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DISASTER RISK REDUCTION DEPARTMENT

ASSESSING THE FEASIBILITY OF CLIMATE CHANGE ADAPTATION INITIATIVES FOR SMALLHOLDER COMMUNITIES IN CHANUHWA VILLAGE, BIRIIRI WARD 17, CHIMANIMANI DISTRICT, ZIMBABWE

BY

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A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE BACHELOR OF SCIENCE HONOURS DEGREE IN DISASTER MANAGEMENT SCIENCES

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JUNE 2026

DECLARATION

I thus certify that my thesis is the product of my own unique research and efforts, which have been submitted elsewhere for degree evaluation. References have been used to acknowledge the information from all other sources.

Ndhlovu Nomsa



Date: 06 /05/ 2026

APPROVAL FORM

The signatory attests to having reviewed the dissertation, approving its submission for grading, and verifying that it complies with departmental criteria.

Doc. H. Musarandega (Thesis Supervisor)

Date: 06/05/2026

DEDICATION

This project is dedicated to God and my devoted, loving, and hardworking parents, whose sacrifices and hard work have enabled me to fulfill my dream of earning this degree. I can not put into words how much I appreciate you. I hope you live a long life so you can enjoy the results of your hard work.

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ABSTRACT

In Chanuhwa village, Biriiri Ward 17, Chimanimani District, Zimbabwe, this study evaluated the feasibility of climate change adaptation initiatives. Growing effects of extreme weather conditions on rural livelihoods in rural areas, especially for farmers from smallholding, who mostly rely on agriculture based rainfall, served as the drive for the study. Examining farmers understanding of climate change, identifying adaptation measures being implemented, evaluating the success of these activities, and some obstacles affecting their implementation were the goals of the research. A mix of qualitative as well as quantitative methodologies were combined in a mixed-methods research strategy. Focus group discussion, structured questionnaires were given to 30 registered smallholder farmers, and key informant interviews with key stakeholders like TSURO Trust, AGRITEX Officers, the Chimanimani District Development Coordinator, the Chimanimani Rural District Council and local farmer representatives were used to gather data. Thematic analysis was used to analyse the data, and the findings were presented in tables and bar graphs.Findings demonstrated that farmers that were well aware of the impacts of changing weather. According to the study, unpredictable patterns of rainfall, lower crop harvest, widespread pest problems, and livestock losses are some of the impacts climate change is causing within Chanuhwa village. Several adaptation initiatives such as conservation farming, water harvesting, agroforestry, aquaculture, crafting, and apiculture have been adopted by farmers within Chanuhwa village. The study discovered that these adaptation efforts have generally increased food security, crop yields, and resilience to shocks related to extreme weather conditions. The study concludes that climate change adaptation initiatives in Chanuhwa village are feasible and have positively contributed to improving community resilience, greater supports required to enhance their sustainability and effectiveness. The study suggests strengthening farmer training, improving access to agricultural inputs and financial assistance, investing in irrigation infrastructure, promoting stakeholder collaboration, and encouraging livelihood diversification to enhance resilience against climate change.

ACRONMYS

NGO	Non-Governmental Organisation
TSURO Trust	Towards Sustainable Use Of Resource Organisation Trust
ICT	Information Communication Technologies
AGRITEX	Agricultural Technical Extension

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CHAPTER 1: INTRODUCTION

1.1 Chapter Introduction

This section introduces a research study on assessing climate change adaptation initiatives among smallholder farmers, focusing on awareness, current practices, effectiveness, and potential improvements to enhance resilience. The purpose of the research is to evaluate the feasibility and effectiveness of extreme weather conditions adaptation initiatives within smallholder farmers from Chanuhwa village, Biriiri Ward 17, Chimanimani District, Zimbabwe. The objectives comprise evaluating awareness and knowledge of climate change, identifying current adaptation strategies, assessing their effectiveness, and proposing context-specific solutions for Chanuhwa to enhance sustainable resilience against climate change impacts.

1.2 Background of the study

Globally, changes in temperature and weather patterns is particularly the greatest pressing pressing of the modern era, threatening food systems, water availability, and livelihoods, particularly in developing countries. Intergovernmental Panel on Climate Change (IPCC, 2022) states that increase in temperatures, unpredictable rainfall, alongside increased occurrence of the catastrophic events have intensified vulnerability, especially among agricultural communities. Sub-Saharan continent is among the hardest-hit regions, with smallholder farmers facing growing climate risks based on their dependency on water-based farming together with little capacity for adaptation. Lombamo (2021) states that Southern Africa, in particular, is experiencing recurrent droughts and floods, resulting in widespread food insecurity and livelihood disruption. Farmers from smallholdings in Zimbabwe have particularly important to the country's food security, yet they remain vulnerable to the effects of climate change , facing high vulnerability due to their reliance on unpredictable rainfall. Among the most vulnerable are communities dependent on water-based farming, whose sustaining activities and food availability are directly threatened by climatic variability. According to Chingombe and Musarandega (2021), smallholder farmers in Chanuhwa village, Ward 17 of Chimanimani district in Zimbabwe are highly exposed to the adverse effects of climate-induced hazards like droughts, Cyclone Idai 2019, alongside flash floods, which continue to threaten food security, income stability, and socio-economic development.

Historically stable seasonal patterns have given way to increased climate variability, manifesting as more prevalent and severe droughts, unpredictable precipitation, and severe flooding events. Kunedzimwe et al. (2021) state that these intensifying climatic shocks have deep and flowing impacts. Tirado et al. (2022) state that droughts result in widespread crop failure, livestock mortality, and critical water shortages while intense rainfall events trigger soil erosion, damage to infrastructure, and the loss of productive land. Cumulative effectiveness is a direct and severe risk to household food availability, economic stability, as well as, the overall social well-being of the community. In response, Musarandega et al. (2021) state that several climate change adaptation initiatives, including promotion of drought-resistant crop varieties, conservation farming techniques, water harvesting projects and techniques, and agroforestry systems, have been introduced in the region by government agencies, non-government organisations (NGOs), and international development partners. Some farmers from smallholding opted crops that thrive in drought and livestocks, aquaculture, and conservation farming, as well as off-farm practices that include apiculture, craft work, and trade. Mitchell (2013) states that various adaptation initiatives that have been implemented and proposed by governmental and non-governmental organisations to build resilience, their practical suitability and potential for long-term success are often unclear.

However, a significant challenge persists as many of these programs are created and carried in a centralized approach. Kunedzimwe et al. (2021) state that this approach often creates a disconnect between the proposed solutions and the local farmers. Some barriers, including the socio-economic capacity of households to invest in new practices, the environmental appropriateness of the technologies, and the strength of local institutions to provide sustainable support, are frequently inadequately addressed.

Therefore, there is an urgent need to move beyond theoretical assessments and evaluate the practical feasibility of these initiatives through the lens of the smallholder farmers themselves. This research seeks to close this critical gap by perfoming a community-centered assessment in Chanuhwa village, Ward 17, Chimanimani district, Zimbabwe.

1.3 Statement of the Problem

According to Berrang-Ford et al. (2021), despite growing awareness of warming temperature impacts as well as the introduction of adaptation solutions, assessing the worldwide advancement on people's adaptation initiatives to global warming is an urgent priority. Shackleton et al (2015) add that many adaptation initiatives fail to achieve their intended outcomes, particularly in rural, resource-constrained settings. A more thorough analysis of the barriers to adaptation is necessary in order to improve comprehension of the process of climate change adaptation efforts and to make the design and execution of social adaptation strategies easier. This often stems from a mismatch between top-down policy generation and the lived realities, necessities, and capacities to the local communities. Without a comprehensive assessment of feasibility, resources may be misallocated, and adaptation efforts may not lead to sustainable resilience. In Chanuhwa, Chimanimani District, a lot of climate change response education has been mainstreamed over an extended period. Likewise, a myriad of intervention initiatives have also been mainstreamed by various community resilience-building agencies. What stands to be fully assessed is the degree to which the various programs have helped towards fulfiling the adaptability goal. Therefore, this research seeks to bridge this knowledge gap by offering a thorough, community-centric assessment of the efficiency of the climate change adaptation initiatives in the research area.

1.4 Aim

The study aims to assess the feasibility and effectiveness of climate change adaptation initiatives among smallholder farmers in Chanuhwa village, Ward 17, Chimanimani District, Zimbabwe.

1.5 Objectives of the study

The objectives of this study are:

i. To assess the awareness and knowledge of smallholder farmers in Chanuhwa village about climate change and its impacts.

ii. To determine the current climate change adaptation initiatives being implemented by smallholder farmers in Chanuhwa village.

iii. To evaluate the effectiveness of climate change adaptation initiatives in improving the resilience of smallholder farmers.

iv. To propose options for enhancing smallholder resilience to climate change in Chanuhwa village, Chimanimani.

1.6 Research Questions

i. What levels of awareness and knowledge do smallholder farmers in Chanuhwa village have regarding climate change and its impacts?

ii. What specific climate change adaptation initiatives are currently being implemented by smallholder farmers in Chanuhwa village?

iii. How effective are the existing climate change adaptation initiatives in enhancing the resilience of smallholder farmers in Chanuhwa village?

iv. What options can be proposed to improve the resilience of smallholder farmers to climate change in Chanuhwa village, Ward 17, Chimanimani?

1.7 Justification of the study

Chanuhwa village in Biriiri Ward 17 of Chimanimani district, Zimbabwe, had been identified as a high-risk area for climate-related hazards. Kunedzimwe et al. (2021) state that it had suffered from an increase in the occurrence and severity of extreme weather events, such Cyclone Idai in 2019 and Cyclone Freddy. These incidents had resulted in significant harm to infrastructure, disrupted agricultural livelihoods, and led to significant human suffering. Therefore, there had been a need to assess the efficiency and sustainability of existing and proposed adaptation solutions. Most of the population in Chanuhwa depended on water-based farming, leading them susceptible to erratic precipitation patterns, seasonal dry spells, and shortened rainy seasons.

Various organisations and the government had implemented extreme weather adaptation projects in the district; however, the effectiveness as well as, the long-term viability of these initiatives were not well documented. Thus, the feasibility study aimed to evaluate existing initiatives, ensure sustainability, inform policy and investment (for example, findings from the study would have provided evidence-based information to policymakers, non-governmental organisations, and community leaders, helping them to prioritize and allocate resources to the most effective and feasible adaptation practices, like climate-smart agriculture), as well as, empowering the community.

1.8 Definition of terms

Climate is defined as the long-term pattern of weather conditions in a particular area, typically averaged over 30 years or more, including elements like temperature, precipitation, wind, and sunshine.

Climate change is a shift in the long-term weather patterns that define different parts of the world. (Valavanidis 2022).

Climate change adaptation is the practical set of actions we take to adjust to our changing world, protect ourselves from its risks, and build a more resilient society (IPCC, 2022).

1.9 Organisation of study

This research project is organised into five chapters.

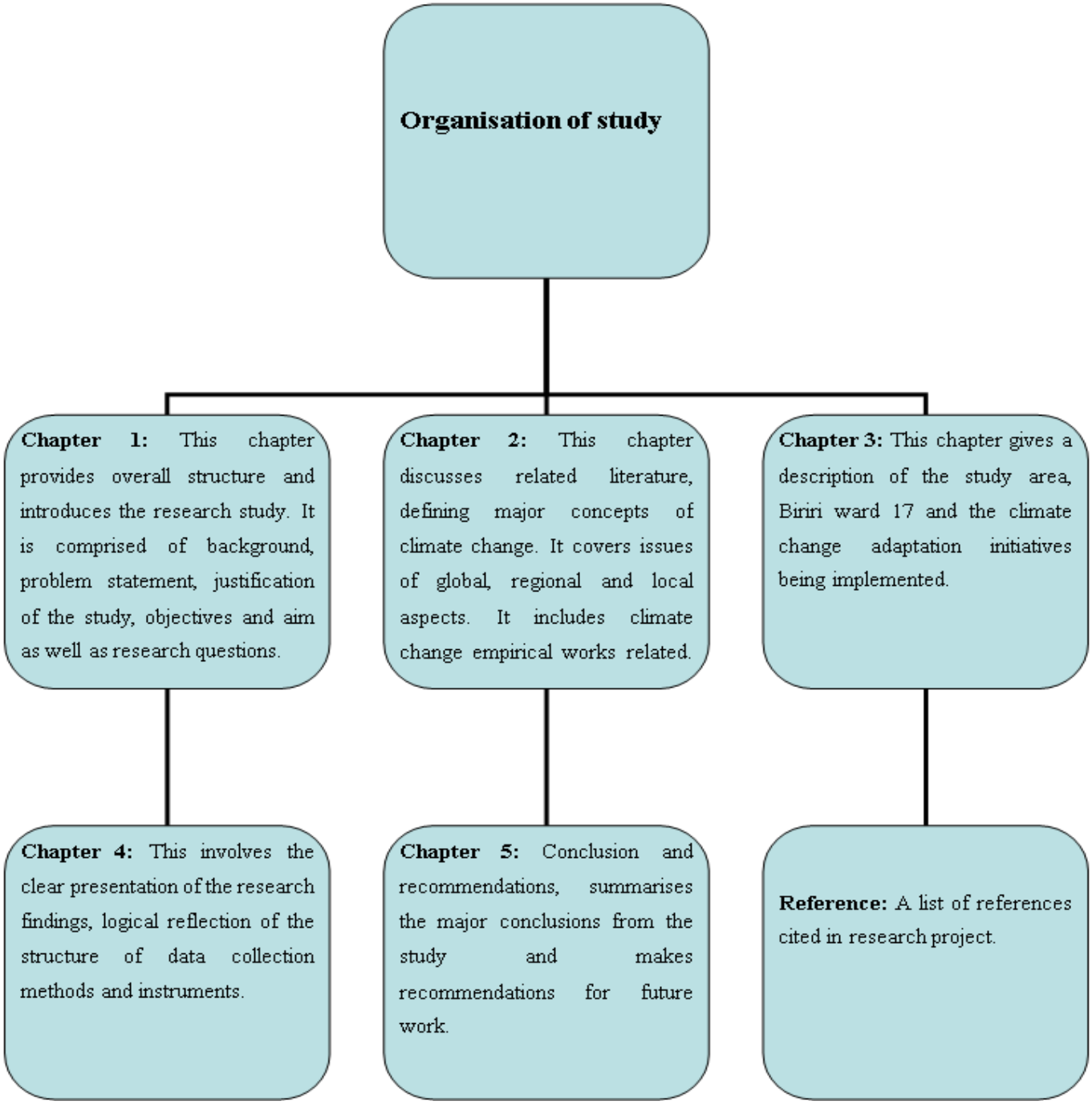


Figure 1.1 Chapters within the research project

1.10 Conclusion

This chapter has introduced the vital challenge of climate change along with its disproportionate effects on vulnerable smallholder farming communities, particularly in Chanuhwa village, Ward 17, Chimanimani District, Zimbabwe. With agricultural systems heavily reliant on increasingly unpredictable rainfall patterns, these communities face significant threats to their food availability and livelihoods. The research aimed to evaluate the feasibility and effectiveness of existing and proposed climate change adaptation initiatives in this world, set against the background of centralised approaches that often fail to address the lived realities and capacities of local farmers. The objectives included evaluating awareness and knowledge of climate change, identifying current adaptation strategies, assessing their effectiveness, and proposing options for enhancing resilience. Key research questions explored the levels of awareness, specific adaptation initiatives, the effectiveness of these initiatives, and potential improvements for resilience. The subsequent chapters will delve into the specific context of Chanuhwa village, examining the implemented adaptation initiatives and analysing their feasibility through socio-economic, environmental, and institutional lenses. Ultimately, this research seeks to provide a community-centered analysis that informs policy and investment decisions, empowering which help develop long-term climate change resilience among smallholder farmers.

CHAPTER 2: LITERATURE REVIEW

2.0 Introduction

This section appraises most related lpublications and findings in the research. The chapter appreciates the contribution of worldwide perspectives on the feasibility of climate change adaptation initiatives, and also the current climate change adaptation initiatives being implemented by smallholder farmers and their impacts.

2.1 Theoretical framework

2.1.1 The sustainable livelihoods framework

The sustainable livelihoods framework, as articulated by the United Kingdom's Department for International Development around 1999, is a people-centered, holistic analytical tool used to understand the complexities of poverty and identify effective development interventions. Ellis (2000) states that it moves beyond narrow definitions of poverty like income level to consider the diverse factors that influence a persons' ability to build a sustainable life. Figure 2.1 shows the sustainable livelihood framework of 1999 by the Department for International Development, indicating the main factors affecting livelihoods and their interrelationships through the five main components.

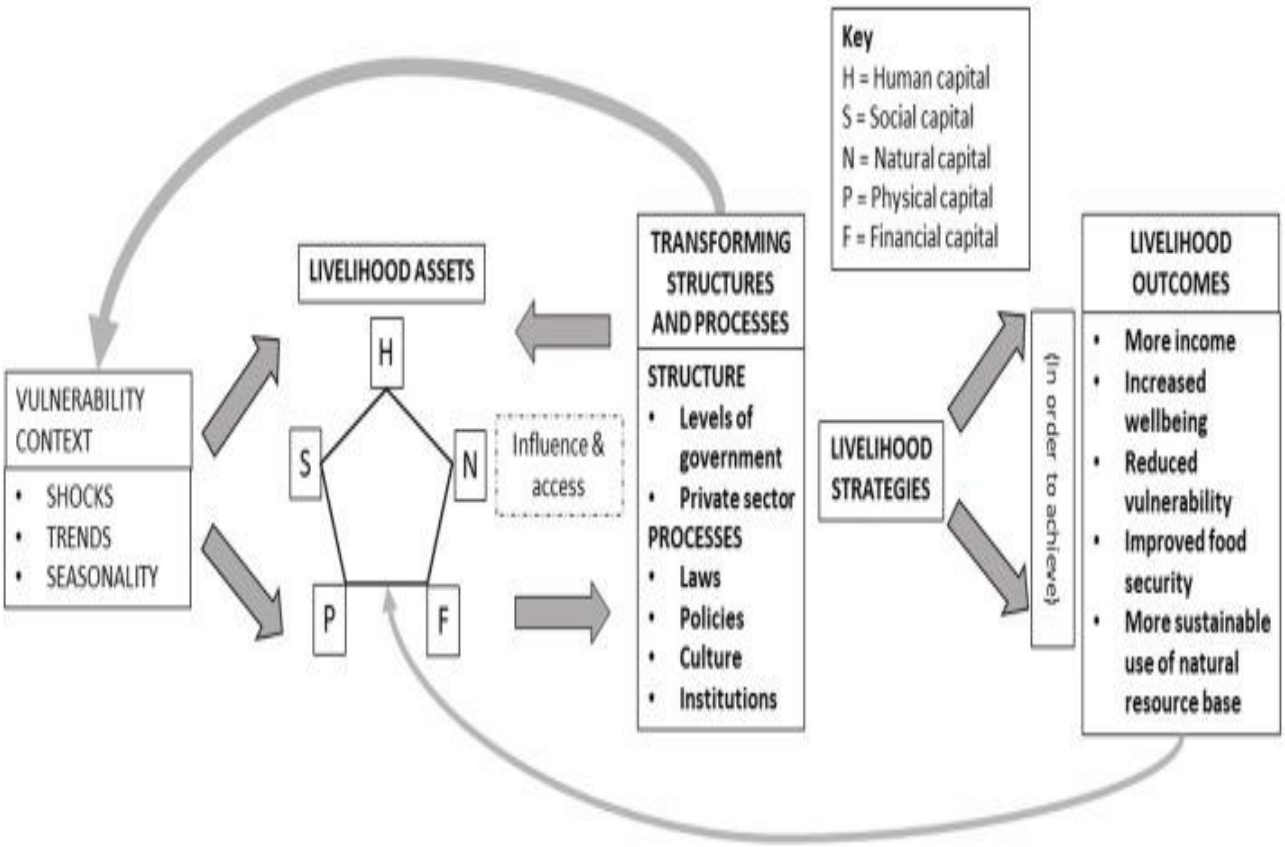


Figure 2.1 The Department for International Development (1999) sustainable livelihood framework

The framework is guided by several core principles that distinguish it from traditional approaches. The Department for International Development (1999) highlighted that it is focused on individuals, beginning with an awareness of people's strengths and priorities rather than external problems. It is holistic, recognising that livelihood strategies are complex and influenced by factors across different sectors and scales. Furthermore, it is dynamic, responsive, and participatory, aiming to be sustainable across economic, social, institutional and environmental dimensions.

