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ENHANCING RURAL COMMUNITY RESILIENCE ON FOOD INSECURITY THROUGH AGRICULTURAL PRACTICES IN CHIMANIMANI DISTRICT, ZIMBABWE.

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A dissertation submitted in partial fulfilment of the requirements of the Bachelor of Science Honours Degree in Agricultural Economics and Management.

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DECLARATION

I, Sithabile T.S. Moyo, declare that this dissertation titled Enhancing Rural Community Resilience on Food Insecurity through Agricultural Practices in Chimanimani District, Zimbabwe, is my original work and has not been submitted elsewhere for any degree or qualification. I acknowledge that I have received guidance and support from my supervisor, Dr. V.T. Munyati, and other academic staff during this research; however, the intellectual content and presentation of this dissertation are entirely my own. I have followed the guidelines and regulations of the Bindura University of Science Education regarding plagiarism and academic integrity, and I have properly cited and referenced all sources of information used in this dissertation.

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DEDICATION

I dedicate this project to:

God the Almighty, who has been my source of strength and inspiration

My family has been my rock throughout this journey. Your unwavering support and encouragement have meant a lot to me.

My supervisor, Dr V.T. Munyati, I appreciate your guidance and mentorship.

My colleagues, friends have provided a supportive and stimulating environment.

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ABSTRACT

This research examines how sustainable agricultural practices can enhance rural community resilience to food insecurity in Chimanimani District, Zimbabwe. The Chimaimani district faces significant challenges, which include climate change, poverty, and inadequate farming practices, resulting in elevated levels of food insecurity. Employing a mixed-methods research design, this study examines the effects of sustainable agricultural practices on household food security and community resilience through the analysis of current farming methods, identification of effective climate adaptation strategies, and assessment of sustainable practice impacts.

Results demonstrated that sustainable agricultural practices, particularly conservation farming (93.4% adoption) and organic farming (76.8% adoption), significantly improve food security outcomes. Households practicing conservation farming showed substantially higher meal frequencies, with 49.2% consuming three meals daily compared to lower consumption rates among non-practitioners. The study identified six primary climate adaptation strategies, with conservation farming (84.4%) and crop diversification (77.7%) emerging as the most widely adopted approaches. These practices contributed to enhanced crop yields, improved household nutrition, and increased resilience to climate variability.

The results also indicated that food insecurity can be reduced by making sustainable agricultural implications like conservation farming and crop diversification, which are proven by the upturn in the frequency of meals as well as general household nutrition. The research study emphasizes the value of communal involvement especially the role of women when trying to enforce successful farming interventions. It, further, highlights on the dire need of local measures that can be undertaken in countering the persisting phenomenon of climate change on agricultural production. The findings of the research are useful to policy makers and farmers to be aware of future course of action in enhancing food security and to achieve sustainable development in such type of scenario. This research study will cut across more issues on resilience and sustainable livelihoods in rural areas by working on the source of food insecurity

Keywords: food insecurity, rural community resilience, agricultural practices .

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LIST OF ACRONYMS AND ABBREVIATIONS

CSA - Climate-Smart Agriculture

CBA - Cost-Benefit Analysis

FAO - Food and Agriculture Organization

FGD - Focus Group Discussion

FNC- Food and Nutrition Council

GIS - Geographic Information Systems

IFAD - International Fund for Agricultural Development

KII - Key Informant Interview

NDS1 - National Development Strategy 1

PSM - Propensity Score Matching

SAPs - Sustainable Agricultural Practices

SDGs - Sustainable Development Goals

SLA - Sustainable Livelihoods Approach

WFP - World Food Programme

ZimVAC - Zimbabwe Vulnerability Assessment Committee

CHAPTER ONE

INTRODUCTION

1.0 BACKGROUND OF THE STUDY

Food insecurity has emerged as a critical global challenge affecting millions of people worldwide. Global hunger affected 9.2 percent of the world population in 2022, compared to 7.9 percent in 2019, which translates to between 691 and 783 million people facing hunger (IFAD, et al., 2023). Food insecurity poses severe threats to economic stability globally, as it can hinder physical and cognitive development, negatively impacting labor productivity across various sectors (Royer, et al., 2021). Research by (Berkowitz, et al., 2018), stated that food insecurity is associated with higher healthcare use, as large shares of healthcare costs are incurred for small proportions of patients, who are often emergency department patients admitted for lengthy stays. As expressed in the Sustainable Development Goals (SDGs) the global community is determined to realize three major goals by 2030 namely eradicating poverty, eliminating hunger, and taking urgent actions on climate change and its consequences. (Lipper, et al., 2018).

Landlocked countries mainly in Africa face particular challenges with food insecurity. These factors create substantial barriers for rural communities, impacting their livelihoods and overall well-being. Results from research conducted by (Ndiweni & Manik) affirmed that there is a correlation between education attainment and the food security status of children. Children experiencing food insecurity are more likely to miss out on school and have very low educational attainment. Food insecurity can also lead to increased crime rates as individuals resort to illegal methods of obtaining food. (DiFore , et al., 2022) noted that lower food insecurity prevalence was associated with higher perceived neighborhood safety, social cohesion, and lower police-recorded violent crime rates. The government may need to increase expenditure on social safety nets to support households experiencing food insecurity, thereby straining public finances, (Baptista, et al., 2022).

Due to the 49 percent of the population living in the extreme poverty level, Zimbabwe as a landlocked country has serious food security challenges (WFP, Zimbabwe Country Brief, 2023).

According to the Rural Livelihood Assessments report by the Zimbabwe Vulnerability Assessment Committee (ZimVAC) 2023, it is estimated that 29 percent (1.5 million) of those in the urban areas (population of 2023) and 19 percent (1.9 million) in the rural regions are cereal insecure (FNC, 2023). The report further postulated that 26 percent (2.7 million people) of the rural population will be food insecure during the January-March 2024 hunger period. The Zimbabwe Vulnerability Assessment Committee (ZimVAC) 2023 report estimates that an estimated 29 percent (1.5 million) of the urban population and 19 percent (1.9 million) of the rural population are cereal insecure (FNC, 2023), and the projection indicates that 26 percent (2.7 million) of the rural population are likely to experience food insecurity during the January to March 2024 hunger period.

Chimanimani District continues to experience great challenges, which impact negatively on agricultural production such that agricultural production yields are low resulting in insecurity of food. Chimanimani District records a high rate of food insecurity and the reports have shown that it is one of the most food insecure regions in the Manicaland Province caused by the factors such as recurrent droughts, poor harvests and the detrimental effects of cyclone Idai which was very active in this region. Different varieties of Cyclones had been recorded in Chimanimani District over the years with massive effects on the agricultural topography of the area as well as the community strength. Cyclone Idai in 2019, Cyclone Kenneth 2019, Cyclone Eline 2000 happened to be the most notable cyclones.

This District was hardest hit by Cyclone Idai (March 2019) it claimed 173 lives, 279 missing persons and 318 were injured. A total of 2252 households were affected thereby leaving 4073 households homeless, it also destroyed a lot of infrastructure such as bridges, roads, telephone lines, powerlines, etc. due to these losses agricultural production was affected. Since Cyclone Idai occurred a lot of work like agriculture has been down towards reconstruction of the damaged infrastructure.

According to research carried out by the Food and Nutrition Council (2023), food insecurity is a critical issue in Chimanimani since the district has a high prevalence of chronic malnutrition and a substantial proportion of children below the age of 5 years is stunted, the situation is worsened by frequent drought and floods that will cause disruptions in agricultural practices and activity as

crop yields are reduced. Literature indicates that food insecurity is one of the problems affecting a greater percentage of homes in Chimanimani especially during the off seasons.

The prevalence of chronic malnutrition in Chimanimani is worrying and proportionately a significant number of the children under the age of five years suffer stunting. This has been made worse by frequent droughts and floods that affect farm activities resulting in low crop production. The challenges that are affecting the communities of Chimanimani District are enormous and this impacts their livelihoods and lives of the people and the resilience of the rural communities is paramount towards ensuring that development is sustainable and well-being of the communities are enhanced. The agricultural activities are crucial in promoting the resilience of rural communities because through them, the communities have access to income, food, and job (FAO, 2020). Thus, the study aims to critically examine the agricultural activities that can be employed by the farmers to improve the resilience of the rural communities to overcome food insecurity in the District of Chimanimani in Zimbabwe.

1.2 PROBLEM STATEMENT

Food security is key in ensuring that all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life. The Chimanimani District is also characterized by some major challenges in form of extreme state of food insecurity because of climate change, poor agricultural practices, and also social economic issues. The farmers in the district also struggle with major hindrances that do not allow them to make sustainable production despite the high agricultural potential of the region. The proposed study aims at filling the gap in knowledge on how sustainable agricultural means can result into improved food security and resilience among the rural people in Chimanimani. In the year 2023, Zimbabwe ranked at 107 because it had a global hunger index of 28 which is in the range of 20.0 to 34.9 which is a serious hunger (CONCERN & WHH, 2023).

Attributable to the regular weather patterns, such as Cyclone Dineo in 2017, Cyclone Idai in 2019, and Cyclone Eloise in 2021, Chimanimani District has been struggling with food security challenges. The devastating agricultural disasters occurred as a result of these extreme weather events have displaced communities and sacrificed local food production systems. Data obtained from the Zimbabwe Vulnerability Assessment Committee (ZimVAC) indicates that an estimated

22% of the Chimanimani population will be food insecure by 2023. This percentage grows drastically during and after the events of cyclones (FNC, 2023). Ruch rural communities are now under threat because of the current impacts of climate change and poor agricultural practices which makes the high resilience necessary by adopting sustainable agriculture techniques to be realized as fast as possible. It is necessary to resolve these issues to enhance food security and make the community more stable in Chimanimani. The study as well will examine the interaction between socio-economic and agricultural activities in an attempt to determine whether there are effective mechanisms that can be used in an attempt to address food insecurity in the area. Back in 2020, according to the United Nations report, Zimbabwe was among the leading global food crises in the world (Maiden, 2020). By December 2022, a total of 5.2 million people in Zimbabwe had been reported to experience inadequate food consumption (WFP, 2023) and a total of 15,000 children are admitted annually to treat severe wasting (UNICEF, 2023).

Chimanimani food insecurity is widely varied and it may either be chronic hunger, undernourishment, seasonal food crisis among many others. Recent evaluation showed a high number of the population is highly food insecure, and the vulnerable population is primarily women and children, who are affected immensely (Mavhura, 2017). The contract between poverty and opportunity to make a living with poor yields in agriculture is having part in the cycle of insecurity on foods causing sweeping specific action on this.

1.3 RESEARCH QUESTIONS

1. What is the effect of sustainable agricultural practices on food security in Chimanimani District, Zimbabwe?
2. What are the strategies farmers in Chimanimani District use to adapt to climate change?
3. How do the farming methods used by farmers in Chimanimani District?

1.4 OBJECTIVES OF THE STUDY

1.4.1 Main Objective

- To enhance rural community resilience on food security in Chimanimani District

1.4.2 Specific Objectives

1. To analyze the effect of sustainable agricultural practices on food security
2. To identify the strategies that farmers can use to adapt to climate change
3. To examine the farming methods used by farmers in Chimanimani District

1.5 HYPOTHESIS

Conservation farming significantly improves food security levels among smallholder farmers in Chimanimani district, Zimbabwe

- Null hypothesis: There is no significant difference in food security levels between smallholder farmers practicing conservation farming and those not practicing conservation farming in Chimanimani district, Zimbabwe.
- Alternative hypothesis: Smallholder farmers practicing conservation farming in Chimanimani district, Zimbabwe, have significantly higher food security levels compared to those not practicing conservation farming.

1.6 JUSTIFICATION

This study offers me an opportunity to increase my knowledge, my academic background in the **Bachelor of Science Honours Degree in Agricultural Economics and Management** has provided me with the analytical skills so as to explore more on the issues of agriculture and food security. The improvement of food insecurity in Chimanimani District will be an important intervention to uplift the lives of inhabitants and the overall economy of Zimbabwe. This research will lead to useful findings that can benefit policymakers and guide development work on investigating the role of sustainable agricultural practices in a bid to come up with appropriate statements that can reveal its relevance. The results will be reflected in the latest discussion about food security, sustainable development, and rural resilience, and present evidence-based solutions that could be modified to a similar situation. In this analysis, this paper seeks to advance the knowledge on food insecurity and agricultural sustainability, which is of value to future scholars and graduate school students in agricultural economics and food policy. The research will provide evidence-based measures that farmers can borrow to enhance the sustainability and productivity of the farms and they will make sound recommendations concerning the diversification of crops and conservation of resources that will eventually lead to higher levels of production in terms of the produce and the health of the communities respectively. To the government and policymakers, the findings will be used to shape data driven policies that can be used to fight against food insecurity by influencing specific interventions that will promote sustainable practice, better food distribution systems and resource access to the vulnerable people.

1.7 SCOPE AND LIMITATIONS OF THE STUDY

This research will look at how the agricultural practices impact food security resilience in Chimanimani District, Zimbabwe, and evaluate the post-harvest losses, crop diversity, and nutritional adequacy while identifying effective climate change adaptation strategies like water management techniques and soil conservation practices. This study contributes to the fulfillment of the requirements for a bachelor's degree, it also enhances my understanding of rural development dynamics, agricultural systems and community-based adaptation strategies for future professional engagement.

This study documents modern and traditional farming methods across different agroecological zones, seed selection, pest management, intercropping systems, and post-harvest handling. This study will involve various stakeholders such as male and female farmers, agricultural extension offices, local authorities, traditional leaders and NGOs in a bid to cover on all the grounds with regards to determining the factors influencing agricultural resilience and food security in this District. The results of the research will serve as a guide to farmers who want to diversify their agricultural activities and enable them to become more resilient to food insecurity because it will determine adaptation measures that are already being used by resilient farmers in the district. However, the study uses information gathered from farmers in Chimanimani District, which might be biased because of the sample group's specialization.

Anthropometric measurements were not used as they require a lot of resources and time to gather, and the respondents may give false information as they might associate their responses with whether they are going to receive food and cash assistance. The research had no control over the effects of political or even socio-economic variables on food security. This research provides critical evidence-based insights that can inform the development of more effective rural development policies and agricultural support programs to policy makers and the government. The research focus on community resilience aligns with the Zimbabwe's National Development Strategy (NDS1) and the Agriculture and Food Systems Transformation Strategy which focus on the importance of building resilient agricultural systems.

1.8 STRUCTURE OF THE STUDY

The research project is categorized into 5(five) chapters, whereas chapter one(introduction) represents the background of the study, problem statement, research objectives, research questions, justification, scope, and limitation of the study and structure of the study. Chapter two (literature review) this chapter gives extensive literature on the research conducted on food security. The structure of this chapter includes introduction, definition of terms, empirical review on analyzing sustainable agricultural practices and their impact on food security, empirical review on identifying effective strategies for farmers to adapt to climate change, empirical literature review on the farming methods utilized by farmers in Chimanimani district, theoretical framework, conceptual framework and insights from the literature. The third chapter focuses on the research method that was used in data collection, it gives description of methods and procedures that were utilized in data collection. Chapter four presents' data analysis, tables will be used to represent data, presentations of the research findings and create transparency of the findings. Lastly chapter five, it gives a research summary, conclusions, recommendations and references.

