives of the participants involved (Flick, 2014). This approach stands in contrast to the quantitative, or positivist, research tradition, which emphasizes the objective evaluation of data using scientific measurements and disregards subjective opinions (Rahman, 2016). The qualitative, or anti-positivist, approach argues that the positivist approach is inadequate for studying human behaviors and responses and should be limited to scientific laboratories (Hammarberg et al., 2016).

Therefore, this study on Community-Based Disaster Risk Reduction appropriately utilized qualitative research methods to gather rich and insightful data from the participants (Creswell, 2014).

3.2.2 Methodological Considerations

A qualitative methodological approach was used in the proposed research for this study's data collecting and analysis. The study was carried out in Zimbabwe's Chirumanzu region, and document analysis, focus groups, and interviews were used to collect data.

The study's goals, which included evaluating and establishing community-based disaster risk reduction (CBDRR) strategies in the agricultural sector, particularly among smallholder farmers impacted by hydrometeorological hazards, supported the use of a qualitative technique. The qualitative approach enabled the researcher to describe, interpret, and contextualize the communities' resilience fostered by CBDRR initiatives, as well as gain in-depth insights into the prominent issues and best practices that ensure sustainable impact (Jamshed, 2014).

Smallholder farmers in the Chirumanzu Rural District are facing a range of challenges, including droughts, extreme temperatures, dry spells, and livestock loss, which required a comprehensive exploration to understand the impact of CBDRR approaches in addressing these issues. The study's phenomenological approach allowed the researcher to obtain a clear and deep understanding of the situation from the perspectives of the affected community members (Creswell & Poth, 2016).

The qualitative research paradigm is underpinned by a subjective ontology and often utilizes an ethnographic approach, which facilitates the exploration of how and why social processes occur within the geographical context under investigation (Merriam & Tisdell, 2015). This approach enabled the researcher to establish a direct relationship with the target population, the victims of the various shocks and stressors, and capture their lived experiences, feelings, and opinions regarding the phenomenon under study (Denzin & Lincoln, 2011).

The research employed a qualitative methodology, as qualitative research was well-suited to explore phenomena that cannot be easily quantified, such as feelings, opinions, and behaviours of the population under study (Walia, 2015). Qualitative research use interpretive and material methods, such as field notes, interviews, observations, discussions, photos, and recordings, to turn the world into a sequence of representations (Walia, 2015).

Qualitative research has similar traits to scientific research in that it aims to explore a research problem, employs predetermined protocols, gathers data, and generates conclusions that have implications outside of the study's immediate parameters (Walia, 2015). This method works well for gathering culturally relevant data regarding the beliefs, attitudes, actions, and social settings of populations, giving rich textual accounts of how people feel about the research question (Walia, 2015).

Qualitative research is strong because it can detect intangible variables that may be important to the research issue but are not always obvious, such as societal norms, socioeconomic status, gender roles, ethnicity, and religion (Walia, 2015). Because of this, qualitative research was a good fit for the planned study, which examined how smallholder farmers in Zimbabwe's Chirumanzu region were affected by community-based disaster risk reduction (CBDRR) strategies.

3.3.1 Data Collection Sites

Mapiravana, Ward 1, is a rural administrative area in the northern Chirumanzu district of Zimbabwe, known for its predominant agricultural activities and smallholder farming. According to the 2022 census data, the ward has a total population of 3,852 individuals across 1,068 households, divided into 47 villages with traditional leadership structures. The ward is served by 4 primary schools, 1 secondary school, 2 dip tanks, and 2 rural health clinics, but the water infrastructure is inadequate, with many boreholes requiring repair.

The local economy is centred around smallholder crop and livestock farming, with major crops including maize, sorghum, millet, groundnuts, and various horticultural vegetables. The rearing of livestock, especially goats, poultry, and cattle, is also quite important. Ward 1 is primarily rural and agricultural, making the smallholder farmers there extremely vulnerable to the effects of hazards and disasters brought on by climate change. To increase the community's ability for adaptation and guarantee food security in the area, it was essential to comprehend its resilience and the efficacy of community-based disaster risk reduction (CBDRR) strategies. The map below, adapted from Kori et al. (2014), illustrates the geographical location of Ward 1, Mapiravana, within the Chirumanzu district.

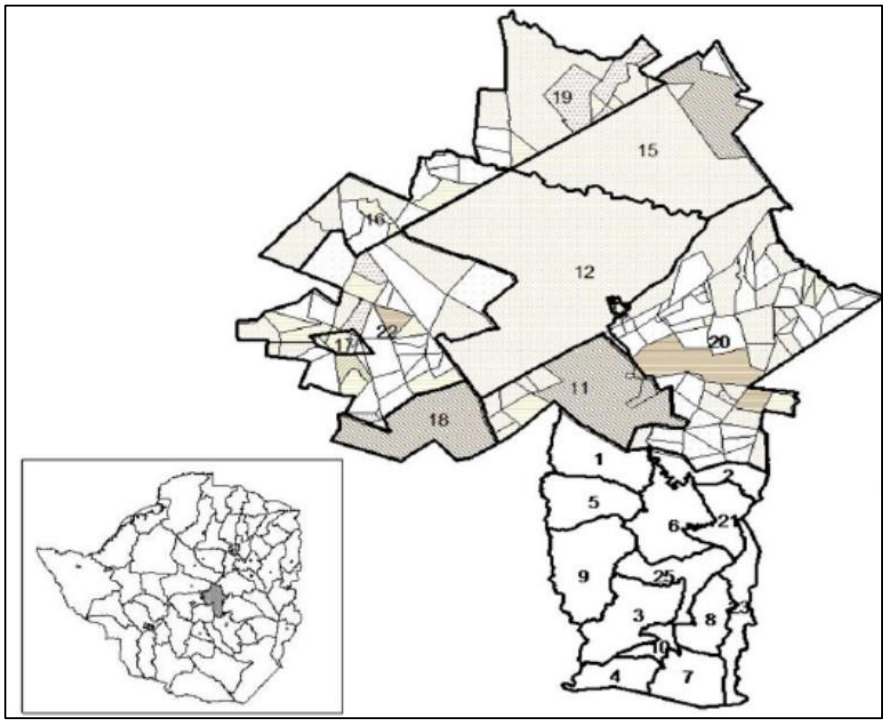

Figure 3.1: Chirumanzu District Map Showing Wards Boundaries in Chirumanzu District
Source: Kori et al 2014

3.3.2 Target population

This study evaluates the effectiveness of Community-Based Disaster Risk Reduction (CBDRR) measures employed by smallholder farmers in Chirumanzu to mitigate and adapt to the impacts of climate change. The targeted population for this research consists of community members who are smallholder farmers residing in the designated ward. Participants also included representatives of non-governmental organizations (NGOs) and several government departments that were using community-based disaster risk reduction (CBDRR) techniques.

A total of 120 smallholder farmers were selected for this study, comprising twenty champion farmers and one hundred regular smallholder farmers. The non-probability sampling technique was utilized for the selection of the one hundred smallholder farmers, while purposive sampling was employed for the twenty champion farmers and two officials from the Agritex and Veterinary and Livestock departments, one official from the District Development Coordinator's office, one official from the Department of Social Development, one official from the Chirumanzu Rural District Council, the Ward Councillor, local leadership one member, and one official from NGOs implementing programs in the district.

3.3.3 Sampling

The researcher employed a purposive sampling technique to choose a sample from the district government stakeholders in Chirumanzu and key informants in order to collect the primary data for this study.

This sampling strategy was also used to select 13 villages from the target population with a total of 326 households. The villages were chosen based on the concept of saturation, where the characteristics of the villages were assessed and found to exhibit over 95% similarity. This suggested that the findings from one village would be largely representative of the others, allowing the researcher to skip some villages and focus the sample on a subset.

Additionally, the proximity of the villages was considered when determining the sample, with the study selecting villages spread across the ward to ensure geographical representation. From the total population of the sampled villages (326 households), a sample size of 120 smallholder farmers was drawn for the study.

This sampling methodology, grounded in the principles of saturation and geographical representation, enabled the researcher to obtain a sample that was both efficient and representative of the target population. By selecting villages with highly similar characteristics

and ensuring spatial distribution, the study was able to capture the diversity of the smallholder farming community while optimizing the use of resources.

The justification for the sample size of 120 smallholder farmers was based on the need to achieve a sufficient level of data saturation and ensure the reliability of the qualitative findings. This sample size is commonly employed in qualitative studies of this nature, where the emphasis is on depth of understanding rather than breadth of generalization.

The purpose, goals, and research questions of the investigation all had an impact on the use of purposive sampling. The main characteristics that determined the eligibility of the respondents were households that had been affected by droughts and food shortages. This selective approach allowed the researcher to exercise discretion in the selection of respondents, ensuring that the study sample aligned with the research objectives.

Furthermore, preferences were given to stakeholders and field officers from various community-based organisations implementing CBDRR approaches in Chirumhanzu rural, with the primary focus being on government extension officers and officials of organisations actively engaged in CBDRR activities within the district. The study selected 8 stakeholder as key informants for the study. The table below gives a detailed breakdown of the sampling.

Table 1: Breakdown of sample per village and stakeholder

Village	**Total Population**	**Sample**
Jangara	35	10
Chivanga	25	9
Mangwende	19	9
Magada	35	10
Dhongi-Zinhu	24	9
Nhokovedzo	23	9
Majoni	26	9
Bhachi	18	9
Marufu	34	10
Mapiripiti	24	9
Shavane	19	9
Rukovo	21	9
Mudzigwa	23	9
TOTAL	**326**	**120**
District Stakeholders/Key Informants		
District Development Coordinator	-	1
Chirumanzu Rural District Council	-	1
Department of Social Development	-	1

Agritex (Ward based)	-	1
Veterinary Services (Ward based)	-	1
Ward Councilor	-	1
Local Leadership	-	1
NGOs	-	1
TOTAL		**8**

3.4.1 Data Collection Instruments

The researcher employed a comprehensive data collection approach to examine the community-based disaster risk reduction (CBDRR) strategies within the agriculture sector. This involved the gathering and analysis of both climatic and agricultural data from smallholder farmers residing within the research domain.

Focus groups (FGDs), questionnaires, and in-depth interviews were the main techniques used to collect data. These instruments were carefully selected for their proven effectiveness in generating a thorough and unbiased understanding of the dynamics within the agriculture sector.

Through the implementation of these data collection techniques, the researcher aimed to identify potential areas and opportunities where CBDRR strategies can be leveraged to enhance agricultural productivity and strengthen the resilience of the smallholder farming community. The triangulation of data obtained from multiple sources and methods enabled the researcher to develop a holistic perspective on the challenges and opportunities inherent in the CBDRR-agriculture nexus.

With the aid of these data collecting instruments, the researcher was able to compile comprehensive, contextualized data that would help with the creation of focused CBDRR interventions that are suited to the unique requirements and conditions of the smallholder farmers in the research area. In the end, this integrated approach to data collection helps to formulate evidence-based recommendations for strengthening the agriculture sector's resistance to the negative effects of climate change.

i. Interviews

The study employed in-depth interviews as a qualitative research methodology to collect comprehensive data on community-based disaster risk reduction (CBDRR) as perceived by important informants and stakeholders. This technique involves one-on-one conversations

between the researcher and the participants, following a structured question-and-answer format to leverage interaction as a means of data collection (Knott et al., 2022).

