Bindura University of Science Education

Faculty of Agriculture and Environmental Science

Department of Agricultural Economics, Education and Extension

Knowledge, Attitude and Practices of farmers on Sustainable Agriculture: A case study of ward 3, Chimanimani District, Zimbabwe.

A Research Project submitted in partial fulfilment of the requirements for the Master of Science Degree in Food Security and Sustainable Agricultural (Production)

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DECLARATION

I declare that the research project titled, "**Knowledge, Attitude and Practices of Farmers on Sustainable Agriculture; A case study of ward 3, Chimanimani District, Zimbabwe,** submitted to Bindura University of Science Education, Department of Agricultural Economics, Education and Extension is a record of an original work done by me under the guidance and supervision of **DR. N. MAFUSE** and this work is submitted in partial fulfilment of the requirements of a Master Science Degree in Food Security and Sustainable Agriculture. The results embodied in this thesis have not been submitted to any University or Institute for the award of any degree or diploma.

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DEDICATION

To myself, I am proud of myself for this far the Lord has taken me.

May God exceedingly, abundantly bless me.

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For each and every one of you, I express love and gratitude!

LIST OF ABBREVIATIONS

FAO: The Food and Agriculture Organization

WFP: World Food Program

IKS: Indigenous Knowledge Systems

ABSTRACT

Climate irregularities have become an ever-present phenomenon impacting the performance of agriculture in the world. Coupled with economic hardships in developing country particularly Sub-Saharan Africa, farmers are experiencing difficulties in withstanding climate related changes. This study was conducted to assess the knowledge, attitude and practices of farmers on sustainable agriculture among ward 3 dryland farmers in Chimanimani district. This study utilized the quantitative and qualitative methodology to unpack the subjective experiences of farmers with knowledge, attitude and practices on sustainable agriculture. The adoption of sustainable agriculture by farmers was studied using their knowledge, attitude and practices. The study found that the farming community of Chakohwa faces several climatic trends such as low rainfall, and extreme weather patterns. The study also highlighted the knowledge farmers have on sustainable agriculture such as water harvesting, hybrid seeds to withstand pressing climate trends in the area. The specific objectives of the study were: a) To measure knowledge of farmers on sustainable agriculture, b) To assess the attitude of farmers regarding sustainable. C) To investigate the sustainable practices farmers are doing in order to cope up with climate change. Agricultural production should be increased through sustainable solutions

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CHAPTER 1

1.0. INTRODUCTION

Climate-related changes have become an unfolding challenge with no known end. It is growing to the extent that it weaken economic benefits, prevent social and financial advancement, and the quality of life of people all over the world (UNFCCC, 2019). According to UN.org Climate change refers to long terms, shifts in temperatures and weather patterns. These shifts may be natural, but since the 1860's, human activities have been the main driver of climate change, primarily due to the burning of fossils fuels (like coal, oil and gas, which produces heat - trapping gases.)

The Agricultural activities that are being done in order to cope up with climate change in the arid areas of Chimanimani district are , water harvesting techniques, use of small grains, rearing of small livestock and use of certified seeds. These activities are done at low level, most farmers are still holding on to the old methods of farming. We are experiencing climate change in this era, farmers should also change their way of farming activities so as to be food secure. Findings revealed that farmers believed that climate change is mainly occurring due to anthropogenic activities, drought, insects, crop diseases and heat stress are their main concern regarding adverse impacts of climate change (A Belay .2022). Farmers have knowledge of good farming methods to cope up with climate change but don't hid to the information since behaviour change is a process. Farmers have negative attitude to the farming methods which have to do with climate change, this is because most activities are labour intensity and need a lot of resources. The practices the farmers are doing do not able them to cope up with climate change, hence this has resulted in low yields.