CHAPTER TWO

LITERATURE REVIEW

2.1 INTRODUCTION

This chapter gives extensive literature on the research conducted on food security, which also provides an explanation of the terms used in food security studies to help various researchers have a deeper comprehension and appreciation of food security challenges at both the local and global levels. It also reveals related theoretical and empirical literature on enhancing rural community resilience to food insecurity. This chapter summarizes research techniques to enhance rural community resilience to food insecurity and presents the opinions of scholars on the subject. It examines how other researchers conducted their studies and the techniques they employed for data analysis.

2.2 DEFINITION OF TERMS

2.2.1 Rural Community Resilience

(Clutter & Derakhshan, 2015)conceptualized rural community resilience as the ability of rural social systems to absorb disturbances, recognize and retain essential functions, structures and feedbacks while maintaining their identity in the face of increasing environmental, economic and social stressors. On the other hand, (Norris, et al., 2016)defines community resilience as a process that links adaptive capacities to a positive trajectory of functioning and adaptation after a disturbance. In this study, rural community resilience is the ability of a rural area to adapt to change and maintain a standard of living while also recovering from mistakes. It can also be defined as the ability of rural communities to withstand, adapt and recover to various uncertainties such as natural disasters, social changes etc. Abegunde and Bolaji (2024) defined rural community resilience as the sustained ability of rural communities to utilize available resources to respond to, withstand, recover from and recognize in response to crises drawing strength from social cohesion, indigenous knowledge systems and adaptive agricultural practices to ensure livelihood sustainability.

2.2.2 Food Insecurity

The Zimstat report of 2025 defines food insecurity as a situation where access to appropriate amounts of nutritious and safe food deprives people or households of an assurance that there is access to food. The report also shows that in Zimbabwe poor people have to survive on the single food meal a day or can purchase food less than a dollar every day. This is the case of poor resources to get the required dietary requirements to enjoy a healthy and active living. The report underlines that this type of a low access to food affects both the general well-being and the health outcome properly. Food insecurity according to FAO 2018, is defined as when people do not have sufficient access to food to meet their dietary needs, this definition takes into account the multifaceted nature of the issue. It also takes into account both financial and physical access. In the United States, the term "food insecurity" refers to the social and economic issue of food insecurity caused by resource or other limitations, not by dieting or voluntary fasting, disease, or other causes. According to this definition, which is backed by ethnographic research by (Coleman-Jensen, et al., 2020), (Whittle, et al., 2021) further clarified this distinction through ethnographic research in urban communities, documenting how resource constraints force households to make compromised food choices that would not occur under voluntary circumstances. Their definition explicitly contrasts food insecurity with situations where individuals have adequate resources but choose to limit intake. Similarly, (Rose-Jacobs, et al., 2019) employed mixed-methods research to define food insecurity as the economic and social condition of limited access to adequate food, distinguishing it from temporary food limitation due to illness or religious practices

2.2.3 Agricultural Practices

Tilman, D., et al. (2018) defines agricultural practices as the particular methods and strategies used to cultivate crops and rear animals in a way that minimizes environmental effect and satisfies the demands of food production. According to (Kassam, et al., 2022)defines agricultural practices as a set of methods that includes soil management, crop rotation, and resource conservation aimed at enhancing agricultural productivity and ecological balance. Moyo, S. (2021) defines agricultural practices as the combination of traditional and contemporary methods used to enhance agricultural productivity while ensuring environmental sustainability and adaptation to socio-economic changes. In this study agricultural practices refers to the methods, techniques and the systems used

to cultivate, manage, and harvest crop and livestock, types of agricultural practices are intensive farming, commercial agriculture and shifting cultivation.

2.3 THEORETICAL FRAMEWORK

2.3.1 Sustainable Livelihoods Approach (SLA)

The Sustainable Livelihood Approach was created in the mid-1980s by the researchers Robert Chambers and Gordon Conway in order to assess different contexts of vulnerability and to enhance the efficiency of development cooperation. The concept of sustainable livelihoods is made up of multiple ideas and interests, in which a number of different strands in the development debate have come together. This approach holds that the main goals of poverty depletion initiatives should be to enable the poor to take use of their own opportunities, facilitate their access to resources, and create an institutional and regulatory environment that supports them. It is evident that livelihood approaches position people and their priorities at the center of development by striving to understand the differences between different groups of people and work with them in a manner that is suitable for their social environment, current livelihood strategies, and capacity for adaptation.

Livelihoods approaches are basically participatory as they try to balance economic, institutional, social and environmental sustainability. The livelihoods approaches recognize the dynamic nature in the sense that a livelihood comprises the capabilities, assets (stores, resources, claims and access) and activities required for any means of living. Livelihood strategies are a mixture of activities that people choose to undertake in order to attain their livelihood goals, the livelihood strategies include productive activities, investment strategies and reproductive choices. The most influence on people's choice of livelihood strategies is their access to policies and assets, institutions and processes that affect their ability to use these assets in order to achieve positive livelihood outcomes. These livelihoods approaches attempt to understand on the strategies pursued and factors behind the people's decisions, to strengthen the positive aspects of the strategies and mitigate against constraints.

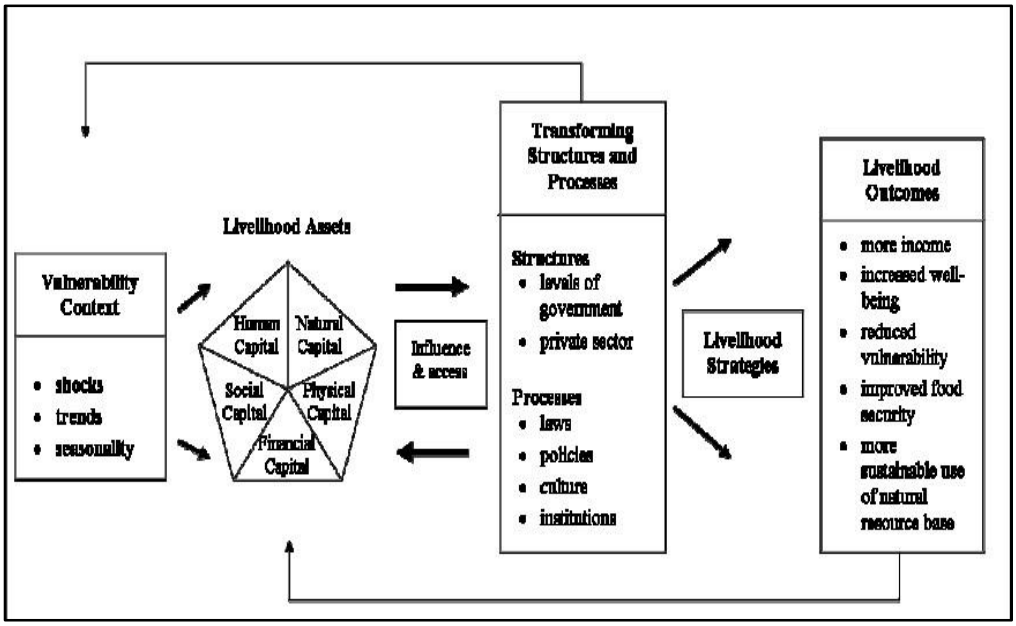

Figure 1 : Sustainable Livelihood Approach

Source: DfiD, (1999)

Figure 2.1 shows livelihoods assets, vulnerabilities, structures and processes, livelihood strategies and livelihood outcomes, these elements are to be explained below:

Livelihoods assets

Assets belongs to an individual or household constitute the building blocks upon which people can attain their own personal goals of the type and quality of life they desire and these assets are classified into five categories which are namely Human capital comprising of personal characteristics such as health, knowledge, education and the capacity to adapt; Natural capital which comprises of environmental resources such as land access, water resources, ecosystem services, crop production, biodiversity and climatic conditions; Social capital consist the characteristics of connections with others which includes informal and formal groups, networks, formal and informal groups, opportunities for participation and understood rules which therefore

provides support system; Financial capital comprises of economic characteristics such as pensions wages, savings, credit access and debts that can be invested in agricultural activities ;Physical assets comprising of infrastructure and technologies such as communications tools, energy and roads . According to (Manyani, 2017)communities with diversified livelihood assets have greater capacity to withstand shocks like extreme weather events that threaten food security.

Vulnerabilities

This context encompasses external environment that affects people's livelihoods and food security (Munsaka, 2019)The vulnerability perspective of the Sustainable Livelihoods Approach (SLA) encompasses influences from economic trends, population dynamics, governance, and technology, as well as seasonality factors like prices, productivity, and employment opportunities, alongside shocks from natural conditions, health issues, and conflicts. The latter exposes a household to various experiences of vulnerability in association with sensitivity and exposure, but in a decreasing level of adaptive capacity. Sustainable livelihoods critically depend on the capacity of the people to recover and absorb shocks without losing the household assets and the natural resource bases. According to (Chanza, & Musakwa , 2022) knowing these vulnerabilities are the key to establishing specific resilience measures in agricultural commodities.

Some people live in poverty because of the disparities associated with demographic attributes, which reduce their possibilities of overcoming or resisting shock (Quandt, 2018); (Patel, et al., 2020): (Musavengane, et al., 2020) These inequalities as well as capabilities and asset problems must be addressed to create effective reduction of poverty. Shocks or sudden shocks, be it due to negative environmental situations, indebtedness, or sickness, may have lasting effects, especially, among those with low coping capabilities. When there is a massive event, such as the death of a spouse or chronic issues, such as climate change, shifts in livelihoods may need to be made at larger scales (Chikoore and Bowden, 202); (Muyambo, et al., 2017). The resilience to such shocks is very important in influencing the livelihood style of individuals in their decision making process and requiring the need to examine the many different strategies which they adopt.

Structure and process

Ncube and Shava (2018) transforming structures and processes are institutions, organizations, policies and legislation that shape livelihood opportunities. Structures and process is an important component within the Sustainable Livelihoods Approach (SLA) serves as the transforming mechanisms that determine how assets are accessed, utilized and conveyed into livelihoods outcomes. (Goldman,, et al., 2023)emphasize that strengthening supportive institutional structure significantly improves agricultural resilience in eastern Zimbabwe.

Livelihood strategies

These are the choices and activities people tend to make to achieve their livelihood goals. Gautam and Andersen (2016) stated that the livelihood strategies represent the combination of activities that people may choose to undertake so as to achieve their livelihood goals. In rural contexts, livelihood strategies often include livelihood diversification and agricultural intensification with households frequently employing multiple strategies simultaneously to reduce vulnerability (Asfaw , et al., 2019). The selection of specific strategies depends heavily on asset portfolios and institutional contexts, as (Belay and Bekwet 2015) emphasizes that households with greater access to natural and financial capital typically pursue more sustainable and profitable strategies.

Outcomes

This is the last element of the Sustainable Livelihood Approach (SLA) in which it recognizes outcomes that households intend to attain when they employ particular coping strategies. However, it should be noted that not all strategies and their respective outcomes are applicable to all circumstances that people find themselves in. They represent the achievements, results that were derived from strategies that were employed (Asmamaw,, et al., 2019)observe that livelihood outcomes are co-produced through interactions between household strategies and institutional environments documenting how similar strategies yield dramatically different outcomes depending on governance structures.

2.3.2: Food availability decline approach (FAD)

The main focus of FAD is on food supplies as a major cause of food insecurity and this led to great investments in green revolution technologies that were designed to increase food suppliers for both consumption and exports. The Food Decline Approach framework represents a documented

perspective on the cause of a severe and scarcity of food leading to an extreme hunger and starvation within a nation. The FAD approach proposes that starvation occurs when there is a significant decrease in the total amount of food available in the nation, this decline is seen as the primary driver of widespread hunger and starvation.

The FAD approach has played the most significant role in shaping our understanding of hunger, it has helped to draw closer attention to the importance of food production and distribution in the prevention of hunger and starvation. Understanding this approach is important because it was the prevailing theory of hunger and starvation. However, the realization that food availability alone does not ensure access by all, that malnutrition could be caused by diseases or digestive problems, that inequality in access to resources will lead to unequal distribution of food and opportunities and, above all, that purchasing power is of paramount importance, led to the decline of this approach and the emergence of the entitlement approach.

The FAD concept has been faulted on the fact that it underrates the influences of governance, social networks and political stability on food security. Problems like corruption, policy failure and social stratification may interfere significantly to food distribution and Food availability. In the FAD approach, the total food output of a locality generally reduces translating into rising cases of hunger and malnutrition. This way of thinking focuses on the measurable features of food production such as the agricultural outputs, animal population, and food imports.

The FAD approach suggests a direct correlation between food production levels and the occurrence of famine. When food availability drops below a certain threshold, the risk of famine increases, affecting the most vulnerable populations. Since famine ultimately kills an individual who fails to gain access to the national food basket, it is important to shift focus to individual food access and its contribution to the macro-supply of food in addition to other sources of supply.

2.4 REVIEW OF EMPIRICAL LITERATURE

2.4.1 Empirical Review on Analyzing How Sustainable Agricultural Practices Affect Food Security

Research shows that sustainable agricultural practices can have a significant impact on farmers' food security. A study; Agroecology and the decision of climate change re-silient farming systems by (Altieri, et al., 2015) implies that, soil health, and biodiversity favored by agroecological practices enhance crop yields and resilience of the re-silient farming systems to climate variability. In a meta-analysis of (Pretty, et al., 2018) Global assessment of agricultural system redesign for sustainable intensification concluded that in developing countries, sustainable practices in agriculture raise production by 80% or more hence improving food security. Notwithstanding, various socio-economic components affect adoption of sustainable practices, including availability of credit and education among others, which has a strong influence on the tendency of farmers to adopt sustainable practices. Farmers taught at higher levels are likely to apply innovative methods that increase productivity and minimize climate risks.

Research has been conducted using regression analysis on the factors which determine the adoption of sustainable agriculture practice (SAP) by farmers in West Africa. In West Africa, a study conducted by (Kpadonou et al. 2020) carried out a study on the regression analysis to analyze the factors that determine the adoption of SAPs by farmers and the results indicated that factors such as extension services, education and access of credit influenced the adoption of SAPs among farmers. (Makate, et al., 2017)'s study increasing resilience of smallholder farmers to climate change through multiple adaptions of proven climate-smart agriculture innovations- lessons from Southern Africa has shown that farmers who have adopted SAPs have increased their maize productivity and farm income. The adoption of SAPs therefore, has a greater potential for eliminating poverty and food insecurity problems among rural households. In recent years, SAPs have garnered significant attention due to their potential to increase farmers' income and food security while promoting environmental sustainability (Mekonnen et al., 2020). In order to address food security and climate change, experts and international institutions have recommended the adoption of SAPs.

The economic viability of SAPs and their potential to increase farm revenue and food security have also been evaluated using cost-benefit analysis (CBA), an analytical technique. The economic practicality of SAPs in Africa was examined by (Pretty et al. 2018) using CBA. The findings indicated that the adoption of these sustainable agricultural practices was both economically

feasible and had the potential to increase farm revenue and food security. Studies have demonstrated that SAPs may greatly increase agricultural revenue and food security. According to research by (Murendo, et al., 2019) farmers who used sustainable agricultural practices saw a 25–30% gain in farm revenue. The increase in income can be attributed to improved crop yields, reduction of soil erosion and enhancing soil fertility (Ajala, et al., 2020)

To assess the impact of sustainable farming methods on farmers' income and food security, propensity score matching (PSM), has been used. The adoption of SAPs greatly increased farm income and food security, (Mekonnen, et al., 2020)'s study Can household dietary diversity inform about nutrient adequacy? Lessons from a food systems analysis in Ethiopia that used PSM to analyze the effects of SAPs in East Africa. He attributed this favorable effect to SAPs' capacity to increase crop yields, decrease soil erosion, and boost biodiversity. The adoption of SAPs had a beneficial effect on farm income and food security, especially among smallholder farmers, according to Mwongera et al.'s study, which also employed the PSM to assess the impact of SAPs on farm income and food security in Sub-Saharan Africa.