The interactive nature of in-depth interviews facilitates natural discourse, enabling participants to engage with one another while exchanging ideas and responding to questions (Knott et al., 2022). This dynamic exchange allows researchers to gain valuable insights by delving into the thoughts, emotions, and lived experiences of the participants. The rich, contextual data obtained through these personalized interactions provided critical perspectives on the implementation and efficacy of CBDRR strategies within the target community.

By employing in-depth interviews, the researcher was able to foster an environment that encouraged open and honest dialogue. This method made it easier to comprehend the sociocultural, economic, and environmental elements that influence a community's susceptibility to disasters and ability to recover from them. The detailed qualitative data gathered through these one-on-one conversations complemented quantitative information collected through other research methods, contributing to a more comprehensive analysis of CBDRR in the research domain.

In-depth interviews were used as a research tool in this study, which was in line with the qualitative methodology used to fully comprehend the viewpoints and experiences of smallholder farming communities with relation to CBDRR plans in the agricultural sector. The interactive and personalized nature of this method enabled the researchers to capture the nuanced and contextual insights necessary to address the research objectives and questions effectively.

ii. Focus Group Discussions

Focus Group Discussions (FGDs), a qualitative research technique, were used in this study to collect detailed and complex information on community-based disaster risk reduction (CBDRR) strategies in the agriculture industry. FGDs involve group interviews conducted in a structured, semi-structured, or unstructured format, enabling researchers to engage multiple participants simultaneously and systematically (Boateng, 2012).

The FGD approach was employed to elicit diverse perspectives, experiences, and insights from smallholder farmers, the target population for this research. By fostering a collaborative and interactive environment, the researcher was able to leverage social interaction to comprehend more deeply of the effectiveness of CBDRR strategies within the agricultural community.

The structured, semi-structured, or unstructured nature of the FGDs allowed the researcher to adaptively guide the discussions, while still providing participants the flexibility to express their views openly. This flexibility was a key advantage, as it enabled the researcher to explore complex phenomena, such as the contextual factors influencing the implementation and efficacy of CBDRR approaches, in-depth.

The FGDs were organized with groups of 8-12 smallholder farmers from the target communities. This group size was chosen to facilitate meaningful discussions and ensure that all participants had the opportunity to contribute their perspectives. The composition of the groups was carefully selected to ensure diversity in terms of age, gender, and socioeconomic status, as these factors can shape the experiences and perceptions of disaster risk reduction strategies.

The FGDs were conducted within the villages at a neutral venue, to establish a welcoming and accustomed atmosphere for the attendees. A total of 13 FGDs were conducted across the study area with one meeting per village from the sampled 13 villages, to gather a comprehensive understanding of CBDRR approaches from the perspectives of smallholder farmers.

The use of FGDs in this study was justified by their cost-effectiveness, strong face validity, and efficient data collection outcomes (Boateng, 2012). Moreover, the synergistic approach of FGDs enabled the researcher to elicit unanticipated themes and gain a deeper understanding of the research topic, which was crucial for the exploration of CBDRR strategies in the agricultural sector.

iii. Questionnaires

This research study employed a qualitative approach, combining open-ended and closed-ended questions, to obtain in-depth knowledge about community-based disaster risk reduction (CBDRR) tactics in the agriculture industry from smallholder farmers (Eckerdal & Hagstrom, 2017). The rationale for this research design was to yield a rich dataset that captures both the depth and breadth of participants' perceptions, attitudes, and knowledge about CBDRR approaches.

The open-ended questions were included to encourage respondents to provide unique and elaborative answers, enabling the elicitation of nuanced perspectives and experiences. This qualitative component allowed participants to share their personal stories, beliefs, and insights, which can provide critical contextual information for understanding the implementation and effectiveness of CBDRR approaches within the target community. In contrast, the close-ended

questions with predefined response options facilitated the collection of structured data, which can be analysed to identify patterns and trends.

The research design involved scheduling pre-arranged appointments with participants across 13 villages in Ward 1, with a total of 120 questionnaires administered. This approach allowed the researcher to allocate sufficient time for each participant, fostering an environment conducive to open and honest dialogue, and reducing the risk of incomplete or unreliable responses.

The justification for this carefully designed research methodology lies in the need to generate comprehensive and reliable insights into the effectiveness of CBDRR approaches within the target community of smallholder farmers. By employing this approach, the study aimed to provide a nuanced and in-depth understanding of the complex and multifaceted issue of community-based disaster risk reduction in the agricultural sector.

The integration of open-ended and close-ended questions, as well as the use of pre-scheduled appointments, was justified by the need to generate comprehensive and reliable insights into the effectiveness of CBDRR approaches within the target community. The study attempted to provide a nuanced and comprehensive understanding of the intricate and varied problem of community-based disaster risk reduction in the agricultural sector by utilizing this well planned research technique.

3.5.1 Data Analysis

The gathered data underwent a thorough analytical procedure to guarantee the validity and trustworthiness of the study on community-based disaster risk reduction (CBDRR) initiatives in the agricultural sector. The researcher considered various factors when analysing the research instruments to maintain the quality and integrity of the findings. Before the analysis, the returned questionnaires were carefully inspected to ensure completeness. If any questions are left unanswered, the researcher proactively contacted the participants to understand the reasons, thereby identifying areas requiring further clarification and enhancing the accuracy of the data.

The analysis employed a combination of descriptive and content analysis techniques. Descriptive analysis presented the data qualitatively, highlighting the recorded narratives gathered during the interviews to provide rich, contextual insights into participants' perceptions and experiences regarding CBDRR approaches.

Concurrently, content analysis was utilized to identify recurring and less recurring themes and issues from the interviews, questionnaires, and Focus Group Discussions (FGDs). The data was carefully cleaned and captured into a spreadsheet to facilitate the generation of trends and patterns, enabling the researcher to uncover meaningful insights and discern key factors influencing the effectiveness of CBDRR strategies within the agricultural sector.

3.5.2 Results Presentation Methods

The research findings on community-based disaster risk reduction (CBDRR) approaches in the agricultural sector of Chirumanzu were presented through a comprehensive narrative analysis. This approach highlighted the key themes, patterns, and insights that have emerged from the collected data. Detailed descriptive accounts and relevant verbatim quotes were provided to support the findings, conveying the richness and nuances of the participants' experiences and perspectives.

Furthermore, the study leveraged visual methods, such as diagrams, charts, and infographics, to present the results in a visually appealing and succinct manner. These visual aids served to summarize complex information and emphasize the significant findings and relationships uncovered during the research process. The strategic incorporation of these visual elements was intended to enhance the accessibility and impact of the research findings for the intended audience.

Where appropriate, the data was also summarized using tabular formats to provide a concise and visually compelling representation of the key outcomes. This multi-faceted approach to data presentation, blending narrative descriptions, visual aids, and tabular formats, contributed to the overall reliability and validity of the study. By grounding the research findings in a comprehensive and rigorous assessment of the collected data, the study aim to deliver a holistic and impactful understanding of CBDRR approaches within the Chirumanzu agricultural sector.

3.6 Research Outcomes

The principal aim of this study was to provide empirical evidence about the effectiveness of community-based disaster risk reduction (CBDRR) strategies in improving the readiness of farmers operating in the Chirumanzu agricultural sector against disasters. The anticipated findings aimed to reveal that the implementation of CBDRR strategies leads to a marked increase in farmers' awareness, knowledge, and adoption of preparedness measures, such as early warning systems and crop diversification techniques.

Additionally, the study aimed to determine how CBDRR initiatives contributed to the overall resilience of the Chirumanzu region's agricultural systems. It was anticipated that the study would show that implementing sustainable farming methods, such as agroforestry, climate-smart agriculture, soil and water conservation, and other best practices, not only lessens the negative effects of disasters but also boosts agricultural productivity over the long run and increases system resilience.

By adopting a rigorous and comprehensive analytical approach, the study aimed to generate empirical findings that demonstrate the efficacy of CBDRR strategies in enhancing disaster preparedness and building resilient agricultural systems within the Chirumanzu context. It was anticipated that the study's findings would have a major impact on the creation and execution of catastrophe risk reduction strategies and initiatives in the agriculture industry.

3.7 Ethical Consideration

This research study was conducted with the highest standards of ethical integrity. All secondary source information was properly referenced, with full acknowledgement of the original authors as per the guidelines set forth by Giles and Councill (2004).

The researcher first asked Bindura University of Science Education for ethical permission before starting any primary data collecting. This important stage made sure that the institution's stated ethical norms and guidelines were followed during the data collection process.

The respondents were not compensated in any way for their volunteer participation in the study. As per the guidelines suggested by Baysari et al. (2020), every participant was given an informed consent form. This explained the goals of the research, the privacy safeguards in place, and the participant's freedom to discontinue participation at any time.

By adhering to these rigorous ethical practices, the researcher aimed to uphold the principles of autonomy, beneficence, and justice throughout the entire research process. This commitment to ethical integrity contributed to the overall credibility and trustworthiness of the study's findings.

3.8 Limitations

Chirumanzu agricultural sector may have restricted sample size and limited representativeness when it comes to the generalizability of qualitative research on CBDRR techniques. In order to overcome these constraints, the researcher thought about performing comparative case studies and gave a detailed explanation of the research environment and constraints. The focus should be on transferability rather than generalizability, as qualitative research aims to provide

rich contextual details according to Creswell (2014). To enhance the validity and applicability of the findings, the researcher carefully selected a diverse sample that includes various stakeholders in the agriculture sector of Chirumanzu. Purposeful sampling techniques can be employed to ensure the inclusion of relevant perspectives, as suggested by Morse (2015).

Summary

This chapter offers a thorough explanation of the processes, methodology, and research design used in the current study. It encompasses a comprehensive discussion of the research methodology, the overarching study design, the sampling techniques utilized, as well as the data collection methods employed.

Furthermore, this chapter delves into the underlying research philosophy and the moral issues that have informed the research. The primary objective of this chapter is to offer a thorough justification for the methodological approach adopted, demonstrating its alignment and suitability in relation to the phenomenon under investigation.

By rigorously explicating the research design, methodology, and ethical framework, this chapter establishes the foundational elements that undergird the overall research process. This meticulous explication serves to enhance the rigor, transparency, and replicability of the study, thereby strengthening the credibility and trustworthiness of the research findings.

Chapter 4
Analysis, Presentation, and Discussion of the Results

4.1 Introduction

The research findings are analysed and discussed in this chapter. As mentioned in Chapter 3, in order to fully comprehend the viewpoints and experiences of smallholder farming communities with relation to community-based disaster risk reduction (CBDRR) initiatives in the agricultural sector, the study used a qualitative research technique. Thematic analysis was utilized to organize and present the data, wherein the findings were discussed in alignment with the research objectives and questions. This analytical approach allows for a rich and contextual examination of the phenomenon under investigation.

The results are structured and analysed under the following research objectives:

i. To establish the factors causing climate-induced disasters among smallholder farmers in Chirumanzu district, Zimbabwe.
ii. To determine the CBDRR strategies adopted by smallholder farmers to mitigate and adapt against climate change.
iii. To assess the effectiveness of CBDRR strategies implemented by Chirumanzu smallholder farmers in mitigating and adapting to the effects of climate change.
iv. To develop a CBDRR model to promote the resilience of smallholder farmers to climate change.

For each objective, the relevant themes and sub-themes that emerged from the data are presented, supplemented by illustrative quotes from the participants. This approach provides a nuanced understanding of the CBDRR experiences and perceptions of the smallholder farming community in Chirumanzu district.

The thematic organization of the findings directly addresses the research objectives and questions, facilitating a comprehensive discussion and interpretation of the results. Consequently, this establishes the basis for the creation of the CBDRR model and the development of useful suggestions to improve smallholder farmers' resilience to the effects of climate change.