2.1.2 Core Components of the Framework

The SLF diagrams the key factors affecting livelihoods and their interrelationships through five main components.

2.1.3 The Vulnerability Context of smallholder farmers to climate change

The external environment in which people live is included in the vulnerability context and is defined by factors beyond their immediate control. Farmers in Chanuhwa village live with high exposure to climate risks. Droughts, erratic rainfall, and destructive events such as Cyclone Idai have disrupted agricultural production and damaged infrastructure. Seasonal changes also affect planting and harvesting cycles, making livelihoods unstable. These shocks and trends form the vulnerability context within which adaptation initiatives must operate. The Department for International Development (1999) state that the vulnerability context includes shocks such as natural disasters, economic crises, trends such as population, economic, or resource patterns and seasonality, such as weather, employment, and pricing seasonality. People's resources and choices are therefore directly impacted by the vulnerability setting.

2.1.4 Livelihood Assets

The Department for International Development (1999) highlighted that the components that people employ to develop their livelihoods are known as livelihood assets. The framework categorises them into five core types of capital, which are:

Human capital (H) is the sum of a person's abilities, knowledge, and health as well as their capacity to work. The feasibility of adaptation initiatives lies in the availability of local human capital. For example, a project introducing a new drought-resistant crop requires the knowledge and physical capacity to cultivate it successfully. Human capital helps in determining the capacity to learn, implement, and manage new adaptation technology. Human capital is central to identifying current initiatives being implemented within the study area, like training in climate-smart agriculture, environmental education, and disaster preparedness. Awareness and the knowledge of climate change impacts are directly tied to human capital, hence it is important to evaluate community preparedness in Biriiri Ward 17, Chanuhwa village.

Social Capital (S) defined the social systems, relationships of trusting connections together with, membership in groups within a society, which enable them to work together effectively for mutual benefit. Social capital in Chanuhwa manifested through farmer cooperatives, traditional leadership groups, and local institutions, which play a vital role in enabling collective climate adaptation actions. These networks can support shared irrigation schemes, communal disaster

risk reduction efforts, and the sharing of climate data, thereby improving the feasibility of adaptation initiatives. Thus, this study helps in assessing whether the social capital is active within Chanuhwa village by noting down how social networks facilitate cooperation during climate shocks and how information is shared among smallholder farmers.

Natural capital (N) is made up of the natural resource stocks and environmental services including land, water, forests, and biodiversity that are used to support people. Climate change directly threatens natural capital in Chimanimani through increased rainfall variability, land degradation, and water scarcity. The feasibility of adaptation initiatives in Chanuhwa village is therefore closely linked to their ability to protect, restore, or sustainably enhance this capital base without leading to maladaptation such as environmental degradation.

Physical capital (P) comprises the tools, producer commodities, and basic infrastructure required to sustain livelihoods, for example, roads and irrigation systems. In Chanuhwa village, limited physical capital, such as reliable water infrastructure, is a critical determinant of the feasibility of adaptation strategies that aim to reduce dependence on erratic rainfall. Access to irrigation infrastructure, climate-resilient roads, and water harvesting technologies significantly increases the feasibility of adaptation initiatives aimed at reducing dependence on erratic rainfall patterns. Awareness and knowledge of climate change impacts are crucial as communities must recognise the link between environmental degradation and increased vulnerability. Thus, this study will assess irrigation systems and roads that may help to make climate change adaptation initiatives feasible and also assess the level of awareness and knowledge smallholder farmers within Ward 17, Chanuhwa village possess.

Financial Capital (F) denotes the people's access to credit, remittances, savings, and other financial resources. Initiatives that incorporate access to financial capital, such as microfinance, can significantly increase the community's adaptive capacity. Financial capital helps in the identification of adaptation initiatives such as village saving groups, donor-funded projects, and microfinance schemes, and assesses their effectiveness by considering how financial resources enable investment in climate change adaptation initiatives. Hence, this research will identify and assess the effectiveness of village saving groups and microfinance in adaptation to climate change in Chanuhwa village.

2.1.5 Policies, Institutions, and Processes

The sustainable livelihoods framework emphasises a people-centered, asset-based approach that considers local realities, institutional dynamics, and vulnerability contexts, making it ideal for designing practical and sustainable climate solutions in rural Zimbabwe. The procedures, organisations and policies components includes the organisation, policies, legislation, and culture that shape livelihoods. Ellis (2000) states that these structures and processes are crucial as they influence access to assets, mediate the ability to convert those assets into positive outcomes, and determine the range of viable livelihood strategies.

According to Ellis (2000), livelihood strategies are the variety and mix of actions and decisions people make in order to accomplish their livelihood objectives. Some of the farmers in Chanuhwa village are testing out strategies for instance crop diversity, conservation agriculture, and irrigation on a small scale to cope with climate stress. Some households combine farming with casual labour or small businesses to spread risk. These strategies reflect the dynamic nature of livelihoods and the need to adapt continuously; hence, this study seeks to examine whether people are shifting from traditional farming to climate-resilient strategies such as conservation farming and small livestock.

The Department for International Development (1999) highlighted that the accomplishments or effects of livelihood strategies include more income, better wellbeing, decreased vulnerability, increased food security, and a more sustainable use of the natural resource base. Hence, by applying the Sustainable Livelihoods Framework to the Chanuhwa village context, this study can identify which adaptation initiatives are feasible, which assets and institutions need strengthening, and how local strategies can be supported to achieve sustainable outcomes. This linkage ensures that the framework is non-intangible but directly informs the analysis of climate change adaptation in Ward 17, Chanuhwa village.

2.2 Definition and characteristics of smallholder farmers in Zimbabwe

Smallholder farming systems in Zimbabwe are defined as agricultural practices carried out by households on relatively land that is little, typically less than five hectares. These systems rely heavily on family labour, traditional tools, and rain-fed production as compared with large-scale

commercial farms, where smallholders operate with limited resources, yet they remain the backbone of rural livelihoods and national food security. According to Manyanga et al. (2025), smallholder maize-based farming systems are central to Zimbabwe's agricultural economy, providing food and income for millions of households. Most smallholder farmers in Zimbabwe cultivate small plots allocated through communal tenure systems. Land is often inherited or allocated by traditional leaders, and formal title deeds are rare, which limits farmers' ability to access credit or invest in long-term improvements. Land destruction is common with households dividing plots among family members, leading to smaller and less productive units.

Smallholder farming depends mainly on household labour, including men, women, and children. According to Thierfelder et al. (2018), due to financial constraints, hired labour is rare, and access to contemporary inputs such as enhanced seeds, fertilisers, and pesticides is limited.Farmers frequently use local wisdom and customs to manage soil fertility and pests. The main crops grown include maize, sorghum, millet, groundnuts, beans, and sweet potatoes. Maize is the staple food, but small grains such as sorghum and millet are important in drought-prone areas. This shift, as noted in the Gokwe South by Chatsiwa et al. (2024), moves the system away from purely subsistence activity towards partial commercialisation. Livestock such as cattle, goats, and chickens play a key role in providing food, income and draught power. Some of the smallholder farming systems are diverse and adapted to local conditions, hence farmers practice mixed cropping, agroforestry, intercropping, and crop rotation to manage risks and improve soil fertility.

These practices reflect the resilience and creativity of farmers in coping with resource constraints. Smallholders produce mainly for household consumption, but they also sell surplus crops in local markets. Access to formal markets is limited due to poor infrastructure, high transport costs, and a lack of storage facilities. Farmers rely on indigenous knowledge passed down through generations, which helps them in observing weather patterns, soil conditions, and crop behaviour to make decisions. However, climate change has made traditional knowledge less reliable, and farmers need new information and technologies. Farming activities are linked to seasonal rituals, community cooperation, and traditional practices. Women play a central role in food production, while men often focus on cash crops and livestock. Youth involvement is

declining due to migration and a lack of opportunities, raising concerns about the future of smallholder farming.

2.2.1 Concepts of smallholder farming systems in Zimbabwe

Smallholder farmers are important as they play a part in global food security systems, particularly in developing countries such as Africa and Asia. According to Careslen et al. (2017), smallholder farmers are defined as farmers with small plots of land, often less than 2 hectares, whose agricultural activities are closely tied to household survival, unlike large-scale commercial farmers who operate under significant resource constraints, which shape both their production methods and their socio-economic conditions. Makuvaro et al. (2017) state that smallholder farmers are limited in the size of their landholdings and mostly rely on family labour and use simple tools, with farming activities integrated into household livelihood strategies. Hence, this reliance on unpaid labour distinguishes them from commercial farms that depend on hired workers and mechanisation.

The World Bank (2019) states that smallholder farmers produce a share of food consumed locally and are central to achieving food security and poverty reduction goals, though they are affected by resource constraints, their vulnerability to climate change, and poor infrastructures such as irrigation systems. However, Careslen et al. (2017) highlighted that some of them diversify their income through off-farm employment while others remain in cycles of low productivity. They also rely much of informal networks for labour exchange, seed sharing, and local knowledge exchange.

2.2.2 Economic and Social importance of smallholder farming systems in Zimbabwe

Smallholder farmers play a vital role in advancing sustainable agriculture, particularly in emerging and least developed nations. In addition to being essential to Zimbabwe's food supply, smallholder farming techniques are also essential to the country's economy and social structure. They provide employment, income and food security for millions of households while sustaining rural communities and cultural traditions. According to the World Bank (2025) smallholder agriculture supports nearly 70% of the Zimbabwean population, making it the most important livelihood source in the country. Because they grow the majority of the main crops that feed both rural and urban populations, like maize, sorghum, and millet, smallholder farmers make a

substantial contribution to the country's food security. Chang (2022) asserts that smallholders are the driving force behind a more resilient and sustainable ecology, as well as the accomplishment of UN Sustainable Development Goals 13 on climate action and 15 on life on land.

Regenerative agriculture will help achieve Sustainable Development Goals 1 (No poverty) and 2 (Zero hunger) by reducing poverty, promoting stable food production, and ensuring food security as it lessens the effects of climate change. According to Mukarumbwa et al. (2018), smallholder farmers' production of vegetables and tomatoes has the potential to improve livelihoods by increasing access to income and food security. Farmers sell surplus crops in local markets, for example, smallholder farmers in Chimanimani sell their products at Nhedziwa market as well as in other informal sectors. Although earnings are often small, they provide cash for school fees, healthcare, and household needs. Rafael (2023) highlighted that smallholder farming also contributes to employment through seasonal labour opportunities, such as harvesting provide income for landless households, making smallholder farming a key source of livelihood in rural areas.

Social role is vital as it sustains rural communities by providing food, strengthening social networks, and preserving cultural practices in the sense that farming activities are organised around community cooperation such as shared labour, seed exchanges and collective marketing thus by building resilience and solidarity among households just like farmers in Chanuhwa village, Ward 17 are being supported by surrounding NGOs like TSURO Trust and World Vision, however the level of success after they get assisted to implement climate change adaptation initiatives remain as a gap which this study will bridge. Women are responsible for food crops, household nutrition, and small livestock, which contribute to family survival and community stability. However, Makuvaro et al (2017) state that women face challenges such as limited access to land, credit, and decision-making power in climate change adaptation.

2.2.3 Challenges of climate change on smallholder farmers in Zimbabwe

Zimbabwe has experienced repeated droughts in recent decades, particularly in the southern and eastern regions. Smallholder farmers in Zimbabwe make up the majority of the rural population. They grow crops like maize, groundnuts, and beans, and keep livestock for food as well as

income. However, farming has become increasingly challenging due to climate change. According to Ndlovu (2020), shorter rainy seasons and longer dry spells have made rainfall less predictable, which has an impact on planting and harvesting, lowering yields and raising the possibility of crop failure. Farmers in Chimanimani District report that rainfall patterns have shifted, making traditional farming calendars unreliable. According to Vincent and Ngulube (2025), smallholder farmers in Africa face major challenges in adapting to climate change, including a lack of resources, limited access to information, and weak institutional support.

Musarandega and Chingombe (2021) state that Cyclone Idai in 2019 highlighted Zimbabwe vulnerability to extreme events. The cyclone devastated Chimanimani and Chipinge, destroying homes, roads, and farms. Thousands of households lost crops and livestock, and recovery has been slow. Such events show how climate change can wipe out years of progress in rural development. Additionally, soil erosion, land deterioration and deforestation are worsening due to climate stress and poor land management in the sense that farmers clear forests for cultivation, reducing natural protection against floods and increasing vulnerability.

Zimbabwe is one of the least equipped nations for climate change, despite being one of the most susceptible. According to the African Development Bank Group (2023), weak institutions, poor infrastructure, and limited access to finance constrain adaptation. Many farmers fail to afford improved seeds, fertilizers, and improved irrigation systems, whilst there has been success in other areas, such as extension services and NGOs stretched to assist smallholder farmers, their coverage is low in remote areas, their level of success and the ability to reach some areas remain a gap which this study will bridge.

Livestock systems are affected by water shortages, heat stress, and disease outbreaks. Farmers report increased cases of tick-borne diseases and reduced pasture availability. Crop pests such as fall armyworm have also become more common, destroying maize fields and reducing food security. Chitongo et al. (2020) state that gender inequality and land tenure insecurity reduce adaptive capacity.Women who are heavily involved in farming frequently do not have access to loans or secure land rights, while youth also face unemployment and limited opportunities, making them less able to invest in adaptation.

2.2.4 Impacts of climate change on smallholder farmers

In Africa, agriculture is the backbone of rural livelihoods, yet it is increasingly unstable due to climate stress. According to Chanza et al. (2020), Zimbabwe is a clear example of this vulnerability, which has faced repeated droughts, erratic rainfall, and destructive events such as Cyclone Idai in 2019, which devastated Chimanimani District. These shocks show how climate change can wipe out years of progress in food security and rural development. The Intergovernmental Panel on Climate Change (IPCC, 2022) cautions that if significant adaptation measures are not taken, climate change will continue to threaten food security and is already lowering crop production in many areas. Through the use of fertiliser, animal production, and changes in land use, agriculture contributes to greenhouse gas emissions worldwide. Bibi and Rahman (2023) claim that abiotic stress brought on by climate change, such as drought and temperature fluctuations, is severely impairing crop physiological response, productivity, and overall yield, ultimately posing a major danger to agro ecosystems and world food security.

Chemical pesticides and fertilisers are used, which accelerates climate change and further deterioration. Therefore, to lessen the effects of climate-related harm on the agricultural sector, more cautious, environmentally friendly, and sustainable approaches are needed. According to Madamombe et al. (2024), the effects of climate change on agriculture include shorter growing seasons, decreased soil fertility, and erratic rainfall, all of which reduce crop production. Sakrand (2025) claims that disease outbreaks, heat hardship, and water scarcity all lower animal health. As noted by Jiri et al. (2017), to lessen susceptibility, adaption techniques like crop diversification, conservation farming, irrigation, and agroforestry are being pushed. However, Mutombo (2023) mentioned that adoption is uneven and many farmers lack the resources, training, and institutional support to implement these practices fully. Hence, this study will focus on identifying the climate change initiatives being adopted in Chanuhwa village.

2.2.5 Vulnerability of smallholder farmers to climate change

Zimbabwe has experienced repeated droughts in recent decades, particularly in the southern and eastern regions. With shorter rainy seasons and longer dry spells, rainfall has become less predictable. According to Chinwendu et al. (2017), vulnerability is a level of risk and an incapacity to adjust to variations in the climate. Due to their direct reliance on weather and

natural resources, Zimbabwe's smallholder farming systems are extremely vulnerable to climate change. Due to their reliance on rain-fed agriculture, the majority of smallholders are vulnerable to changes in temperature and precipitation. Climate change has already brought more frequent droughts, floods, and cyclones, and these events are disrupting farming activities, reducing yields, and threatening food security. According to Dube-Takaza et al. (2024), smallholder farmers in southern Zimbabwe face high levels of vulnerability due to limited resilience options and weak institutional support.

Farmers in Chimanimani District report that rainfall patterns have shifted, making traditional farming calendars unreliable. Extreme events such as Cyclone Idai in 2019 highlighted the vulnerability of a country, as thousands of households lost crops, livestock, and infrastructure. Rana and Routray (2018) state that in Chanuhwa village, Ward 17, vulnerability was high due to exposure to cyclones, droughts, and floods. Soil erosion and deforestation have reduced natural protection against floods, while water sources are drying up; hence, there is a need to assess the level of awareness and knowledge of Chanuhwa village smallholder farmers on climate change and propose actions to improve resilience to climate change adaptations.

Given the strong correlation between smallholder farmers' household income and agricultural output, the detrimental effects of climate change on crop productivity make farmers more vulnerable. According to Alam et al. (2017), farmers' agricultural output is impacted by climate change, but their household well-being and food security are also at danger. The enormous destruction and displacement caused by Cyclone Idai, as noted by Chapungu (2020), demonstrate the vulnerability of people and communities to climate change-related disasters. Farmers often lack irrigation systems, improved seeds, and fertilizers, making them more exposed to climate variability. Recovery from Cyclone Idai has been slow, and many households remain in poverty. Adaptation initiatives such as conservation farming, agroforestry, and small irrigation schemes have been introduced, but there is a gap in the feasibility of the implemented adaptation initiatives, which this study seeks to address.

2.2.6 Policy and Institutional frameworks for smallholder farmers

Policies and institutions play a critical role in shaping how communities adapt to climate change for smallholder farmers in Chanuhwa village, Ward 17. Strong policies and institutions are essential for accessing resources, training, and support. Farmers can adopt new practices and technologies, but their success often depends on the support they receive from the government, NGOs, and international organisations. The viability of adaptation efforts in Zimbabwe is directly impacted by the institutional and policy framework, particularly for smallholder farmers in vulnerable areas like Chanuhwa village, Ward 17, Chimanimani. Zimbabwe has developed a number of policies and strategies to address climate change. The National Climate Policy of 2017, according to the Government of Zimbabwe (2017), offers a framework for incorporating climate factors into development planning. It emphasises adaptation in the agriculture, water, and energy sectors. The National Adaptation Plan (NAP) process, supported by the UNFCCC, aims to identify priority adaptation actions and mobilize resources. These policies highlight the importance of building resilience in rural communities, but implementation has been slow due to limited funding and institutional capacity. Hence, this study will help to propose actions to improve resilience for climate change adaptation.