Propensity score matching (PSM) has been used to evaluate the significance of sustainable agricultural practices on farmers' income and food security. A study by (Mekonnen, et al., 2020) used PSM to examine the impacts of SAPs in East Africa and the results shows that the adoption of SAPs significantly improved farm income and food security, he attributed this positive impact to the ability of SAPs so as to improve crop yields, reduce soil erosion, and enhance biodiversity. (Mwongera, et al., 2017)also used the PSM to evaluate the impact of SAPs on farm income and food security in Sub-Saharan Africa. This study found that SAPs adoption had a positive impact on farm income and food security, particularly among smallholder farmers. The authors noted that SAPs helped to improve crop productivity, reduce post-harvest losses, and enhance market access.

Agricultural practices, broader socio-economic factors play a crucial role in shaping food security outcomes. Studies by the (Washington Dc, 2020) highlight that poverty is a significant driver of food insecurity. Households with limited financial resources are less able to invest in sustainable practices, leading to a cycle of poverty and food insecurity. Furthermore, climate change exacerbates these challenges, as erratic weather patterns disrupt agricultural production and threaten food availability.

Adopting sustainable agricultural practices, such as crop diversification, composting, mulching, minimum tillage, and integrated pest management, has been shown to dramatically raise farmers' incomes. An African study effects of adoption of ecological farming practices on farm income in rural households: Central Kenya (Kamawu, et al., 2024) found that households that implemented a full suite of ecological practices saw a 9.2% increase in farm income.

2.4.2 Empirical Review on Identifying Strategies for Farmers to Adapt to Climate Change

To achieve environmental sustainability and food security, especially in vulnerable zones, adaptation to climate change in the agricultural world is a necessity. A number of research findings have come up with effective ways that farmers can use to mitigate the effects of climate change. The fact that farmers depend on some weather patterns puts them at risk of the effects of climate change. Temperature, precipitation, and climatic extreme events can lead to changes in growing seasons, rise in pest and disease prevalence as well as reduced agricultural yields (Vermeulen, et al., 2012) Options for support to agriculture and food security under climate change. It is important that farmers change their ways to curb these effects and make the production sustainable.

The urgency of adaptation is underscored by projections of rising global temperatures and associated risks to agricultural productivity (Zhao chuang, et al., 2024)'s study on Climate-adaptive crop distribution can feed food demand, improve water scarcity, and reduce greenhouse gas emissions. Diversifying crops and livestock is an important method for mitigating risks associated with climatic variability; this method helps farmers to distribute risks across numerous species that may respond differently to changing conditions. (Pardeep & Sharma., 2020) varied agricultural methods can increase food security and resilience. The addition of legumes to rotation, say in crop rotations, better soil fertility and reduces the need of chemical fertilizers (Bhandari, et al., 2022). Diversification is a well-known strategy of adaptation, and not only does it reduce the risks being faced due to climatic variability, it is used by increasing ecosystem resilience whereby crop and livestock production is diversified. Various farmers can hedge the single crop failures because of unfavorable weather conditions by planting multiple types of crops.

GIS technology examines spatial data about the effects of climate change and farming methods. Planning for climate-resilient agricultural systems, evaluating land use changes, and mapping vulnerable areas are all made easier by it (Zhao chuang, et al., 2024). GIS has enabled identification of areas susceptible to most climate changes and development of specific plans on adaptation. Climate change is a big challenge in terms of water shortage to agriculture. An increase in rain distribution variability requires farmers to adopt superior water management practice that includes rainwater collection, drip irrigation, and soil moisture regulation. As per (Chikozho, et al., 2020) rainwater gathering systems can help farmers save water during the rainy season to be used in the future. Drip irrigation, while initially pricey, has been demonstrated to considerably increase agricultural yields while using less water in locations with limited water resources (Fereres, et al., 2016). Soil moisture management techniques, such as mulching and the use of cover crops, are effective in improving soil water retention (FAO, 2021).

Researchers, including increasing resilience of smallholder farmers to climate change through multiple adoption of proven climate-smart agriculture innovations, Lessons from Southern Africa by (Makate, C, et al., 2019) have employed various clustering techniques, hierarchical, k-means, and two-step approaches, respectively to categorize farmers based on their adaptive behaviors and contextual factors. Such studies have always uncovered a number of cluster categories of farmers with the frontiers being the innovators of different forms of adaptation synergies (these farmers were reported to have a 37% increase in yield stability during a set of extreme weather events), and the non-adapters still on a conventional approach.

It is essential that soil health is maintained in the fight against climate change. Cover cropping, limited tillage, as well as adding organic matter to soils can enhance soil structure and fertility, and this causes crops to be more resistant to drought. As stated by a review of (Daryanto, S., et al., 2016) these practices not only enhance soil moisture retention but also contribute to increased agricultural productivity. Surveys are frequently used to gather information about farmers' attitudes, convictions, and strategies for adapting to climate change.

Econometric models have become common in determination of the effectiveness of adaptations strategy. The latter evaluate the climate variables (temperature and precipitation) relationship with agricultural productivity considering various adaptation approaches (Rosenzweig, C., et al., 2018)

As an illustrative example, (Ayinde et al. 2020) conducted the research to determine the effects of crop diversification on the economic performance of Nigerian farmers based on the panel data regression model. Such models can help measure the advantages of adaptation measures and how it can be used to enhance resistance to climatic changes.

Another effective thing is the introduction of crops that are resistant to climate changes. A study conducted by (Kumar et al. 2017) proves that the food security in changing climate conditions can be increased significantly, due to genetically improved varieties which are able to resist drought or flood. Those farmers who use these varieties will be able to tolerate stresses caused by the climate. Farmers also adjusted their time of planting and harvesting to suit new weather conditions. The approach allows farmers to adjust to seasonal changes and loss of crops because of extreme weather conditions (Boko et al., 2017). The farmers at the locations where the rainy season is due to change might be making earlier or later seed plantations to match the evolving precipitation cycles. The effectiveness of the said method however relies on the capacity of farmers to effectively forecast weather patterns and this is where superior weather forecasting will be vital.

It is important to empower farmers with education and training on ways of adapting to the climate. In research undertaken by (Tambo and Abdoulaye 2012), it is revealed that there is a positive effect on the adaption ability of farmers by agricultural extension services which provide information to farmers on climate-smart agricultural practices. The increase process of sharing of knowledge use among farmers can also enable delivery of successful adaptation strategy among the people. Dissemination of knowledge through agricultural extension service activities and farm networks is a valuable means of enacting sound adaptation responses. Adeoti et al. (2019) discovered that having farmers exchange information on successful strategies of adaptation to climate changes, there is a higher tendency to implement anti-resilience practices. In West Africa, the farmers who participated in farmer field schools and community-based workshops had more awareness on climate risks and they adopted improved practices which led to improved production and sustainability.

Research conducted by (Manda et al. 2020) gives details on the significance of weather information access to farmers to enhance their adaptive capacity. Mobile apps and other digital solutions can help farmers modify their farming methods according to forecasted weather

developments, e.g. by planting earlier or later to avoid droughts or planning irrigation to match expected rain which limits crop failure rates and boosts the output. This skill of making informed choices using right and up to date weather information.. PRA is a qualitative research strategy that includes local communities in evaluating their own needs and resources. This has been applied to gather data on the measures of local adaptation and determine their success using the farmers perspective, informing farmers in the research process PRA assists in ensuring the methods developed are pertinent and feasible Stern, 2000.

Some of the effective strategies that farmers can consider in adapting to climate change are diversification of crops and livestock, better management of water, soil conservation measures, planting of climate friendly crops as well as training and sharing of information and adoption of innovation technologies. Devising such solutions is likely to boost the capacity of agricultural systems to withstand the adverse effects of climate change to eventually lead to food security and sustainable livelihoods.

2.4.3 Empirical Literature Review on the Farming Methods Utilized by Farmers

Chimanimani's farming methods are largely smallholder-based, combining traditional expertise with current agricultural practices. Muzhinji et al. (2019) point out that crop farming, livestock keeping and agroforestry are the main activities, and maize, millet, sorghum, and groundnuts are the most widespread. Livestock including cattle, goats, and chicken are significant elements of livelihoods because they are a source of income and they serve as a source of insurance against crop failure through mobility and flexibility. The system of farming is integrated thus mixed crop and animal production diversify the revenue and enhance resistance to climate-related shocks. Even though new agricultural technology is increasingly being utilized, lack of adequate infrastructure of irrigation and bad soils in certain areas prohibits optimum production.

Crop diversifications have proven to reduce risk exposure that comes along with climate change and changes in the market thus adopted by many farmers. It entails intercropping to guarantee security in terms of food and income. Based on empirical evidence, credit is given to the farmers who diversify their crop production as they are at a better position to cope with unfavorable

weather conditions since various crops exhibit varying levels of reaction to drought and pests. In order to gain maximum soil fertility as well as alternative source of income, farmers have incorporated more legumes and vegetables in their cropping. Study about global spread of conservation agriculture by (Kassam, A., et al., 2019) examined the practice of adoption of conservation agriculture through descriptive statistics in African countries. They came up with the results that showed that practices like minimum tillage, cover cropping, and crop rotation showed much improvement like soil and yield, thus leading to food security. The study reemphasizes the need for sustainable agrarian practices in Africa.

In response to the changing climate, farmers have increasingly implemented climate-smart agriculture techniques aimed at enhancing output while reducing environmental effect. The district has a high concern on soil and water conservation in terms of its climate-smart agriculture (CSA). Nyikahadzoyi et al. (2020) point out that some of the soil conservation efforts adopted by farmers involve contour farming, mulching, and terrace building. The purpose of these measures is to avoid erosions of soil, enhance water holding capacity and the fertility of soils which leads to increases in agricultural production despite the erratic rain fall. Through statistical analyses, Chikowo et al. (2019) investigated the impacts of conservation agriculture on the productivity and health of the soil. Regression analysis is common in determining the influence of different factors on crop yields and use of sustainable practices by researchers.

Case studies are in-depth evaluations of individual agricultural techniques and their results. To better comprehend the intricacies of agricultural systems, researchers perform in-depth examinations of specific farms and communities. Chivandi et al. (2018) performed case studies on livestock integration in highlighting both the benefits and obstacles that farmers confront in this technique. Farming in Africa depends a lot on native knowledge of farmers. The traditional ecological knowledge has assisted many local farmers like the date of planting and selecting crops depending on the weather. The practice is often passed down over the generations and is vital to adaptations of changing environmental circumstances. As research suggests, farmers with mixed traditional methods, such as intercropping and agroforestry, show higher cultivation levels and soils conditions than those who only employ modern production practices (Muzhinji et al., 2019; Nyikahadzoyi et al., 2020).

Although farmers have the strength to practice resilience in Southern Africa, they are subject to a lot of challenges, which impede their farming outputs. Some of the major obstructions entangle poor access to financial resources, insufficient infrastructure, and climate change implications. As an example, most of farmers complain about inaccessibility to credit facilities and this aspect limits their capacity to purchase better seeds and better technology of farming. The infrastructural issues that farmers face are restricting access of markets to farmers hence their income and food security is being compromised e.g. poor road networks.

The farmers have gained more awareness in adapting to the climate change. Among the changes that have been adopted to adapt to the changes include adopting drought tolerant varieties of crops, better water management practices and adoption of soil conservation initiatives. A study shows that when farmers employ these precautionary measures then they become more productive despite the climatic stresses. As an example, adopting the farming methods of conservation agriculture involving the best practices of minimum tillage and cover cropping has been demonstrated to increase moisture content in soils and control erosion, thus boosting crop yields. Agribusiness farmers in a Eastern Africa find the agricultural extension services to be very valuable to them in terms of the training and other facilities they get to implement new farming methods and improve their productivity. The extension services are known to make farmers more resilient to variable weather conditions (Mwakiwa & Mutambara, 2021).

2.5 CONCEPTUAL FRAMEWORK

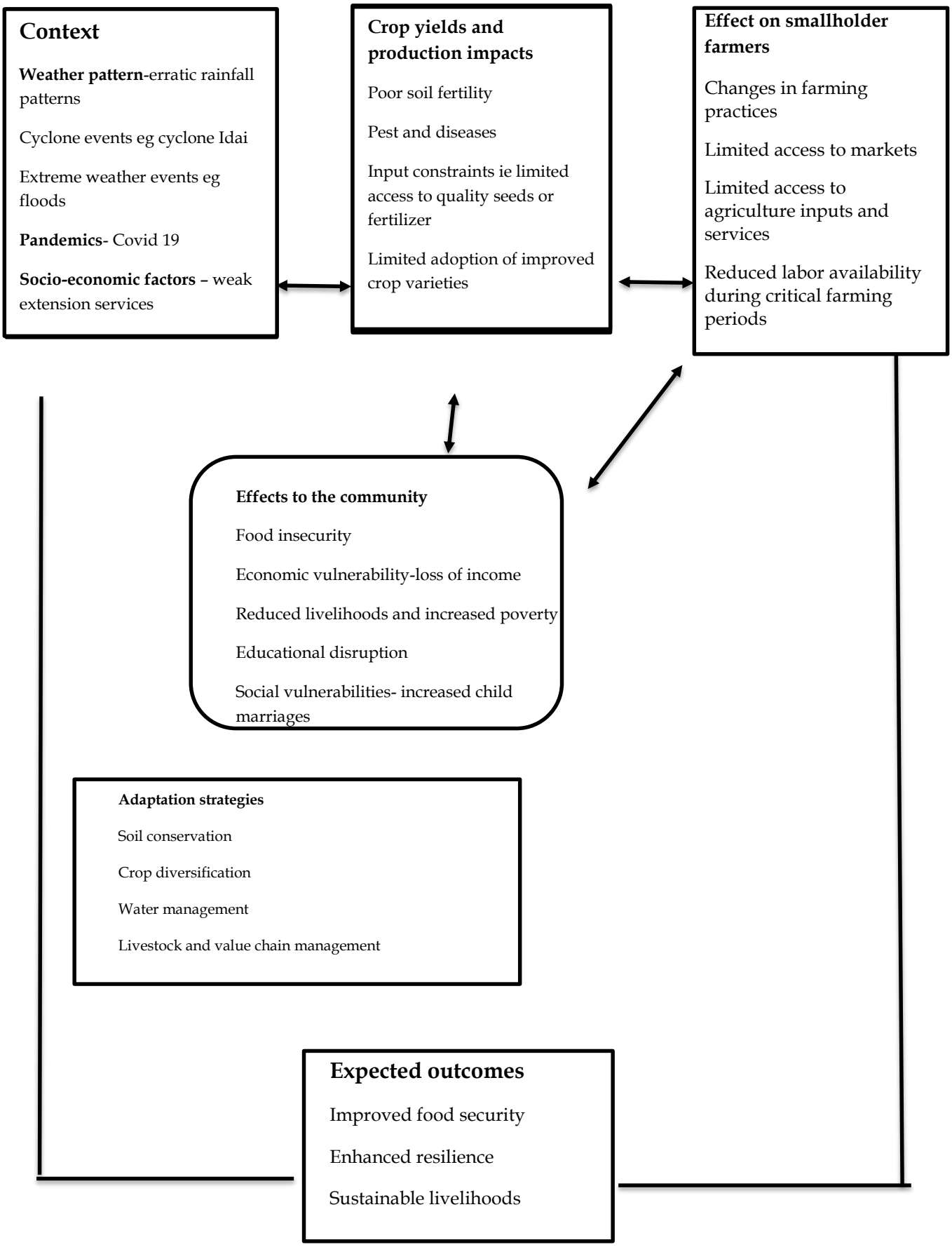
Context
Weather pattern-erratic rainfall patterns
Cyclone events eg cyclone Idai
Extreme weather events eg floods
Pandemics- Covid 19
Socio-economic factors – weak extension services
Crop yields and production impacts
Poor soil fertility
Pest and diseases
Input constraints ie limited access to quality seeds or fertilizer
Limited adoption of improved crop varieties
Effect on smallholder farmers
Changes in farming practices
Limited access to markets
Limited access to agriculture inputs and services
Reduced labor availability during critical farming periods
Effects to the community
Food insecurity
Economic vulnerability-loss of income
Reduced livelihoods and increased poverty
Educational disruption
Social vulnerabilities- increased child marriages
Adaptation strategies
Soil conservation
Crop diversification
Water management
Livestock and value chain management
Expected outcomes
Improved food security
Enhanced resilience
Sustainable livelihoods

Figure 2: Conceptual framework

Source: own

Figure 2 illustrates the interconnected effects of the agricultural issues on smallholder farmers and their coping measures. The figure begins with some background factors that form the basis of agricultural vulnerability, such as irregular weather patterns and rainfall, cyclones, unfavorable weather conditions like floods, pandemic shocks like COVID-19 and socio-economic challenges like poor agricultural extension services. These situational stresses affect farm yields and agricultural production by several pathways including declining land fertility, increasing pest and disease pressures, lower availability of quality farming inputs like fertilizers and seeds and slow adoption of better-quality crops that enhance productivity.