4.1.2 Respondents' demographic characteristics

The demographic composition of the individuals engaged in key informant interviews reveals a predominantly male presence among the participants. as shown in Figure 4.1.

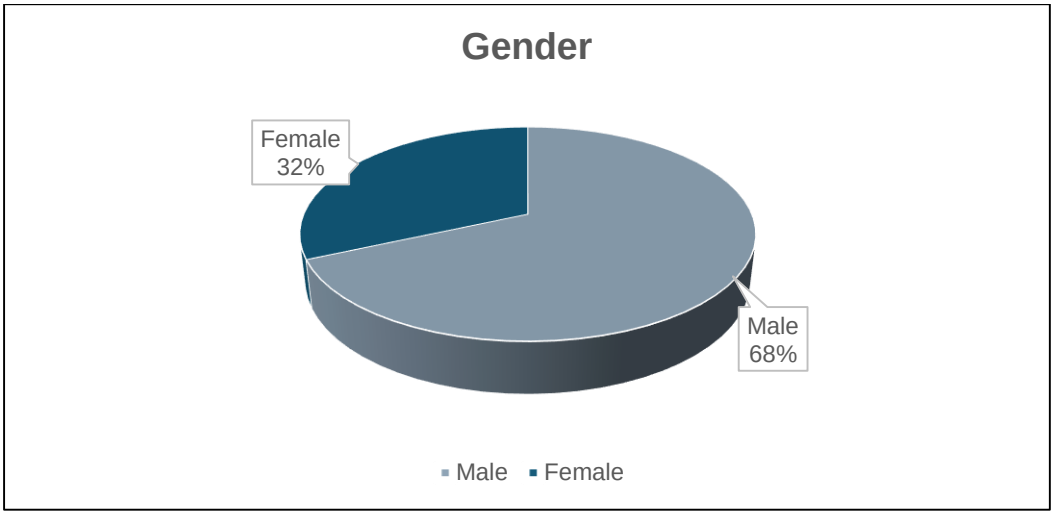

Figure 4.1 Chirumanzu Study Respondents' Gender Breakdown
Source: Author

This dominance of males over females highlights the prevailing gender disparity in household leadership, where male individuals largely assume the role of household heads in comparison to their female counterparts. The study specifically aimed to examine smallholder farming households, which were primarily represented by male household heads. Consequently, this underscores the persisting gender-biased nature of land ownership in rural areas, where women are marginalized due to entrenched traditional and patriarchal customs. Notably, the minority of households with female heads consisted predominantly of widows. Among the total of 120 smallholder farmer respondents included in the study, 82 (68%) were male, with the remaining 38 (32%) respondents being female as illustrated in Fig 4.1.

4.1.3. The respondents' status and educational attainment

To fully understand the complexities of community-based disaster risk reduction in the agricultural sector of rural farming communities, especially concerning their response to climate change and climate-induced disasters, it was important to know the educational attainment of the participants in the 13 sampled villages. It is essential to promote education and create awareness about climate change and its accompanying climate-induced disasters to improve the respondents' response and preparation in reducing the effects of climate change. A breakdown of the respondents' stated educational levels is shown in the following table:

Table 2: showing the number of respondents and their educational attainment

Level of education	Male	Female
No formal education	32	9

Primary education	23	2
Secondary education	16	1
Tertiary education (inclusive of Diploma and Degree levels)	15	2
Total	82	38

The educational background of the respondents significantly influences their annual household income within the context of the study. A predominant proportion of participants reported having completed primary education, resulting in comparatively lower annual household incomes compared to individuals with middle and high levels of education residing in the same region.

4.1.4 Contextual analysis: Climate-induced disasters and responses

This extensive assessment sought to provide valuable insights into the specific CBDRR approaches employed within the agricultural sector of the Chirumanzu district. This was in harmony with what Cutter (2017) calls a thorough investigation which is undertaken to comprehensively analyse the contextual and situational elements within the study area

The climate-induced disasters prevalent in the district predominantly consisted of droughts, flooding, mid-season dry spells, crop pests and diseases, heatwaves, soil erosion, reduced water availability, and erratic rainfall patterns as illustrated in Fig 4.2. This was highlighted across all the 13 villages sampled which highlighted that they experience similar climate induced disasters. These events have substantial ramifications for various aspects of the local community, including agricultural productivity, water resources, and overall socio-economic well-being. Significantly, the detrimental consequences of climate change were observed to affect diverse demographic cohorts, encompassing men, women, and children alike as indicated throughout the 13 focus group meetings that were held (IPCC, 2021).

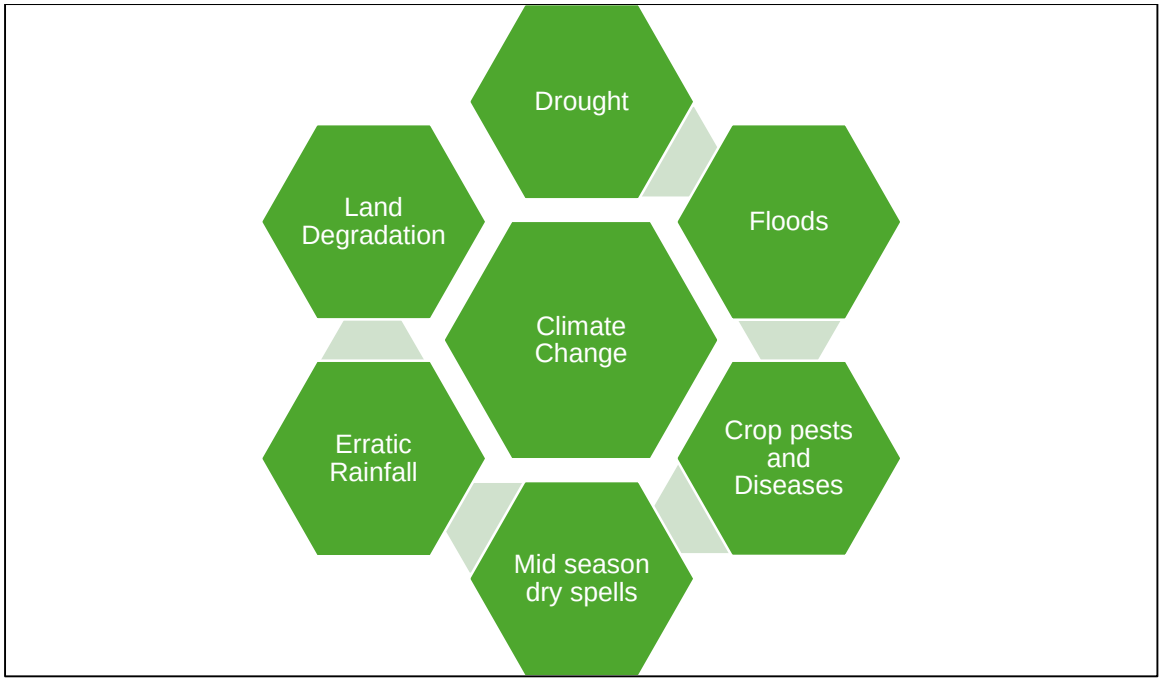

Figure 4.2 Climate Induced Disasters Prevalent in Chirumanzu
Source: Author

From the16 participants for the focus group discussions in Magada and Mangwende it emerged that certain social groups, such as disabled individuals, the elderly, and those suffering from chronic illnesses, were disproportionately affected by factors such as the distance to water sources, breakdowns in borehole infrastructure, and limited access to suitable grazing areas for their livestock.

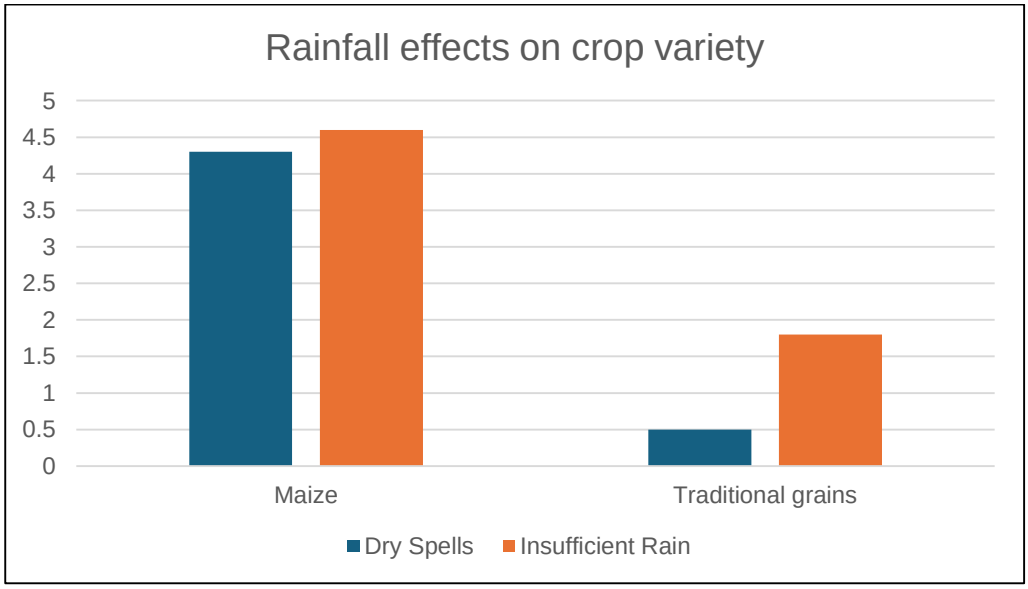

Figure 4.3 Chirumanzu Rainfall Effects on Crop Variety Preferences
Source: Author

Furthermore, it was observed in Marufu, Rukovo, Jangara and Chivanga villages that individuals who primarily cultivated maize instead of traditional grains were particularly

affected by prolonged dry spells and insufficient rainfall as illustrated in Fig 4.3. Given the climatic conditions prevailing in the district, the cultivation of traditional grains was deemed more resilient against droughts (Ngadze, 2016). All the 38 respondents highlighted that, over the past five agricultural seasons, they experienced only one successful year, as depicted in Figure 4.4 presented below.

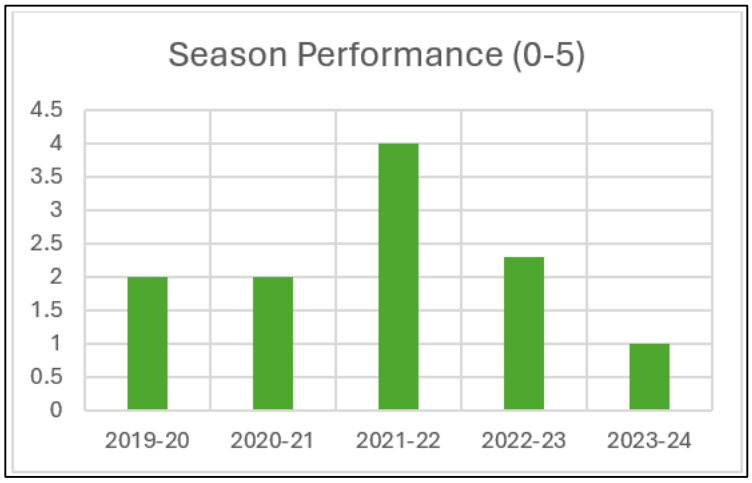

Figure 4.4: Agricultural Season Performance Over the past 5 years in Chirumanzu
Source: Author

The escalating frequency and intensity of recurrent droughts have emerged as significant stressors and shocks for the 120 sampled smallholder farming households in Chirumanzu, leading to profound food insecurity and the adoption of unsustainable livelihood alternatives, such as gold panning and cross-border trading (IPCC, 2021). From 2019 to 2024, the region experienced a constrained water supply for both productive and domestic purposes, as wells, rivers, and boreholes suffered from depletion and breakdowns due to excessive utilization (Rijsberman, 2006). A study across all 13 sampled villages and the 8 interviewed key informants emphasized that the 2023-24 season posed substantial threats, as it witnessed meagre rainfall, indicating insufficient water availability in the boreholes. Additionally, 23 of 27 respondents in Bhachi, Nhokovedzo and Chivanga villages highlighted inadequate fodder, resulting in livestock losses and poverty-induced fatalities due to drought. The prevalence of January Disease has further exacerbated livestock losses, also noting that the poultry industry faced challenges due to a scarcity of feed.