The government has promoted conservation agriculture, small grain production, and irrigation development as key adaptation strategies. Government of Zimbabwe (2024) mentioned that programs such as *Pfumvudza*/Intwasa encourage farmers to use minimum tillage, mulching, and crop rotation to improve yields under climate stress. These programs have reached many households, but challenges remain in terms of input distribution, monitoring, and sustainability. For instance, farmers in Chanuhwa village often report delays in receiving inputs or a lack of follow-up support. Hence, it clearly indicates that there is an information gap on the effectiveness of climate adaptation initiatives that include *Pfumvudza*, which this study will therefore address. Institutions such as the Ministry of Lands, Agriculture, Fisheries, Water and Rural Development, local government authorities, and NGOs play a role in supporting adaptation. Government of Zimbabwe (2025) states that extension services provide training and advice, while NGOs introduce projects such as small irrigation schemes and agroforestry. Chitiga and Mabugu (2024) state that international organisations like FAO and the World Bank

support climate-smart agriculture initiatives; however, coordination among institutions is often weak, leading to duplication of efforts and gaps in coverage. Traditional leaders, farmer associations, and community-based organisations also influence adaptation. They mobilize local resources, enforce land use rules, and support collective action. In Biriiri Ward 17, Chanuhwa village, community groups have helped rebuild after Cyclone Idai and promote soil conservation practices.

2.2.7 Smallholder agricultural practices

Agricultural practices like conservation farming, crop diversity, agroforestry, livestock management, soil and water conservation, and organic farming provide practical ways to cope up to climate change. These practices build on local knowledge and are suitable for smallholder farmers in Zimbabwe, for example, for communities in Chanuhwa village. Adopting climate-smart practices is important for minimising vulnerability, improving food security, and building resilience. However, adopting new agricultural practices requires training, resources such as inputs and support, which many farmers lack. Additionally, cultural preferences play a role as some farmers are reluctant to switch from maize to small grains; also, gender inequality limits women's participation in training and decision-making, which may set back the adoption of agricultural strategies.

Agroforestry is a long-term adaptation strategy that strengthens resilience and offers numerous advantages. According to the Government of Sweden (2019), the effects of climate change are particularly severe in agriculture, forestry, and fisheries, where they disrupt ecological balances, reduce biodiversity, and threaten food security. The Intergovernmental Panel on Climate Change (2022) noted that incorporating trees into farming systems improves soil fertility, reduces erosion, and offers numerous livelihood benefits, also supplies fodder for livestock, thus strengthening long-term resilience. In Chanuhwa village, Ward 17, Chimanimani, soon after Cyclone Idai 2019 hit, trees were planted by community members that involve smallholder farmers in collaboration with some Government stakeholders and NGOs along contour ridges and rivers to reduce soil loss during heavy rains and as a recovery strategy but their effectiveness in enhancing resilience is a gap that this study seeks to address.

Rain-fed farming systems' moisture stress and crop failures can be decreased with better soil and water management techniques. Farmers use contour ridges, terracing, and planting pits to conserve soil as well as water, and these practices reduce erosion, improve water infiltration, and increase yields. For example, in Chimanimani, soil conservation is critical because steep slopes are prone to erosion during heavy rains. According to Moyo et al. (2020), farmers can maintain nutrients in the root zone by lowering the frequency, quantity, and length of watering events. Water conservation practices and rainwater harvesting improve resilience to drought. Mosello et al. (2017) state that in Zimbabwe, smallholder farmers mainly use flood irrigation. Soni et al. (2022) highlighted that organic farming is affordable and environmentally friendly, and it involves practices such as composting, manure application, and natural pest control to improve soil health and reduce dependence on chemical inputs. However, the application of these practises in Chanuhwa village remains a gap that needs to be addressed by this study.

Crop rotation, mulching, and minimal tillage are all part of conservation agriculture. These methods lessen erosion, preserve moisture, and increase soil fertility. According to Lee and Thierfelder (2017), conservation agriculture, which emphasises crop residue retention, diversification, and little soil disturbance, may enhance a variety of soil properties and be a viable farming strategy for Zimbabwean farmers' resilience to climate change. NGOs and extension services support conservation agriculture as a long-term solution to climate change. Mvumi et al. (2017) state that conservation methods can be crucial for achieving high crop yield and income in semi-arid regions. However, the effectiveness of these practices and their adoption within Chanuhwa village are yet unclear, therefore this study will close that gap.

Many rural people in Sub-Saharan Africa rely heavily on livestock systems for their livelihood. Livestock are important assets for smallholder farmers, serving as savings and insurance against shocks. Better management increases productivity and resilience through improved livestock practices include rotational grazing, fodder production and disease control. Rotational grazing prevents overuse of pastures while fodder crops provide feed during dry seasons. Vaccination and veterinary services reduce disease outbreaks. According to Henchion et al. (2021), livestock systems are responsible for a significant contribution to food security and rural livelihoods.

2.3 Definition and scope of climate change

According to the Intergovernmental Panel on Climate Change (2017), climate change is a long-term, usually decades-long shift in the mean and variability of the climate's characteristics. These modifications may result from human activity or natural processes that change the composition of the atmosphere worldwide. According to the United Nations Framework Convention on Climate Change (2017), climate change is defined as a change in climate that is either directly or indirectly caused by human activities that modifies both natural climate variability observed over a comparable time period and the composition of the global atmosphere. According to Myers et al. (2017), human health, food security, and water resources are only a few of the ecosystems that climate change may affect.

Ecosystem services and human well-being may be lost as a result of altered plant and animal abundance and distribution brought on by rising temperatures and shifting precipitation patterns. According to Smith et al. (2017), burning fossil fuels and deforestation are two examples of human actions that have greatly increased greenhouse gas emissions and caused climate change. Adaptation and mitigation strategies such as lowering greenhouse gas emissions, encouraging land use, and strengthening resistance to climate-related hazards are essential to addressing the problems caused by climate change. A thorough understanding of the climatic system and the social and economic settings in which climate change happens is necessary for effective adaptation and mitigation.

2.3.1 Overview of climate change

One of the most important worldwide issues of our day is climate change. Its effects are more severe in places like Southern Africa. One of the Southern African nations most at risk from climate change is Zimbabwe. On timeframes ranging from decades to millennia, climate change is a natural process that regulates the climate of our planet. Jaramillo and Mendoza-Ponce (2022) state that the greenhouse effect drives this process in which some atmospheric gases retain radiation in the atmosphere. Risk (2021) mentioned that the country has experienced more frequent droughts, heat waves, and cyclones in recent years. For example, Cyclone Idai in 2019 caused massive destruction in Chimanimani and other districts, leading to loss of lives, crops,

and infrastructure. Changes in the Earth's system naturally caused distress in the Earth's energy balance.

The many feedback processes involved in the process will determine how the climate system reacts. A climate forcing that differs from a straightforward linear response will result from the interaction of positive and negative feedback processes. According to Irfan et al. (2024), human activity disrupts the Earth's energy balance by releasing significant amounts of greenhouse gases. Storms, intense heat, floods, droughts, wildfires, and other climate-related phenomena are becoming more often as the climate shifts. These incidents demonstrate how livelihoods can be disrupted by climate change, further impoverishing populations. Crop yield, soil fertility, and water availability are all impacted by climate change. The primary source of food and revenue for Zimbabwe's smallholder farmers, rain-fed agriculture, is becoming less dependable. Lower yields and more food insecurity result from farmers' inability to plan their planting and harvesting due to the shorter and less predictable wet season. Human health is also fundamentally threatened by climate change. The World Health Organization (2023) states that all facets of human and natural systems, including social and economic circumstances and the operation of health systems, are impacted by climate change in addition to the physical environment. As a result, it is a threat multiplier that might undo decades of advancements in health.

2.3.2 Global perspectives on climate change

It is well acknowledged that one of the biggest risks to agriculture and food systems is climate change. Crop yields, animal production, and fisheries are already being impacted by rising temperatures, shifting rainfall patterns, and an increase in extreme weather. According to FAO (2023), since the 1960s, climate change has decreased agricultural productivity worldwide by roughly 21%, with tropical regions suffering the worst losses. The Intergovernmental Panel on Climate Change (2022) emphasises that adaptation must consider technological, financial, institutional, and socio-cultural feasibility to be effective. Barclay et al. (2017) research on adaptation feasibility highlights that even well-intended interventions can fail when they ignore context, scale, appropriate resources, or the community capacities.

One of the most visible global impacts is the shift in crop suitability. Staple crops such as maize, wheat, and rice are sensitive to temperature and rainfall changes. Studies by Zhao et al. (2017) show that maize yields could decline by up to 24% globally by 2050 if emissions continue at current levels. Wheat and rice are also at risk, particularly in Asia and Africa, hence this threatens global food security, especially for populations that depend on these staples. Sakrand (2025) mentioned that livestock systems are also affected due to heat stress that reduces milk production, fertility, and animal health. Also, diseases such as foot-and-mouth and tick-borne illnesses are spreading to new areas due to warmer conditions. Fisheries face similar challenges, with ocean warming and acidification reducing fish stocks and threatening coastal communities.

Climate change also affects global trade and food prices. Extreme events disrupt supply chains, reduce harvests, and increase costs. For instance, global price surges brought on by droughts in large grain-producing nations like the US and Australia have disproportionately affected developing nations. According to the IPCC (2019), the sector produces about 23% of global greenhouse gas emissions, mainly from livestock, fertilizers, and deforestation. This means that agriculture must both adapt to climate change and reduce its own emissions. Climate-smart agriculture integrates mitigation and adaptation is being promoted worldwide as a solution.

2.3.3 Regional impacts of climate change on Sub-Saharan Africa

One of the areas most at risk from climate change is Sub-Saharan Africa. The majority of people rely on agriculture as their primary source of income in rural areas, and it also makes a substantial contribution to national economies. However, most farming in Sub-Saharan Africa is rain-fed, meaning it depends directly on rainfall patterns. This makes the region highly sensitive to climate variability. According to Serdeczny et al. (2017), average temperatures in Sub-Saharan Africa have increased by about 1°C over the past century, and projections suggest further rises of 1.53°C by 2050. Rainfall patterns are shifting, with some areas experiencing prolonged droughts while others face intense flooding. These changes disrupt planting and harvesting cycles, making farming less predictable. For example, East Africa has seen more frequent floods, while Southern Africa, including Zimbabwe, has faced repeated droughts. Staple crops such as maize, sorghum, millet, and cassava are highly vulnerable. Studies by Sloot et al. (2024) show that maize yields could decline by 2030% in Sub-Saharan Africa by mid-century if

adaptation measures are not adopted. Sorghum and millet, which are more drought-tolerant, may perform better, but they are less preferred by consumers. Cash crops like coffee and cocoa are also at risk with changing temperatures affecting quality and production zones.

Livestock systems are affected by heat stress, reduced pasture availability, and increased disease outbreaks. In pastoral communities, droughts force households to migrate in search of water and grazing, leading to conflicts over resources. Fisheries are also impacted by warming waters, reducing fish stocks in lakes and coastal areas. This threatens protein sources for millions of people. In Sub-Saharan Africa, climate change exacerbates food insecurity. Omokpariola et al. (2025) claim that hunger has already grown and agricultural output has decreased due to climate change. Because they spend a significant portion of their income on food, poor households are most affected by price rises brought on by climatic shocks. Williams et al. (2019) state that poverty and inequality deepen as vulnerable groups, especially women and youth, struggle to adapt to climate change.

2.4 Definition of adaptation to climate change

The Intergovernmental Panel on Climate Change (IPCC, 2022) defines adaptation as actions that help societies cope with climate risks like droughts, floods, heat waves, and cyclones. For smallholder farmers in Zimbabwe, adaptation is not just a theoretical concept, it is a daily reality. Climate change has already altered rainfall patterns, shortened growing seasons and increased the frequency of extreme events. Farmers in Chanuhwa village, Ward 17, Chimanimani have experienced these changes directly, especially during Cyclone Idai in 2019, which destroyed crops, homes, as well as infrastructure. For smallholder farmers in Chanuhwa village, adaptation means finding practical solutions to cope with droughts, floods, and cyclones while ensuring food security and sustainable development. It is both a necessity and an opportunity to build stronger, more resilient communities. Ncube et al. (2017) highlighted that without adaptation, households face food insecurity, poverty, and loss of livelihoods; therefore, adaptation becomes a survival strategy.

Individuals, communities, and institutions can all undergo adaptation. Both short-term and long-term adaptation are possible. Chikosi et al. (2017) state that short-term adaptation includes

immediate actions like replanting crops after a flood or using mulching to retain soil moisture. Long-term adaptation involves structural changes such as building irrigation systems, reforming land tenure policies, or investing in renewable energy. Adaptive capacity is an important aspect of adaptation, which is the ability of households and communities to adjust to climate change. According to Mubaya and Mafongoya (2017), adaptive ability is dependent on resource availability, knowledge, technology and institutions. In Zimbabwe, adaptive capacity is often limited by poverty, weak institutions, and poor infrastructure. Farmers may know what needs to be done but lack the means to do it.

2.4.1 Types of adaptation strategies

Since the effects of climate change are a major obstacle to sustainable urban development, ecosystem-based adaptation such as utilising ecosystem services and biodiversity is increasingly being explored as a substitute for conventional, engineering-based methods. However, according to Zolch et al. (2018), there is a dearth of empirical information about the efficiency and uptake of ecosystem-based adaptation in strategic adaptation planning, and there has been minimal study conducted in urban settings. The particular methods and techniques utilised to deal with climate change are known as adaptation strategies. In order to build resilience and secure sustainable livelihoods, smallholder farmers in Chanuhwa village used autonomous, planned, reactive, and community-based tactics. Intergovernmental Panel on Climate Change (2022) defines autonomous adaptation as natural actions taken by individuals or communities without external support. Farmers often adjust planting dates, switch crops, and use traditional coping mechanisms based on their experience. Autonomous adaptation is important because it builds on local knowledge but it is limited by resources and may not be enough to deal with severe climate shocks.

2.4.1.1 Planned adaptation

Planned adaptation involves deliberate actions supported by institutions, policies, and external funding. Governments, Non-Governmental Organisations and development agencies design programs to help farmers adopt new practices that include conservation agriculture projects, irrigation schemes, and distribution of improved seeds. In Zimbabwe, Non-Governmental

Organisations such as Towards Sustainable Use of Resource Organisation (TSURO Trust) have introduced small irrigation systems and farmer training programs in Chimanimani to support planned adaptation, which is being taken into action by Chanuhwa smallholder farmers. According to studies by Rahman et al. (2018), Bangladesh is frequently regarded as one of the world's most climate-vulnerable nations, and both the government and the impacted people are pursuing a number of steps to promote climate adaptation.

As a result, other national and regional development plans and activities, as well as other globally guided adaptation planning, have influenced and assisted the planned adaptation decisions and measures being made for the northeastern floodplain. According to Kamal et al. (2018), these various processes have guided the planned adaptation actions in the floodplain region in three ways: institutional capacity building to address local adaptation needs, soft technology-based adaptation action to create locally available adaptation, and hard infrastructure development through engineered construction projects designed to extend physical protections against climate change impacts.

2.4.1.2Autonomous adaptation

Autonomous adaptation, which is based on how the impacted communities perceive and define their vulnerability to climate change, is how climate-affected communities intervene with spontaneous responses to climate effects when they lack the capacity to organise planned adaptation efforts. According to Rahman et al. (2018), community members in the floodplain feel more exposed to the effects of climate change if they have fewer opportunities for employment, an excessive reliance on natural resources, high crop diversity, low crop rotation, and crop losses as a result of both climatic and non-climatic change impacts. However, as Rahman et al. (2018c) point out, livelihood diversification's efficacy as an independent adaptation strategy depends on the outside assistance provided by larger market systems. Therefore, there is still a gap in the use and efficacy of planned and autonomous adaptation measures in Chanuhwa village, which this study will examine.

2.4.1.3 Reactive adaptation

Local farmers' ability to adapt to climate change events directly affects the challenges of climate change in developing nations and its associated effects on agriculture. According to Jian et al. (2022), farmers' decisions about adaptability are significantly influenced by their view of themselves as fundamental producers. Reactive adaptation occurs after a climate shock has already happened; for instance, farmers may rebuild homes, replant crops, and sell livestock after a flood or drought. Tinch et al. (2024) define reactive adaptation as specific changes made by an individual in response to direct negative climate experiences, targeting known risks to alleviate negative impacts once they have occurred. Reactive adaptation is often costly and less effective because it happens after damage has occurred. After Cyclone Idai in 2019, the adoption of climate change initiatives remains a gap, particularly in Chanuhwa village, which this study seeks to bridge by identifying the implemented initiatives and their effectiveness in enhancing resilience.

2.4.1.4 Community-based adaptation

This approach is built on local knowledge and priorities, making adaptation more relevant and sustainable as the community will be involved in planning and implementation of the strategies. The goal of community-based adaptation to climate change, according to Forsyth (2017), is to involve vulnerable individuals in the development and execution of adaption plans. Simple, easily available technology, like storing waters during flooding, are the most visible examples of CBA. According to Rafique and Khoo (2018), certain international organisations and development non-governmental organisations have advocated CBA as a way to highlight the significance of participatory and deliberative approaches in climate change adaptation.

As a means for communities to address the growing risks and intricate demands presented by climate change, community-based adaptation has garnered substantial interest on a global scale. In addition to the worsening of vulnerability brought on by top-down adaptation strategies, this bottom-up approach offers an alternative to the long-term dependence on and general inefficiency of mitigation techniques to slow down climate change. This study aims to close the knowledge gap about community-based adaptation's efficacy, as stated by Clarke et al. (2019).

Community-based adaptation is exemplified by farmer field schools and community seed banks in Zimbabwe.

2.4.1.5 Transformational adaptation

Transformational adaptations can happen in front of risks as well as during and after severe climate change consequences. Galvin (2021) asserts that when transformative adaptations are intentional, they are usually planned and carried out collaboratively, but they can also arise from independent adaptations made by people and organisations. They typically involve technological, behavioural, and institutional changes. Some scholars like Hadarits et al. (2017) define transformational adaptation as a deep-structural change in systems and institutions to deal with climate change, for example, reforming land tenure policies, shifting to renewable energy, and redesigning agricultural systems to be more resilient. Transformational adaptation is necessary when incremental changes are insufficient to cope with severe climate risks. According to Patterson et al. (2017), transformational adaptations support sustainability by altering the structural and functional elements of social-ecological systems in ways that result in novel interactions and consequences.

2.4.2 Climate change adaptation strategies

Despite the multitude of barriers, various adaptation initiatives have been implemented in Chimanimani District to enhance the resilience of smallholder farming communities. These interventions encompass a range of approaches, ranging from technological, environmental solutions to institutional capacity building, though specific details about initiatives exclusively targeting Chanuhwa village are limited in the available literature, which this study will provide, such as the awareness and knowledge smallholder farmers possess and the currently implemented initiatives, as well as their effectiveness. Mavhura et al. (2017) state that the adaptation landscape in the district reflects a combination of local knowledge and externally driven interventions, with varying degrees of effectiveness and community ownership.