Chimanimani District is capacitated with different Non-Governmental Organisations (NGOs) that has to do with climate change. World vision has constructed solar powered gardens which use drip Irrigation as a way of increasing food security in mumeral garden ward 20 and Hapare garden ward 3. It also constructed greenhouses and aquaculture Nechirinda garden ward 20 and Hapare garden ward 3. TSURO TRUST promotes removable kraal in the fields, cattle are to sleep for certain days at one piece of land and moved to another. The cow dung and urine will fertile the land, also TSURO TRUST is promoting the use of indigenous seeds. PORET is one of the organisation that promotes Agroecology Performance that is the use of homemade fertilizer by the name bokash and

construction of water harvesting techniques like swales. Also, we have Plan international ,that construct boreholes in schools, with that schools can do agricultural activities all year round hence food security is improved. With all the activities and information these organisations are giving, farmers are still holding to old farming methods hence low yields which results in food insecure.

The knowledge, practice and attitude of farmers didn't change against the background of climate change. Climate change is destroying the old methods of farming farmers are holding on. Due to the holding of farmers in old methods of farming, farmers are experiencing low yields which lead to food insecurity.

1.1. Problem statement

IPCC WG 11, (2007, 30) describes climate as changes in the environmental that results either from natural causes or from human activity and continues for decades or longer. It is now indisputable that the global environment is changing, due to the burning of fossils and the changes in land use associated with agriculture resulting in greenhouse effect. Though farmers have always had traditional ways of depicting climate change, Troccoli et al 2007 303 admitted that such practices are losing value and farmers are also looking up to new ways of withstanding climate change

Findings revealed that the majority (46, 1%) of the respondents had medium knowledge on climate change while (32, 7%) and 21, 2% having high and low knowledge categories respectively. From above, it can be said that, the respondents who have medium to high knowledge about effects of climate change on agriculture MY Madaki 2023, A Belay 2022. The findings revealed that 51, 2 percent of the farmers had moderately favourable attitude towards climate change effect while 42, 1 percent had slightly favourable and 6, 6 percent had highly favourable attitude https://www.ncb:.nih.gov>pms. Farmers predict a combination of positive and negative impacts from global warming, but most think that logistical changes will enable them to adapt to climate change, and most would also consider the possibility of introducing new crops such as navy beans https:||www.sciencedirect.com>pii. The farmers are trying to adapt through the use of improved agricultural practices like increasing on farm tree planting, soil and water conservation, adjustment of planting dates, crop diversification, improved crop varieties and use of Agricultural inputs like fertilizers and pesticides. Farmer’s capacity to choose effective adaptation options is influenced by

household demography, as well as positively of farm size, income, access to markets, access to climate information and extension and livestock production. L Hubertus.2023

L Hubertus.2023 subsistence farmers with high dependency on natural resources are exceptional vulnerable to rainfall changes. Farmers use a variety of local indicators for weather forecasting and climate prediction inorder to adapt to climate variability and change. Intergrating Indegenous Knowledge Systems (IKS) with the efforts of climate scientists can contribute to effective on farm adaptation initiatives. September 2015 Asian journal of Medical and biological Research 2015(12):367-379. The findings revealed that 51, 2 percent of the farmers had moderately favourable attitude towards climate change effect while 42, 1 percent had slightly favourable attitude. The correlation tested showed that the education, farming experience, farm size, annual income, training received and agricultural knowledge had positive significant relationships with farmers attitude towards climate change effect on agriculture while the rest of characteristics had no relationship in the present study were that, the attitude of the farmers is changing due to changes in the climate conditions and there was a positive effect of it on agriculture. The majority of the farmers have perceived changes in rainfall and experienced the effects of a changing climate over a period of two decades. That is, extended dry periods and declining precipitate more frequent across the agro ecologies in the district. As a result both livestock and crop production by smallholder farmers have already been adversely affected.