Moreover, respondents reported inadequate water supply for traditional grain cultivation during the 2023-2024 agricultural season, attributed to the El Niño phenomenon. Among the respondents in Bhachi and Marufu Villages, 15 out of 19 indicated that cattle were no longer kept in enclosures due to drought, as they sought grazing and drinking water along distant water

sources. In Dhongi-Zinhu and Majoni Village, 13 out of 18 respondents reported the loss of at least one cattle, while 7 respondents stated that they had lost more than 7 cattle during the specified period. Figure 4.5 illustrates the effects of climate induced disasters on livestock;

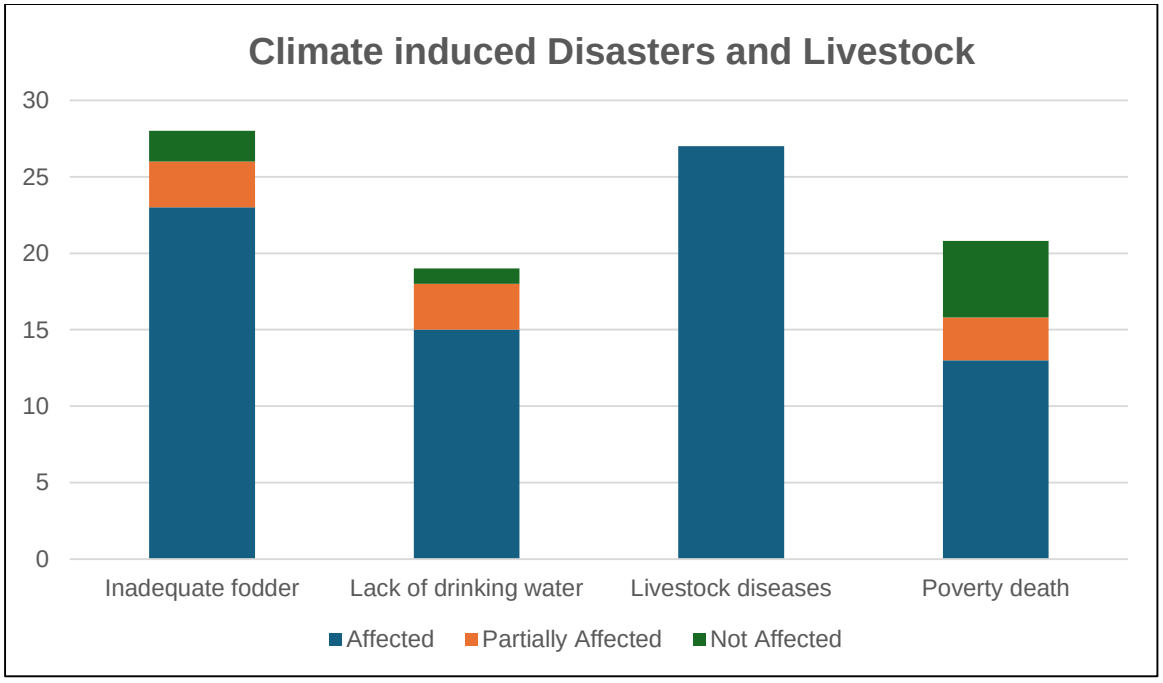

Figure 4.5 Chirumanzu Climate induced disasters and livestock
Source: Author

Households facing financial constraints were especially vulnerable to climate-induced disasters, resorting to negative coping mechanisms. The Department of Social Development's food distribution registration prioritized vulnerable groups such as the elderly, widows, children, and chronically ill individuals. Of the sampled 120 smallholder farmers, 93 reported that they needed social assistance during bad years. However, the distributed packages, consisting solely of maize, failed to address all nutritional requirements.

Out of the 82 male smallholder farmers sampled, 69 men faced increased pressure to provide food for their families and feed livestock, while women struggled to feed their children due to the adverse effects of water challenges on household gardens, which serve as a source of food and income through produce sales. To mitigate hunger resulting from poor seasons, women turned to the utilization of wetlands in the ward to establish household gardens, particularly in Marufu, Bhachi, Rukovo, Mangwende and Majoni villages which lie closer to wetlands. Devoting significant time and effort to this endeavour, they encountered limitations in terms of subsistence production, exacerbated by water scarcity.

In response to the drought and climate change, artisanal mining emerged as another coping strategy in Chirumanzu with 12 of the 120 smallholder farmers indicated. They turned to artisanal mining as livelihood alternatives, given the collapse and unreliability of options such as small livestock rearing and crop cultivation. Casual employment also served as a means of responding to climate-induced disasters for 47 of the sampled 120 smallholder farmers. 7 smallholder farmers indicated that they practised cross-border trading as a coping strategy, going to South Africa. A young smallholder farmer from Jangara village articulated this perspective, stating,

"...those who did not have any other income sources would end up doing artisanal mining in the Savanna and Lalapanzi area for money or food."

Twelve of the smallholder farmers involved in the study worked as artisanal miners at some point. Farmers who did not engage in mining or cross-border activities cited their advanced age as a limitation, relying on their physically fit children to engage in artisanal mining and support them in responding to climate-induced disasters. An illustration of the coping strategies adopted by the smallholder farmers is provided in Figure 4.6 provided below.

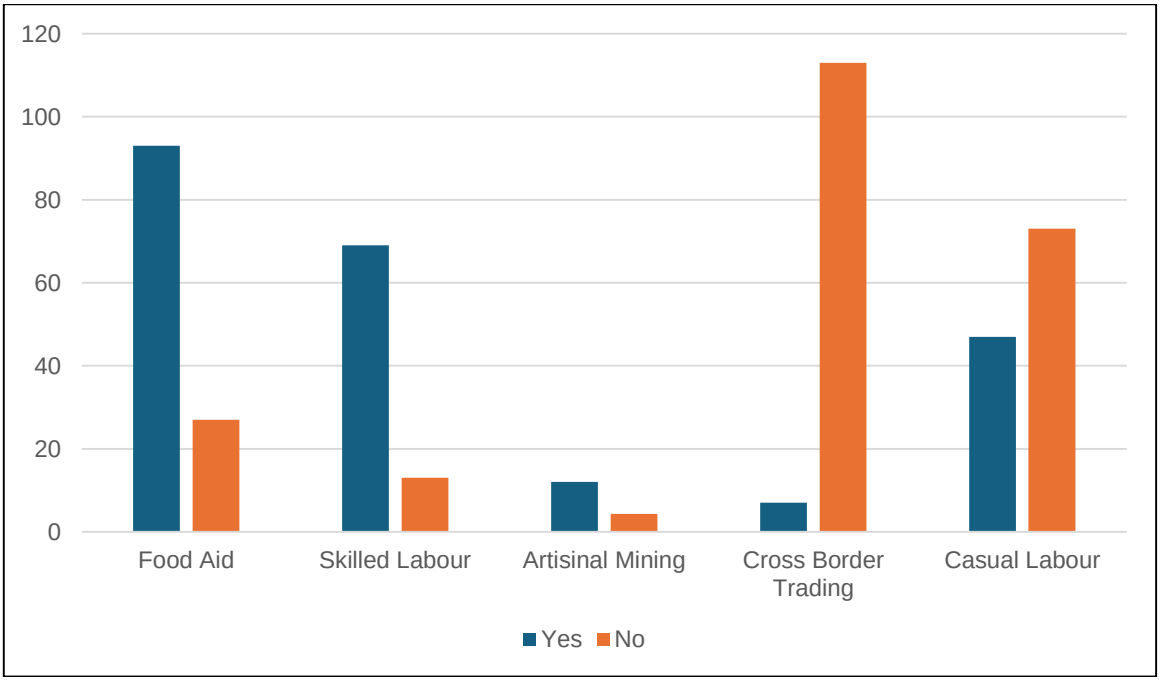

Figure 4.6 Coping Strategies Adopted by Smallholder Farmers in Chirumanzu
Source: Author

103 out of the 120 smallholder farmers who participated in the study emphasized that solarized boreholes were necessary to address this challenge effectively. This was also emphasized by all the 8 key informants interviewed in the research who highlighted the need to establish alternative farming mechanisms including irrigating.

4.2 Factors causing climate-induced disasters among smallholder farmers

Due to the El Nino phenomenon experienced during the 2023-24 agricultural season, food security was significantly threatened. The 120 study participants, consisting of smallholder farmers, highlighted that they have consistently experienced climate-induced disasters since the 2019 farming season, with varying frequencies and intensities. The lack of alternative livelihood sources, including limited technological advancements such as small-scale irrigation, was identified as the main factor contributing to these disasters in villages such as Ngavi, Chabuda, Shavane, and Jangara (Rockström, et al, 2010). 114 out of 120 smallholder farmers indicated that they lacked alternative resilient livelihood options. Furthermore, 98 smallholder farmers in all 13 sampled villages expressed a lack of financial resources to implement recommended adaptation strategies due to the recurrent climate-related challenges they faced. Only a few households from the sample reported that they had sufficient financial resources and could implement some of the recommended approaches.

Table 3: Challenges encountered by smallholder farmers faced with climate induced disasters

Challenge	Sample size	Number of affected	% Affected
No viable alternative livelihoods	120	114	95
Lack of financial resources	120	98	82
Limited extension services	120	53	44
Limited access to vaccines	27	18	67

In villages such as Rukovo, Mudzingwa, and Mapiripiti, 18 out of the sampled 27 smallholder farmers indicated that they were unable to afford recommended livestock dosing drugs, as advised by local extension officers. Consequently, they resorted to remedies of questionable efficacy. Although 69 smallholder farmers received extension services related to agriculture, they expressed the need for stronger extension services to enhance their community's resilience against the various dangers that climate change poses.

A local leader interviewed in the ward emphasized that developmental support from external partners as also indicated by Dyer, et al (2014), has been scarce since the late 90s, in the following words

"…apart from LID Agency which provided food assistance to vulnerable individuals in 2020. The community gardens established by Care International in the 1990s are no longer

functional due to reduced production and income generation caused by the farmers' old age and their inability to operate hand-pumped boreholes for irrigation…."

86 smallholder farmers in the sampled villages relied on government-provided inputs for their dryland farming, as they lacked the funds to purchase inputs themselves. This resulted in delays in planting which subsequently affected their productivity in the 2023-24 agricultural season.

The heavy reliance of smallholder farmers in Ward 1 on rainfed agriculture, coupled with limited livelihood alternatives, exacerbates their vulnerabilities (Rippke, et al, 2016). The increased occurrence and severity of climate-related disasters have undermined the region's developmental achievements. A total of 72 respondents indicated that their primary source of income is dryland farming, which has been significantly affected by drought over the years, diminishing their productivity and ability to cope with associated shocks and stressors. Consequently, households have resorted to selling fruits, engaging in brickmaking, establishing gardens along wetlands, and even undertaking climate-induced migration. Figure 4.7 exhibits some of the identified factors contributing to climate induced disasters in the agriculture sector.