Irrigation development represents a cornerstone of climate adaptation strategies in the drier parts of Chimanimani District. Chikosi et al. (2019) state that several irrigation schemes have been established in areas with more reliable water sources, including farmers in Nyanyadzi (Ward 8),

Chakohwa (Ward 3), Mutambara (Ward 4), and Mhandarume-Mashowani (Ward 2) use open canals to irrigate their holdings with water drawn from neighbouring big rivers. Mujeyi et al. (2021) state that these irrigation schemes provide a crucial buffer against rainfall variability, allowing farmers to maintain agricultural production during dry spells and in the dry season. However, the extent to which Chanuhwa smallholder farmers benefits from such irrigation infrastructure remains unclear from the available literature, suggesting potential gaps in water infrastructure development in this specific Ward. Ncube et al. (2016) highlighted that the presence of major rivers in the district provides opportunities for expanding irrigation infrastructure to currently underserved areas, including potentially Chanuhwa smallholder farmers, though such expansion would require significant financial investment and technical support.

Diversification initiatives represent another important strand of adaptation interventions in Chimanimani District. Chikosi et al. (2019) mention that multiple fishery projects have been introduced as alternative livelihood options to reduce dependence on rain-fed agriculture; for instance, apt the Mhandarume-Mashowani irrigation scheme in Ward 3 next to Wengezi, nine fish ponds were constructed with funding from World Vision. Mujeyi et al. (2021) state that these integrated livelihood approaches recognize the importance of building resilience through diversified income sources and nutritional options. While there is a gap whether similar initiatives have been implemented in Chanuhwa village Ward 17, the documented presence of such programs in other parts of the district suggests potential models that could be adapted to the specific context of Chanuhwa. According to Mubaya and Mafongoya (2017) other diversification strategies potentially relevant to Chanuhwa village include drought-resistant crop varieties, conservation agriculture practices and small livestock rearing, though further research would be needed to document the specific initiatives implemented in this particular village and the effectiveness of these adaptation initiatives.

2.4.3 Importance of adaptation in smallholder communities

The process of adjusting to the effects of climate change in order to minimise harm and seize potential opportunities is known as adaptation. Ogundeji (2022) emphasised that without adaptation, the livelihoods of smallholder farmers in Africa who depend on rain-fed agriculture which is extremely vulnerable to variations in temperature and rainfall are in harm. Chanza et al.

(2020) state that in Chanuhwa village, Ward 17, Chimanimani District, adaptation is especially important because the area has been hit hard by climate events like Cyclone Idai. Many households lost their homes, crops, and livestock. Recovery has been slow and farmers need support to rebuild their livelihoods. According to Madamombe et al. (2024), adaptation strategies such as agroforestry, crop diversification and early warning systems can help communities become more resilient.

Farmers can overcome obstacles including a lack of resources and inadequate institutional capability by adapting. To lessen reliance on rainfall, farmers can, for instance, establish minor irrigation systems, employ conservation farming practices, and convert to drought-resistant crops. These methods boost water efficiency, strengthen soil health, and shield crops from climate shocks. Climate-smart agriculture has improved food security and income for smallholder maize farmers in Sub-Saharan Africa, according to a study by Mnukwa et al. (2025). For smallholder communities, adaptation is essential because it guarantees food security and reduces hunger. According to Lombe et al. (2024), proactive adaptation techniques, like using enhanced seed types and drought-resistant crops, have been demonstrated to lower the prevalence of hunger in some areas. It stabilises food production in the face of erratic, rain-fed agriculture, allowing for self-sufficiency.

However, adaptation also involves strengthening social networks, improving access to credit and building partnerships with NGOs and government agencies. Farmers need training, tools, and financial support to adopt new practices. As highlighted by Tengapoe et al. (2024), community-based adaptation, where locals participate in the planning process and decision-making, is effective because it builds on local knowledge and priorities. Hence, this study will focus on identifying the climate change adaptation initiatives that are being implemented in Chanuhwa village and evaluate their effectiveness in improving resilience of smallholder farmers.

2.4.4 Technological intervention for adaptation to climate change

Technology plays a central role in helping farmers adapt to climate change. According to Food and Agriculture Organisation of the United Nations (2021), in Zimbabwe, technological interventions provide tools and systems that reduce vulnerability, improve productivity and build resilience. These interventions range from simple innovations such as improved seed varieties to

advanced systems like satellite-based weather forecasting. Mushore et al. (2021) state that the effectiveness of technology depends on accessibility, affordability, and relevance to local conditions.

The creation and dissemination of crop types that are resistant to heat and drought is one of the most significant technological initiatives. Mushore et al. (2021) state that research institutions and seed companies have produced maize, sorghum and millet varieties that can withstand dry conditions and pests. However, access is limited by cost and distribution networks, meaning many households still rely on traditional seeds. In Chimanimani, farmers are encouraged to cultivate little grains that can withstand drought better than maize. Also, crop diversifying reduces risk by spreading production across different species for example, farmers can grow maize alongside sorghum, millet, beans, and vegetables so that if one crop fails due to drought or pests the others may survive. According to Vernooy (2022), crop diversification is still less evident in its effectiveness concerning positive livelihood and resilience, which this study will fill in. However, the adoption of these seed varieties and their effectiveness remains a gap in areas like Chanuhwa village, Biriiri Ward 17, Chimanimani, hence this study will address the gap.

The achievement of the 2030 Sustainable Development Goals of the United Nations depends on water. Another crucial intervention is irrigation technology; treadle pumps and other small-scale irrigation systems, drip irrigation, and gravity-fed schemes help increase resilience to farmers by reducing dependence on erratic rainfall, hence enabling dry season production. According to the World Bank (2020), in Chimanimani, Non-Governmental Organisations such as Plan International, TSURO Trust and World Vision have introduced small irrigation projects that allow farmers to grow vegetables and cash crops even during dry spells. These systems improve food security and income but require investment and maintenance which can be challenging for poor households. According to Angom and Viswanathan (2023) adoption of these irrigation treatments is hampered by current land tenure and cultural concerns, restricted access to credit services and effective irrigation technologies, and an excessive dependence on national governments for assistance. The effectiveness of these irrigation technologies is also concealed in places like Chanuhwa village, Ward 17, which adopted them; therefore, this study will

examine the efficiency. One of the approaches that can be also used to adapt to climatic pattern is in-filled water harvesting. Rainwater harvesting improves water availability during dry spells and enhances soil moisture, making it a cost-effective adaptation strategy for areas with variable rainfall. Intergovernmental Panel for Climate Change (2022) states that rainwater harvesting technologies, such as tanks, dams and contour ridges, help farmers capture and store water for later use. These systems might be useful in areas with erratic rainfall, such as Chimanimani, Biriiri Ward 17. In Chanuhwa, farmers can use harvested water for irrigation, livestock, and household needs, which therefore reduces vulnerability to drought and leads to improved resilience. However, the implementation and effectiveness of these remains hidden. This study will fill the gap. Gezie (2019) emphasised that minimising crop production's susceptibility to climate variability requires climate-smart adaptation through better water conservation and management techniques for agriculture.

Farmers may access market pricing, weather predictions, and farming advice via mobile phones and radio programs. Farmers can make better judgements about planting, harvesting, and selling crops when they have access to timely information. For example, in Chimanimani District, a radio station was introduced soon after Cyclone Idai 2019; therefore, by helping weather alerts warn farmers about upcoming droughts and floods, allowing them to prepare. According to the Intergovernmental Panel on Climate Change (2022), Information Communication Technologies also connect farmers to market, extension services, and training programs, reducing isolation and improving knowledge. Additionally, Higon et al. (2017) discovered that ICT can lower CO2 emissions globally through the development of smarter cities, transportation networks, electrical grids, industrial processes, and energy-saving improvements. Solar-powered irrigation and household energy systems enhance adaptation by providing reliable energy while reducing emissions and long-term costs, contributing to mitigation efforts. According to the World Bank (2020), solar energy is increasingly used in rural Zimbabwe to power irrigation pumps, household lighting, and small businesses. Solar-powered irrigation reduces dependence on unreliable electricity and provides a sustainable energy source.

Sub-Saharan African farmers employ storage facilities to preserve the safety and quality of their crops. Post-harvest technologies that improve storage and processing are important for reducing

losses and increasing income. The Food and Agriculture Organisation of the United Nations (2018) highlighted that, improved granaries, silos, and hermetic bags protect crops from pests and moisture. Processing equipment, such as grinders and oil presses, adds value to crops and creates new income opportunities.

2.4.5 Role of Stakeholders in Adaptation Initiatives

It is commonly acknowledged that climate adaptation is a multi-level governance challenge that necessitates cooperation amongst national authorities, local authorities, civil society, and market actors. Farmers to achieve adaptation it requires the involvement of multiple stakeholders who provide resources, knowledge, policies, and support systems. Intergovernmental Panel on Climate Change (2022) state that, in Zimbabwe, the success of adaptation initiatives depends on the combined efforts of government agencies, NGOs, and community-based organisations, the private sector, and local communities themselves, since each stakeholder plays a unique role and their collaboration is essential for building resilience in vulnerable areas such as Chanuhwa village, Chimanimani District.

2.4.5.1 Government Agencies

Government agencies are central to adaptation because they set policies, mobilise resources, and provide institutional support. Government of Zimbabwe (2021) highlighted that, in Zimbabwe, the Ministry of Lands, Agriculture, Fisheries, Water, and Rural Development is responsible for promoting climate-smart agriculture and supporting smallholder farmers. According to the literature from the World Bank (2021), programs that include pfumvudza encourage conservation farming practices like mulching, crop rotation, and minimum tillage. These initiatives aim to improve yields under drought conditions and reduce vulnerability. However, the literature highlighted that implementation has been slow in Chimanimani district, Chanuhwa village, Ward 17, when Cyclone Idai 2019 hit, due to limited funding and weak institutional capacity.

Government agencies also manage irrigation schemes, distribute inputs, and provide extension services. According to Chanza and Wit (2019), extension services play a important role in supporting climate adaptation in Chimanimani District, with AGRITEX officers providing technical guidance on appropriate farming practices for changing climatic conditions. Perez et al. (2020) highlighted that these services represent a critical knowledge bridge between formal

research institutions and local farming communities, facilitating the co-generation and transfer of contextually appropriate adaptation knowledge. Extension officers are tasked with training farmers on new practices, though coverage is often limited in remote areas. Local government structures such as rural district councils play a role in coordinating adaptation projects and mobilising communities. The Government of Zimbabwe (2017) states that policies such as the National Climate Policy (2017) and the National Adaptation Plan provide frameworks for integrating climate considerations into development planning.

2.4.5.2 NGOs and Community-Based Organisations

Community-based organisations (CBOs) and non-governmental organisations (NGOs) are essential in promoting adaptation at the local level. The United Nations Development Programme (2019) mentioned that they often introduce innovative projects, provide training, and mobilise resources where government support is limited. According to the Food and Agriculture Organisation of the United Nations (2018), in Chimanimani, NGOs have introduced small-scale irrigation schemes, promoted agroforestry, and supported farmer field schools. These initiatives help farmers diversify crops, conserve soil, and improve resilience to droughts and floods. Community-based organisations such as farmer associations, church groups, and cooperatives strengthen social networks and collective action. They organise training sessions, share resources, and promote local solutions. The International Organisation for Migration (2019) mentioned that after Cyclone Idai, Community-Based Organisations in Chanuhwa village helped mobilise recovery efforts, rebuild infrastructure, and provide psychosocial support. Their role shows the importance of community-driven adaptation however, the implementation of these initiatives is a gap that this study will bridge.

NGOs also advocate for policy changes and raise awareness about climate risks. International NGOs such as FAO and CARE have supported climate-smart agriculture projects in Zimbabwe, while local NGOs focus on specific communities. CARE International (2020) states that the strength of NGOs and Community-Based Organisations lies in their ability to reach vulnerable households, empower women and youth, and promote inclusive adaptation.

2.4.5.3 Private Sector Involvement

The private sector contributes to adaptation through investment, innovation, and market development. International Fund for Agricultural Development (2019) states that seed companies develop and distribute drought-tolerant crop varieties while agri-businesses provide inputs such as fertilizers and pesticides. The World Bank (2021) claims that financial institutions assist farmers in investing in adaptation and recovering from shocks by providing credit and insurance products. According to the Food and Agriculture Organisation of the United Nations (2019), private businesses have launched mobile applications in Zimbabwe that offer market prices, weather forecasts, and farming guidance. These technologies improve decision-making and reduce vulnerability. Solar energy companies supply affordable solutions for irrigation and household use, reducing dependence on unreliable electricity.

Value chain development is also influenced by the private sector. By creating markets for smallholder produce, companies provide incentives for farmers to adopt new practices. For example, buyers of small grains encourage farmers to diversify crops, improving resilience to drought. However, private sector involvement is often limited by economic instability and weak infrastructure.

2.4.5.4 Community Engagement and Participation

Initiatives for adaptation are centred on local communities. Since farmers are the ones who are most directly impacted by climate change, their involvement guarantees that strategies are applicable and long-lasting. Chanza and Chigona (2017) state that community engagement comprises involving farmers in planning, decision-making, and implementation, which helps in building ownership and increases the likelihood of success. In Chanuhwa village, community participation has been evident in soil conservation projects, agroforestry, and recovery efforts after Cyclone Idai. Farmers share indigenous knowledge, cooperate in building contour ridges, and support each other during crises. According to Mapfumo et al. (2017), community seed banks and farmer field schools are participatory adaptations that build resilience.

Since women are essential to household nutrition and food production, it is especially crucial to engage women and young people, while youth provide labour and innovation. Inclusive

adaptation initiatives empower these groups and strengthen community resilience. Community engagement also builds trust between farmers and institutions. Farmers are more likely to adopt new methods when they participate in project design. Participatory approaches ensure that adaptation reflects local priorities and cultural values. Furthermore, according to Mavhura et al. (2017), the inclusion of traditional leadership structures in the design and execution of adaptation may improve the cultural suitability and community ownership of interventions, though the specific mechanisms for traditional leader engagement in Chanuhwa village are not detailed; thus, this study will provide the details. Chikosi et al. (2019) state that the presence of multiple chieftainships in the district, each with its own territorial powers and governance approaches, creates a complex institutional landscape that influences the implementation and effectiveness of adaptation initiatives across different Wards.

2.4.6 Feasibility of Adaptation Initiatives

The practicality, attainability, and sustainability of climate change adaptation techniques in real-world contexts are referred to as their feasibility. According to the Food and Agriculture Organization of the United Nations (2018), the viability of smallholder farming in Zimbabwe, particularly in Chanuhwa village, Biriiri Ward 17, Chimanimani District, depends on a number of factors, including the availability of resources, institutional support, community participation, and long-term sustainability. Many adaptation strategies have been proposed, but their success depends on whether they can be realistically implemented in vulnerable rural communities. Adaptation initiatives often require financial investment. Technologies like irrigation systems, improved seed varieties, and renewable energy solutions can be expensive for smallholder farmers. Programs such as Pfumvudza/Intwasa have provided inputs like seeds and fertilizers but coverage is uneven and sometimes delayed thus, for adaptation to be feasible, initiatives must be affordable and supported by financial mechanisms such as microcredit, subsidies, or community savings groups for example in areas like Chanuhwa village there should be proposed actions to improve resilience to climate change adaptations which this study will help in filling the gap of proposing those actions.

Adaptation strategies must be technically suitable for local conditions. For example, irrigation systems require reliable water sources, which may be lacking in drought-prone areas. Improved

seed varieties must match local soils and climate. According to Nyamangara et al. (2019), conservation agriculture practices like mulching and minimum tillage are technically feasible but require training and labour. Mureithi and Chagumaira (2018) mentioned that in Chanuhwa village, Ward 17, steep slopes and fragile soils make soil conservation practices essential, but farmers need technical support to implement them effectively, the feasibility of technical strategies in Chanuhwa village, Chimanimani district, depends on whether technologies and practices are adapted to local realities, which is the information lacking within some literature that this study seeks to address.

In order to facilitate adaptation, institutions are essential. According to the United Nations Development Programme (2020), extension services, NGOs, and local government provide training, inputs, and technical advice. However, Chanza and Wit (2019) highlighted that institutional capacity in Zimbabwe is often weak; extension officers are few, resources are limited, and coordination among agencies is poor. In Chimanimani, NGOs introduced small irrigation schemes and conservation farming projects, but coverage was limited; hence, for adaptation to be feasible, institutions must be strengthened, coordination improved, and policies implemented effectively. Strong institutions ensure that adaptation initiatives reach vulnerable households and are sustained over time.

Adaptation initiatives must be acceptable to communities and fit within social and cultural contexts. Chanza and De Wit (2016) assert that farmers are more inclined to embrace customs and priorities. For instance, tiny grains that can withstand drought better than maize are millet and sorghum. Mapfumo et al. (2017) state that many households prefer maize due to taste and cultural significance, adoption of small grains requires awareness campaigns and incentives. The Food and Agriculture Organisation of the United Nations (2018) states that as women are crucial to farming but frequently lack access to land and credit, gender and youth involvement are particularly crucial. Youth migration reduces labour availability. Feasible adaptation initiatives must empower women and youth, build on local knowledge and respect cultural practices, this study will evaluate the degree of climate change awareness and knowledge in Chanuhwa village. The effectiveness of adaptation efforts is influenced by political will and governmental policies. Zimbabwe has created policies including the National Climate Policy and the National

Adaptation Plan, according to the Government of Zimbabwe (2017); however, implementation has been sluggish and there is a dearth of data on implementation, which this study will fill in by providing information on the implementation of these adaptation initiatives.

2.4.7 Criteria for assessing feasibility

It is crucial to evaluate the viability of climate change adaptation programs for smallholder farmers by taking into account the techniques' practicality, affordable, socially acceptable, environmentally sustainable, and free from major barriers. This section outlines four key criteria for assessing feasibility, which are economic viability, social acceptability, environmental sustainability, and barriers to implementation in smallholder contexts.The degree to which climate change adaptation programs are accessible, financially sustainable, and able to enhance smallholder farmers' standard of living is referred to as economic viability. In rural communities such as Biriiri Chanuhwa, where households largely depend on subsistence farming and limited cash income, adaptation strategies must be low-cost and accessible. Financial constraints are a significant barrier to adaptation in underdeveloped nations, according to the Intergovernmental Panel on Climate Change (2022), especially for smallholder farmers who lack established credit institutions and savings. This implies that capital-intensive technologies such as mechanised irrigation systems or heavy agricultural machinery may be feasible in Biriiri Ward 17, Chanuhwa village, when there is external support from the government or donor support.

Conversely, low-cost methods like crop diversification, conservation agriculture, and small-scale irrigation are more economically realistic because they rely on locally available resources and family labour. Programmes such as Pfumvudza/Intwasa introduced by the Government of Zimbabwe promote minimum tillage, mulching, and efficient input use as low-cost resilience strategies. According to the World Bank (2021), improving access to climate-resilient agricultural inputs and rural finance systems is critical for strengthening adaptation in Zimbabwe. Therefore, in assessing feasibility in Chanuhwa village, it is essential to evaluate whether farmers can consistently access inputs, credit facilities, and reliable markets to sustain adaptation initiatives beyond short-term assistance.

Social acceptability is the degree to which adaptation initiatives align with local cultural values, gender norms, and community priorities. Adaptation strategies are unlikely to succeed if they conflict with established food preferences, traditional farming systems, or social structures, for example, although small grains like sorghum and millet are more drought-tolerant than maize, maize remains the preferred staple crop in many Zimbabwean rural communities. The Food and Agriculture Organisation of the United Nations (2021) stresses that successful adaptation requires integrating local knowledge and respecting community food systems. Thus, this study will spell out the awareness as well as knowledge on climate change that smallholder farmers in Chanuhwa village possess.