Https://do:org|10.10116|j.env.2022.100516 understanding local knowledge and practices of soil and water conservation is essential for designing and implementing cost-effective and sustainable erosion control programs, and thus reducing soil erosion adverse impacts on agricultural lands. Soil erosion is a process that involves detachment transport and sedimentation or settling of soil particles (Laland Stewart, 1992; Subramanya,3003,.ha|,2008). It is one of the most land degradation on farm lands, accelerated soil erosion could be associated with inappropriate agricultural practices, mining, and climate change and rainfall aggressivity. Therefore soil improvement and conservation through the application of appropriate techniques are necessary not only to maintain soil functions. Farmers perceived indicators of the existence of erosion and soil fertility differently https://www.academia.edu. The loss of fertile soil makes land less productive for Agriculture, creates new deserts, pollutes waterways and can alter how water flows through the

landscape, potential making flooding more common. GB Chum. 2022 eleven soil conservation techniques were known by farmers of which, only six were routinely implemented on farms: 36% mulching, continous or tied ridges 26%, hedge 19%, channels and drains 10% and terraces 2 %.

The effectiveness of each soil conservation strategy at the Farm level depend on the number of techniques. Simultaneously practised by the farmers, the farm location along the slope, the integration of livestock into farming systems, the farmer's main activity and income level and more importantly the farmer's knowledge on soil erosion control measures.

The Agricultural landscape in Chakohwa ward 3, Chimanimani district is undergoing a transformative phase marked by adverse impacts of climate change. This shift is particularly evident in farmers productivity capacity, as they grapple with challenges associated with transitioning from old farming methods to new farming methods. The unpredictability of weather patterns has led to difficulties in harvesting, prompting some farmers to adopt new farming methods as an alternative. Amidst these changes, a critical problem arises; a notable lack of information and awareness of regarding new farming methods adapted to the evolving climate change conditions. Farmers, facing the consequences of climate change, are hindered by a death of knowledge on effective strategies to optimise productivity in this altered environment.

There is a gap in knowledge concerning specific farming practices that can enhance climatic resilience in the context of shifting from old farming methods to new farming methods Exploring and documenting these practices can provide valuable insights for farmers facing similar challenges. The gap extends to the disparities in information accessibility among farmers. Understand how information (or lack thereof) influences decision making in adopting new farming methods is crucial for designing targeted interventions. There is a need of explore and document community specific adaptation strategies. Recognising the unique challenges and opportunities within Chakohwa will contribute to tailoring interventions that resonate with the local context.

Addressing the knowledge gap is pivotal for formulating effective policies and interventions that empower farmers in Chakohwa to navigate the challenges posed by climate change and optimise their productivity in a sustainable manner. Though there is a massive information from

Government partners, NGOS and still there is no change, farmers still hold on to the old farming methods.

1.2. Objectives

1. To measure knowledge of farmers on sustainable farming methods

2. To assess the attitude of farmers regarding sustainable farming

3. To investigate the sustainable practices farmers are doing inorder to cope up with climate change

1.3. Research questions

1. Are farmers aware of conservation farming?

2. What is the knowledge level of farmers regarding sustainable agriculture?

3. What is the attitude level of farmers regarding sustainable agriculture?

4. What are the practices farmers are doing towards sustainable agriculture?

CHAPTER 2 LITERATURE REVIEW

2.0. Introductions

This section presents literature and concepts surrounding knowledge, attitude and practice on sustainable farming. Climate change contributed to substantial and widespread rises in food insecurity, affecting vulnerable households in virtually every country, and the effects are anticipated for the past decade. According to the (WFP, 2021) report, hunger has worsened in Zimbabwe's metropolitan region over the past decade, with 2.4 million people now failing to fulfil their food demands.

2.1. Definition Of Terms

Food insecurity.....the lack of physical, Social and economic access to adequate food to meet nutritional needs and food preferences to lead active and healthy lives (FAO, 2019)

Coping strategies..... According to WFP (2021), these are tactics used to manage crises, conditions, and demands that are distressing. The tactics may either be behavioural and cognitive.