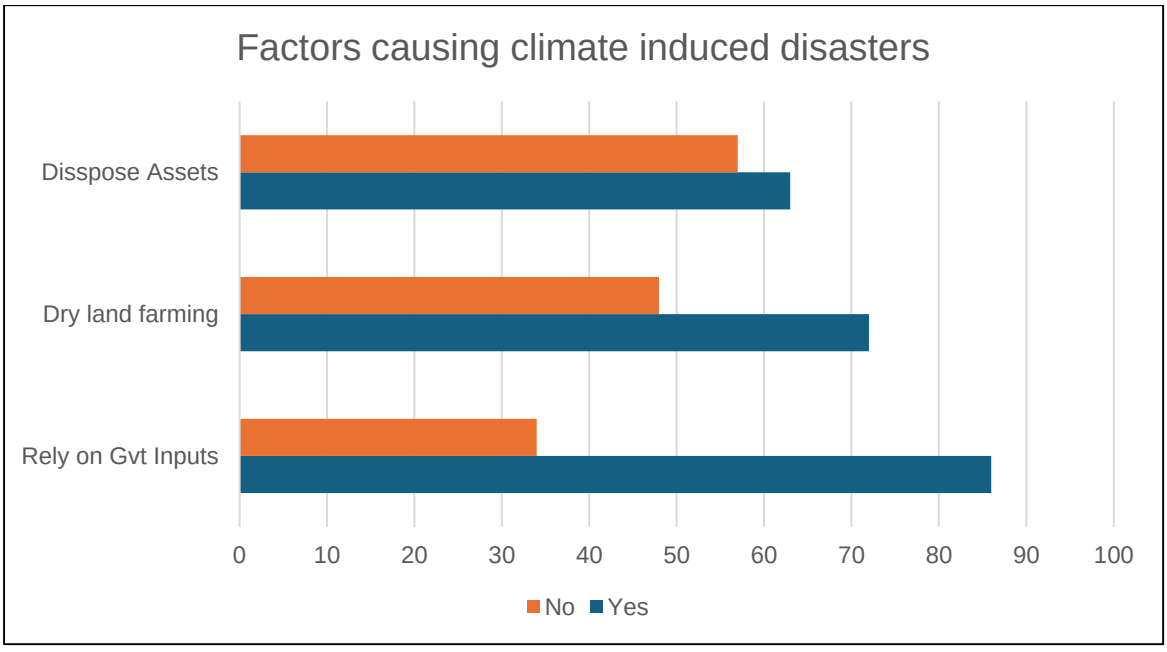

Figure 4.7 Factors causing climate-induced disasters among smallholder farmers in Chirumanzu
Source: Author

In the worst-case scenario, extension staff interviewed, and district stakeholders reported that smallholder farmers were resorting to selling productive assets to cope with the challenges posed by climate-induced disasters. 63 smallholder farmers, both men and women, confirmed that they had to dispose of assets to respond to these disasters, aligning with the assertions made by the 8 key stakeholders interviewed in this study.

Gender inequalities were also identified as a contributing factor, with 37 out of 42 female-headed households reporting better responses to climate-induced disasters compared to smallholder farming women in male-headed households (Kristjanson, et al, 2014). This disparity was primarily attributed to differential access to information, productive assets, and decision-making power.

4.3 CBDRR strategies adopted by smallholder farmers to mitigate and adapt to climate change

Based on findings, the implementation of CBDRR approaches in Ward 1 of Chirumanzu has had a positive impact on smallholder farming households. Out of the 120 smallholder farmer respondents surveyed, 112 respondents confirmed that training in CBDRR approaches enabled farmers to adopt innovative practices, such as the cultivation of traditional grains, destocking of livestock, establishment of horticultural gardens, and prioritizing small livestock to enhance resilience against shocks and stressors. Figure 4.8 gives an illustration of how the CBDRR approaches have positively influenced the agriculture sector;

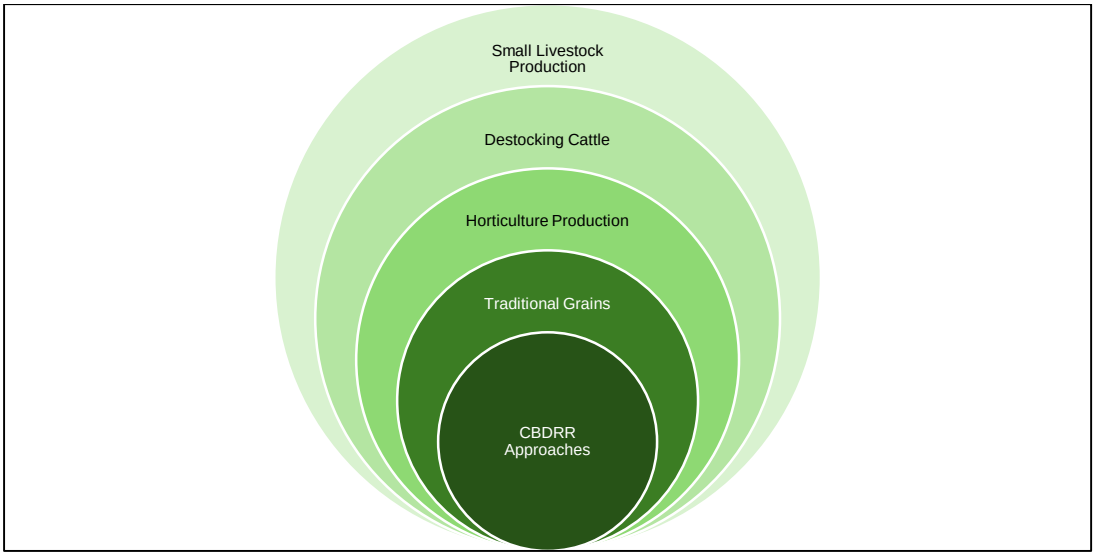

Figure 4.8 CBDRR approaches influence on the agriculture sector in Chirumanzu
Source: Author

The CBDRR approaches were implemented through various departments, including Agritex, MWACSMED, and Veterinary. These initiatives encompassed activities such as disseminating seasonal outlook information and advisories, conducting capacity strengthening training, hazard mapping and risk assessments, and facilitating knowledge sharing. These interventions significantly enhanced the ability of households 112 households sampled to withstand and respond to climate-induced disasters (Mugandani, et al 2022).

The testimony of one Village Head illustrated the evolving nature of CBDRR strategies and their impact on mitigating and adapting to climate-induced shocks.

> ***"… in the past, the seasons were good helping us to produce enough for household consumption. We would send some of our produce to relatives in urban areas but in recent years we have been relying on remittances from the urban relatives and those who had crossed the border mostly to South Africa. Our extension staff have been helping us to adapt to these harsh climate effects by constantly training and informing us on what to do, with CBDRR strategies, the community has learned that one can adapt and reduce the effects of climate change"***.

Other respondents agreed that the methods for reducing and adjusting to shocks brought on by climate change had changed. One respondent from Rukovo village had this to say:

> ***"Ever since I committed to CBDRR strategies I have been able to produce enough for my household except for the 2023-2024 very bad farming season we couldn't even raise a bucket of cereal. Compared to other smallholder farmers within the ward who have not taken heed of the extension staff to engage in CBDRR strategies, I am better off and have been able to meet the cereal requirements for my households, and even more surplus in some good seasons. You can harvest a lot, especially when there is not much rain. This year's harvest was low due to the El Nino"***

Agricultural extension agents were crucial in helping Ward 1 implement CBDRR policies. They provided training on various CBDRR strategies, including climate-smart agriculture, poultry production, internal saving and lending (ISALs), community mobilization, and extension methods. As illustrated in Figure 4.9, from the sampled 120 smallholder farmers, 116 confirmed receiving climate-smart agriculture training, 67 poultry production training, 85 training on ISALS and 54 on governance. These efforts aimed to integrate resilience and promote disaster risk reduction at the household level, particularly in response to droughts.

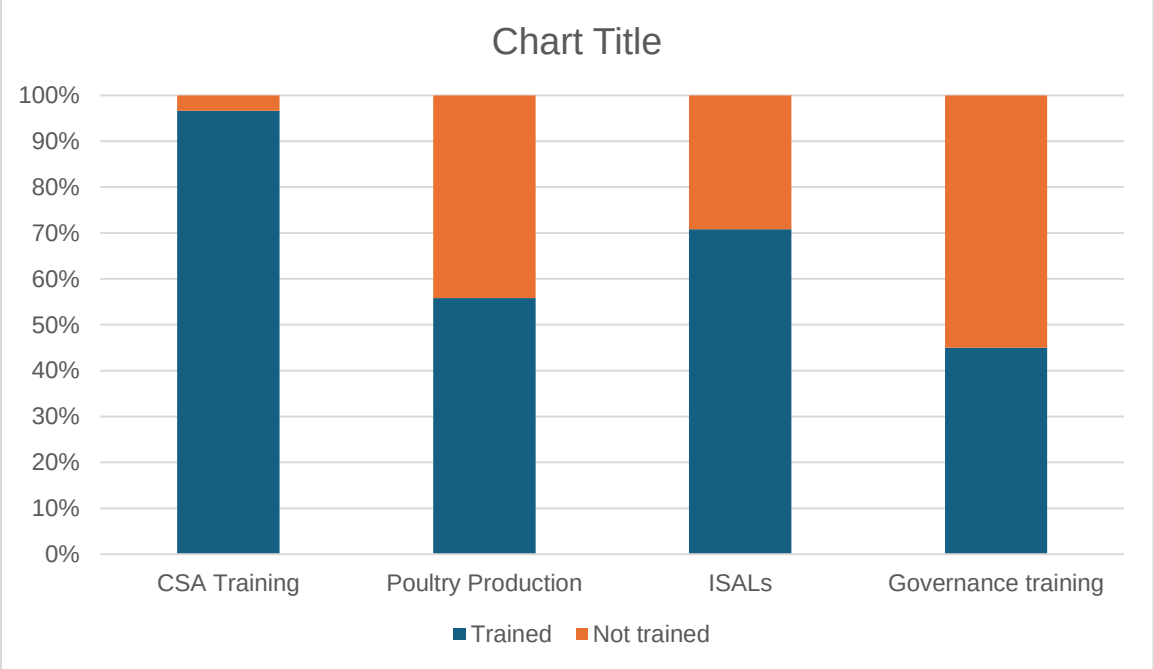

Figure 4.9 Percentage of smallholder farmers who received training in Chirumanzu
Source: Author

While 112 of the surveyed farmers lacked certain CBDRR interventions, such as borehole solarization, social enterprises, and small irrigation schemes, 8 respondents had successfully implemented solarization of boreholes for irrigation purposes. These 8 financially stable households had also taken measures to establish and protect their gardens from animals, ensuring sustainability in horticulture production and generating more income. Access to clean water through solarized boreholes enabled these farmers to tap into local markets and enhance their economic prospects.

Moreover, most smallholder farmers confirmed that they were trained in environmental conservation practices as illustrated in Fig 4.10, including the use of infiltration pits (83), dead-level contours (91), mulching (91), tied ridges (47), and renewable energy utilization (91). Water conservation and harvesting techniques were also taught to maintain soil moisture. However, limited financial resources hindered the widespread adoption of renewable energy practices with only 45 smallholder farmers reporting the utilization of solar.