Gender dynamics also significantly influence social acceptability. In rural Zimbabwe, women are crucial to agricultural production, yet they frequently encounter obstacles when trying to obtain land, financing, and extension services. The United Nations Development Programme (2019) notes that adaptation initiatives that fail to address gender inequalities tend to reinforce vulnerability rather than reduce it. In the context of Chanuhwa village, assessing feasibility therefore requires examining whether women and young people actively participate in the decision-making process for adaptation and whether initiatives promote inclusive participation. Community ownership, especially through local farmer groups and churches that played a role during recovery after Cyclone Idai, further strengthens social feasibility by enhancing trust and local commitment.

Environmental sustainability concerns adaptation initiatives protect ecosystems and natural resources while enhancing long-term resilience. In fragile environments such as Chimanimani District, unsustainable practices such as deforestation, stream bank cultivation, or poorly managed irrigation may provide short-term benefits but increase vulnerability over time. The Intergovernmental Panel on Climate Change (2022) highlights ecosystem-based adaptation, including agroforestry and soil conservation, as essential for building resilience in climate-vulnerable regions. Chanuhwa village is prone to soil erosion, land degradation and flooding, risks that were exposed during Cyclone Idai in 2019. Conservation agriculture supports long-term productivity by strengthening soil structure, increasing water retention, and lowering erosion. Agroforestry systems that integrate trees into farming landscapes help stabilise soils and diversify livelihoods through firewood, fruit and fodder production. According to the Food and

Agriculture Organisation of the United Nations (2021) resilient agri-food systems depend on sustainable land and water management practices. Therefore, assessing feasibility in Chanuhwa village requires evaluating whether adaptation initiatives restore ecosystems and prevent further environmental degradation.

2.4.8 Frameworks for feasibility evaluation

Evaluation frameworks strengthen feasibility assessment by providing structured analytical approaches. Results-Based Management (RBM) shifts attention from activities to measurable outcomes and impacts. In the context of Biriiri, RBM would require clearly defined objectives such as increased drought resilience, improved household food security, and reduced soil erosion, hence by linking inputs (such as seeds and training) to outputs (farmers trained), outcomes (increased adoption), and impacts (improved resilience). According to the World Bank (2021), RBM helps determine whether adaptation initiatives produce meaningful change relative to the resources invested. This is critical in assessing whether scaling up interventions in Chimanimani District is justified

The Logical Framework Approach (LFA) complements this by organising interventions into a cause-and-effect chain. For example, if drought-tolerant crops are distributed, the assumption may be that farmers will adopt them and experience stable yields during dry seasons. However, monitoring may reveal barriers such as a lack of markets or inadequate knowledge. The Logical Framework Approach enables the researcher to identify where breakdowns occur and whether the initiative is practically workable. Theory of Change (ToC) adds depth by mapping the pathways through which adaptation interventions are expected to produce resilience outcomes. In Chanuhwa village, ToC might explain how promoting agroforestry improves soil stability, which in turn reduces landslide risk and enhances agricultural productivity. Participatory Monitoring and Evaluation is relevant in rural Zimbabwe since it involves farmers directly in assessing progress and outcomes. Food and Agriculture Organisation (FAO, 2018) emphasises community participation, which strengthens ownership, ensures incorporated context-specific knowledge, and enhances long-term sustainability. The World Bank (2017) notes that participatory and results-oriented evaluation frameworks are essential for climate adaptation projects in vulnerable rural communities.

2.4.9 Indicators of success for adaptation initiatives

Indicators are measurable signs that show whether adaptation programs are achieving their objectives. They can be quantitative (numbers, percentages) or qualitative (perceptions, experiences. Chanuhwa village lies within a highly vulnerable agro-ecological zone in Zimbabwe, characterised by mountainous terrain, fragile soils, rainfall variability, and exposure to cyclones and landslides. Because of these conditions, adaptation initiatives must produce measurable improvements in resilience.The Intergovernmental Panel on Climate Change (2018) states that reinforced resilience mechanisms, increased adaptive capability, and decreased vulnerability should be used to assess adaptation success. As a result, indicators become the operational instruments for figuring out whether or not these changes are truly taking place.

Agricultural productivity indicators are central in Biriiri ward 17, Chanuhwa village because most households depend on rain-fed subsistence farming, if adaptation initiatives such as conservation agriculture or small grain production are feasible, they should result in observable improvements in yield stability, particularly during below-average rainfall seasons. Yield per hectare, crop survival rates during dry spells and reductions in post-harvest losses provide measurable proof of technical feasibility. However, productivity must be assessed comparatively for example, if small grains perform better than maize under drought conditions, this suggests climate suitability. If no significant difference is observed, the technical advantage involvement may be limited. The Food and Agriculture Organisation (2017) emphasises that agricultural adaptation indicators must focus on average yield increases and also on variability reduction, since resilience is reflected in stability rather than peak productivity.

Resilience indicators are equally critical in Chanuhwa village. Indicators of resilience include households' capacity to bounce back from droughts, cyclones, and floods the length of time required to restore agricultural production and reductions in reliance on emergency food aid. These indicators reflect adaptive capacity rather than short-term gains. The United Nations Framework Convention on Climate Change (2017) highlights that adaptation monitoring should measure long-term vulnerability reduction and recovery capacity. Therefore, if households adopting adaptation strategies recover more quickly after climate shocks than non-adopters, the feasibility is strengthened.

Economic indicators deepen the feasibility analysis by addressing affordability and sustainability. Many smallholder farmers in Chanuhwa village operate under financial constraints, so adaptation initiatives must generate economic returns that justify their costs. Indicators such as net household income, diversification of livelihoods, input-output ratios and market access help determine whether interventions are financially sustainable. For example, if drought-tolerant crops increase yields but have poor market demand, income gains may be negligible. In such a case, technical success fails to translate into economic feasibility. The World Bank (2017) stresses that adaptation initiatives must demonstrate cost-effectiveness and livelihood improvement to justify scaling up. Therefore, cost-benefit analysis becomes an essential evaluative component.

Social indicators are fundamental because adaptation success depends on human behaviour. Adoption rates are often the clearest signal of feasibility in the sense that if a large proportion of farmers voluntarily adopt conservation agriculture or agroforestry without coercion, this indicates social acceptance. However, adoption must also be examined across gender and age groups. Although they may have limited access to land, credit, and training, women in rural Zimbabwe frequently play a crucial role in agriculture. Women's involvement in decision-making, access to resources, and training program participation are indicators that show whether adaptation initiatives are inclusive. Social feasibility is strengthened when interventions align with cultural practices and community priorities. The United Nations Development Programme (2017) underscores that adaptation monitoring must incorporate gender-sensitive and participatory indicators to ensure equitable resilience building.

Environmental indicators are particularly important in Chanuhwa village due to the fragility of the mountainous ecosystem. Soil organic matter content, reduction in gully formation, vegetation cover, tree survival rates and water shed stability provide measurable evidence of ecological sustainability. An adaptation initiative that increases crop production but accelerates soil erosion would undermine long-term resilience therefore, environmental indicators help determine whether adaptation strengthens or degrades the natural resource base. The United Nations Environment Programme (2017) notes that ecosystem-based adaptation should be evaluated through indicators that measure both biodiversity conservation and livelihood benefits. In Biriiri,

where landslides and erosion are persistent threats, improvements in slope stabilisation and vegetation recovery directly signal feasibility.

Institutional indicators assess whether governance and support systems can sustain adaptation initiatives beyond project cycles. These include the frequency and quality of agricultural extension visits, functionality of local disaster risk reduction committees, coordination between local authorities and NGOs, and integration of adaptation into village-level development plans. If adaptation initiatives depend entirely on external donor funding without local institutional integration, long-term feasibility is compromised. Monitoring institutional performance helps determine whether adaptation efforts are embedded within Chimanimani governance structures. Feasibility is strongest when indicators show positive change simultaneously across technical, economic, social, environmental, and institutional domains. For example, increased small grain yields (technical) that raise household income (economic), are widely adopted (social), improve soil cover (environmental), and are supported by extension services (institutional) collectively demonstrate multidimensional feasibility.

2.4.10 Barriers to implementation of adaptation initiatives in Smallholder Contexts

Even when initiatives are economically viable, socially acceptable, and environmentally sustainable, barriers can prevent implementation. Smallholder farmers in Chimanimani District face a complicated web of obstacles that limit their capacity to successfully adjust to climate change. These obstacles function at several levels, ranging from institutional to individual, and they interact in ways that worsen vulnerability and thwart attempts at adaptation. Climate, money, infrastructure, generational change, water resources, ineffective bureaucracy, gender inequity, and health barriers are all interrelated barrier dynamics, according to Chikosi et al. (2019), these, challenges create a situation where even when adaptation technologies and knowledge are available, various impediments prevent their effective implementation and utilisation by vulnerable communities.

One of the biggest obstacles to Chimanimani District's successful climate adaption is a lack of funding. It is difficult for smallholder farmers to obtain the funds required to invest in adaptation technology like drought-resistant seeds, irrigation infrastructure, or alternate sources of income.

Mujeyi et al. (2021) state that this financial constraint is compounded by inadequate infrastructure, particularly in relation to water storage and distribution systems. While some irrigation schemes exist in the district, for example, Nyanyadzi in Ward 8, Chakohwa in Ward 3, Mutambara in Ward 4, and Mhandarume-Mashowani in Ward 2, many farmers, particularly those in more remote areas like Chanuhwa village, Ward 17, lack access to reliable irrigation infrastructure, leaving them dependent on increasingly erratic rainfall. Ncube et al. (2016) mentioned that the remoteness of communities also creates challenges in accessing markets for agricultural inputs and produce, further constraining economic opportunities and adaptive capacity.

A community's ability to effectively adapt to climate change may also be hampered by ineffective institutional arrangements and bureaucracy. Chikosi et al. (2019) state that inefficient bureaucracy and institutional arrangements present significant barriers to effective adaptation planning and implementation in Chimanimani District. Mavhura et al. (2017) mention that the complex governance landscape involving multiple government departments, traditional leadership structures, and non-governmental organisations often results in fragmented interventions that fail to address the multidimensional nature of climate vulnerability. Additionally, Mubaya and Mafongoya (2017) highlighted that information barriers limit smallholder farmers' access to timely, relevant, and usable climate information that could inform agricultural decision-making. According to Perez et al. (2020), existing climate services often fail to reach the last mile, particularly in remote areas like Chanuhwa village, and are presented in formats that are not easily understood or actionable for local farmers. This information gap is compounded by limited technical capacity among both farmers and extension agents regarding appropriate adaptation strategies for changing climatic conditions.

Effective adaptation is severely hampered by gender inequality, as women farmers frequently have restricted access to useful tools, knowledge, and climate adaptation decision-making procedures. Mazvimavi et al. (2022) state that these gender-based constraints are further complicated by generational dynamics, as youth increasingly migrate from rural areas in search of alternative livelihoods, leaving an aging population to manage labour-intensive agricultural activities. Chikosi et al. (2019) highlighted that the health barrier, particularly in the context of the HIV/AIDS pandemic and other endemic diseases, reduces the labour availability and

adaptive capacity of households, as resources that could be invested in adaptation are diverted to healthcare needs. According to Tramblay et al. (2020), these socio-cultural and health-related barriers interact with biophysical and institutional constraints to create a complex barrier landscape that requires integrated, multi-dimensional approaches.

In Chanuhwa village, these barriers are evident. Recovery from Cyclone Idai has been slow due to weak institutions and limited resources. Farmers face challenges in accessing inputs, markets, and training. Addressing these barriers is essential for making adaptation initiatives feasible.

2.4.11 Case studies of climate change and adaptation from other Regions

Learning from case studies in other regions helps identify successful adaptation strategies applicable in Zimbabwe. Lessons from Ethiopia, Kenya, Malawi, India, and Bangladesh can inform adaptation initiatives. For example, small-scale irrigation from Malawi, early warning systems from Kenya, and cyclone resilience from Bangladesh are directly relevant to the challenges faced in Chimanimani. Different countries and communities have developed innovative approaches to cope with climate change, and these experiences provide valuable lessons for smallholder farmers in Chanuhwa village, Chimanimani.

In Ethiopian highlands and semi-arid regions, integrated soil and water conservation, terracing, agroforestry, and sustainable land management have improved degraded landscapes and strengthened smallholder productivity and food security. According to Mekonnen and Kassie (2025), Ethiopia has promoted climate-smart agriculture through programs such as the Sustainable Land Management Project. The Ethiopian example highlights how crucial it is to incorporate adaptation into national development plans and involve people in their execution. Additionally, according to Jebelli (2021), in close cooperation with the local administration, the governments of the Netherlands and Canada funded and initiated the small-scale and micro irrigation project in Ethiopia in 2014. The project has been mobilised to raise the agricultural and water sectors' capacity to employ the newly supplied technologies to boost agricultural product yields and quality, as well as to strengthen their resilience to better adapt to the climate. In order to better prepare for the effects of climate change, the initiative has strengthened resilience and encouraged more effective institutions.

In order to manage climate-related disasters, Kenya has included a number of international, continental, and regional strategies and policies into its national and national initiatives. Kimaru et al. (2021) claim that because of Kenya's drought, there wasn't enough animal feed. As a result, some technologies for improving fodder were implemented in the drylands to boost feed availability during dry spells and diversify revenue streams by selling hay and grass seed to communities in semi-arid regions. Kenya's strategy emphasises how institutions and technology can help manage climate threats. It has developed early warning systems and drought contingency plans to support pastoral communities. According to Njeru and Mwangi (2025), mobile phone technology provides weather forecasts and market information, helping farmers make informed decisions.Vulnerability is decreased through community-based adaptation initiatives like livestock insurance and water harvesting.

Malawi faces a problem with food security due to the country's changing climate and expanding population. According to Duchoslaw et al., Malawi's ongoing drought has necessitated yearly requests for humanitarian aid to impacted households, while development initiatives aim to shield households from the possibility of future shocks. Phiri and Banda (2024) highlighted that Malawi has introduced small-scale irrigation schemes to reduce dependence on rainfall, where farmers use treadle pumps and gravity-fed systems to grow vegetables and cash crops during dry seasons, with positive impacts on food security and income. Particularly for female farmers, these initiatives have increased income and food security. The Malawi case shows that affordable irrigation technologies can transform smallholder farming. According to Rao and Singh (2024), farmer field schools in India offer instruction in climate-smart techniques like organic farming, integrated pest management, and crop diversification. Farmers learn through practical demonstrations and peer-to-peer learning. This approach builds local capacity and empowers communities to adapt. The Indian experience demonstrates the value of participatory training methods.

According to Hossain and Ali (2024), Bangladesh is among the nations most vulnerable to the effects of climate change, even though it contributes very little to global emissions. Investments in early warning systems, cyclone shelters, and flood-adapted agricultural techniques have reduced disaster losses and enhanced livelihood resilience in flood-prone areas. Hossain and

Rahman (2023) claim that Bangladesh has made investments in early warning systems, embankments, and cyclone shelters to shield communities from extreme weather. Farmers use salt-tolerant rice varieties and floating gardens to cope with floods; hence, these measures have reduced disaster losses and improved resilience. Bangladesh's experience is relevant for Zimbabwe, where cyclones like Idai have caused major damage.

2.4.12 Monitoring and Evaluation of Adaptation Programs

Monitoring and evaluation are essential processes in climate change adaptation programs. They ensure that initiatives are implemented effectively, efficiently, and sustainably. Smallholder farmers in Zimbabwe, especially in Chanuhwa village, Ward 17, Chimanimani District, use monitoring and evaluation to help determine whether adaptation strategies are reducing vulnerability, improving food security, and building resilience. Without proper monitoring and evaluation, programs risk becoming short-term projects that fail to deliver lasting benefits.

Monitoring and evaluation are central to determining feasibility because they generate systematic evidence on how adaptation initiatives perform under real environmental and socio-economic conditions. Chanuhwa village, Biriiri Ward 17, located in Chimanimani District of Zimbabwe, is characterised by mountainous terrain, rainfall variability, soil erosion, and exposure to extreme events such as cyclones. In such a high-risk environment, adaptation initiatives like conservation agriculture, agroforestry, small grain production, irrigation schemes, and early warning systems must be carefully assessed to determine whether they reduce vulnerability or merely provide temporary relief. Intergovernmental Panel on Climate Change (IPCC, 2022) highlights that monitoring involves the continuous collection of data during implementation, such as tracking crop yields, adoption rates, soil moisture retention, and training coverage, so as to determine whether the objectives were achieved, resources were used effectively, and outcomes are sustainable. Evaluation examines longer-term outcomes and impacts, such as improvements in food security, resilience to drought, and recovery capacity after cyclones.

Monitoring and evaluation are particularly important since they allow the researcher to test several areas of feasibility. Organisation for Economic Co-operation and Development (2021) states that technically, monitoring and evaluation determine whether adaptation practices

function effectively under Chanuhwa village agro-ecological conditions. Banerjee and Duflo (2017) state that economically, it assesses whether the benefits outweigh the costs for resource-constrained households. Socially, it evaluates if farmers accept and adopt new practices, considering cultural preferences and gender dynamics. Environmentally, it measures whether interventions improve soil stability, reduce erosion, and protect watersheds in a fragile mountainous ecosystem. Institutionally, it examines whether extension services, local leadership, and policy frameworks are strong enough to sustain initiatives beyond donor support. According to the United Nations Development Programme (2017), robust monitoring and evaluation systems are essential for ensuring accountability, learning, and adaptive management in climate change adaptation projects. Similarly, the Food and Agriculture Organisation (2017) emphasises that adaptation monitoring must focus on resilience-building and long-term sustainability rather than short-term outputs. Hence, these perspectives indicate the importance of monitoring and evaluation in Chanuhwa village because communities face repeated shocks such as droughts and cyclones. Some programs and implemented adaptation initiatives must be assessed to ensure they are genuinely feasible, reducing vulnerability and leaving fewer households dependent on external aid.

2.5 Literature Gap

While literature confirms climate change impacts and identifies adaptation barriers in Chimanimani, specific feasibility assessments are lacking for particular adaptation initiatives in Chanuhwa village. Therefore, this study will bridge the gap by conducting a deep dive feasibility assessment in Chanuhwa village, thereby offering localised, actionable insights for policy and practice.

CHAPTER 3: RESEARCH METHODOLOGY

3.1 Introduction

This chapter outlines the research design, which includes the chosen research methodology, data collecting, data analysis, and application of the analysis to the study's objectives. The demographic, ecological circumstances, and the geographic study area where the research was carried out are also described in this chapter.

3.2 Description of the Study Area

The study was conducted in Chanuhwa village, Biriiri Ward 17, Chimanimani District, located in Manicaland Province, Zimbabwe. Chimanimani was characterised by a distinct climate with generous rainfall and fertile soils that traditionally supported fruit cultivation such as pineapples, bananas, and mangoes, and small-scale agriculture. However, Chingombe and Musarandega (2021) state that the district was also highly prone to multiple hydrogeological and meteorological hazards, including tropical cyclones, floods, landslides, and droughts, which made it is an important field of study for adaptation to climate change. Kudejira (2023) claims that Cyclone Idai in 2019 sadly brought attention to the region's vulnerability, which caused widespread destruction, loss of life, and displacement.