The farm production impacts hinder small farmers, essentially changing their farming activities and economic prospects. Farmers are impacted in the manner their customary farming schedules, restricted marketplaces where they dispose of their harvests, face diminished access to necessary agricultural inputs and services, and face difficulties in labor shortages in hectic times of farming when prompt work is needed to achieve bountiful harvests. These farm-level effects cumulate to substantial community-level impacts that go far beyond farming alone, to engender food insecurity, economic exposure through foregone income, livelihoods being eroded to thrust households into poverty, educational disruption as children might end up working rather than being at school, and other social vulnerabilities such as higher levels of child marriage as households become economically desperate.

The strategy also indicates how communities can counter these challenges with adaptation actions that are designed to increase resilience and end the cycle of vulnerability. These adaptations consist of soil conservation practices to conserve and enhance agriculture productivity, diversifying crops to minimize risk and enhance nutrition, water management systems to fight against erratic patterns of rainfall, and livestock and value chain management to develop alternative sources of income and enhance access to markets. When applied properly, such adaptation strategies are likely to

have beneficial impacts such as improved food security for families as well as communities, enhanced aggregate resilience to future stresses and shocks and more sustainable livelihoods which can withstand environmental as well as economic stresses.

The model further indicates that such communities can counter the challenges through the implementation of a range of adaptation strategies in an attempt to enhance resilience and escape the trap of vulnerability. Adaptations applied include conservation agriculture practices to sustain and enhance agricultural production, crop diversification to alleviate risks and enhance nutrition, water management systems to climate-proof against the variability of rainfall patterns, and livestock and value chain management to generate additional sources of income and enhance market access. Upon successful implementation, these adaptation interventions are likely to bring about positive impacts such as enhanced household and community food security, increased overall resilience to potential future shocks and stresses, and more resilient livelihoods that can withstand environmental and economic stresses.

2.6 INSIGHTS FROM THE LITERATURE

Insights from the literature underscore the complex nature of food insecurity, especially in vulnerable areas like the Chimanimani District. Research shows that food insecurity extends beyond mere food scarcity; it is deeply intertwined with broader socio-economic issues such as poverty, market access, and agricultural methods. Studies highlight the significant impact of climate change in worsening food insecurity, as altered weather patterns and extreme events disrupt agricultural yields and threaten local food supplies. The literature points to the importance of enhancing community resilience through diverse agricultural practices and sustainable farming techniques to alleviate these challenges. Nutrition education is also identified as a crucial strategy, equipping communities with the knowledge to make better food choices and utilize available resources effectively. Moreover, robust social safety nets are vital for assisting the most vulnerable groups, providing protection against economic and environmental shocks. Collaborative initiatives involving local stakeholders, including government and NGOs, are essential for creating comprehensive solutions that address the underlying causes of food insecurity while promoting long-term sustainability. Ultimately, a cohesive approach that incorporates these insights is necessary to effectively confront food insecurity and foster resilience in affected communities.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 INTRODUCTION

The main focus of this chapter is mainly to examine the certain methods that are to be used in data collection and data analysis, this approach can therefore allow a comprehensive understanding of the multifaceted actors influencing food security and the impact of agricultural interventions. This study will focus on enhancing rural community resilience to food insecurity through improved agricultural practices, conclusion will be illustrated for the reader giving them a brief understanding of the tools and techniques that will be used in this study.

3.2 DESCRIPTION OF THE STUDY AREA

Chimanimani district is located approximately 120km in the eastern highlands of Zimbabwe, bordering Mozambique. This district is characterized by a different topography as well as extremely varied climatic conditions ranging from natural region 1 to natural region 5. Chimanimani district is distinguished by mountainous terrain, various agroecological zones. This district is at risk of climate change impacts like droughts, cyclones, floods which may then affect agricultural production leading to food insecurity. For example, Cyclone Dineo 2017 contributed to the increased vulnerability to this region and Cyclone Idai which occurred in 2019 this cyclone occurred to be the most terrible event in the sense that it destroyed infrastructures, loss of life and it also affected the agricultural production. Natural Region 1 is characterized by high rainfall 1000mm annually and rainfall distribution tends to be proportional throughout the year

contributing to its sustainability. This natural region 1 have cooler temperatures and is suitable for intensive farming that is tea, coffee, forestry and fruits production.

This District is diversified across many economic activities: it attracts visitors due to its natural attractions which includes the Chimanimani National Park, waterfalls, hiking, trails, Chimanimani tallest tree and scenic mountain landscapes. Mining as another economic activity done in this District with thousands of traditional miners flooding to the region in the mid-2000s following gold discoveries in the Chimanimani mountains. The district's fertile soils and favorable climate conditions in the highlands supports both subsistence farming and commercial farming.

Chimanimani District also falls under the natural region 2, where there are low altitudes, moderately high rainfall (750-1000mm) annually and it is suitable for intensive crop and livestock production. They are certain crops that are grown in region 2 and these are maize, beans, potatoes and horticultural crops. Chimanimani's rainfall is determined by the Inter Tropical Convergence Zone (ITCZ) and the southeast trade winds. This district has twenty-three wards and it is divided into two constituencies that is Chimanimani West and Chimanimani East. Farmers in Chimanimani West specialize on crops that can withstand limited rainfall like millet, sorghum etc whereas farmers in Chimanimani East specialize in intensive farming because of high rainfalls.

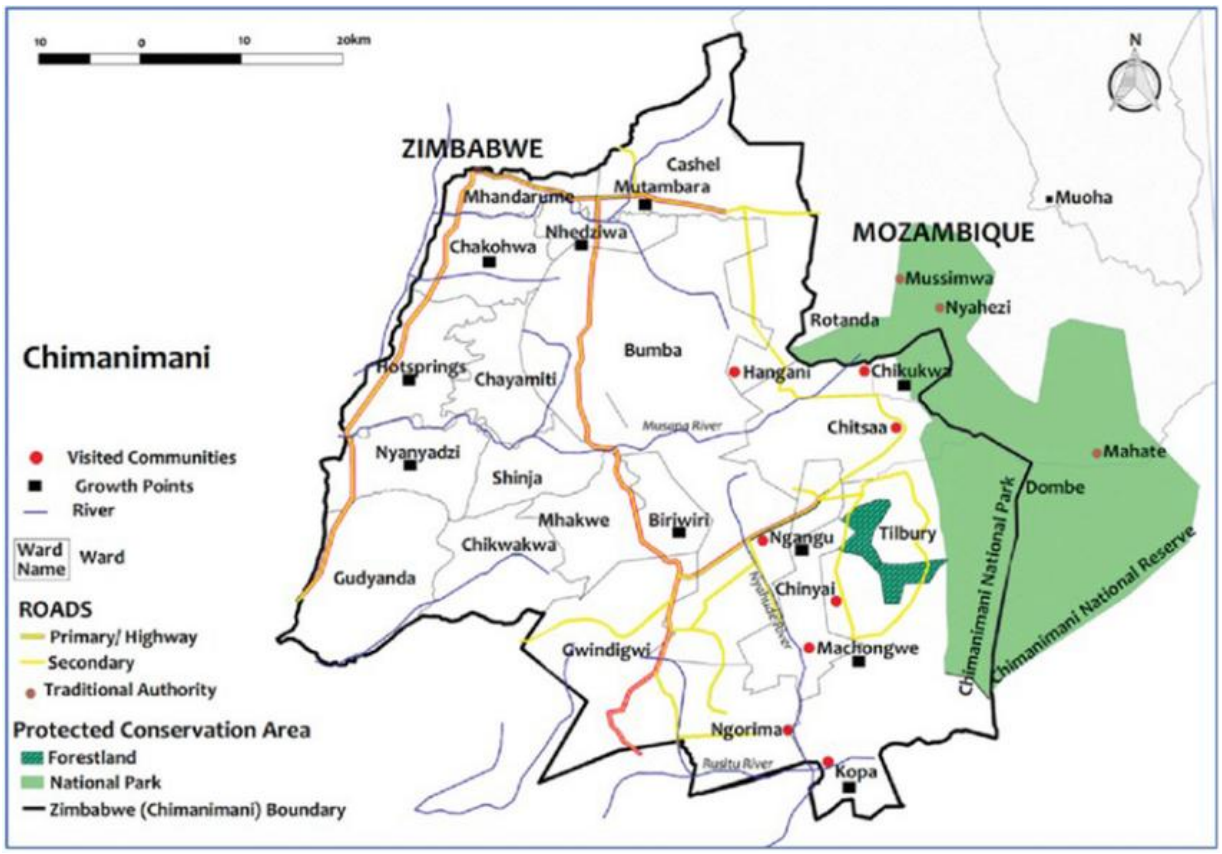

Figure 3: Chimanimani District Map

Source: (Zivhave, et al., 2015)

3.3 RESEARCH DESIGN

A mixed methods approach was employed, this research study is both quantitative and qualitative methods in nature, including surveys, interviews, and document analysis**.** Surveys were carried out so as to collect quantitative data on socioeconomic results, agricultural output, and farmers' access to necessary resources. Qualitative methods were also used to examine the challenges that are being faced by the farmers in accessing and participating in different programs. I used the Yamane sample size determination method to determine the sample size and this can be shown below:

$$\boldsymbol{n = \frac{N}{1 + N(e)2}}$$

Where:$n = \frac{447}{1+447(0.05)2}$

=211

n; is the calculated sample size

N; is the population size of the people

e; is the level of precision and it is 5%

3.4DATA COLLECTION METHODS AND TOOLS

3.4.1 DATA TYPES AND SOURCES

PRIMARY DATA

Original data used in boosting rural community resilience to food insecurity in Chimanimani District include first-hand data gathered directly from farmers and community members via the use of surveys(questionnaires), interviews, focus groups, and field observation. These primary data record important characteristics such as dominant farming practices such as climate-resilient strategies, crop diversification, water conservation, and conservation agriculture, family food security measures seasonal availability of foods, dietary diversity, and coping mechanisms, indigenous knowledge system, perceived climate change, and adaptation strategies were developed locally specific to Chimanimani's agro-ecological zones. The researcher employed the following data collection methods:

Survey Questionnaires

5 enumerators were given the survey questionnaire to administer to a small sample of respondents. To perform this research study, a structured questionnaire was designed, and the use of these questionnaires as a data collection method is proven by their success in gathering structured information from many smallholder farmers in Chimanimani District. A pilot study was done so as to reveal whether questions were clear, understood by respondents as intended and it helps

identifying confusing questions that might lead to unreliable data. Pilot testing was conducted to administer the functionality of the research instruments, and suitability of the uploaded questionnaire and train enumerators for the best possible results to avoid biased information. It was done before the commencement of the main survey which was the preliminary testing stage before getting into the main objective of researching. Three days training procedure was done to equip each individual who partook in this research.

The structured questionnaire covered the most important aspects about food insecurity in this zone such as demographic, socio-economic information, access to institutions and services, rural community resilience, water management practices, sources of income, size of the house hold, highest level of education of any household member, etc. The survey used a cellular phone for the validity of the research method. On using this machine, a software application i.e. Kobo-Collect was installed and structured questionnaires were uploaded. Questionnaires enable the collection of a broad range of data points, making it feasible to address multiple aspects of the research objectives efficiently Bostley, (2019). This approach makes it easier to gather data ensuring consistency in responses and statistical analysis.

Key Informant Interviews

The structured questionnaire was supported by qualitative interviews through key informant interviews (KIIs) and the focus group discussions (FDGs) these were done so as to attain deep insights from individuals who possesses valuable insights and experiences. The key informant interview aimed to gather information on the effective agricultural practices, challenges being faced by rural communities and strategies that can be used so as to improve resilience to food insecurity. Key informant interviews were conducted with local farmers, agricultural extension agents, chiefs, headman's and private companies.

Focus Group Discussion (FGD)

Two focus group discussions were conducted with selected community members in the district with a view of gaining a deeper understanding of enhancing rural community resilience to food insecurity through agricultural practices, understanding communities' experiences, how they dealt and continue to deal with extreme weather patterns.

I collected data from all of these data collection methods so as to ensure a comprehensive understanding.

Secondary Data

The secondary data assisted in developing questions that were posed to the farmer who took part in this study. Secondary data assisted in comparing studies that have been done previously with this study, especially those ones which dealt with the sustainability of farmer livelihoods and food security. (Bryman A 2016) defines secondary data as data that has already been collected and analyzed by other researchers, emphasizing its usefulness in understanding broader patterns in social research.

Research articles

Research articles serve as a crucial type of secondary data in research as it provides scholarly insights into original research findings, literature reviews, and theoretical frameworks. They encompass various types, such as empirical studies that present original data, review articles that synthesize existing research, methodological papers on new techniques, and theoretical articles proposing new frameworks. The significance of articles lies in giving valuable data for comparison, situating new research within the existing knowledge base, informing policy and practice, and providing methodological insights for guidance.