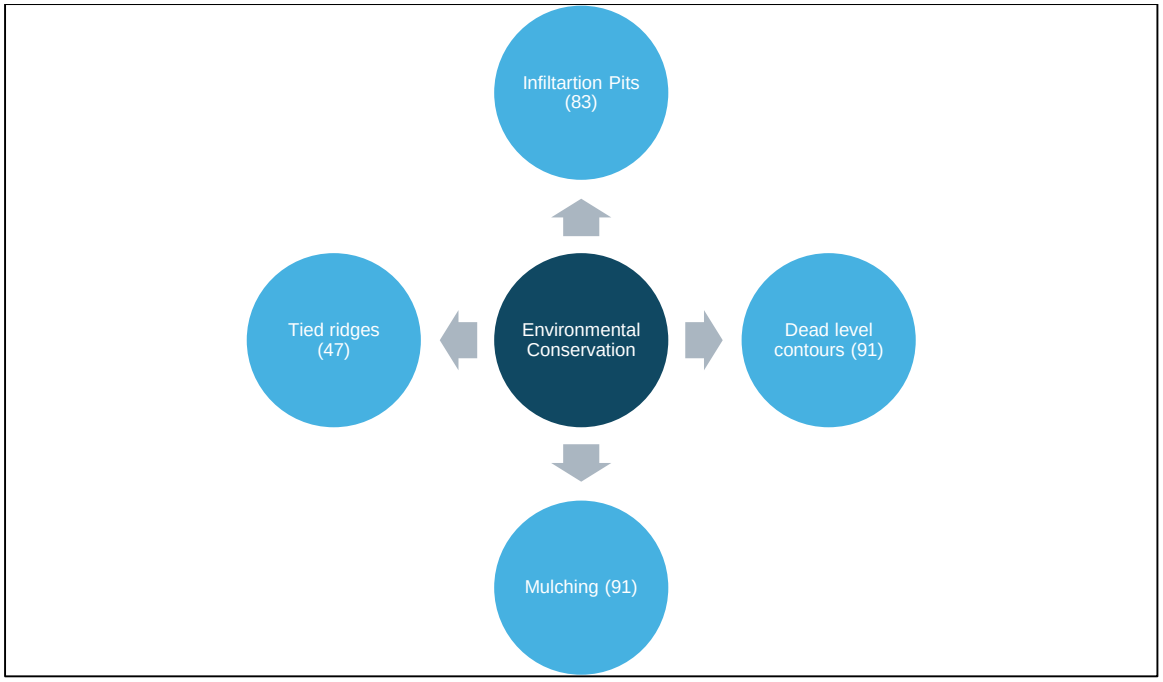

Figure 4.10 Smallholder Farmers who received environmental conservation training in Chirumanzu
Source: Author

CBDRR approaches in the agriculture sector empowered smallholder farmers to engage in traditional grain production, enhancing food security and providing fodder for livestock. Although only 66 of the respondents adopted traditional grain production, these early-maturity varieties proved valuable during droughts. 67 farmers were also trained in poultry feed formulation, utilizing locally available materials like traditional grains and sunflowers.

Finally, Fig 6 provided in the study shows evidence of the effectiveness of CBDRR approaches in Ward 1 of Chirumanzu, as reported by the interview respondents.

In summary, the study demonstrated the positive influence of CBDRR approaches in improving the resilience and livelihoods of smallholder farmers in Ward 1. However, it is notable that there are barriers to the effectiveness of CBDRR approaches. The incorporation of cutting-edge techniques, information sharing, and educational initiatives has been crucial in improving the community's capacity to adjust to climate-related difficulties and lessen shock susceptibility.

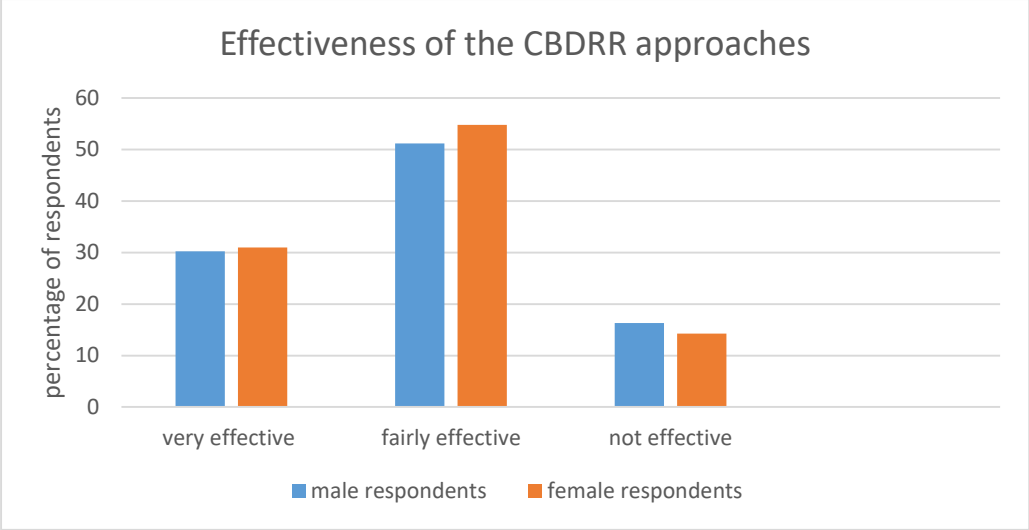

Figure 4.11: Gender-disaggregated data of respondents on the effectiveness of CBDRR approaches in Ward 1, Chirumanzu

Source: Author

Figure 4.11 illustrates the perceptions of male and female respondents regarding The efficiency of CBDRR (Community-Based Disaster Risk Reduction) approaches. Among the male participants, 26 individuals, accounting for 30% of the male respondents, expressed that CBDRR approaches are highly effective. Additionally, 44 males, representing 51% of the male respondents, regarded the approach as moderately effective, while 14 males, equivalent to 16% of the male respondents, reported that the approach is ineffective. As a result, the graph shows that a sizable percentage of male respondents agreed that CBDRR techniques were beneficial, with levels of agreement ranging from moderate to high.

Among the female participants, 13 individuals, constituting 31% of the female respondents, stated that the approach is highly effective. Furthermore, 23 female respondents, accounting for 55% of the female participants, considered the approach to be moderately effective, while six female respondents, representing 14% of the female participants, expressed that the approach was ineffective. According to Alam et al. (2014), these results show that a higher percentage of women thought that CBDRR approaches were helpful, indicating that the strategy displays inclusivity by helping both men and women mitigate and adapt to climate change. Nonetheless, the graph also suggests the existence of barriers that may hinder the effectiveness of CBDRR approaches.

4.4 The effectiveness of CBDRR strategies implemented by smallholder farmers in mitigating and adapting to the effects of climate change

An extension worker conveyed that there exists a prevailing consciousness among individuals regarding the occurrence of climate-induced disruptions in the sector of agriculture, and they

have acquired knowledge of appropriate strategies to address such situations. Moreover, she highlighted that communities have displayed enhanced adaptability and a heightened understanding of the hazards related to climate change as a result of engaging in initiatives facilitated by CBDRR approaches. She explicated this phenomenon as follows:

> ***"…before the CBDRR approaches training one would just maintain the conventional way of farming regardless of the changing climatic conditions. This has led to an increased reduction of yields and loss of livestock. Some smallholder farmers are adamant and have taken a long time to face the reality that the conventional way of farming is no longer sustainable they need to embrace these approaches. Now see that most smallholder farmers in the ward know that these approaches can make an impact and allow them to adjust to the consequences of climate change. For me, this shows that they are now educated and training to be resilient…"***

Of the 120 participants of the study, 106 demonstrated a comprehensive understanding of the interplay and synergy among different approaches, recognizing the potential for generating income in one activity and subsequently reinvesting it in another. According to the MWACSMED Ward Coordinator from Ward 1, it is crucial to initiate risk and hazard mapping exercises and provide timely advisories. Given the district's susceptibility to climate-related disasters, particularly droughts, livelihood diversification emerges as a vital strategy for both individuals and livestock. The Ward coordinator further emphasized the importance of integrating income-generating activities and revolving funds into CBDRR approaches to enhance their effectiveness (Alam, et al 2014). This integration is particularly significant considering that many respondents expressed resource constraints, which hinder the adoption of recommended technologies and alternative value chains. The coordinator also suggested that poultry and goats can serve as valuable assets and even function as a savings mechanism.

According to 32 of the 36 respondents in Nhokovedzo, Dhongi-Zinhu, Mapiripiti and Shavane villages CBDRR training has enabled farmers to be more innovative as households. This includes diversification of activities to be resilient in the face of shocks. For example, if the household were involved in village saving and lending, poultry production, horticulture, small grain production, and income-generating projects, their ability to withstand shocks would be enhanced. From the 120 smallholder farmers, 79 had more than 3 livelihood activities, 26 had

2 to 3 livelihood activities and 15 relied on one livelihood activity. This was supported by one smallholder farmer who had this to say

> ***"I have consistently managed to avoid food insecurity ever since I received training on CBDRR approaches, except this year, which was particularly challenging due to the El Niño phenomenon. Despite the infrequency of rainfall, I have consistently achieved successful harvests……. I have been introduced to some low-cost innovations and adopted various resilience techniques"***

One village head from Bhachi village highlighted the transformation of CBDRR approaches, noting that farming practices used to be relatively straightforward in the past due to favorable seasonal conditions. However, the advent of climate change significantly impacted the agricultural sector. Nevertheless, through the adoption of CBDRR approaches, the community has acquired knowledge on effectively utilizing available resources within their households to enhance resilience against future shocks. According to one smallholder farmer quoted below, over 89 of the study's participants agreed that significant adjustments have been made to the methods used to lessen shocks connected to climate change:

> ***"I have consistently managed to avoid food insecurity ever since I received training on CBDRR approaches, except this year, which was particularly challenging due to the El Niño phenomenon. Despite the infrequency of rainfall, I have consistently achieved successful harvests. The knowledge and skills acquired through working with extension staff on CBDRR approaches have proven advantageous, particularly in cultivating traditional grains. These crops have thrived even in conditions of limited rainfall, resulting in substantial yields. However, this year's harvest was adversely affected by low rainfall."***

4.5 CBDRR model to promote the resilience of smallholder farmers to climate change

According to Agritex key informants, the initial step in promoting resilience should involve conducting training sessions on resilience principles. Such training aims to raise awareness among both men and women in the community. Subsequently, the introduction of traditional grains is recommended, as these crops possess inherent drought tolerance and serve a dual purpose of ensuring food security and providing livestock feed.

In addition to traditional grains, the establishment of alternative livelihoods near water sources, in an ecologically sustainable manner, is considered essential. This approach aims to generate income and enhance dietary diversity. Furthermore, it is crucial to prioritize financial inclusion through the establishment of revolving funds using Internal Savings and Lending mechanisms. Non-farm social enterprises should also be made accessible to smallholder farmers.

Regarding coordination, a key informant from LID Agency, an organization implementing CBDRR in Chirumanzu, emphasized the necessity for a well-coordinated CBDRR plan at the district and ward levels. It was observed that the haphazard implementation of CBDRR approaches undermines their effectiveness. Respondents emphasized the importance of coordination to ensure the successful implementation of layering, sequencing, and integration of CBDRR approaches. Effective coordination can also facilitate the identification of suitable partners.