Specifically, Chanuhwa village was home to community-led resilience initiatives, which were established as part of broader efforts to advance food security and climate-smart agriculture via initiatives such as the BROT project implemented by TSURO Trust. The village was also shaped by complex post-cyclone dynamics, including the resettlement of some displaced community members to areas like Runyararo, which faced its own challenges of water scarcity and drought. This combination of environmental risk, active adaptation projects, and socio-economic transition made Chanuhwa village a perfect case study for determining whether climate change adaption programs are feasible.

3.3 Research Design

The study used a mixed-method research technique using a case study-based methodology. It blends quantitative and qualitative methods. Because it enables the collection of quantifiable data on project outcomes while also capturing the in-depth viewpoints, experiences, and contextual elements that influenced the initiatives' success or failure, this approach is especially well-suited

for feasibility studies. A purely quantitative approach would have missed the nuanced social and governance dynamics, while a purely qualitative one would have lacked the generalisable data needed to assess overall impact. This approach was informed by successful community-led research in the area that used participatory methods to gather deep, contextualised data.

3.4 Data Collection Methods

3.4.1 Structured Questionnaire

A structured questionnaire was used to collect both quantitative and qualitative data on a sample of smallholder farmers in Chanuhwa village.The farmers were targeted because they are the primary actors directly engaged in climate change adaptation initiatives. This method quantified key feasibility indicators such as household food security, adoption rates of climate-smart practices, income from adaptation projects, and access to water resources. A total of 30 smallholder farmers participated, representing a mix of age groups and chosen by purposive sampling to pick people with pertinent backgrounds or expertise in climate change adaptation initiatives in Chanuhwa village to ensure that only households actively involved in small-scale farming were included.

The questionnaires were distributed to the respondents, considering the involvement of smallholder farmers in adaptation projects, considering gender balance, and involvement of local leaders. This approach was appropriate because the study seeks to note down the lived experiences, knowledge among smallholder farmers regarding the effects of climate change, and its impacts, and the current implemented initiatives.

3.4.2 Key informant interviews

Key informant interviews were carried out in-depth with individuals who possessed specialised knowledge about the initiatives and leadership roles relevant to climate change adaptation (see interview guide in Appendix 3, page 96). These included the ward councillor, local government officials, representatives from implementing NGOs such as TSURO Trust, and local traditional leaders. Purposive selection was done based on their expertise, influence, and direct involvement in adaptation initiatives. A total of 6 key informants were interviewed. This method ensured that the research noted insights from decision-makers and technical experts, complementing the perspectives of smallholder farmers by providing institutional and policy-level viewpoints.

Table 3.4.2.1 Summary of organisation, responsibilities, number of key informants, and justification for key informant interviews

Organisation	Key informant	Responsibility	Justification
Ministry of Agriculture Extension Services	1 AGRITEX officer	Implementers of climate adaptation programs.	Implement climate adaptation programs and provide support to farmers.
Chimanimani Rural District Council	1 Planning officer for Ward 17	Local authority on land use and water management.	Understand local policies on land use and management, and community needs, which are vital for climate adaptation.
Chimanimani Development Administrator	1 project officer	Give permission to project implementers to implement projects within Ward 17 based on the need.	Provides information on adaptation initiatives that were implemented and their success or failure.
Towards Sustainable Use of Resource Organisation (TSURO Trust) and World Vision	1 field officer for each organisation	I implement climate change adaptation projects in Ward 17.	They implement sustainable climate change adaptation projects, trainings, inputs, and tools in Chanuhwa village to support the community.
Agricultural Research Institute, such as Participatory Digital Ark	1 research officer	Represents smallholder farmers' interests.	Provides evidence-based information on effective climate-smart agriculture initiatives and the initiatives that are being implemented -+within

			Chanuhwa village.
Local Farmer Association for Biriiri Ward 17, Chanuhwa village	1 farmer rep	Research and capture information on climate-smart agriculture by smallholder farmers.	They ensure that challenges and recommendations on climate change adaptation initiatives are captured.

3.4.3 Focus Group Discussions

Separate FGDs were held with different community groups, such as aquaculture, participants in mushroom farming hubs, as well as youth and women involved in savings and lending groups (see focus group discussion guide in Appendix 2, page 94). Three groups were surveyed each comprised of 8-10 participants, carefully selected to reflect different social categories such as men, women, youth, and a mixed group. The selection was done through the purposive sampling with assistance from local leaders to mobilise respondents and promote gender balance, as each group had 4-5 females and 4-5 males. Gender balance was deliberately maintained, with equal numbers of men and women in the mixed group, while sessions for youth and women allowed participants to express themselves freely without social constraints.

This balance was essential because the effects of climate change affect men and women differently. For instance, women have particular difficulties with household food security and water collection, while men may focus on crop yields and livestock. Considering gender inclusivity helps in capturing diverse experiences and adaptation strategies. FGDs were effective for generating collective insights, understanding community norms, and identifying shared challenges and successes as they discussed the success of current efforts to adapt to climate change in enhancing resilience, as well as proposing measures to improve resilience to climate change adaptation.

3.4.4 Researcher Observations

Researcher observations were done to identify and capture pictures of some adaptation initiatives being implemented by smallholder farmers within Chanuhwa village. Additionally, the observations offer actual data on how people participate in climate change adaptation projects including water collection, agroforestry, and conservation farming. Observations aid in the

identification of obstacles to viability, such as financial limitations, cultural resistance, and a lack of technical know-how.

3.5 Data Collection Instruments

The following instruments were developed and pre-tested before full deployment:

3.5.1 Structured questionnaires

The main tool for gathering quantitative data was a structured questionnaire; Section A included demographic data, while Section B included information on climate change awareness and knowledge, Section C comprises of adaptation strategies that are being implemented within Chanuhwa village, Biriiri Ward 17, Section D comprises of effectiveness of existing climate change adaptation initiative, Section E comprises of proposed actions to improve resilience to climate change adaptation in Chanuhwa village (see structured questionnaire guide in Appendix 4, page 98). For household surveys, containing closed-ended enquiries to collect numerical demographic data, practice adoption, and perceived challenges. According to Babbie (2017), the structured format was selected to facilitate standardised data collection, statistical analysis, and minimise interviewer variability. The questionnaire was developed using the KOBO tool in English and translated into Shona, Zimbabwe's most widely spoken indigenous language, such as Ndau, to ensure comprehension among participants with limited English literacy.

3.5.2 Key Informant Interview Guide

Interview Guides for KIIs contained 15 open-ended questions organised around the study's 4 research objectives, to guide the conversation while allowing for flexibility to explore emergent themes (see key informant interview guide in Appendix 3, page 96). Topics included perceptions on climate change and its impacts, current implemented initiatives, the effectiveness of the existing climate change adaptations in enhancing resilience, and proposed actions to improve resilience to climate change adaptation. According to Tsai (2017), back translation was used to verify linguistic equivalence between the two versions. All interviews were conducted by the primary researcher, audio captured with the respondents' express consent, and enhanced by thorough field notes that document contextual observations, interviewer thoughts, and nonverbal clues.

3.5.3 Observation Guide

To guide direct observation of project sites, such as the condition of infrastructure, such as irrigation systems, farming practices being used, and the general environment (see observation guide in Appendix 5, page 103). A structured observation checklist was utilised to add objective research to the quantitative and qualitative data generated data on the physical environment of selected households and communal areas based on the research objectives, such as awareness, adaptation initiatives, and effectiveness of climate change adaptation initiatives. The observation checklist served as an important triangulation tool, enabling the researcher to verify or challenge self-reported data from the questionnaire and to capture physical evidence that participants might not have included in their written or verbal responses. Observations were conducted in a purposively selected group of households that had participated in the questionnaire survey and provided consent for a follow-up visit. Document analysis template to systematically extract relevant information from project reports and official documents.

3.5.4 Focus Group Discussion Guide

To capture insights on adaptation initiatives, recommendations, focus group discussions were conducted as they provided an opportunity for many vulnerable populations, such as the elderly, the destitute, and those with less priviledge, so that, they can share their insights (see focus group discussion guide in Appendix 2 page 94). To generate rich contextual data that complements other instruments, like researcher observation, discussions were held in focus groups. The information was captured during the conversation by note-taking and audio recording and transcribed later. Three focus group discussions with 8-10 respondents were conducted. Regarding climate change adaptation strategies, men and women have different responsibilities, priorities, and levels of expertise. Hence, with assistance from local leaders for community mobilisation, to capture information that was rich in gender sensitivity, was considered by balancing 4-5 male and 4-5 female responders was maintained in each group. To select the respondents, purposive sampling was applied by identifying specific organisations engaged in climate-smart agriculture, including women farmers, young farmers, and individuals with impairments.

3.6 Target Population

The target population comprised all smallholder farmers of Biriiri Ward 17, Chanuhwa village, with an emphasis on those involved in local climate change adaptation initiatives. Key informants from implementing agencies and local governance structures were also part of the population.

3.7 Sampling Techniques

To compile data regarding climate change's viability adaptation initiatives within Chanuhwa, Chimanimani, the researcher utilised purposive and census sampling techniques. Newing (2020) noted that purposive sampling entails choosing participants according to their appropriateness and readiness to participate as well as their availability and level of education. This method allows the researcher to focus on key participants and youth group leaders who can give relevant information for the study. In qualitative research, purposeful sampling is beneficial because the objective is to collect high-quality data rather than generalise conclusions. Based on their own experience and familiarity with the adaptation efforts, key informants were specifically chosen. Census sampling was employed since the number of registered smallholder farmers was small, and to obtain accurate data. Chanuhwa village was purposively selected due to the presence of documented adaptation projects like aquaculture.

3.8 Sample Size

3.8.1 Quantitative sample

The sample size of 30 registered smallholder farmers for household surveys was obtained from the Agricultural Extension Officer that operate within Chanuhwa village, given that the number of smallholder farmers was small all 30 smallholder farmers participated. Whitaker (2017) highlighted that a fraction of the population investigated on behalf of the group being tested is referred to as a sample. Guest et al. (2020) state that sample size is a crucial idea in qualitative research, when gathering more data produces little or no new themes or insights.

Because the target population was small and controlled, the study used a census approach, also known as complete enumeration, whereby all 30 registered smallholder farmers were included in the study, which was based on the finite and bounded nature of the population. Since the population size was very small and accessible, it was practical and feasible to reach every

registered farmer within the study area; therefore, the default research design choice was to enumerate the entire target population (n=30) rather than drawing a sample that might exclude some participants.

The use of a census also helped to reduce sampling error since there was no selection of a smaller sample from the population. Including all registered smallholder farmers, the study ensured ensuring each member of the intended population had an equal chance to provide data, improving the conclusions' representativeness and dependability. To address possible non-response, the researcher maintained continuous contact with all respondents throughout the data collection period. Farmers who failed to complete the KOBO collect survey at time were regularly reminded through follow-ups and personal communication until responses were obtained from all participants. As a result all 30 registered smallholder farmers completed the survey, giving the study a 100% response rate.

3.8.2 Qualitative sample

The sample size for the qualitative component was determined using purposive sampling guided by the principle of information richness rather than statistical representation. This involved 20 participants from Chanuhwa village for interviews and 3 farmers' focus group discussions, each with 8-10 members, and 6 important sources for in-depth conversations based on their involvement in the study area and the implemented adaptation initiatives. According to Saunders et al. (2018), theoretical saturation, the stage at which more interviews produce significantly new information, was monitored throughout the interview process and data collection was concluded when saturation was achieved.

3.9 Data Analysis Methods

Descriptive analysis was carried out after quantitative data from questionnaire surveys were exported to Excel in KOBO Collect, as it is shown in Chapter 4, represented in tables and graphs. Qualitative data, such as FGDs and interviews were audio recorded with permission, verbatim transcribed, and translated as needed. Thematic analysis was employed following these steps include getting acquainted with the data, creating preliminary codes, looking for themes, evaluating themes, and defining and labelling themes. According to Terry et al. (2017) this approach was selected for its flexibility, its compatibility with a variety of theoretical positions

and its capacity to generate rich, meaningful, and interpretively nuanced themes from textual data. Software NVivo 12 was used to manage the data.

3.10 Data Reliability and Study Validity

The household questionnaire was pre-tested with a small sample (n=30) in order to guarantee the validity of the quantitative tool in a neighbouring village with similar characteristics. The results were used to check for internal consistency and clarity, and necessary adjustments were made. For qualitative data, reliability was enhanced by using consistent interview guides and keeping a thorough audit trail of all choices and procedures used during study. Bryman (2016) described measurement stability, consistency, and reliability over time and in many circumstances.

Internal validity was strengthened through triangulation of methods and data sources. According to Creswell and Creswell (2018), validity is defined as the extent to which a research tool measures what it is designed to measure. The study also employed member checking, where findings were shared with a small number of participants to confirm that their opinions had been accurately interpreted. External validity was enhanced by the random selection of survey respondents, although the qualitative findings were context-specific. The study design was also informed by and compared with existing research from the area to ensure contextual relevance.

3.11 Limitations of the Study

The study acknowledged the following limitations:

Some respondents experienced difficulty accurately recalling past events, such as the exact date they joined a project or their yields from previous seasons. However, this gap was bridged by obtaining information from some other partners that work within the community that collect some stories of change, such as TSURO Trust. Certain parts of Chanuhwa village were difficult to access because of inadequate road infrastructure, especially during the wet season, which affected the sampling strategy and required some adjustments to the fieldwork schedule. However, as a solution to that, the data collection was done when it was sunny. Participants' answers might have been affected by the researcher's presence. This was lessened by spending enough time in the neighbourhood to foster trust and by outlining the goal and confidentiality of the research.

3.12 Ethical Considerations

The study received ethical approval from Bindura University of Science Education and local authorities, which involved the traditional leaders and the District Administrator. Before any data was collected, participants were asked for their informed consent and given the assurance that they might leave the study at any time without facing any repercussions. The principles of anonymity and confidentiality were strictly adhered to all in order to describe qualitative findings, personal identifiers were eliminated from the data and assumed names. Culturally sensitive research methodology was used, respecting the norms and traditions of Biriiri Ward 17, Chanuhwa village.

Chapter Conclusion

The chapter employed using a combination of tools to evaluate the viability of climate change adaptation initiatives in Chanuhwa village, Biriiri Ward 17, and Chimanimani District, Zimbabwe. A sample size of 30 registered smallholder farmers was selected with assistance from the Agricultural Extension Service Officer.Household surveys, focus groups, and key informant interviews were used to gather data on a variety of viewpoints regarding the effects of climate change, adaptation tactics, and community resilience. The study findings will inform recommendations for enhancing climate change adaptation in the Ward.

CHAPTER 4: RESEARCH FINDINGS AND DISCUSSION

4.1 Introduction

The results of the study on climate change adaptation in Chanuhwa Village Ward 17 Biriri, Chimanimani District are presented, examined, and discussed in this chapter. The results are derived from three data sources that involve structured questionnaires, key informant interviews, and focus group discussions (FDGs). Key stakeholders consulted include TSURO Trust, AGRITEX, the Chimanimani District development Coordinator, the Chimanimani Rural District Council, and the local farmer representative. The inclusion of FDGs provided deeper insights into community perceptions, experiences, and collective reactions to the changing climate. Through triangulation, the integration of these data sources improves the conclusions' validity and dependability.

4.2 Respondent rate

A total of 30 structured questionnaires were distributed to all registered smallholder farmers within Chanuhwa village, Ward 17, representing a census of the 30 registered farmers from the Agricultural Extension Officer register. All 30 smallholder farmers managed to participate and return the questionnaires, and the response yield was 100%. This exceptionally high response rate is attributed to the face-to-face administration method used during data collection, which ensured that all questions were answered in the presence of the researcher, and also the response rate guarantees that the results are typical of the population that was sampled and eliminates concerns about non-response bias.

4.3 Demographic profile of respondents

The gender breakdown of the respondents is seen in Table 4.1 for the structured questionnaire interview.

Table 4.1: Indicate gender distribution

Gender	Frequency	Percentage
Female	18	59%

Male	12	41%
Total	30	100%

Table 4.1 displays the respondents' demographic details as the findings indicate that females constituted 59% of the respondents, while males accounted for 41%. This indicates the central role of women in food security and agricultural output in Chanuhwa village, Ward 17. While focus group discussions, participants emphasised that women are often responsible for day-to-day farming activities, including planting, weeding, and harvesting, and were further supported by AGRITEX officers, who noted that women are the more active participants in climate change training programs.

Table 4.2 Respondents' age distribution

Age group	**Frequency**	**Percentage**
18-35	3	9%
36-60	25	86%
Above 60	2	5%
Total	30	100%

Table 4.2 indicates a summary of the age distribution for respondents who participated in questionnaire interviews.The bulk of responders (86%) were between the ages of 36 and 60. FDG participants explained that the age group represents experienced farmers who have observed long-term climatic changes. There is low participation of youth in agriculture due to migration in search of employment to some urban areas, which poses a challenge for the sustainability of adaptation practices.

4.4 Awareness and knowledge of climate change and its impacts

The questionnaire survey results indicate that all 30 smallholder farmers have heard about climate change, demonstrating universal awareness within Chanuhwa village. The bar graph in Figure 4.1 provides a summary of the knowledge smallholder farmers possess.

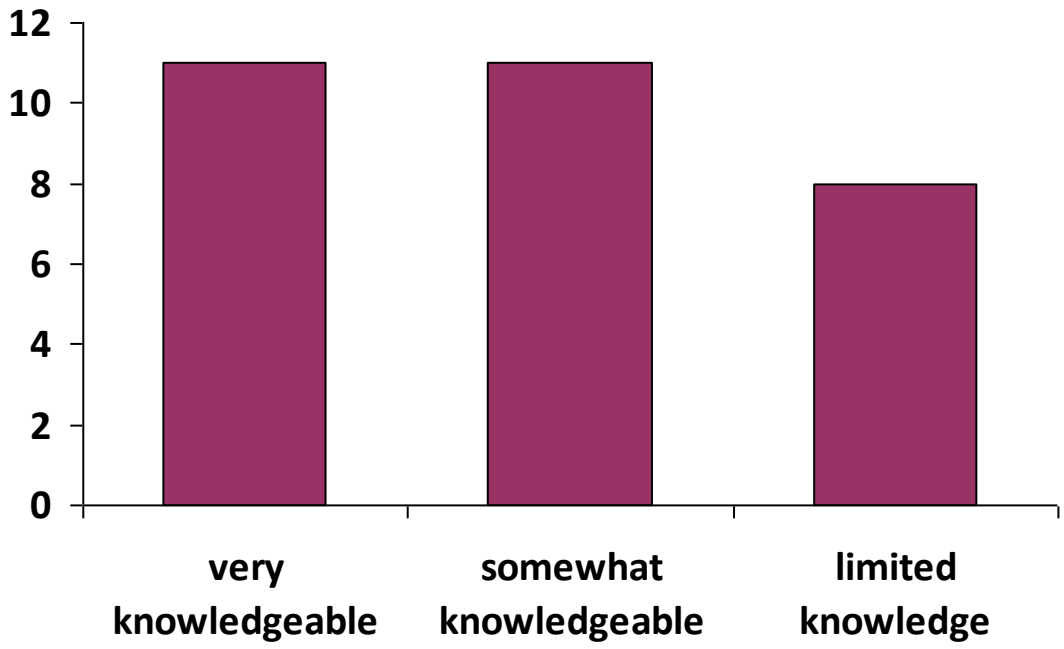


Figure 4.1 Smallholder farmers knowledge of climate change

This discovery aligns with focus group discussions, where participants described climate change in terms of observable changes such as changes in weather patterns, which are delaying their planting seasons and temperatures. As it is presented in Figure 4.2, specifically, 11 (36%) respondents rated themselves as very knowledgeable, another 11 (36%) as somewhat knowledgeable, and 8 (27%) respondents indicated that they have limited knowledge; hence this suggests that while awareness is widespread, depth of understanding remains uneven as some farmers misinterpret climate change and climate variability which therefore affects climate change response.