3.4.2 PRIMARY DATA COLLECTION METHODS AND TOOLS

Table 1: primary data collection methods and tools

Specific Research Objective	**Data concepts and variables/indicators**	**Data collection methods/tools**	**Respondents/subjects**
To analyze the effect of sustainable agricultural practices on food security	sustainable agricultural practices (independent variable)	-Questionnaires - household surveys	-smallholder farmers -extension officers

	-crop yields (dependent variable		
To identify effective strategies that farmers can use to adapt to climate change	- adoption of climate-smart agricultural practices - yield difference (kg/ha) between adopter's vs non-adopters -time to adoption (months) from awareness to implementation	-Focus group discussions -Observational studies -Questionnaires -Key informant interviews	-farmers -Agricultural extension officers Community leaders
To examine the farming methods used by farmers in Chimanimani District	- sustainable agricultural practices - fertilizer usage -planting and harvesting calendars	-interviews -questionnaire -household survey	-Agricultural extension officers -small holder farmers -community headman

3.4.3 SAMPLING

The sampling procedure for this study involved the application of a purposive sampling method, targeting farmers in Chimanimani District, Zimbabwe. To conduct the research study a structured questionnaire was designed, and it covered the most important issues about various aspects. The study involved the application of a purposive sampling method, targeting smallholder farmers in Chimanimani District in Zimbabwe. This area was selected because it is prone to food insecurity

in Manicaland province, and since this area is predominantly rural, they primarily concentrate on agriculture for domestic consumption. Chimanimani district is prone to natural disasters such as floods, cyclones, and droughts, and these are the reasons behind effects on farm products and food security. concentrating on this district primarily enables me to know how the previously mentioned agricultural-named natural disasters impact resilience and agriculture. Questionnaires upon which the household survey was conducted to obtain data for the research study were administered to 211 households. For the household, I used stratified sampling whereby households where being divided into meaningful strata for example, livelihood activities, income level, geographic location etc, I used this sampling technique because it allows comparison between different groups.

3.5 DATA ANALYSIS METHODS

Table 2: data analysis methods

Specific Research Objective	**Data concepts**	**Data Variables/Indicators**	**Data analysis tools**
To analyze how sustainable agricultural practices improves crop yields to enhance food security in Chimanimani District	-access to nutritious food -the output of crops grown is measured in tons per hectare	-Sustainable agricultural practices (independent variables) -crop yields (dependent)	Cross Tabulation SPSS
To identify effective strategies that farmers can use to adapt to climate change	-climate change adoption (climate smart agriculture) - institutional factors (policy support)	-Use of Different Seeds (Adoption of drought-resistant varieties) Binary: Yes/No	Descriptive Statistics (frequency analysis) Copying strategies index

	-farmer characteristic (farmer's level of education)		SPSS and Microsoft Excell
To examine the farming methods used by farmers in Chimanimani District	-practices that reduce soil erosion -sustainable agricultural practices (practices that focus environmental sustainability.	-Crop Production Method (tillage practices) ha	Descriptive Statistics SPSS and Microsoft Excel

Cross Tabulation

The methodology of the research will be described on the effect of agricultural practices on food security with reference to the connection between sustainable agricultural practices and the number of meals consumed per day. The research design will be quantitative, and it enables appropriate data collection and analysis in a systematic manner. Sample consist of 211 people who are involved in different agricultural activities. The structured surveys will be used to collect data among the respondents with questions touching on the agricultural practices they use in their farms, including crop rotation, organic farming, and agroforestry. Participants shall be asked how many meals they take per day by placing them into following categories one, two, three, or four meals.

After the data has been collected, it will be structured on a cross-tabulation table. The seven practices of sustainable agriculture will be presented in the rows of this table whereas the columns will show the categories of meal consumption. All the cells of the table will show how many respondents follow a certain sustainable practice and indicate a specific number of meals. This methodical process will allow us to discover the trends and connections between the variables and we will decide whether households that engage in sustainable agriculture tend to eat more meals, which can be considered as a positive effect on the food security.

The analysis will entail explaining the results on the basis of the patterns that the cross tabulation reveals. Such an interpretation will enable a researcher to make conclusions of whether the influence of sustainable agricultural practices has affected food security.

Frequency Analysis

To address the objective of identifying effective strategies that farmers can use to adapt to climate change, frequency analysis is a fundamental statistical tool. It involves summarizing the appearance of different adaptation strategies within a sample size of 211 in Chimanimani District, Zimbabwe, by calculating the frequency and the percentage. We can therefore be in a position to get an initial understanding of the generality, which can show the observed effectiveness of different approaches. Frequency analysis allows a direct comparison of the adoption rates across the different adaptation strategies, and this comparison can show which strategies are preferred by farmers in the face of changes in climatic conditions. This overview helps in detecting the areas where interventions might be needed to promote the adoption of less prevalent adaptation strategies.

Descriptive Statistics

As for quantitative data analysis, the research used descriptive statistics. This method enables the measurement, examination and classification of farming practices throughout the Chimanimani District therefore providing a detailed understanding of the agricultural environment. The descriptive statistical analysis method will start by measuring the occurrence of different farming methods in Chimanimani including monocropping, livestock production, mixed farming, etc. The frequence allocations would indicate which methods are most commonly used across the different regions of this district, while measures of central tendency (mean, median, mode) would identify the typical farm size, crop diversity levels, and yields associated with each method. Understanding the variance and standard deviation of these variables would highlight the consistency of outcomes across similar farming systems. Cross-tabulations were utilized for examining relationships between specific farming methods and food security outcomes.

3.6 Ethical Considerations and Limitations

Ethical considerations in this study are crucial so as to ensure that it was done responsibly and respectfully. This study, which enhances rural community resilience to food insecurity through agricultural practices in Chimanimani District, Zimbabwe, faces many ethical considerations. Informed consent was obtained from all farmers, ensuring they understood how their data would be used in multiple linear regression, cluster analysis, and descriptive statistics. The research ensures equitable representation across gender, age, and socioeconomic status to prevent the reinforcement of existing inequalities. Reciprocity is essential, with research findings shared with participants in accessible formats and practical recommendations developed that directly benefit the Chimanimani farming community. The study was carried out by guiding ethical standards, such as respecting participants' right to privacy, maintaining the confidentiality of any information submitted, and avoiding unauthorized access to corporate property.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.1 INTRODUCTION

This chapter presents the findings of the research, focused on enhancing rural community resilience to food insecurity in the Chimanimani District, Zimbabwe through agricultural practices.

4.2 CHARECTERISTICS OF SAMPLED HOUSEHOLDS

A total of 211 households participated/ were surveyed so as to understand how agricultural practices can enhance rural community resilience to food insecurity, by analyzing household demographics that is age group, gender, educational level, household size, marital status.

4.2.1 Age Group

The age distribution of the 211 sampled households in the survey. Upon the age, findings indicates that the average age of the farmers from the sample size was 54 years which explicative that most of the farmers are adults. The pie chart above shows that 73% are adults and 27% are classified

as old, this shows that the majority of surveyed households consists of the adults suggesting workforce-oriented population which influences agricultural practices, economic activities and decision-making processes within these households.

On the setup of the questionnaire, they were restrictions set to only deal with farmers above the age of 18 years and this implies that no interview was conducted to a child-headed family and/or to a household without adults above the age of 18 years. This was to produce unbiased data presentation and for extracting data from the experienced farmers who know more about farming. Within the selected households, findings indicate that the youngest farmer interviewed was 27years old and the oldest farmer interviewed had 83 years with a median age of 52years. The descriptive also shows that the mode for age of the selected farmers was 46, 52 and 65 years which are multiple modes indicating that most of the selected smallholder farmers were 46, 52 and 65 years old.

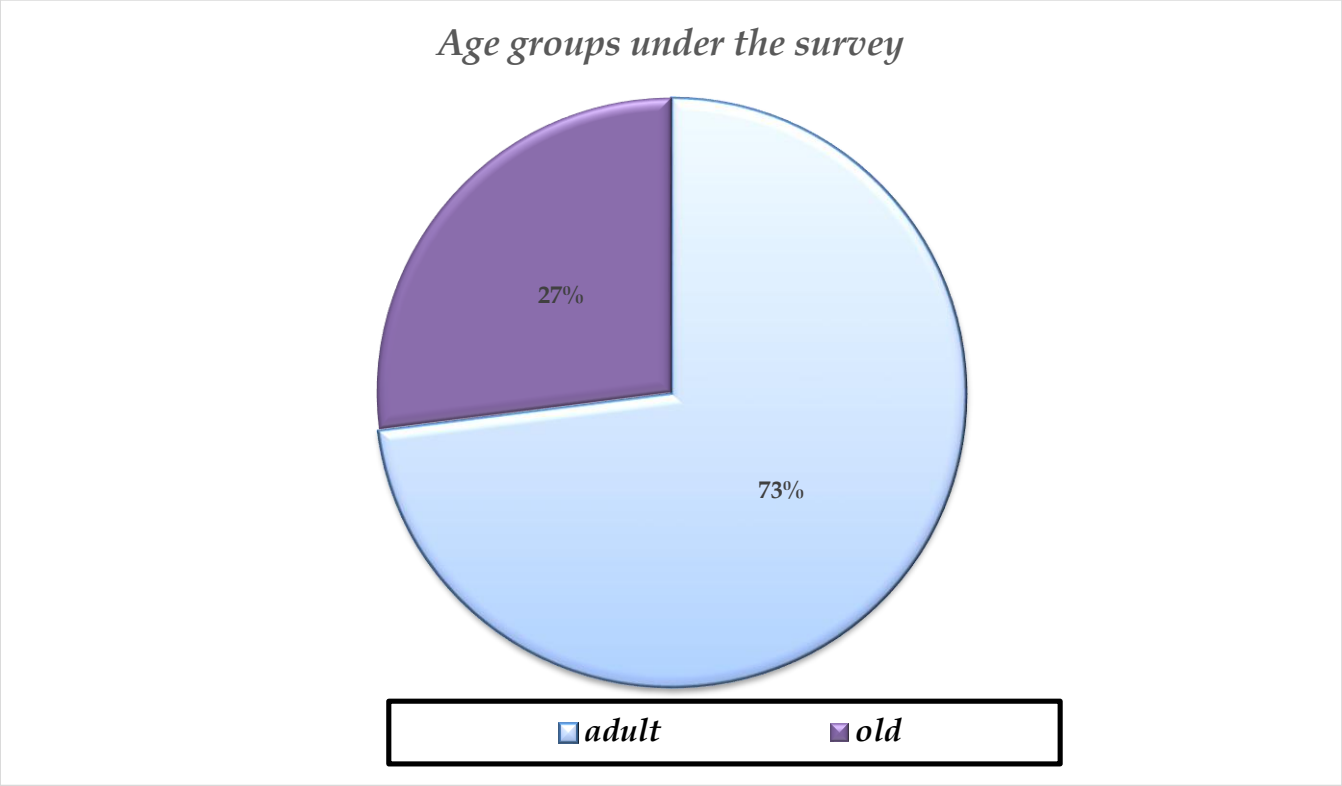

Figure 4: Age group under the survey

4.2.2 Gender

The findings show that of the 211 surveyed farmers of Chimanimani District, 51% were males and 49% were females (Figure 5) showing a relatively balanced gender distribution. The similar presentation of both genders shows a diverse demographic that may influence different aspects of household agricultural practices, decision making and community engagement. This balanced gender pie chart allows for a more comprehensive analysis of the needs and preferences of the population ensuring that programs, policies aimed at agricultural development and climate adaptation which considers the perspectives of both men and women. Belay et al.., 2023 opposes with these results as they stated that women wake up more than 50% of the agricultural labor force but contributes less than 30% to agricultural productivity. The characteristic of the sampled households reflects on gender diverse population which is essential for fostering inclusive and effective strategies in addressing agricultural and climate related challenges. These results align with those of (Radchenko & Corral, 2017)demonstrated that the male headed households are more food secure compare to female headed households with the latter depending more on agriculture so as to increase household food levels.

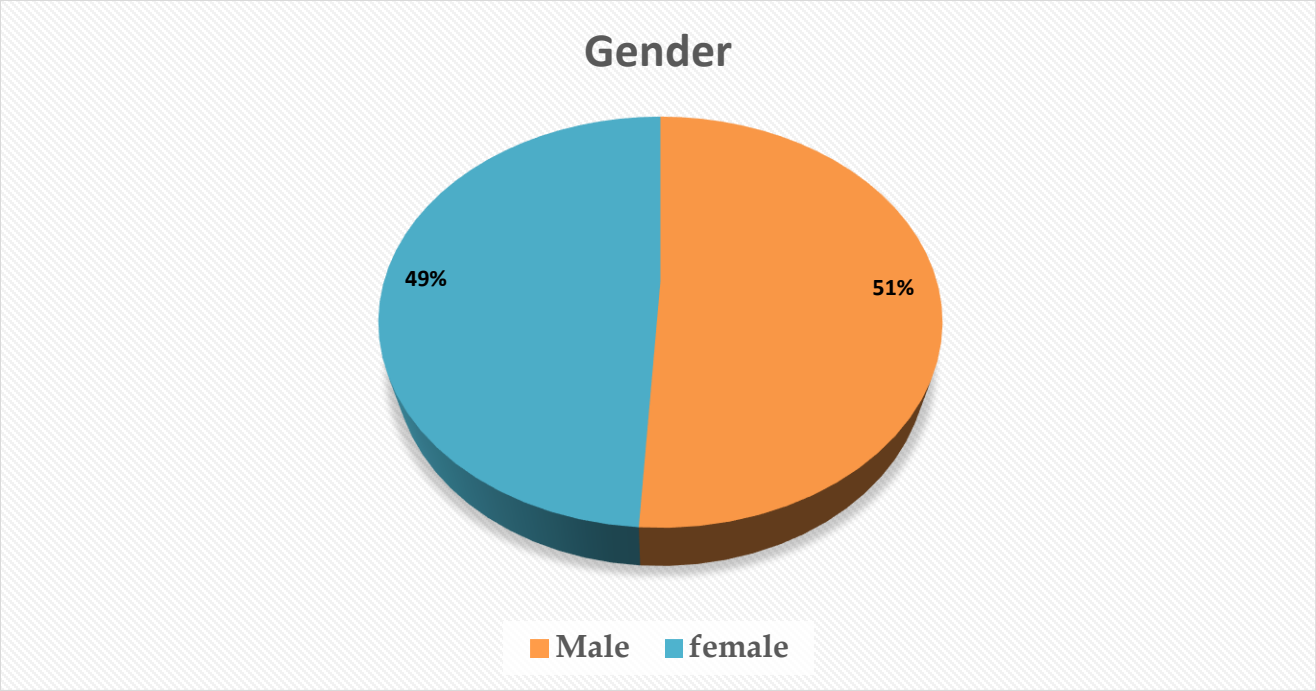

Figure 5: Gender

The bar chart below (fig 6) shows the educational levels of the 211 households sampled in the survey, categorizing respondents into four groups: primary education, secondary education, tertiary education, and those with no formal or informal education. The data reveals that a significant majority of respondents have attained secondary education, while a notable portion has completed primary education. In contrast, the percentages for tertiary education and those with no formal or informal education are considerably smaller. By assessing educational level, one of another reason was that educational level determines the effectiveness of agricultural extension programs as they play a crucial role in sharing knowledge, empowering farmers and driving agricultural production. characteristics of the sampled households reflect a population with varying educational backgrounds, emphasizing the need for inclusive strategies that cater to different educational levels to promote effective agricultural development and climate adaptation.