While the 8 key informants respondents acknowledged the criticality of CBDRR, they noted that the specific patterns may vary based on factors such as gender, age, geographical location, and the types of climate-induced disasters prevalent in a given community. For instance, during a focus group discussion in Marufu village, they suggested that capacity-strengthening training could be introduced as the initial step, followed by the introduction of technologies and sustainability models. Another group in Jangara village stressed the significance of social enterprises and Internal Savings and Lending mechanisms as integral components of a revolving fund. To foster resilience, the group emphasized the need for smallholder farmers to engage in multiple livelihood activities. In response to a question regarding the CBDRR model that promotes smallholder farmers' resilience to climate change, a champion farmer from Ward 1 expressed the following viewpoint:

> ***"An organized and collaborative approach to tackling the issues brought on by climate change proves advantageous, as this phenomenon has far-reaching implications on various aspects of our lives. It impacts production, livelihoods, markets, and the environment. Thus, relying solely on a single government department is insufficient; instead, seeking assistance from other development partners becomes imperative. While government initiatives may offer technical expertise, collaborating with development partners is crucial for introducing innovative solutions and limited technologies to our ward. It is worth noting that such resources may only be accessible to those individuals who receive remittances and external support for their children."***

Another respondent from the Jangara village provided a firsthand account of their experience with CBDRR approaches aimed at fostering the smallholder farmers' adaptability to climate change:

> ***"As a smallholder farmer, I have personally witnessed the transformative impact of CBDRR approaches in enhancing the resilience of farmers like me against the challenges posed by climate change. Through these approaches, we have gained valuable knowledge and skills that enable us to adapt our farming practices to changing climatic conditions. The introduction to climate-smart technologies, such as drought-tolerant crop varieties and efficient irrigation methods, has significantly improved my agricultural productivity and food security. The collaborative efforts between government departments and development partners can played a pivotal role in providing us with technical expertise and innovative solutions tailored to our specific ward. Overall, CBDRR approaches have empowered rural smallholder farmers like me to face the uncertainties of climate change with resilience and confidence."***

The results of the 13 focus group discussions (FGDs) held in the 13 sampled villages in Ward 1 provide significant new information about the uptake and application of community-based disaster risk reduction (CBDRR) strategies in the agricultural industry.

The 8 groups that participated in the FGDs indicated that they were currently employing unsustainable and unsafe coping strategies in response to various agricultural challenges. However, all 13 groups expressed the perceived value and importance of the CBDRR approaches being implemented in the agriculture sector. The farmers mentioned that to prepare for and lessen the effects of climate change, they had tried to implement CBDRR techniques.

However, 98 smallholder farmers from every village identified one major obstacle as the insufficient funding needed to carry out the suggested CBDRR initiatives. As a result, they often reverted to traditional farming methods. Only a few farmers who could afford irrigation systems, inputs, and small livestock reported successful implementation of the CBDRR approaches.

Of the 13 FGDs, 9 also revealed the influence of religious and cultural factors on the adoption and efficacy of CBDRR strategies. This underscores the critical role of sociocultural dynamics in shaping the implementation of CBDRR approaches (Alam, et al 2014). Similarly, the

prevailing patriarchal system in the communities was noted to exclude women from decision-making processes and limit their access to productive resources.

116 smallholder farmers from the 120 sample acknowledged that their knowledge, attitudes, and practices regarding CBDRR approaches had been enhanced through continuous training and capacity-building efforts. However, they highlighted several persistent gaps, including limited access to timeous information, delays in the provision of farming inputs, and the lack of irrigation infrastructure development in the communities.

Additionally, the FGDs in Rukovo, Shavane, and Mudzingwa villages revealed that the smallholder farmers' interactions were primarily limited to the extension staff from Agritex (Agricultural Technical and Extension Services) and Veterinary Services. They expressed the need for greater involvement and collaboration of various stakeholders to ensure the sustainability of CBDRR approaches in the agriculture sector of Chirumanzu district.

These FGD results offer insightful information about the intricate institutional, cultural, and socioeconomic elements that affect smallholder farmers in the Chirumanzu district's adoption and efficacy of CBDRR practices. The results of this study have the potential to guide the development of more focused and situation-specific interventions aimed at strengthening the agricultural sector's ability to withstand natural disasters and the effects of climate change.

4.6 Summary

This chapter was primarily centered on the presentation and analysis of the collected data, employing descriptive analysis as the chosen method for presenting the study's findings. The analysis adopted a thematic approach, whereby themes aligned with the research objectives are identified and utilized. The chapter also had a thorough situational analysis, which includes a study of the effects of climate change and the responses that follow disasters caused by climate change.

Chapter 5: Synopsis, Findings, and Suggestions

5.1 Introduction

This chapter gives a comprehensive review of the research findings, summarizing them succinctly, drawing inferences, and making recommendations in light of the findings.

5.2 Summary of Findings

This study's main goal was to assess how well community-based disaster risk reduction (CBDRR) strategies work in Chirumanzu Rural's agriculture sector. A case study of Ward 1 Mapiravana was chosen to assess the effectiveness of these methods. The research was predicated on several important hypotheses. Firstly, the study assumed that the region experienced low rainfall patterns during the agricultural seasons from 2019 to 2024, which negatively impacted the livelihoods of smallholder farmers in Chirumanzu district, with the agricultural season of 2023-24 being particularly severe. This situation has raised significant concerns among district stakeholders. Secondly, it was assumed that climate-induced disasters occurring between 2019 and 2024 have been impeding the uninterrupted functioning of smallholder farmers, and addressing this issue would yield practical benefits for the smallholder farming population in Chirumanzu district.

Previous attempts in Ward 1 at implementing livelihoods and resilience-building activities have proven ineffective in providing sustainable solutions. The provision of food aid interventions by various NGOs, notably the World Food Programme and LID Agency, has also failed to address the long-term challenges posed by shocks and stressors within the community. In response to these limitations, the implementation of community-based disaster risk reduction (CBDRR) approaches in Chirumanzu district aimed to enhance the absorptive, adaptive, and transformative capacities of smallholder farming communities in mitigating the impacts of climate-induced disasters.

In Chirumanzu district, the implementation of Community-Based Disaster Risk Reduction (CBDRR) approaches follows a systematic and sequential process, concentrating on farmers. This approach involves facilitating training and activities in a logical sequence to ensure their effectiveness. Specifically, within the agriculture sector, training initiatives have been introduced to promote the adoption of drought-tolerant crop varieties, such as traditional grains. Additionally, farmers have received training and practical demonstrations on climate-smart agriculture techniques, small livestock production, and market gardening. These activities have been integrated into existing government structures and involve collaboration with

stakeholders including Agritex and Veterinary extension staff, as well as other key development actors operating within the district. While NGOs have provided limited support, it is important to highlight that the success of these approaches hinges on adequate financing. Access to financial resources is crucial for vulnerable smallholder farmers to generate income and implement the CBDRR approaches effectively. This research study aimed to explore the CBDRR approaches specifically within the context of the agriculture sector in Chirumanzu district.

The major objectives of the study included (i) establishing the factors causing climate-induced disasters among smallholder farmers in Chirumanzu district, Zimbabwe, (ii) determining the CBDRR strategies adopted by smallholder farmers to mitigate and adapt against climate change, (iii) assessing the effectiveness of CBDRR strategies implemented by Chirumanzu smallholder farmers in mitigating and adapting to the effects of climate change and, (iv) to develop a CBDRR model to promote the resilience of smallholder farmers to climate change.

The research findings indicate that implementing CBDRR approaches in Chirumanzu rural district demonstrates a moderate level of effectiveness. However, several challenges were identified during the implementation process. These challenges encompassed financial limitations, inadequate availability of resources, low utilization of innovative technologies, and deficient coordination among stakeholders. Furthermore, the livelihoods of smallholder farmers have been severely harmed by climate-related calamities, as they mainly depend on rain-fed crops. These climate change-related adversities have also emerged as a substantial threat to the overall success of CBDRR approaches in the district.

Furthermore, the study revealed that the implementation of CBDRR training has fostered increased innovation among farmers, particularly in terms of livelihood diversification to enhance resilience against shocks. Within the district, CBDRR approaches have promoted the adoption of various response activities, such as internal saving and lending schemes, poultry production, horticulture, traditional grain cultivation, and social enterprises. The purpose of these programs is to increase household resilience to climate-related risks and adaptation strategies. Nevertheless, the limited availability of resources and insufficient financing emerged as notable obstacles, impeding the overall effectiveness of the CBDRR approaches.

The study findings reveal that stakeholders within the district perceive the CBDRR approaches to lack effective coordination and integration, operating in isolation instead of adopting a collaborative approach. Given the complex nature of climate-induced disasters, stakeholders

emphasise the need for a comprehensive and coordinated strategy. The stakeholders view the CBDRR approach favourably and express the importance of increasing its implementation while finding ways to finance it, particularly to support smallholder farmers who are more vulnerable. To address the challenges encountered in the application of CBDRR, stakeholders suggest the development of comprehensive ward-based CBDRR plans and district-level CBDRR plans. These plans would serve as crucial tools for decision-making processes and facilitate the sourcing of funds from development partners. Stakeholders further emphasize the significance of strengthened coordination and collaboration to ensure the success of the CBDRR approach.

5.3 Conclusion of the study

Gender inequality has resulted from the patriarchal social structure that is common in the studied area, where men have more access to resources and decision-making authority than women. The sample's male-dominated family heads predominate, and the few female-headed households—mostly widow-headed households—show that women are marginalized because of prevailing gender norms. It is imperative to tackle the gendered dimensions of asset ownership and decision-making to advance equitable approaches to climate change adaptation.

Numerous climate-induced disasters, such as droughts, floods, pests, and unpredictable rainfall patterns, have affected the study area. These events have had a negative influence on smallholder agricultural productivity, water supplies, and the socioeconomic well-being of farming households. Lack of water, especially for horticulture production, has resulted in nutritional problems, notably for social groups. Selecting the right crop variety is essential for increasing farmers' resilience; traditional grains show more resistance to drought than maize.

Livestock and poultry production have also been impacted by climate change, with producers facing more difficulties due to water scarcity and El Niño events. Households' inability to adapt to climate-related calamities has resulted in the adoption of unfavourable coping mechanisms due to financial limitations. Although there has been some respite from initiatives aimed at vulnerable individuals, farmers' ability to successfully address climatic concerns has been hindered by inadequate external help.

Smallholder farming households have benefited from community-based disaster risk reduction (CBDRR) strategies, which foster resilience via creative problem-solving and knowledge sharing. Effective cooperation amongst development partners, government organizations, and ministries is essential to the successful execution of various CBDRR plans. Farmers are now more adaptable due to their increased awareness of the risks associated with climate change,

and introducing environmentally friendly alternative livelihoods close to water supplies can increase revenue and diversify diets.

5.4 Recommendations

Objective (i) - To establish the factors causing climate-induced disasters among smallholder farmers in Chirumanzu district, Zimbabwe:

Mitigating gender-based inequities in the ownership of productive assets and participation in decision-making processes is a critical imperative. Interventions should be prioritized to bolster women's involvement and leadership in agricultural activities within the target community. This can be achieved through the implementation of empowerment-focused initiatives that enhance women's engagement in making decisions about risk reduction and climate change adaptation. Raising awareness surrounding gender equality principles and providing targeted training can contribute to the empowerment of women, thereby fostering their active participation in climate-related programs and activities. Furthermore, a comprehensive understanding of the factors precipitating climate-induced disasters among smallholder farmers will inform the development of tailored interventions aimed at addressing gender-specific vulnerabilities and inequalities.