Focus group discussions further revealed that many farmers rely on experiential knowledge rather than formal training, as some extension service officers who should train them have limited information on climate change adaptation initiatives since they are diploma holders. For example, participants explained that they understand climate change based on changing rainfall patterns rather than the scientific explanations. Participants from focus group discussions reported that rainfall patterns have become unpredictable, often starting late and ending early, which therefore disrupts planting schedules. Some smallholder farmers indicated that crops fail

even after planting due to mid-season dry spells and increased pests such as fall armyworm, which has significantly affected maize production. Multiple participants from the first focus discussion revealed the effects of climate change on agriculture, including lower yields, altered planting seasons, livestock loss, and a rise in pests and illnesses as a result of temperature and weather changes.

Findings from stakeholders provided an important part in assisting with climate change adaptation since both the government and NGOs are responsible for providing training, developing infrastructure, and strengthening extension services. According to the Intergovernmental Panel on Climate Change (2022), the success of adaptation initiatives depends on the combined efforts of government agencies, NGOs and community-based organisations, and the local community itself. From key informant interviews, some stakeholders like AGRITEX confirmed that awareness campaigns on climate change have been conducted effective there is still a need for more technical training on climate-smart agricultural practices, such as the growing of tiny grains, which aid in adjusting to the effects of climate change. This was echoed by the AGRITEX Extension Officer, who stated:

> *Farmers in Chanuhwa village know that the climate is changing because they see it every season, but translating that awareness into the right farming practices is still a challenge. We need more hands-on training, not just information sharing.*

Hence, this clearly shows that farmers in Chanuhwa village have received information on climate change, though they are failing to interpret and adapt accordingly to the impacts of climate change, which is affecting crop yield. As it was supported by TSURO Trust, which confirmed that: *" Erratic rainfall and rising temperatures are key drivers of the decline in agricultural productivity in Chanuhwa village, Ward 17"* .

4.5 Adaptation strategies practised by farmers

This study looked at how farmers in Chanuhwa village, Ward 17, are adapting to climate change. Musarandega et al. (2021) state that a number of climate change adaptation measures, including the development of drought-tolerant crop varieties and conservation agricultural practices, water harvesting techniques, crafting and agroforestry systems have been introduced in in Zimbabwe by government agencies, non-government organisations and international development partners,

among these adaptation initiatives farmers in Chanuhwa village are using a range of adaptation strategies that involve conservation farming, agroforestry, using crops resistant to drought, collecting water, raising cattle, small-scale irrigation, crafting, and traditional practices. Among these, conservation farming and water harvesting appear to be the most commonly practised, represented by 91% respondents. This was supported by evidence from observations as it is shown in Photograph 4.1, that, due to dry spill and late rainfall experience farmers within Chanuhwa village are taking water from the nearby river and small check dams.



(a) (b)

Photograph 4.1 (a) and (b) water harvesting techniques being implemented by smallholder farmers in Chanuhwa Village.

As highlighted by focus group discussions conducted, water harvesting, aquaculture projects, and conservation farming are widely adopted because it helps retain soil moisture and improve yields under low rainfall conditions. Farmers also reported that they are using traditional knowledge and practices, such as adjusting planting dates and selecting resilient seed varieties, though the adoption levels vary across households due to limited resources to implement the adaptation practices, such as the use of bokashi, better irrigation systems, and the use of improved small grains seed but 71% of respondents indicated reliance on indigenous knowledge and practices.

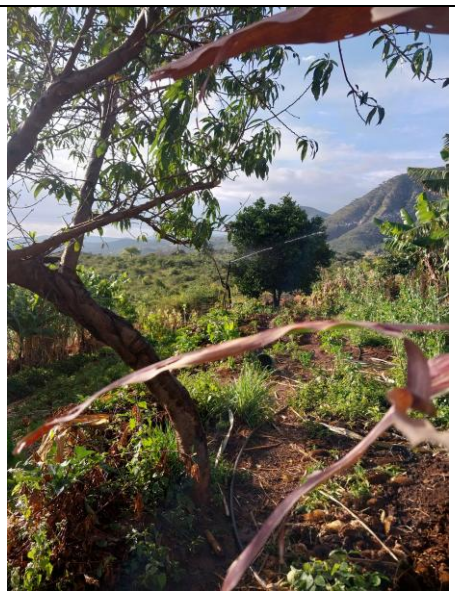
Smallholder farmers within Chanuhwa Village reported that they have some off-farm activities that they are also relying on as a way of adapting to climate change impacts, which involve

crafting. As it was highlighted by Musarandega and Chingombe (2021), old aged women smallholder farmers in Biriiri Ward 17 rely on Biriiri Women Craft centre in the sense that they sell handmade products at local markets and roadside stalls, though most of these farmers highlighted that the effectiveness of crafting is hindered by climate change as the natural resources that is around Chanuhwa village such as reeds, grasses and trees used in craft production is affected thus, reducing access to materials. As it was revealed by participants from focus group discussions, Women craft in Biriiri Ward helps women to adapt better to climate change by diversifying livelihoods, improving income security, enhancing food security, and strengthening community resilience.

Trading activities as a way of supplementing their household income also increased in Biriiri Ward 17, as they depend mainly on farming activities. According to Mukarumbwa et al. (2018), to improve food security and improve livelihood, some smallholder farmers sell tomatoes, firewood, mushrooms, and onions, which help them to cope with the impacts of climate change and improve access to income. It was supported by evidence from observations, which show that smallholder farmers within Chanuhwa village are adopting informal selling of surplus produce, tomatoes, mushrooms, and firewood on the roadsides. As it was revealed by focus group discussion, farmers from Chanuhwa village are selling their produce at Nhedziwa market, which helps them in promoting income stability, which they will use to pay school fees and purchase improved seeds. Photographs 4.2 indicate some of the observed adaptation practices within Chanuhwa village.



(a)



(b)

Photographs 4.2 (a) Apiculture and (b) small irrigation through the use of sprinklers in Chanuhwa village

As it is represented in Photographs in 4.2, small irrigation is being implemented to reduce dependence on rainfall, as it was done in Malawi highlighted by Phiri and Banda (2024), that small-scale irrigation schemes were introduced to reduce dependence on rainfall. Other commonly adopted practices include aquaculture, which consist 64% respondents, drought-resistant crops with 59%, agroforestry (55%), and irrigation schemes (55%), which therefore reflect efforts by farmers to diversify their livelihood and reduce vulnerability to climate variability. However, apiculture was the least practiced adaptation strategy, with only 5% of respondents engaging in it. This was due to limited knowledge and awareness of its benefits. Overall, the findings suggest that farmers in Chanuhwa village ward 17 are actively adopting multiple adaptation strategies,exhibiting a high degree of climate change responsiveness. The variance in adoption rates, however, suggests that the selection of adaptation strategies is influenced by institutional support, knowledge, and resource availability. Table 4.3 indicates some adaptation practices that are being implemented by smallholder farmers within Chanuhwa Village.

Table 4.3 Climate change adaptation practices (n=30)

Adaptation Practices	Frequency	Percentage %
Conservation farming	27	91
Crafting	27	91
Agroforestry	17	55
Drought-resistant crops	18	59
Apiculture	2	5
Aquaculture	19	64
Water harvesting	27	91
Irrigation schemes	17	55
Traditional practices	23	77

Some stakeholders, like Chimanimani Rural District Council, noted efforts to improve natural resource management and improve water access, as TSURO Trust highlighted its role in supporting irrigation schemes and training farmers in sustainable practices through encouraging farmers to conduct farmer field visits to offer an opportunity to exchange knowledge on climate change and sustainable farming. The TSURO Trust Field Officer remarked:

> *We have been working with farmers in Chanuhwa village to promote conservation farming and water harvesting. The uptake has been encouraging, but the biggest gap remains access to inputs and financial support to sustain these practices beyond our project cycles.*

The Chimanimani Rural District Council Planning Officer also noted that:

> *Our role is to coordinate land use and ensure that adaptation initiatives align with broader district development plans. What we observe in Chanuhwa is that farmers are willing, but the infrastructure support, particularly irrigation, is still very limited.*

As it was noted by the Chimanimani Rural District Council Planning Officer its role is particularly linked to the SDG 13 on Climate Action, which therefore emphasise strengthening resilience and the ability of smallholder farmers to adapt to climate-related impacts through

effective adaptation and institutional support as it is highlighted in literature by Chang (2022), that smallholder farmers are the ones who contributed much on achieving the SDGs related to the environment. However, in Chanuhwa village, the concern raised was that there is limited irrigation infrastructure, which is closely linked to SDG 6 on clean water and sanitation, which promotes efficient water management and sustainable access to water resources for agricultural productivity that will be used for aquaculture and irrigation purposes.

4.6 Effectiveness of adaptation strategies

The impact of climate change adaptation measures on agricultural yields, food security, and farmers' capacity to handle climate-related shocks was used to evaluate their efficacy. majority of the respondents from survey interviews indicated that adaptation strategies have improved their crop yields and food security by 100%, which helps them to cope with climate shocks such as droughts. Participants from focus group 1 and 2 discussions noted that practices such as water harvesting and conservation farming have enabled them to maintain production even during dry seasons. However, some of these participants expressed concerns about the sustainability of these practices, particularly those that require high labour demand and external support. The summary of their responses is presented in Table 4.4.

Table 4.4 Smallholder farmers' ability to cope with shocks

Response	Frequency	Percentage
Yes	10	32%
Somewhat	20	68%
No	0	10%
Total	30	100%

As shown in Table 4.4 the majority of respondents from the questionnaire survey (68%) rated the adaptation strategies as moderately effective since they are experiencing surplus harvest after adopting organic manure, which increases crop yield hence by fulfilling SDG 2 which is Zero Hunger that focuses on hunger eradication, improve nutrition and promoting agriculture sustainability, while 32% considered them very efficient, and none of the participants reported that the tactics were ineffective. The effectiveness of adaptation initiatives was assessed through

smallholder income levels, the farmers' food security and their capacity to cover educational costs. The smallholder farmers were asked to state whether they were able to cope with climate change impacts or not, if climate shocks occurred.

Several key challenges that include a lack of tools that are advanced tools, high labour demand for some adaptation initiatives to be implemented, like *pfumvudza,* and limited knowledge on how to effectively implement the initiatives were consistently highlighted by respondents and weak extension officers for monitoring. As stated by Chanza and Wit (2019), institutional capacity in Zimbabwe is weak, extension officers are few, resources are limited, and coordination is lacking among stakeholders. Focus group 3 discussion provided further detail, with participants explaining that conservation farming is labour-intensive, making it difficult for households with limited labour capacity to implement these initiatives. As it was noted by Makuvaro et al. (2017), that women encounter challenges when it comes to access to land and improved seeds, it was revealed from the second focus group discussion conducted in Chanuhwa village, that some chiefs, cultural barriers within Chanuhwa village limit widows and women's access to information, seeds and land which therefore affects their capacity to cope up to climate change impacts. Another significant obstacle was found to be financial limitations as many farmers fail to afford inputs such as improved small grain seeds, which therefore limit them to grow small grains that can be applied to prepare for droughts and other effects of climate change. As revealed by various stakeholders involved in climate change adaptation within Chanuhwa village, some of the initiatives are becoming successful, though the adoption of some initiatives is still limited.

In the words of the District Development Coordinator:

> *The initiatives we see in Chanuhwa, such as aquaculture and apiculture, are promising, but they are largely donor-driven. When donor funding ends, we risk losing everything that has been built. There is an urgent need to build community ownership and local funding mechanisms.*

The Participatory Digital Ark highlighted that:

> *Most farmers in Chanuhwa village are implementing fish farming, which clearly shows that it is effective and helpful as compared to some adaptation initiatives like apiculture, which is implemented by a few farmers.*

The local farmer representative from the Biriiri Ward 17, Chanuhwa village, added:

> *Conservation farming and water harvesting have genuinely helped us. In seasons with low rainfall, farmers who use these practices still manage to harvest something, while those who do not suffer complete crop failure.*

Stakeholders also supported the findings from the questionnaire survey by highlighting that poverty adoption of climate change is hampered by restricted access to extension services and inputs adaptation initiatives, and size of coverage that the extension officer needs to monitor is big.

The AGRITEX Extension Officer stated:

> *We visit farmers as often as we can, but with only one officer covering the entire Ward 17, it is simply impossible to provide the regular follow-up that farmers need. Many of them implement practices incorrectly because they lack continuous technical guidance.*

As it is clearly mentioned, farmers fail to carry out successful adaptation programs because of a lack of knowledge on how to monitor the adaptation initiatives, due to a lack of expert extension officers who provide sufficient training, guidance, and manage to visit smallholder farmers within Chanuhwa village. Sigh (2024) states that in India, some farmer field visits were conducted as a way of sharing information on climate change adaptation initiatives within smallholder farmers, which is similar to Chanuhwa village. Some farmer field visits have been helpful, as there is where they obtain knowledge on crop diversification and organic farming.

The Participatory Digital Ark Research Officer similarly noted:

> *Our evidence shows that farmers in Chanuhwa are highly motivated to adopt climate-smart practices, but poverty remains the single greatest barrier. Without subsidised inputs or credit access, even the most willing farmer cannot sustain these practices.*

The researcher' s field visits, which were done through the village, also supported what the questionnaire survey and interviews pointed to. Whilst the farmers made commendable effortsto address the issues posed by climate change, there was proof of a lack of adequate farm produce to feed most households throughout the year. The photographs 4.3 (a) and (b) show a successful aquaculture project that is being implemented within Chanuhwa village, captured during field visits.



(a)



(b)

Photographs 4.3 (a) and (b) indicate successful aquaculture projects.

Additionally, as revealed by field observations, some of the adaptation initiatives that include fish farming are effective within Chanuhwa village, as most of the farmers within the village have adopted them, which clearly shows that it is effective. Smallholder farmers from focus group discussions highlighted that fish farming is really helping them through income generation, which they use for fee payments and purchasing other basic needs they want.

4.7 Proposed measures to improve resilience

Smallholder farmers within Chanuhwa village suggested a number of strategies to increase resilience, such as the encouragement of conservation agriculture, construction of irrigation infrastructure, establishment of more nutrition gardens, and support for small-scale businesses, such as crafting. Some respondents from the questionnaire survey noted that diversifying livelihoods is important to reduce reliance on rain-fed farming, but gardening, raising chickens,

and small enterprises can work as alternatives for income sources. In Chanuhwa village, focus group discussions revealed that smallholder farmers value the support provided by organisations but emphasised the need for more consistent engagement. Participants also highlighted the importance of community-driven initiatives such as group labour systems, knowledge sharing, and natural resource management, which are crucial in resilience building for initiatives to adapt to climate change, notwithstanding the absence of youth participation in implementing these initiatives.

Stakeholders and farmer representatives in Chanuhwa village highlighted several strategies to increase climate change resilience, such promotion of drought-resistant crops, improving drought-resistant crops, capacity building programs, and livelihood diversification. Stakeholders supported some of the proposals from smallholder farmers, noting that integrated approaches that combine agricultural and economic interventions are essential for building resilience. AGRITEX confirmed that strengthening irrigation infrastructure is vital for improving agricultural resilience, and Towards Sustainable Use of Resources Organisation emphasised that capacity building and livelihood diversification are equally critical and reduce dependency syndrome.

The TSURO Trust field officer stated that:

> *The fish ponds we helped establish have transformed livelihoods in Chanuhwa village. Farmers who participate in aquaculture now have a year-round income source that buffers them from crop failure during droughts. But we need to scale this up and ensure communities can manage these projects independently, hence the farmers should be able to cope with shocks on their own to reduce the donor syndrome within farmers.*

The Chimanimani District Administrator said:

> *In Chanuhwa village, there is a need to promote sorghum and drought-resistant crops, which can withstand erratic rainfall and give us reliable harvests when maize fails. Also, encouraging apiculture and small livestock rearing, which reduce smallholder farmers' dependence on crops alone.*

Since most of the farmers within Chanuhwa village are mainly focusing on aquaculture, there is still the need for farmer training on apiculture and small livestock rearing, such as rabbit

keeping, which can help in adapting to climate change impacts by selling honey, which they harvest, and meat from rabbits, thus promoting income that helps them to purchase improved seeds.

4.7.1 Support needed to enhance adaptation

Figure 4.2 presents the questionnaire data on the support that the smallholder farmers within Chanuhwa village need when implementing adaptation initiatives.

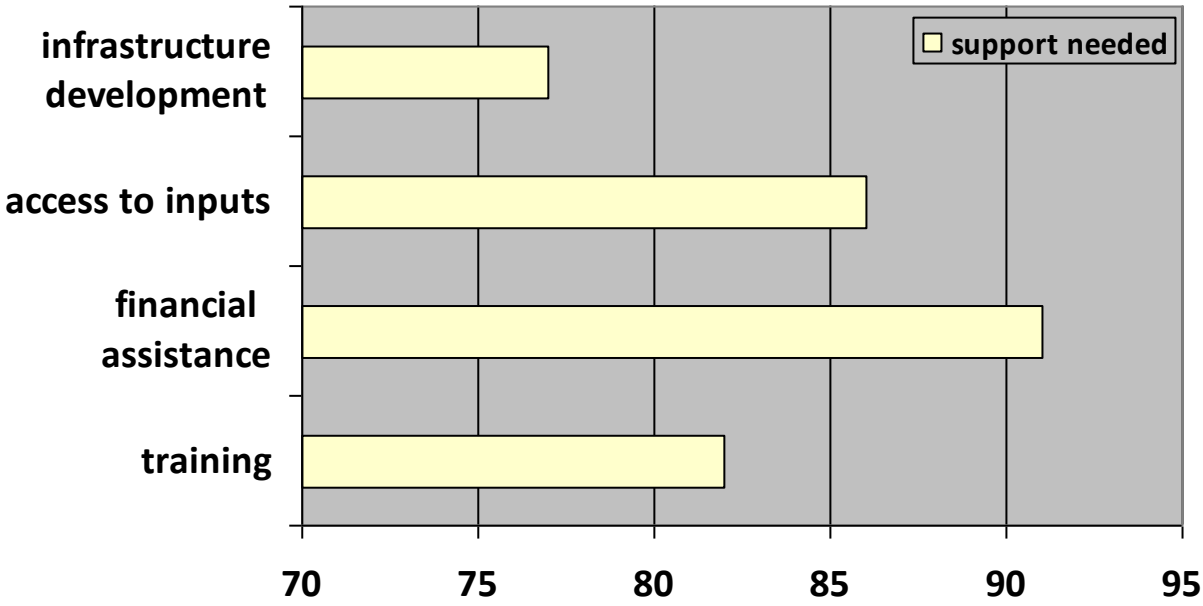


Figure 4.2 Support needed to enhance climate change adaptation

The questionnaire data show that respondents require training, financial assistance, access to inputs, and improved infrastructure to enhance adaptation efforts. As financial assistance was the most frequently cited need reported by 27 respondents (91%), followed by 26 respondents (86%) who need access to inputs, 25 respondents which is 82% that need training on how to implement some adaptation initiatives, and 23 respondents (77%) emphasised the need for infrastructure development that involves irrigation schemes. These needs were strongly emphasised in focus group discussions where participants requested more frequent training sessions and improved access to extension services. Participants also stressed the importance is hampered by a lack of funding, insufficient access to inputs. According to the research findings, farmers are actively implementing adaptation practices, though their effectivenessis hampered by a lack of funding, insufficient access to inputs, and insufficient irrigation schemes.