4.2.3 Educational Level

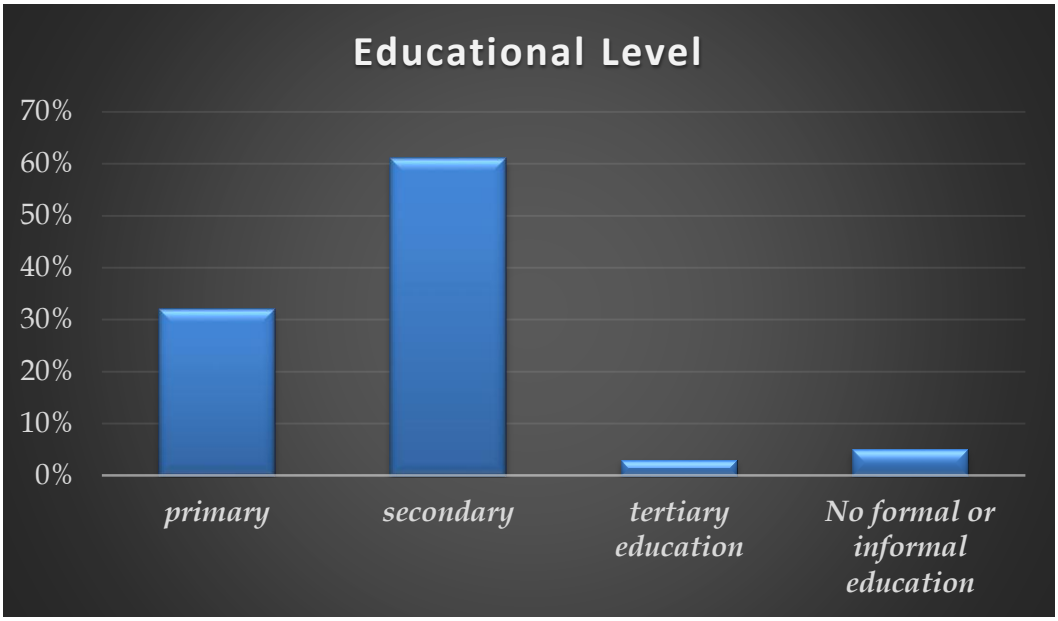

Figure 6: Educational Level

In summary, Figure 6, Figure 7, and Figure 8, represent some of the most important demographic elements/characteristics observed from the farmers.in terms of marital status it is notable that the majority of the households are married with 69%, widowed with less than 50%, single at 6% and divorced with 5%. the households used different modes so as to get more information like climate change etc. these modes consist of radios, television, newspapers, internet etc. This can therefore improve their lifestyle and socioeconomic status as it makes their work easier and quicker.

4.3 TO ANALYZE THE INFLUENCE OF SUSTAINABLE AGRICULTURAL PRACTICES ON FOOD SECURITY

Cross tabulation was used to analyze the influence of sustainable agricultural practice on food security mainly focusing on the numbers of meals consumed per day.

Table 3 below is crosstabulation that shows the association between the two different variables that were investigated on the 211 respondents, the first variable is the agroforestry practice, which is a classificatory and binary type of variable with either Yes or No as its possible answers whereby

Yes will imply that the respondent practices agroforestry and No implying that they do not practice agroforestry. The second variable is the meals consumed per day that is a discrete quantitative variable and can take 4 values with a measurable range between 1 meal per day and 4 meals per day. As it is seen in table 3 below, most of the respondents 139 (66%) are not using agroforestry in agriculture, whereas only 72 (34%) have embraced it. 3 meals per day shows am increased positive responses across multiple practices, particularly in organic farming, where 83 households reported engagement. This trend suggests that as meal frequency increases, so does participation in sustainable practices, supporting the notion that food security may enhance the ability to engage in sustainable agriculture (Bennett, 2020)

99 respondents (47%) consume 2 meals per day and 105 respondents (50%) consumes 3 meals per day though few households are at extreme ends of food insecurity 2 households (1%) consuming 1 meal per day and food abundance 5 households (2%) consuming 4 meals per day. Table 3 also indicated that, there are trends when it comes to the adoption of agricultural practices based on the level of food security. Distribution of households using agroforestry shows that 37 of these households fall in the 3 meal per day category, with 32 falling in the 2meal category and only 3 falling in the 4meal category with of course no household falling in the most food-insecure 1meal per day category, this indicates that farmers who practice this agroforestry tend to have moderate up to high food security even though they are not one of the most exposed of food insecurity individuals. There is a wider range across all food security levels among households that are not using agroforestry 68 respondents eat three meals a day, 67 respondents consume two meals a day, 2 respondents fall into the most food insecure 1meal group, and two respondents fall into the most food secure 4 meal category.

Table 3: Agroforestry Crosstabulation

Number of meals consumed per day	Yes	No	Total

1	0	2	2
2	32	67	99
3	37	68	105
4	3	2	5
Total	72	139	211

Based on the crosstabulation table 4 below, 93 of the respondents (44%) use integrated crop and livestock production, and 118respondents (56%) do not. This shows that it is relatively slow adoption rate. The spread of adoption evenly distributes both among the food security levels with most practitioners in the 2 meal (44 respondents) and 3-meal (46 respondents) and above categories. no households that receive a single meal a day are integrated crop and livestock production meaning that this practice requires some minimum level of food security or resource base to pursue. 60 percent of households that have the highest level of food security, with four meals a day, implying that there is a positive link between this farming activity and higher food security levels.

Table 4: Integrated crop and livestock production Crosstabulation

Number of meals consumed per day	**Yes**	**No**	**Total**
1	0	2	2
2	44	55	99
3	46	59	105
4	3	2	5
Total	93	118	211

Cross tabulation table 5, Mixed cropping shows the highest adoption rate among the practices examined with 141(67%) respondents practicing this sustainable agricultural practice compared to only 70 (33%) respondents that do not. Table 5 illustrates the strong adoption across food security levels with 71 respondents in 3 meals category and 68 respondents in 2 meals category, no respondents on 1 meal category practicing this practice reinforcing that the most food insecure respondents do not adopt to these agricultural practices. Mixed cropping shows unique pattern where adoption is regularly high across the 2 meals category and 3 meal categories with practitioners out numbering non-practitioners by more than 2:1 in both groups, suggesting this practice is widely accessible and beneficial across different food security levels.

Table 5: Mixed cropping Cross tabulation

Number of meals	Yes	No	total
1	0	2	2
2	68	31	99
3	71	34	105
4	2	3	5
Total	141	70	211

Monocropping illustrates (table 6) the lowest adoption rate among all the practices that are done in Chimanimani District, with only 23% (48) respondents engaging in this practice while 77% (163) do not practice it. These results shows that non practitioners outnumber practitioners across all food security categories with 82 respondents not practicing monocropping in the 3 meals category and 75 respondents are in 2 meals category. Only 4 respondents who do not do mixed

cropping consume 4 meals per day whilst 1 from those who practice mixed cropping consumes 4 meals per day. 22% practice monocropping which is even lower than the adoption rate, indicating that more food secure households avoid this practice.

Table 6: Monocropping Crosstabulation

Number of meals	Yes	No	Total
1	0	2	2
2	24	75	99
3	23	82	105
4	1	4	5
Total	48	163	211

Table 7 indicates farmers who are into organic farming and meals they are consuming per day. Organic farming demonstrates a high adoption rate with 162 respondents (77%) who are into this farming technique and 49 respondents (23%) who do not practice this farming technique. This shows a rapid adoption across food security levels, with 83 respondents consuming 3 meals per day, 72 respondents in the 2-meal category, 4 respondents consume 4 meals per day and these practice organic farming. Table 7 shows that organic farming is widely adopted by many farmers and this clearly illustrates that it can be beneficial across different food security levels with practitioners outnumbering non practitioners by more than 53%.

Table 7: Organic farming Crosstabulation

Number of meals consumed per day	Yes	No	Total
1	1	1	2
2	74	25	99

3	83	22	105
4	4	1	5
Total	162	49	211

Conservation farming tends to be the highest adoption rate of all practices done in Chimanimani District with 197 respondents (93%) practicing this technique and only 14 respondents do not practice this farming technique (7%). The distribution demonstrate that this practice has been widely adopted by respondents with varying levels of access to food, with 97 respondents in 3 meal category, 94 respondents consume 2 meals per day , 4 respondents consume 4 meals per day and 2 respondents consume 1 meal per day whereas 14 respondents do not practice conservation farming and their meals consumed per day are distributed as 8 consume 3 meals per day, 5 respondents consume 2meals per day, 1 respondent consume 4 meals per day and 0 consume one meal per day.

Table 8: Conservation Farming cross tabulation

Number of meals consumed per day	**Yes**	**No**	**Total**
1	2	0	2
2	94	5	99
3	97	8	105
4	4	1	5
Total	197	14	211

Overall, the crosstabulation shows a positive relationship between sustainable agricultural practices and food security, as measured by the number of meals consumed per day. Based on the seven sustainable agricultural practices that are being practiced in Chimanimani District, conservation farming demonstrates the strongest association of with food security outcomes, with

197 households adopting to this practice (93,4%) among conservation farming agriculture practitioners 49.2 % consume 3 meals per day and 47,7% consume 2 meals per day this shows that the majority respondents in Chimanimani District achieve adequate food security levels. The results were supported by a study of (Thierfelder , et al., 7 April 2017) who documented significant improvements in household food security through conservation agriculture practices in Sub-Saharan Africa, primarily through enhanced soil fertility, increased crop productivity and water retention. The high adoption rate and positive outcomes support findings by (Berresaw, et al., January 2015).

Organic farming tends to be the second most adaptive sustainable agricultural practice with 162 out of 211 respondents (76,8%), the results show that among organic farmers 51,2% (83) consume 3 meals per day, 45,7 % consume two meals per day, with 2.5% experiencing severe food insecurity consuming one meal per day this is consistence to a study of (Seufert & Ramankutty, 2017). The strong performance of organic farming supports those organic practices, while sometimes producing lower yields and contributing to long term food security through Improved soil health, reduction of input costs and enhanced nutritional quality of produce (Ritchie, et al., 2022). meta-analyses showing that food security improved in seven of eight cases examined in Africa, with yield improvements in 19 of 25 cases and net income improvements in 19 of 23 cases (Arah, october 2015).

Mixed cropping shows similarly positive results with 66.8% adoption rates and favorable food security outcomes among practitioners where 50, 4% (71) consume three meals per day and 48% (68) consume two meals per day, this aligns with a research by (Altieri & Nicholls, 2017) demonstrated that diversified farming systems enhance food security through risk reduction , improved nutrition and increased overall farm productivity. The crop rotation follows a similar pattern 146 (69.2%) adoption and strong food security outcomes supporting findings of (Castellazi et al.., 2020) regarding the benefits of crop diversification for sustainable production systems.

Monocropping shows an inverse relationship with food security with only 22.7% of respondents practicing this farming technique, among mono cropping farmers there is a higher proportion of food insecure respondents this corresponds with a study by (Renard & Tilman , july 2019)highlighting the vulnerability of monoculture systems to pest outbreaks, weather variability

and market fluctuations. the low adoption rate of monocropping in my study area suggests that farmers may have learned from experience about the risks associated with single crop systems.

4.4 TO IDENTIFY STRATEGIES FARMERS CAN USE TO ADAPT TO CLIMATE CHANGE.

Based on the focus group discussions and responses of the key informants, the farmers in Chimanimani District have been adopting various techniques to cope with climate change. Table 9 and Figure 7 are results of smallholder farmers, which are reported in this District. Table 4.1 results indicate that among a sample of 211 respondents, the farmers implemented 6 climate change adoption strategies, and this indicates the existence of differences in each of the measures. The most used strategy seems to be conservation farming since 178 farmers have adopted these practices, with the percentage being 84.4. This rate of adoption of the strategies means that farmers recognize the importance of the concepts of conservation farming, such as mulching, covering the soil to enhance resilience in the face of climate variability, and minimum tillage.

The importance of crop diversification has shown that a high percentage of 77.7 (164) of the farmers are applying this mode of adoption as one major way of adoption and this has been a well-known strategy of alleviating risk by avoiding dependency on one crop. They include moderately used strategies such as use of water more economically with a frequency of 110(52.1%) whereas 101 are not using the strategy. Droughts and fluctuation in rainfall patterns are becoming more common and meeting water demand effectively is becoming a strategy implemented by more than half of the surveyed farmers in Chimanimani, a phenomenon that shows how greater awareness to water conservation is being perceived in the new climatic conditions. Application of varieties of seeds, such as drought-resisting ones, in the newspaper is embraced by 97 farmers at 46%, and this will be one method of dealing with climate change and, therefore, be a mode of improved agricultural production. The strategy of the least adoption that the Chimanimani farmers used is soil conservation and was adopted by 56 farmers at the rate of 26.5%.

Table 10: Effective strategies used by farmers to adapt to climate change

Based on those who practiced adaptive strategy

Climate adoption strategies	Sample size	Frequency(N)	Percentage (%) based on those who are practicing
Crop diversification	211	164	77.7
Soil conservation	211	56	26.5
Use of different seeds	211	97	45.9
Conservation farming	211	178	84.4
Use water more efficiently	211	110	52.1
Planting at different times	211	131	62

The above table shows the climate adoption strategies, sample size, frequency, and the percentage

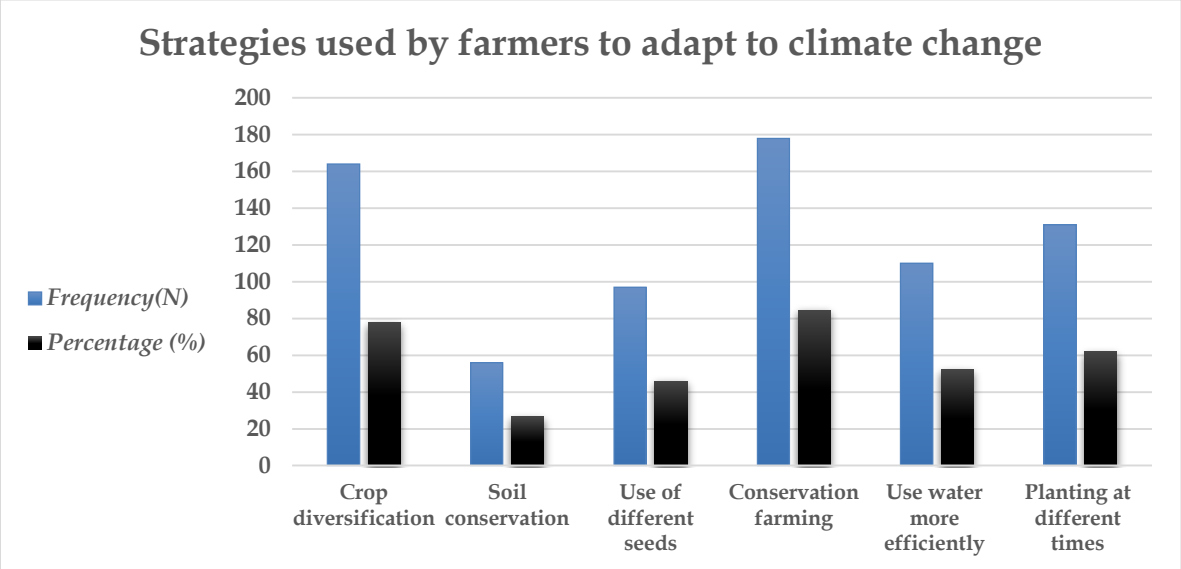

Figure 7: Strategies used by farmers to adapt to climate change

The above bar chart shows that many farmers used conservation farming as an effective strategy to adapt to climate change. The high adoption rate of conservation farming practices of 84.4% among Chimanimani farmers aligns with (Mango, et al., 2017) who found adoption rates of 78-82% in similar mountainous regions of eastern Zimbabwe and this exceeds the 65% adoption rates that were reported by (Mutenje, et al., 2019)in flatter regions of the country suggesting that topographical challenges may increase farmers receptiveness to conservation farming. This also matches with research by (Musiyiwa, et al., 2017)which shows that conservation agricultural techniques significantly increase yields in variable climatic conditions and it shows that conservation farming practices in Zimbabwe improved soil moisture retention by up to 40% during drought periods. This is consistent with previous research by (Nyagumbo, et al., 2016) the study highlighted that conservation farming techniques increased smallholder farmers maize yields by 20-60% whilst reducing labor requirements by up to 45% after the first two seasons.