Objective (ii) - To determine the CBDRR strategies adopted by smallholder farmers to mitigate and adapt against climate change:

One of the top priorities is the creation and execution of comprehensive, community-based disaster risk reduction (CBDRR) plans at the district and ward administration levels. These localized CBDRR plans should be designed through a participatory process that actively engages a diverse array of community stakeholders, including marginalized groups, to ensure the plans are reflective of their unique needs and vulnerabilities. The empirical findings derived from the assessment of disaster risk factors and community vulnerabilities can directly inform the design and implementation of these CBDRR plans, thereby ensuring they are evidence-based and tailored to the specific contextual realities. This community-centric approach will serve to enhance the overall effectiveness of disaster preparedness and response measures, while also bolstering community ownership and resilience. Regular monitoring and evaluation of the CBDRR plans should be conducted to identify areas for improvement and ensure the plans remain relevant and responsive to the evolving disaster landscape within the target communities.

Objective (iii) - To assess the effectiveness of CBDRR strategies implemented by Chirumanzu smallholder farmers in mitigating and adapting to the effects of climate change:

Customizing community-based disaster risk reduction (CBDRR) approaches based on gender, age, and geographical location is critical to ensure the interventions address the diverse needs and vulnerabilities within target communities. Empirical assessment of existing CBDRR strategies should guide the customization and refinement of these approaches, necessitating a rigorous analysis of their differential impacts on demographic segments and adaptations to unique contexts. CBDRR techniques can be customized to meet the unique needs and problems of diverse community members by incorporating these empirical findings. This customized, evidence-based approach will ensure inclusive, equitable, and responsive interventions, thereby bolstering overall smallholder farmers resilience to disasters.

Objective (iv) - To develop a CBDRR model to promote the resilience of smallholder farmers to climate change:

Encouraging the adoption of climate-resilient crop varieties and promoting the diversification of livelihood options for smallholder farmers are crucial strategies to enhance community-based disaster risk reduction (CBDRR) efforts. The CBDRR model should incorporate these complementary interventions to bolster the overall resilience of smallholder farming communities. Adopting crops that are resistant to drought or pests can assist smallholder farmers reduce the effects of climate-related disasters while preserving production and food security.

Concurrently, diversifying livelihood options beyond traditional farming, like off-farm income-generating activities or livestock rearing, can provide alternative sources of income and reduce vulnerability to shocks. Integrating these climate adaptation and livelihood diversification strategies into the CBDRR model can further strengthen the resilience of smallholder communities. CBDRR interventions can facilitate the adoption of climate-resilient practices, provide training for livelihood diversification, and foster market linkages to support smallholder farmers. This holistic approach will enhance the capacity of smallholder communities to withstand and recover from disaster events.

5.5 Chapter Summary

This chapter serves as a comprehensive culmination of the entire study, aiming to provide a definitive conclusion. It encompasses a concise summary of the study's findings, the conclusions derived from these findings, and the recommendations put forth to ensure the sustained efficacy of neighbourhood-based catastrophe risk reduction strategies in the agricultural industry. This chapter provides a thorough synthesis of the research outcomes by incorporating the study's findings, conclusions, and suggestions.

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Appendices

❖ **Appendix A:** Interview Guide Questions with Key Informants

1. From your perspective, what are the main climate-related hazards and disasters affecting smallholder farmers in this district?

   Explain: .....

2. What are the underlying socioeconomic, environmental, and institutional factors contributing to the vulnerability of smallholder farmers to these climate-induced disasters?

   Explain: .....

3. Can you provide specific examples of how these climate-related hazards have impacted the livelihoods and food security of smallholder farmers in this region?

   Mention: .....

4. What CBDRR strategies have you observed smallholder farmers in Chirumanzu district implementing to cope with and adapt to climate change?

   Explain: .....

5. Can you describe the specific CBDRR practices that farmers are utilizing?

   Explain: .....

6. Based on your experience, how effective have the CBDRR strategies adopted by smallholder farmers been in reducing their vulnerability and enhancing their resilience to climate change impacts?

   Explain: .....

7. What are the key factors that contribute to the successful implementation and impacts of these CBDRR approaches in the local agricultural context?

   Mention: .....

8. What are the main challenges or limitations encountered in the effective application of CBDRR strategies by smallholder farmers?

   Mention and explain: .....

9. In your opinion, what are the key elements or characteristics of an effective CBDRR moddistrict.an enhance the resilience of smallholder farmers to climate change in this district?

   Explain: .....

10. How can this CBDRR model be effectively integrated into existing agricultural extension services, disaster risk management systems, and community development initiatives?

    Explain your answer: .....

11. What are the institutional, financial, and capacity-building requirements for the successful implementation of such a CBDRR model?

Explain your answer: .....

The END of the interview
Thank you for your co-operation

Appendix B: Focus Group Discussion Questionnaire

1. What is the most common climate-related hazards and disasters that you and other smallholder farmers in this district have experienced in recent years?
2. How have these climate-induced disasters impacted your agricultural activities, livelihoods, and food security?
3. What are the underlying social, economic, and environmental factors that contribute to the vulnerability of smallholder farmers in this region to these climate-related disasters?
4. Can you provide specific examples or case studies of how these factors have influenced the severity of climate-induced disasters in your community?
5. What types of CBDRR strategies have you or other smallholder farmers in your community implemented to cope with and adapt to the impacts of climate change?
6. Can you describe the specific CBDRR practices that you and other farmers have utilized?
7. How have these CBDRR strategies been integrated into your existing agricultural and disaster risk management practices at the community level?
8. What are the key factors that have enabled or hindered the adoption of these CBDRR strategies by smallholder farmers in your community?
9. In your experience, how effective have the CBDRR strategies adopted by smallholder farmers been in reducing your vulnerability and enhancing your resilience to climate change impacts?
10. What are the key factors that contribute to the successful implementation and impacts of these CBDRR approaches in the local agricultural context?
11. What are the main challenges or limitations you have encountered in the effective application of CBDRR strategies as a smallholder farmer?
12. Can you provide specific examples or case studies of how CBDRR strategies have helped your community mitigate or adapt to climate change-related disasters?
13. In your opinion, what are the key elements or characteristics of an effective CBDRR model that can enhance the resilience of smallholder farmers to climate change?
14. How can this CBDRR model be effectively integrated into existing agricultural extension services, disaster risk management systems, and community development?
15. What type of institutional support, financial resources, and capacity-building efforts do you think are necessary for the successful implementation of such a CBDRR model in your community?

16. Can you suggest any specific CBDRR approaches or strategies that you believe would be most beneficial for smallholder farmers in your district to adopt?

The END

Thank you for your co-operation

Appendix C: HOUSEHOLD QUESTIONNAIRES

Please kindly answer the following questions by putting (x) or by writing your answer in the provided space

SECTION 1: GENERAL QUESTIONS

1. Gender

Male	
Female	

2. In which age category to you belong?

18-25	26-30	31-35	36-40	40+

3. What is your highest level of education?

No formal education	Primary Education	Secondary Education	Tertiary Education

4. Which of the following categories best describes your position as head of the household?

Male Married, resident	Male Married, working away	Divorced or widowed	Female with married daughter at the households	Female with married sons at the households

SECTION 2: Application of CBDRR approaches

5. Do you understand CBDRR approaches in the agriculture sector?

Yes	No	Not sure (specify)

6. Have you applied CBDRR approaches in your farming? And for how long?

Never applied	1-3years	3-5 years	5-7 years	Over 7 years

7. How effective have been CBDRR approaches in the agriculture sector?

Not Effective	Fairly Effective	Very Effective	Other (Explain)

8. What types of climate-related hazards and disasters have your household experienced in the past 5-10 years (e.g., droughts, floods, storms, etc.)?

_____

_____

_____

9. How have these climate-induced disasters impacted your household's agricultural production, food security, and overall livelihoods? Yes _____ No _____
10. If yes, please specify how: _____

_____

_____

11. What are the main socioeconomic, environmental, and institutional factors that contribute to your household's vulnerability to these climate-related disasters?

_____

_____

_____

12. Can you describe any specific instances where these factors have exacerbated the negative impacts of climate-induced disasters on your household?

_____

13. What types of CBDRR strategies has your household implemented to cope with and adapt to the impacts of climate change?

    Give the types:

    1. _____
    2. _____
    3. _____
    4. _____

14. How have these CBDRR strategies been integrated into your existing agricultural and disaster risk management practices at the household and community levels?

    _____

    _____

    _____

SECTION 3: Challenges and Recommendations

15. What factors have enabled or hindered the adoption of CBDRR strategies by your household?_____

    _____

    _____

16. In your experience, how effective have the CBDRR strategies adopted by your household been in reducing your vulnerability and enhancing your resilience to climate change impacts?

    .....

    .....

17. What are the key factors that contribute to the successful implementation and impacts of these CBDRR approaches in your local agricultural context?

    .....

    .....

18. What are the main challenges or limitations your household has encountered in the effective application of CBDRR strategies?

    .....

    .....

19. In your opinion, what are the key elements or characteristics of an effective CBDRR model that can enhance the resilience of smallholder farmers like yourself to climate change in this district?

    .....

    .....

20. What type of institutional support, financial resources, and capacity-building efforts do you think are necessary for the successful implementation of such a CBDRR model in your community?

    .....

.....

The END of the questionnaire

Thank you for your co-operation

PLEASE RETURN THE COMPLETED QUESTIONNAIRE TO THE RESEARCHER

Appendix D: Permission Letter from DDC

Tel: +263 542 532 234
+263 542 532 352
+263 542 532 235
www.mlg.gov.zw

REF:

The District Development Coordinator
Ministry of Local Government and Public Works
P.O. Box 63
Mvuma

ZIMBABWE

TO WHOM IT MAY CONCERN

RESEARCH PERMISSION FOR TAKUNDA MVUWU

The office of the District Development Coordinator has no objection in permitting Takunda Mvuwu, holding ID Number 29- 256651 G 77 and Bindura University Science Education student number B226353B, to conduct a research cited in his letter.

Kindly allow him to do the same for the purpose of research.

Yours Sincerely

PP .....

Chimedza J

District Development Coordinator-MVUMA

DISTRICT DEVELOPMENT COORDINATOR MVUMA DISTRICT
30 MAY 2024
P.O. BOX 63, MVUMA
TEL: 054-2532352

Appendix E: Permission Letter from Local Authority

HEAD OFFICE
Chirumanzu Rural District Council
Stand 14, Napier Road
Box 27
Mvuma
Zimbabwe
Tel: 263-32-266/7

Chirandura Sub Office
Box 27
Mvuma

Lalapanzi Sub Office
Box 27
Mvuma

TO WHOM IT MAY CONCERN

RESEARCH PERMISSION FOR TAKUNDA MVUWU

The Chirumanzu Rural District Council has granted Takunda Mvuwu permission to conduct research in Chirumanzu Ward 1. Takunda Mvuwu, holding ID Number 29-256651-G-77 and Bindura University Science Education student number B226358B, will be focusing on the topic 'Community-based Disaster Risk Reduction approaches in the agriculture sector: A case of Chirumanzu' as part of his MSc in Climate Change and Development.

With the council's approval, Takunda Mvuwu is allowed to collect data, conduct surveys, and undertake necessary research to achieve his research objectives. The council expects Takunda Mvuwu to adhere to ethical guidelines, respect the local community and its customs, and conduct his research responsibly and respectfully. The findings and outcomes of his research have the potential to provide valuable insights that could inform future policies and initiatives in the Chirumanzu Rural District Council.

Yours faithfully

pp

L. Chatikobo
CHIEF EXECUTIVE OFFICER

CHIRUMANZU
RURAL DISTRICT COUNCIL
CHIEF EXECUTIVE OFFICER
MVUMA