4.8 Summary of findings

The study found that farmers are highly conscious about climate change in Chanuhwa village, supported by both stakeholders and community discussions. However, knowledge levels remain uneven, affecting the effectiveness of adaptation strategies. Farmers are actively adopting various practices, which have shown positive results, but face significant challenges related to resources, labour, and knowledge. The combination of results from focus groups, key informants, and questionnaires emphasises the significance of a multi-stakeholder approach to climate change adaptation. Strengthening collaboration between communities, government, and NGOs is essential for improving resilience and ensuring the sustainability of adaptation initiatives.

CHAPTER 5: CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

The findings and suggestions of the study on smallholder farmers' efforts to adapt to climate change in Chanuhwa Village, Ward 17, Chimanimani District, are presented in this chapter. Results from focus groups, key informant interviews with pertinent stakeholders, and surveys (n = 30) form the basis of the debate. The chapter is organised in accordance with the study's four research objectives, which are followed by recommendations aimed at strengthening adaptation and enhancing resilience to climate change.

5.2 Research Objective 1: Awareness and Knowledge of Smallholder Farmers

The study established that awareness of climate change among smallholder farmers in Chanuhwa Village is very high. All respondents confirmed familiarity with the concept, largely due to awareness campaigns by government agencies, NGOs, and local leadership. However, while awareness is widespread, knowledge of specific impacts and adaptation strategies is uneven. Many farmers demonstrated limited technical understanding of climate-smart practices, which constrains their ability to fully implement effective adaptation measures.

5.3 Research Objective 2: Current Climate Change Adaptation Initiatives

Farmers in Chanuhwa Village have adopted diverse adaptation initiatives, including conservation farming, agroforestry, drought-resistant crops, water harvesting, irrigation, and traditional practices such as collective labour (nhimbe). These initiatives reflect proactive responses to climate change and demonstrate that farmers are not passive victims but active agents of resilience. Stakeholders such as AGRITEX and TSURO Trust have been instrumental in advancing climate-smart agriculture and supporting community-driven strategies.

5.4 Research Objective 3: Effectiveness of Adaptation Initiatives

According to the report, adaptation efforts have often increased crop yields and enhanced resilience to climate shocks, particularly droughts. However, effectiveness varies depending on access to resources, technical knowledge, and institutional support. Farmers to inputs, irrigation, and training reported greater success, while resource-poor households struggled to sustain adaptation practices. Challenges such as high labour demands, financial constraints, and inadequate infrastructure continue to limit overall effectiveness.

5.5 Objective 4: Options for Enhancing Smallholder Resilience

The study concludes that resilience can be strengthened through improved knowledge, resource access, infrastructure development, and stakeholder collaboration. Community participation and collective action remain vital, as practices such as knowledge sharing and natural resource management complement formal interventions. Sustainability of adaptation initiatives requires stronger local ownership and reduced dependence on external funding.

5.6 Recommendations

5.6.1 Recommendations for practices

- Livelihood diversification is a crucial recommendation that smallholder farmers should consider. An excessive dependence on rain-fed agriculture makes one more susceptible to climate shocks, as households are left exposed when crops fail. Farmers should be supported to engage in alternate sources of revenue, such raising small cattle, gardening, and small-scale enterprises. Diversification not only spreads risk but also provides households with multiple streams of income, thereby enhancing resilience. By reducing dependence on climate-sensitive livelihoods, communities can better withstand shocks and maintain stability given the effects of climate change.

5.6.2 Recommendations for policy

- Investment in irrigation infrastructure is another essential recommendation. The study highlighted the unreliability of rainfall as a major constraint to agricultural productivity. Farmers depend on rain-fed farming are extremely susceptible to droughts, leading to food insecurity and income instability. To address this, government agencies, working through the Chimanimani Rural District Council and the District Development Coordinator office, should prioritise the construction and rehabilitation of dams, boreholes, and irrigation schemes. Improved irrigation facilities would enable farmers to produce crops consistently throughout the year, reduce dependence on rainfall, and stabilise household food supplies. This infrastructural investment is not only a technical solution but also a long-term resilience strategy.

- Strengthening farmer education and training emerges as a critical priority in enhancing climate change adaptation in Chanuhwa Village. Although awareness of climate change is widespread, the study revealed significant gaps in technical knowledge. Farmers often understand the existence of climate change but lack the practical skills needed to implement climate-smart agriculture effectively. AGRITEX and NGOs such as TSURO Trust should therefore intensify training programs that go beyond theoretical awareness and focus on hands-on demonstrations of practices like conservation farming, agroforestry, and water harvesting. Continuous capacity building will ensure that farmers

not only adopt these strategies but also sustain them over time, thereby bridging the knowledge gap that currently limits resilience.

- Policies should promote youth involvement in agriculture through training programs and land access. Participation of youth in agriculture is critical for the sustainability of adaptation initiatives. The study noted low participation of young people in farming activities, which threatens the continuity of climate-smart practices. Targeted programs should be developed to encourage youth engagement, including training opportunities, access to land, and provision of resources. Promoting agriculture as a viable economic activity for young people will ensure that adaptation strategies are carried forward into the future. Youth involvement also brings innovation and energy, which can strengthen community resilience. Community-based natural resource management should also be promoted. Activities such as tree planting, soil conservation, and water management are vital for maintaining the ecological balance necessary for sustainable agriculture. Strengthening these practices through community participation ensuresthat adaptability is social as well as technical. Integrating indigenous knowledge systems with scientific approaches can further enhance effectiveness, as local practices often provide context-specific solutions that are well adapted to the environment.

- Access to agricultural inputs and financial resources also requires urgent attention. Farmers in Chanuhwa Village face challenges in obtaining seeds, tools, and other essential inputs due to financial constraints. Without these resources, even the most well-designed adaptation strategies cannot be effectively implemented. Stakeholders should therefore consider providing subsidised inputs or establishing credit facilities tailored to smallholder farmers. Such financial support mechanisms would empower farmers to adopt climate-smart practices more widely and overcome one of the most significant barriers identified in the study; thus, by easing resource constraints, farmers can fully utilise their knowledge and training to improve productivity and resilience.

- Collaboration among stakeholders is equally important. The study revealed that while organisations such as TSURO Trust and AGRITEX have been instrumental in promoting adaptation, interventions often operate in isolation and depend heavily on external

funding. To maximise impact, platforms for stakeholder engagement should be set up to coordinate actions between local leaders, NGOs, government institutions, and communities. This would ensure that interventions are context-specific, avoid duplication, and promote sustainability. Effective collaboration would also strengthen local ownership of adaptation initiatives, reducing dependence on external actors and funding.

- Sustainability of adaptation initiatives must be prioritised. Many current interventions depend on external funding, raising concerns about their long-term viability. Stakeholders should therefore focus on building local capacity and promoting community ownership of projects by embedding adaptation practices into local governance structures and ensuring that communities can sustain them independently. Resilience will be strengthened in a robust and independent manner. Long-term success needs on reducing dependence on external actors and fostering a culture of local responsibility and innovation.

5.6.3 Recommendations for further research

- Future research ought to concentrate on the long-term sustainability of climate change adaptation strategies in rural farming communities and also incorporating traditional knowledge systems with contemporary climate-smart agriculture.
- Additionally, studies should also examine youth participation and gender dynamics in climate adaptation initiative implementation so as to provide valuable policy insights.

5.8 Summary

Based on the results of the investigation, conclusions and suggestions have been provided in this chapter. The study found that while many adaption measures are being used and there is a high level of awareness about climate change, their effectiveness is limited by resource constraints, knowledge gaps, and infrastructural challenges. Increasing institutional support, facilitating better resource access, and encouraging a variety of livelihoods are key to enhancing resilience among smallholder farmers in Chanuhwa Village. Implementing the recommendations in this chapter will contribute significantly to sustainable climate change adaptation in Ward 17.

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Appendices

Appendix 1: Bindura University of Science Education Research Clearance Letter

Bindura University of Science Education

DISASTER RISK REDUCTION DEPARTMENT
Private Bag 1020,
Bindura, Zimbabwe
Tel 263 – 66210-7531-6, 7621-4
Fax: 263-66210-7534
E-mail: emavhura@buse.ac.zw or edmavhura@gmail.com
Cell: +263 773 487 211

BINDURA UNIVERSITY OF SCIENCE EDUCATION

26 NOVEMBER 2025

To Whom It May Concern:

This is to confirm that **NDLOVU NOMSA,** Registration Number **B223027B** is a student doing a Bachelor of Science Honours Degree in Disaster Management Sciences in the Disaster Risk Reduction Department at Bindura University of Science Education and is required to do a Research Project as part of her Degree programme. The student is expected to gather data for her project from various sources including your institution.

This letter therefore serves to kindly ask you to assist the above-mentioned student with information relating to her project entitled:

ASSESSING THE FEASIBILITY OF CLIMATE CHANGE ADAPTATION INTIATIVES FOR SMALLHOLDER COMMUNITIES IN WARD 17, CHIMANIMANI DISTRICT ZIMBABWE.

Thank you.

EMMANUEL MAVHURA (PhD)
CHAIRMAN

DISTRICT DEVELOPMENT COORDINATOR
MINISTRY OF LOCAL GOVERNMENT
AND PUBLIC WORKS
0 4 FEB 2026
MANICALAND
P.O. BOX 20, CHIMANIMANI
TEL: 027205 2252/2265

Appendix 2: Focus Group Discussion Questions

Section A: Demographic Information

My name is Ndhlovu Nomsa. As a student from Bindura University of Science Education l' m carrying out an interview regarding climate change adaptation initiatives in Chanuhwa village, Biriiri Ward 17, Chimanimani District, Zimbabwe. You have been selected to be part of this interview, and I would like to ask you certain questions in relation to climate change adaptation initiatives, which may take 30 minutes. This interview is voluntary; all the information provided will be kept confidential. If you have questions about the interview, please feel free to call 0788749220 or email nomsandhlovu@gmail.com. Do you agree to continue? Yes/No

Section B: Awareness and knowledge of climate change

1. What do you understand by the term, and what are the causes of climate change?

2. What changes in weather or the environment have you noticed in Chanuhwa village over the past years?

3. How do these changes affect your farming activities and livelihoods?

4. Where do you get information about climate change, e.g., radio, community leaders, NGOs?

Section C: Adaptation strategies

5. What current climate change adaptation practices are the smallholder farmers around Chanuhwa using on their farms, e.g., conservation farming, agroforestry, drought-resistant crops?

6. Who introduced these initiatives to you, i.e., NGOs, Government agencies, and how were you trained or supported?

7. If someone visited Chanuhwa village today, which climate change adaptation initiatives would be noticed and why?

8i. What adaptation strategies have you heard about but have not tried them, for example, the use of bokashi?

8ii. What reasons do farmers usually give for not trying those methods?

9. Are there any traditional or indigenous practices that help you to cope with climate change?

Section D: Effectiveness of Existing Climate Change Adaptations

10 i. What changes have farmers noticed since the adoption of climate change adaptation initiatives, e.g., improved crop yield, improved soil fertility?

10 ii. Have these practices helped you cope with droughts, floods, or soil erosion?

11. What challenges do you face in implementing these initiatives, e.g., labour, tools, costs, and knowledge?

12. Do you feel these initiatives have improved your household' s resilience to climate shocks more than before?

Section E: Proposed actions to improve resilience to climate change adaptation

13. What additional support would you make these initiatives more successful, e.g., training, financial assistance, access to inputs, promote livestock diversification, and crop diversification?

14. What role can the community itself play in improving resilience, for example, promote climate knowledge sharing, promote sustainable community projects such as nutrition gardens, and tree planting initiatives?

15. How can the government, NGOs, or local leaders better support you in adapting to climate change, e.g., encourage strong farmer groups, promote community-based preparedness plans, and better coordination with NGOs?

Appendix 3: Key Informant Interview Guide

Section A: Demographic information

My name is Ndhlovu Nomsa. As a student from Bindura University of Science Education, I' m carrying out an interview regarding climate change adaptation initiatives in Chanuhwa village, Biriiri Ward 17, Chimanimani District, Zimbabwe. You have been selected to be part of this interview, and I would like to ask you certain questions in relation to climate change adaptation initiatives, which may take 30 minutes. This interview is voluntary; all the information provided will be kept confidential. If you have questions about the interview, please feel free to call 0788749220 or email nomsandhlovu@gmail.com. Do you agree to continue? Yes/No

Name of respondent----------

Gender of respondent----------

Age of respondent

a) 0-17 ☐

b) 18-35 ☐

c) 36-60 ☐

d) Above 60 ☐

Name of Organisation----------

Section B: Awareness and knowledge of climate change

1. From your own perspective, how knowledgeable are smallholder farmers in Chanuhwa village about climate change and its impacts?

2. What signs of climate change have you observed in this community, e.g., crop failure, rainfall patterns?

3. How do farmers usually access information about climate change, e.g., traditional leaders, NGOs, media?

4. In your view, what gaps exist in farmers' awareness or understanding of climate change?

Section C: Adaptation strategies

5. What climate change adaptation initiatives are currently being implemented by smallholder farmers in Chanuhwa village, e.g., crop diversification, water harvesting techniques, and sustainable projects?

6. How common are these practices among farmers?

7. Are there indigenous or traditional practices that farmers rely on to cope with climate variability?

8. Who has introduced or supported these initiatives, e.g., NGOs, Government stakeholders?

Section D: Effectiveness of Existing Climate Change Adaptations

9. Based on your observations, how effective have these initiatives been in improving farmers' resilience?

10. Are there successes and challenges in implementing these initiatives, and what are they?

11. What factors have contributed to the success or failure of adaptation practices in Chanuhwa village?

12. Do you think these initiatives are sustainable in the long term, and why?

Section E: Proposed actions to improve resilience to climate change adaptation

13. What additional support or interventions could improve the resilience of smallholder farmers in Chanuhwa village, for example, promote livelihood diversification, strengthen access to inputs, and promote climate-smart agriculture support?

14. What role should the government, NGOs, and local leadership play in strengthening adaptation efforts, for example, supporting community-based projects, and enforcing local bylaws against deforestation?

Appendix 4: Structured questionnaire

Section A: Demographic Information

My name is Ndhlovu Nomsa. As a student from Bindura University of Science Education, I' m carrying out an interview regarding climate change adaptation initiatives in Chanuhwa village, Ward 17, Chimanimani District, Zimbabwe. You have been selected to be part of this interview, and I would like to ask you certain questions in relation to climate change adaptation initiatives, which may take 30 minutes. This interview is voluntary; all the information provided will be kept confidential. If you have questions about the interview, please feel free to call 0788749220 or email nomsandhlovu@gmail.com. Do you agree to continue? Yes/No

Name of respondent----------

Gender of respondent----------

Age of respondent

a) 0-17 ☐
b) 18-35 ☐
c) 36-60 ☐
d) Above 60 ☐

Name of village----------

Section B: Awareness and knowledge of climate change

1. Have you heard about climate change? Yes/No

2 i. How do you rate your knowledge of climate change impacts on farming?

a) Very knowledgeable ☐
b) Limited knowledge ☐
c) No knowledge ☐
d) Somewhat knowledgeable ☐

2 ii. How do you think climate change affects your farming activities?

a) Reduced crop yields due to irregular rainfall ☐

b) Changes in planting seasons ☐

c) Increased pests and diseases that affect crops ☐

d) Livestock deaths due to heat stress and lack of water ☐

e) Others please specify:----------
---

3. What changes in weather patterns have you observed in the past 10 years?

a) Increased drought ☐

b) Flooding ☐

c) Cyclones ☐

d) Soil erosion ☐

e) If others specify----------

4. What sources of information do you rely on?

a) Radio ☐

b) NGOs ☐

c) Community leaders ☐

d) Government extension services ☐

e) If others please specify----------

Section C: Adaptation strategies

5 i. What do you understand about climate change adaptation?

---

5 ii. Which of the following adaptation practices are you currently using?

a) Conservation farming ☐

b) Agroforestry ☐

c) Drought-resistant crops ☐

d) Apiculture ☐

e) Aquaculture ☐

f) Water harvesting ☐

g) Irrigation schemes ☐

h) Traditional practices ☐

i) If others specify----------

6. Who introduced or supported these practices?

a) Government ☐

b) NGOs ☐

c) Community leaders ☐

d) Self-initiated ☐

e) Others, specify----------

7. How long have you been practising these initiatives?

a) Less than a year ☐

b) 1-3 years ☐

c) More than 3 years ☐

Section D: Effectiveness of Existing Climate Change Adaptations

8 i. Have these changes improved your crop yields/food security?

a) Yes ☐

b) no ☐

8 ii. How effective have these initiatives (crop diversification, water harvesting, use of organic manure, and use of traditional pesticides) been in improving your crop yields?

a) Very effective ☐

b) Moderately effective ☐

c) Not effective ☐

9. Have these practices helped you cope with climate shocks, e.g., floods, drought?

a) Yes ☐

b) No ☐

c) Somewhat ☐

10. Do you think these initiatives are sustainable in the long term? Give a reason for your answer.

a) Yes----------

b) No----------

c) Not sure ☐

11. What challenges do you face in implementing these initiatives?

a) Lack of tools ☐

b) High labour demand ☐

c) Limited knowledge ☐

Section E: Proposed actions to improve resilience to climate change adaptation

12. What additional support would make adaptation initiatives more successful?

a) Training ☐

b) Financial assistance ☐

c) Access to inputs ☐

d) Better infrastructure, e.g., irrigation schemes ☐

e) Others, specify----------

13. What new ideas or practices would you like to see introduced in Chanuhwa village?

a) Conservation agriculture ☐

b) Construction of dams and boreholes for irrigation ☐

c) Use of compost and bokashi ☐

d) Small businesses, such as crafts ☐

e) Nutrition gardens ☐

f) Farmer trainings on climate-smart agriculture ☐

g) Increased support from NGOs and the governmen☐

h) If others specify----------
---

14. How can the government, NGOs, and local leaders support farmers in adapting to climate change?

a) Involve communities in planning and decision-making. ☐

b) Enforce environmental bylaws, such as preventing deforestation☐

c) Promote the use of indigenous knowledge ☐

d) Support vulnerable groups ☐

e) Provide training and awareness on climate-smart agriculture ☐

f) Develop irrigation infrastructures ☐

g) Strengthen agricultural extension services ☐

h) If others specify,----------
---

15. What role can the community itself play in improving resilience?

a) Promote natural resource management. ☐

b) Participate in group labour systems such as nhimbe ☐

c) Sharing knowledge on climate change and farming practises ☐

d) Tree planting ☐

e) Participate in irrigation projects ☐

f) If others specify----------

Appendix 5: Researcher Observation Guide

Observation attributes	Field comments
• Evidence of crop diversification, such as small grains, drought-tolerant varieties (millet, wheat, and cow peas).	
• Sustainable projects are being implemented for livelihood diversification.	
• Soil conservation techniques.	
• Water management practices.	
• Evidence of seed banks.	
• Land size	
• Positive and negative impacts of climate change on crop growth (crop health)	