This research shows identified that crop diversification is (77.7%) in Chimanimani District , (Makate, et al., 2016) provided valuable insights into the typical composition of such diversification strategies in eastern Zimbabwe , findings that farmers typically incorporated 3-5 additional crop varieties , that are drought-resistant small grains and short season legumes selected for different drought tolerances and maturation periods. This help in contextualizing our findings suggesting that Chimanimani's 77.7% adoption likely represents similar multi-crop approaches rather than limited two crop rotations, aligning with Makate et al..,'s conclusion that diversification represents a low cost, high impact adaptation strategy accessible to even resource constrained households particularly relevant for the predominantly smallholder farming systems in our study area.

Conservation farming includes practices like crop rotation, minimum tillage and maintenance of soil cover. In this study conservation farming was adopted by many farmers because it reduces labor costs, improves soil health and it betters the water retention making it an attractive comprehensive solution for farmers facing erratic rainfall and soil degradation. From a practical implementation standpoint conservation farming mainly focuses on traditional knowledge systems and this makes it more culturally acceptable and easily adopted by smallholder farmers.

From figure 4.2 it shows that crop diversification is the second mostly adopted strategy. Crop diversification's popularity comes from its role as a natural risk management strategy that is allowing farmers to focus on planting different crops on the same land with a varying climate tolerance and market demands, due to this strategy when one crop fails due to excessive rainfall, drought etc farmers can still harvest other crops ensuring levels of being food secure and income stability. This strategy is adopted because the costs are lower as farmers adopt it without requiring entirely new skills.

Planting at different times and efficient water use as the moderately adopted strategies. The % rate of adopters shows that these strategies require more specific knowledge, infrastructure etc. and these cannot be accessible to all farmers in this District. Planting time demands accurate weather forecasting's and knowledge on the changing of seasonal patterns and hence it cannot be adopted by many farmers as the background differs. While water efficiency requires irrigation systems or water saving technologies which requires more costs.

The moderate uptake of different seeds varieties reflects issues to do with seed availability, farmers knowledge on the new seed, cost and concerns about the market acceptance. Soil conservation shows the lowest rate of adoption despite its long-term benefits this is because it requires sustained effort over multiple seasons before visible results appear and for instance farmers facing immediate survival needs may prioritize strategies with a quicker return.

4.5 TO EXAMINE THE FARMING METHODS USED BY FARMERS IN CHIMANIMANI DISTRICT

The descriptive statistics data show that the 211 farmers surveyed in Chimanimani District used a wide variety of farming practices, and it seems that the community strongly promotes sustainable agricultural practices. Conservation farming, for example, has the greatest adoption rate, at 93%. With 77% of farmers reporting using organic farming, it is also widely adopted. A broad shift away from less sustainable mono-cropping methods used by just 23% of farmers is shown by the significant adoption rates of crop rotation, 69%, and mixed cropping, 67%. While still representing a significant portion, the adoption of integrated crop and livestock production stands at 44%,

suggesting a moderate level of system diversification. whereas agroforestry, despite its ecological benefits, shows a lower adoption rate of 34%. The consistency of adoption, as indicated by the standard deviations, is highest for conservation farming and mono-cropping, implying a more uniform application of these methods. The varying adoption rates across these farming methods highlight the complex interplay of farmer knowledge, access to resources, perceived benefits, and local contextual factors in shaping agricultural practices within Chimanimani District.

Table 11: Farming methods used by farmers in Chimanimani District

Farming methods	Mean	Std deviation
Agroforestry	0.34	0.475
Mixed cropping	0.67	0.472
Mono cropping	0.23	0.420
Organic farming	0.77	0.423
Conservation agriculture	0.93	0.249
Integrated- crop and livestock	0.44	0.498
Crop rotation	0.69	0.463

From the above table, conservation agriculture is the most adopted farming method by many farmers in Chimanimani District and its remarkably low standard deviation of 0.249 indicates extensive agreement among farmers about its value suggesting that nearly all farmers have adopted this method due to its quick and tangible benefits including improved soil health, better resilience to climate variability and reduction of labor costs. The results provided in the table above are consistent with findings by (Kassam, et al., 2018) who reported that conservation agriculture has accelerated globally due to its triple benefits of productivity, profitability and environmental sustainability. However, the results above contradict with those of (Andersson and D'Souza, 2019)

found that conservation agriculture adoption in Zambia was on 23% amongst smallholder farmers with most farmers practicing partial adoption rather than full implementation.

Organic farming as the second top farming method used by many farmers in Chimanimani, reflects both market incentives and practical considerations. This is highly adopted because many smallholder farmers practice organic farming due to limited access to synthetic inputs. The results of this study oppose with those of (Conor, 2018) who challenges the economic rationale for organic farming adoption, arguing that premium prices are temporary market distortions that disappear as supply increases, his economic modeling suggests that the 77% rate on my study would lead to market saturation and losses for farmers. The relatively low standard deviation suggests that this method is being driven by the consumer demand for organic products and reduction of inputs costs over time. These results were supported by (Willer and Lernoud, 2018) who stated the significant growth in organic farming adoption, mainly on smallholder farmers seeking high market access and reduction of input costs.

Crop rotation popularity from this study stems from its role as a fundamental sustainable agricultural practice that tends to address many challenges simultaneously, many farmers use this farming method so as to break pest and diseases cycles, improve soil fertility and income diversification throughout the year and this farming method requires minimal additional investment whilst providing clear benefits in terms of yield and soil maintenance. Mixed cropping is also a moderate farming method in this study; it reflects its effectiveness as a risk management strategy where different crops provide more insurance against individual crop failures. The higher standard deviation suggests that more variability in adoption due to different land sizes, farmer knowledge of consistent crop combinations, market access. Most farmers may find mixed farming challenging due to different inputs requirements for different crops.

The lower adoption rates for integrated crop-livestock farming and agroforestry reflects that their higher complexity and resource requirements. Agroforestry is relatively low because tree crops take time to mature requiring farmers to have long-term land security and financial capacity. Integrated crop-livestock farming requires more knowledge for both crop and livestock management, adequate land and capital for livestock investment should be considered. The high

standard deviation for this farming method indicates a significant variation in the adoption influenced by factors like access to livestock, regional farming traditions etc.

From the table above, monocropping tends to be the lowest farming method, this is surprisingly because this is when a farmer specializes on a single crop which will lead to an increase in efficiency. Looking at these results this farming method is low because it likely reflects farmers awareness of monocropping risks in my study area such as pest and diseases outbreak, market fluctuations and climate shocks and some few farmers continue using this farming method due to factors like specialized equipment, specific crop needs. These results contradict historical agricultural intensification patterns but it aligns with recent sustainability paradigms. This study supports the Sustainable Intensification Framework proposed by (Pretty, et al., 2020) which advocates for diversified systems over simplified monocultures.

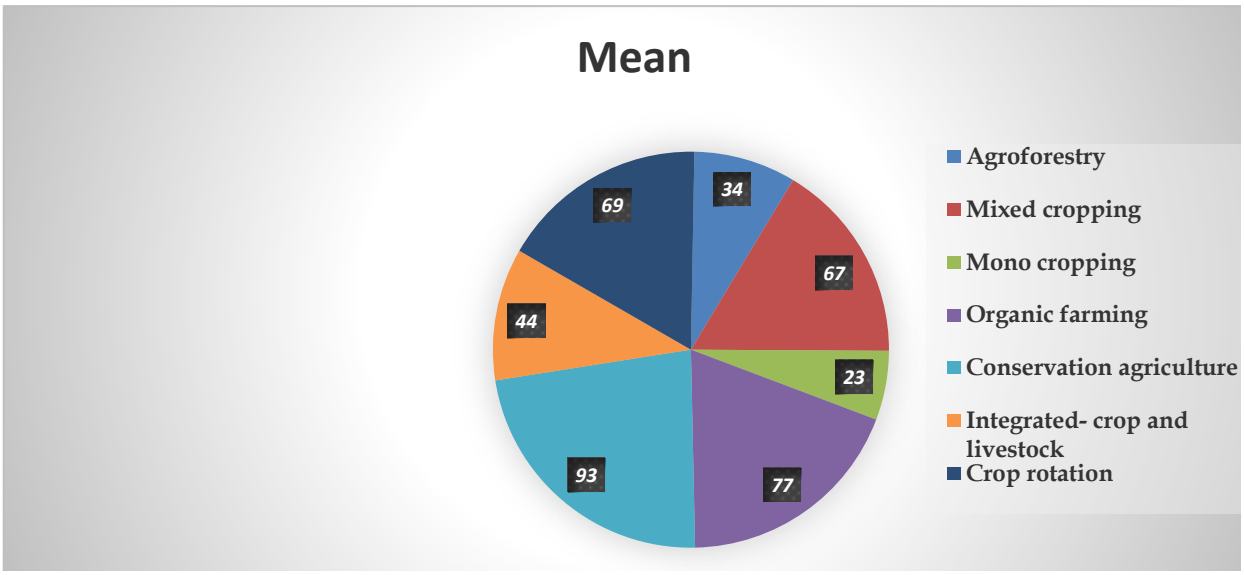

Figure 8: Mean of farming methods

From the figure above, it can be seen that most farmers in Chimanimani District tend to practice mainly conservation agriculture. This pie chart illustrates the proportion of farmers in Chimanimani District who utilize different farming methods. Each slice of the pie chart represents a specific farming method, and its size is proportional to the percentage of farmers adopting that

farming method. Conservation Agriculture dominates, followed by significant uptake of Organic Farming, Crop Rotation, and Mixed Cropping, showing a widespread move towards environmentally sound and diversified systems that enhance long-term productivity and stability. While Agroforestry and Integrated Crop and Livestock are present, their adoption is less prevalent, suggesting potential for further integration to strengthen resilience. The minimal use of monocropping points to a preference for more sustainable and less vulnerable farming strategies.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1 SUMMARY

The research was undertaken in quest of enhancing rural community resilience on food insecurity through agricultural practices in Chimanimani District, this chapter highlights the recommendations and conclusions drawn from the study, which the researcher found the problem at hand as laid down in the problem statement in chapter one. The main objective of this study was to enhance rural community resilience on food security in Chimanimani District. The study collected data through both quantitative (household questionnaires) and qualitative and this study made use of cross tabulation, frequency analysis, and descriptive statistics. The research study made use of 211 sample size, As the main objective stated, the study reveals a significant adoption of diverse agricultural practices that mainly contribute to this goal, the wide spread implementation of conservation agriculture, organic farming, crop rotation, mixed cropping makes a strong foundation for building sustainable and resilient at the community level as these practices has positive impacts on soil health, biodiversity and yield stability indicating a proactive approach by smallholder farmers in mitigating vulnerabilities to environmental shocks therefore strengthening their food security.

5.2 CONCLUSIONS

5.2.1 TO ANALYZE THE EFFECT OF SUSTAINABLE AGRICULTURAL PRACTICES ON FOOD SECURITY

The findings from chapter 4.3 have revealed that the households involved in upholding sustainable agricultural practices, especially conservation farming and organic farming, shows meal consumption frequencies that are high. For example, among the respondents, who are involved in conservation farming, 93% consume two or more meals in a day, and 49.2 % consumes three meals per day. This indicates that sustainable agriculture has a role to play in food security by increasing the production of crops and the availability of a steady food supply. Research findings show that to improve food security in Chimanimani District, there is need to promote sustainable agriculture where there is an increasing trend in the number of meals taken by the practicing households. To reinforce food security and community resilience further, this is why it is important to consistently provide support and teach sustainable practices.

In contrast, where such households had failed to adopt such practices, there were low rates of meals; thus, some of the households mentioned that they only had a single meal a day, which was a key indicator of how insecure such households would be to food insecurity. The statistics emphasize that the implementation of sustainability practices in the agricultural sector not only enhances food provision but also plays a harder role in guaranteeing that families can maintain a decent level of nutrition

5.2.2 TO IDENTIFY EFFECTIVE STRATEGIES THAT FARMERS CAN USE TO ADAPT TO CLIMATE CHANGE

The results in the Chapter 4.4 indicated the variety of effective measures that farmers in Chimanimani District make to adjust to changes in climate. It is worth noting that conservation farming has turned out to be the most adopted strategy with 84.4 percent of farmers being in

support of their belief that the strategy is effective towards building their resilience to changes in the environment. The diversification of crops is found to be one of the major methods used and 77.7 percent of the farmers resorted to this method to reduce risk of fluctuations in the climate. The data divulges that these practices were not only useful in the stabilization of food production but were also useful in enhancing the general farm productivity. farmers had adapted to the changes through mechanisms like proper water management and planting use of drought resistant crop varieties, there exist obstacles especially in implementing soil conservation measures which were not highly participated even though they are beneficial in the long term. The findings serve as a reminder on how agricultural extension services based on tailored services can play an instrumental role in assisting farmers to implement these strategies successfully. the adaptive mechanisms identified in this research form the basis of strengthening food security in Chimanimani District in times of climate change through agricultural resilience.

5.2.3 TO EXAMINE THE FARMING METHODS USED BY FARMERS IN CHIMANIMANI DISTRICT

The analysis of farming practice in Chimanimani District shows that there is a remarkable change in regards to sustainable and diversified method of farming among smallholder farmers. The statistics reveal that conservation agriculture is the most popular one with the highest mean result that 93 of farmers apply the practices. This transition materializes as a result of the appreciation that conservation farming has numerous advantages, which include healthier soils, increased resilience associated with weather changes and cheap labor. Organic farming, crop rotation, and mixed cropping are not in the minor exception but instead their adoption rates are 77, 69, and 67 respectively. These habits do not only result in higher levels of food security, but they also imply a deeper view of the significance of environmental sustainability. the least practiced approach is monocropping, indicating that farmers know better about the dangers of this approach as these farmers can easily be vulnerable to the pests as well as the changes in the market. The differences in the adoption process point out to the different strategies adopted by different farmers depending on the availability of resources, knowledge, and the local situations. Generally, the results indicate the importance of the further support and specific interventions driving these sustainable practices,

guaranteeing enhanced agricultural productivity and stability in the society. Farmers of the Chimanimani District are therefore equipped more to deal with the arising effects of climate change and food security by adopting a diversified way of farming.The examination of farming methods in Chimanimani District reveals a significant preference towards sustainable and diversified agricultural practices, which are foundational for enhancing rural community resilience and food security.

5.3 RECCOMENDATIONS

5.3.1 Recommendations to the Government and Policy makers

To improve food security and resilience in Chimanimani District, government should focus more on the adoption of conservation agriculture, this modality has been considered useful to promote soil health, boost crop yield and enlarge the ability of the farmers to live with variability in climate. Farmers who adopt sustainable agricultural practices like minimum tillage, crop rotation and covering the land may be provided with incentives in the form of subsidies or low interest loans. Such incentives would help farmers to change to the conservation practice at the beginning at a lesser financial cost to them. The government can also assist in improving the impact of climate change on agricultural production by promoting programs that promote the idea of adopted conservation farming practices. Government has the ability to promote training opportunities that would make farmers aware of the long-term value of conservation farming whereby the labor cost will decrease and soil fertility will be higher. Through a positive regulatory framework and investment in educational support and practice, the government can play a pivotal role in overcoming the current landscape of agricultural damage and eventually achieve sustainable prosperity and food safety in the district.

Enhancing agricultural extension services is the key to enhance resilience and productivity of farmers in Chimanimani District, through farming training on sustainability activities like agroforestry and integrated crop-livestock arrangements, extension can go a long way in increasing

the proficiency and knowledge of farmers. This holistic approach will both provide citizen farmers with the required methods of optimization farming activities and will also help them to gain more precisely insight of ecological and economic benefits of diversification. Frequent workshops, field visits and personal consultations with extension agents may help to spread the knowledge and motivate farmers to use of new innovative practices to adjust them to their local circumstances. The continuous professional development of the extension workers would help them to be always aware of the recent agricultural research and technologies. When the extension services are effective, they will enable the government to empower farmers to take informed decisions that will result in sustainable agricultural systems and this will help with better food security and community resiliency.

Access to credit ensures that smallholder farmers in Chimanimani District would be in a position to produce more produce. Credit is crucial in order to empower these farmers and make them more resilient and able to increase their agricultural outputs. Coming up with financial packages like the provision of loans at a low interest or the issuing of grants that the individual farmers can use to invest in better inputs and more sustainable farming methods will also go a long way in helping to succeed in reducing this financial burden that such farmers encounter. The financial products provided to the borrower should also be customized to their needs that is the smallholder farming has special characteristics that should be taken into consideration, the repayment rates may also be higher. Education of farmers in the areas of financial management and financial grip will also enhance that farmers will be able to manage such funds and use it properly to bring long-term success in agriculture. Attention should be paid to access to credit because this way the government can ensure more vibrant agricultural sector which in the end leads to food security and economic stability in the district.

To enhance rural community resilience, realizing of agricultural productivity and climate adaptation by the farmers in Chimanimani District, it is important for research and development so as to provide farmers with tools to help them cope with the climatic condition. The government can coordinate resources that help in developing climate-resistant crop varieties and sustainable agricultural technology that will help in developing climate-resistant crops and by developing of this, it can disarm the pest and diseases that are involved within the climatic changes. Research

and development effort can also be made to research on innovative farming methods which can enhance the yields as well as to reduce impact on the environment, this can be through integrated pest management and soil conservation efforts. The collaborations between the agricultural research institutions, the universities and local farmers can have a participatory approach that is to say that the research has to respond to the real needs as well as challenges.

5.3.2 Recommendations to the Farmers

To effectively enhance community resilience in Chimanimani District, farmers should focus on efficient water management. Efficient water management methods are very important in mitigating the resilience of agriculture in a district like Chimanimani where a drastic shift in rainfall patterns is being witnessed. Rainwater harvesting has been adopted whereby farmers are able to harvest rain water and store rain water during the wet season in a way that the farmers have a good supply of water in the dry season. With this approach, reliance on irregular rainfall is minimized, as well as irrigated water consumption is maximized. Embracing the use of drip irrigation systems is another way of improving use of water and these systems are very effective because there is little wastage of water and the crops are given the required amount of moisture to ensure efficient growth. The combination of these methods allows the farmers to continue producing higher quantities of crops even during poor weather conditions and thereby encouraging food security and food sustainability in their communities, such practices lead to a healthier soil condition and to less erosion, developing a stronger agricultural system which is able to withstand the fluctuation of climate.

Creation of networks of farmers or cooperatives is also vital in enhancing their knowledge exchange in agricultural communities. These networks may be used as the platform through which farmers share knowledge on the best practices and good adaptation strategies, especially during climate change and food security. These groups can enable the farmers to embrace new methods of doing agriculture through peer-to-peer learning, such a group work model does not only improve the competence and knowledge of individual farmers, but it also builds resilience within the community because members of the community help each other in addressing the challenges. Collective action could be realized through such networks where farmers in the area could have

access to resources, share tools and engage in marketing activities and eventually improve their livelihoods and practices thereof in a sustainable agricultural business.

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ANNEXURE 1: SURVEY TOOLS

QUESTIONNAIRE ON ENHANCING RURAL COMMUNITY RESILIENCE ON FOOD INSECURITY THROUGH MODERN AGRICULTURAL PRACTICES IN CHIMANIMANI DISTRICT ZIMBABWE

SURVEY INFORMATION AND INFORMED CONSENT

My name is Sithabile T.S. Moyo from Bindura University of Science Education. I am studying towards a Bachelor of Science Honors degree in Agricultural Economics and Management. In partial fulfillment of my studies, I am undertaking research on Enhancing Rural Community Resilience on Food Insecurity through Agricultural Practices in Chimanimani District, Zimbabwe.

I am a student who is carrying out interviews for my study. Your household has been selected by chance from a list of households that benefited from this project.

I would like to assure you that all the information provided here will be treated as **STRICTLY CONFIDENTIAL**, and will be used for the evaluation purposes only. Your name will not be mentioned anywhere in the work. Therefore, try as much as possible to be accurate and objective in your responses. In the process of interview, you are free to interrupt me and ask for any clarification. I respect all the responses you give and appreciate your cooperation. Interview will take about 60 minutes.

Interviewer: *Complete these questions and please interview the* ***household head or the person who knows more about farming*** *decisions and activities. This person* ***must be 18years or older.***

Questionnaire

No:…….Date:…….……..……

Interviewer's name: ……

Time:…….....

Village:……

Ward: ……

District: CHIMANIMANI Province: MANICALAND

SECTION A: RESPONDENT AND HOUSEHOLD BACKGROUND INFORMATION

A. HOUSEHOLD DEMOGRAPHIC AND SOCIO ECONOMC INFORMATION					
A1. Head of household					
a. Gender	Male			Female	
b. Age					
c. Marital status	Married	Single		Divorced	Widowed
d. Highest level of education of household head					
	No formal or informal education	Informal education	Primary	Secondary	Tertiary education
e. Highest level of education of any household member					
	No formal or informal education	Informal education	Primary	Secondary	Tertiary education

A2. What is your principal occupation?			
A3. What is the size of your household?		Adults (≥18)	Children (<18)
	Male		
	Female		

SECTION B: SOCIAL CAPITAL, NETWORKING, ACCESS TO INSTITUTIONS AND SERVICES

B	**DISTRICT CHARACTERISTICS**				
B1	Year resettled at the farm/plot				
B2	Experience in farming	*…….years*			
B3	Distance to the main market from the residence	*……..km*			
B4	Mode of transport used	*1.Walking; 2. Bicycle; 3. Tractor; 4. Minibus; 5. Other, specify……*			
B5	Quality of the road to the main market	*1= Very poor; 2= Poor; 3= Average; 4=Good; 5= Very good*			
B6	Distance to the nearest source of agro-dealer from residence	*……..km*			
Agricultural extension services					
		How many times do you interact/discuss with […] in the past 12 months	*How many field days/training organized by [.....] did you attend in the past 12months*	*How relevant was the information/training 1=very high; 2=high; 3=okay; 4=not relevant; 5=don't remember*	Type of information from the extension worker (rank) *1-seed varieties, 2-fertiliser application, 3-pests and diseases, 4-Post harvesting, 5-marketing 6-other specify*
B7	Government extension service providers				
B8	N.G.O				
B9	TSURO Officers				

Section C -Rural Community Resilience

C1. Was a needs assessment conducted to know your needs as a household? *1-Yes, 2-No*
C2. If yes, when was the needs assessment done?
1- Before the project started, 2-at the start of the project, 3- when the project has already started
C3. Was the process consultative and participatory? *1-Yes, 2-No*
C4. Did the project manage to address your household needs? *1-Yes, 2-No*
C5. If No, which needs were not addressed? Specify.....
C6. Were the project's activities and objectives designed and implemented in a way avoiding future harm to children, youth and the environment? *1-Yes, 2-No*
C7. Were you involved in planning and implementation of the project as a community?
1-Yes, 2-No
C8. Which other stakeholders are participating in the project besides TSURO TRUST? .....

SECTION D: CROP PRODUCTION

Type of crops	**Estimated area** (Get answer in acres, if possible)	**Type of fertilizer**	**Source of seed**	**Do you produce surplus food crops for sale?**	**Did your household sell surplus crop during the last 12 months**	**Where did you sell your surplus crop**
		1-Not used, 2-Organic, 3-Chemical, 4-Organic+Chemicals	*1-previous harvest, 2-neighbour, 3-local agro dealer, 4-major cities, 5-TSURO Project 6- ZunderaMambo* 7- Other *(specify)*	*1-Yes, 2-No*	*1-Yes, 2-No*	*1-own village, 2-Middlemen 3-market/town*
Maize						
Potatoes						
Madhumbe						
Cowpeas						
Groundnuts						

Bambara nuts						
Beans						
Tomatoes						
Leaf vegetables						

SECTION E: MAIN INCOME SOURCE

What have been the FIVE major sources of INCOME for your household over previous 12 month? **(Rank the sources by priority from 1 to 5)**

E1: MAIN SOURCE OF INCOME

N0	Source of income	Rank	Comment
1a	Sale of crop produce		
1b	If crop produce, name them		
2	Sale of animal and animal products		
3	Hire out agricultural labour		
4	Hire out non-agricultural labour		
5	Petty trade		
6	Formal employment/salary		
7	Aid/food for work		
8	Gifts/begging		
9	Fishing/hunting		
10	Brewing		
11	Remittance		
N0	**Question**	**Response option**	**Code**
1	How stable / unstable your household income has been over previous 12 month? (Circle the answer)	1. Stable 2. Moderately stable 3. Unstable	
2	What is the estimate of your average monthly expenditure in the past 12 months		
3	What is the estimate of your average monthly expenditure on food in the past 12 months		
4	What is the estimate of your average monthly income on non-food items in the past 12 months		

SECTION F: FOOD SECURITY

F1: FOOD AVAILABILITY

N0	Question	Response option	Code
1	Do you have any food stocks in your household at the moment?	0 = No 1=Yes	

2	What was the source of these stocks	1. Own production 2.aid 3. market 4. Gifts	
3	How long will these stocks last your household		

F2: MAIN SOURCE OF FOOD

What have been the THREE main sources of accessing food your household over previous 30 days?

N0	Source of accessing food	Rank
1	Own production	
2	Sale of livestock	
3	Trade / small business	
4	Regular monthly salary	
5	Daily (Agriculture and non-agriculture labour)	
6	Remittance	
7	Public help	
8	Help from relatives/friends	
9	Relief program	

F3: HOUSEHOLD COPING STRATEGY (HCS)

In the last 30 days, did your household have to use any of the following strategies to overcome daily food insecurity? If so, how often did your household use each of these strategies?

N0	**Type of copping strategy**	**Response option** 0)No 1)1-2 times a week 2)3-5 times a week 3)5 times a week 4) Daily
	Reduced coping strategy	
1	Borrowed food, helped by relatives	
2	Relied on less preferred, less expensive food	
3	Reduced portion size of meal	
4	Reduced in the quantity consumed by adults/ mothers for young children	
5	Have you/your children taken any type of alcohol to cope with the lack of food or money to buy food	
	Livelihood coping strategy	
6	Purchased food on credit	
7	Consumed seed stock held for next season	
8	Adults ate less food that children could eat more	
9	Sent children to live with relatives	
10	Used up savings	

11	Reduced expenditure on health and education	
12	Borrowed money from relatives / neighbours	
13	Sold Household poultry – chicken , ducks, etc.	
14	Sold household goods (utensils, blankets, building materials ,jewellery)	
15	Sold small animals – goats, sheep	
16	Sold big animals (Cattle, donkeys, camels, …)	
17	Sold agricultural tools, seeds.	

SECTION G – Sustainable Agriculture and Climate Change

G1. Which farming methods were used by the household in the last 12 months? **(multiple responses possible)**

1-agro-forestry, 2-integrated crop and livestock production, 3-mixed cropping, 4-mono cropping 5- Organic farming, 6-Conservation farming, 7-crop rotation

G2. How has this farming method affected your yield?

1-increased, 2-decreased, 3-no change

G3. Have you heard of "climate change"? *1-yes, 2-no*

G4. Where have you heard about climate change? (Tick as many as you feel apply):

1-TV, 2-radio, 3-newspaper, 4-internet, 5-TSURO officers, 6-school, 7-government agencies, 8-friends, 9-other (specify)

G5. How important is the issue of climate change to you? *1-very important, 2-quite important, 3-not very important, 4-not at all important*

G6. During the last 5 years, has there been any notable climate change within your farming area? *1-yes, 2-no,*

G7. What has changed?

1- Rise in average temperatures, 2- Decline in average temperatures, 3- Increase in precipitation, 4- Decline in precipitation, 5- Early start to rainfall season 6- Late start to rainfall season, 7- Premature end of rainfall season, 8- Prolonged mid-season dry spells, 9- Increase in floods

G8. How has the household responded to these changes?

1- *Growing different crops, 2- Using different seeds, 3- Changing type of fertiliser, 4- Using conservation farming 5- Planting at different times, 6- Relying more on small livestock, 7- Use water more efficiently 8- Moving to a new place*

ANNEXURE 2: Focus Group Discussions (FGD) Guide

My name is Sithabile T.S. Moyo from Bindura University of Science Education. I am pursuing a Bachelor of Science Honors in Agricultural Economics and Management. In partial fulfillment of my studies, I am undertaking research on Enhancing Rural Community Resilience on Food Insecurity through Agricultural Practices in Chimanimani District, Zimbabwe.

I am a student who is carrying out interviews for my study. Your household has been selected by chance from a list of households that benefited from this project. I would appreciate it if you could freely participate in this discussion. The information that you will provide will be kept confidential.

SECTION 1 : Participant Background (Demographics)

- What is your age?
- What is your gender?
- What is your educational background?
- How many years of farming experience do you have?

Section 2 : Current agricultural practices

- What farming methods do you currently use? (e.g., conservation agriculture, organic farming, mixed cropping)
- Why did you choose these particular methods?

- How long have you been using these methods?

Section 3: Challenges Faced

- What challenges do you encounter with your current farming practices? (e.g., climate change, pests, market access)
- How do these challenges affect your food security?
- Can you provide specific examples of these challenges?

Section 4: Food Security

Food Availability

- How would you describe your household's food security situation?
- What strategies do you use to ensure food availability throughout the year? (e.g., storage methods, food purchasing strategies)
- How many meals do you typically consume in a day?

Nutritional Quality

- Do you believe your farming practices impact the nutritional quality of your food? How?
- What types of crops do you prioritize for nutrition?

Section 5 : Climate Change Adaptation

Awareness and Perception

- How aware are you of climate change and its effects on agriculture?
- What changes have you noticed in weather patterns in recent years? (e.g., rainfall, temperature)

Adaptation Strategies

- What strategies have you implemented to adapt to climate change? (e.g., crop diversification, improved water management)
- How effective do you find these strategies in maintaining food security?
- Can you share any success stories related to adaptation?

Section 6: Community Support and Resources

Support Systems

- What local resources (e.g., agricultural extension services, NGOs) do you access for support in your farming?
- How effective are these resources in helping you improve your farming practices?
- Have you participated in any training or workshops? If so, how helpful were they?

Suggestions for Improvement

- What additional support do you think would help enhance your farming practices and food security?
- Are there specific training programs or resources you feel would be beneficial for you and your community?