Crop rotation..... Is the practice of planting different crops sequentially on the same plot of land to improve soil health, optimise nutrients in the soil, combat pest and weed pressure (https://rodale Institute.org, crop-rotation)

Knowledge.....definition from the Oxford language, are facts, information, and skills acquired through experience or education, the theoretical or practical understanding of a subject,."a thirst for knowledge"

Awareness of familiarity, gained by experience of a fact or situation

Attitude.....is a settled way of thinking or feeling about something.

Practice.....is actual application or use of an idea, belief, or method, as opposed to theories relating to it, it can also mean the customary, habitual, or expected procedure or way of doing something.

Food security.... Is that availability of food in a country and the ability of individuals within the country to access, afford and source adequate food stuff (Wikipedia)

Climate Resilience....Folke (2006) is the capacity of a socio-ecological structure to absorb stresses imposed on it but climate change, as well as to adapt, Reorganise and develop into more desirable formations that enhance the systems sustainability, making it better prepared for the forthcoming

climate disasters. According to Nelson and Adger (2007), climate Resilience encompasses a dual function, to absorb shock as well as to self-regenerate, is the primary means it can be differentiated from the concept of climate adaptation.

Adaptation.....is viewed as a group of processes and actions that help a system to captivate changes that have previously occurred, or maybe predicated to occur in the future.

Climate change.....from United Nation UN.org. Refers to long term shifts in temperature and weather patterns. These shifts may be natural, but since the 1860's, human activities have been the key driver of weather change, primarily due to burning of fuel (such as coal, oil and gas, which produces heat-trapping gases.

Mitigation is making the impacts of climate change less severe by preventing or dropping the production of greenhouses gases into the atmosphere. Mitigation is accomplished either by dropping the sources of gases- for example by increasing the portion of renewable energies, or starting a cleaner flexibility system- or by enhancing the storage of these gases, that is by increasing the size of forests . Mitigation is a human intervention that reduces the source of Greenhouse gases emissions and or improves the sinks.

2.2. Demographics And Economic Activities In Chakohwa Ward 3

Chakohwa ward 3 is densely populated near the business centre and along the highway. Farming in the irrigation scheme and garden, vending, brick moulding are the collective livelihood activities in the ward. Numerous locals work is the informal economy which is farming and vending. Individuals in the area have been required to turn to homogenous businesses such as hair salons, barbershops, vending in addition hand crafted furniture due to excessive unemployment (Tendai, 2016)

Climate change has had an important influence on the live hoods in addition to wellbeing of Chakohwa area residents. Continuous climate change left residents little time to save and stickup arranged food and even to practice sustainable agriculture. Though farmers have always had traditional ways of depicting climates change, (Trocooli et al 2007 303) admitted that such practices are losing value and farmers are also looking up to new ways of withstanding climate change

Amidst these changes, a critical problem arises: a notable lack information and awareness of regarding new farming methods adapted to the evolving climate conditions. Farmer, facing the consequences of climate changes, are hindered by a death of knowledge on effective strategies to optimise productivity in this altered environment. There is a gap in knowledge concerning specific farming practices that enhance sustainable agriculture. Addressing the knowledge gap, it is pivotal for formulating effective policies and interventions that empower farmers in Chakohwa ward 3 to navigate the challenges posed by climate change and optimise their productivity in a sustainable manner.

2.3.0. Technology, Climate Information And Climate Resilience In Practice

2.3.1. The Global Context

Weather transformation has become a global problem that has directly and indirectly affected the lives of people within the globe. Globally, environmental monitoring systems have saved thousands of lives each year. According to ITU (2018) Work Meteorological organisation and ICTs, together with other United Nations agencies, administrations and organisations, contributes to the development of environmental monitoring systems. The research forecasting on the knowledge, attitude and practices of farmers for adapting to climate variability.

2.3.2. The Regional Perspective

Measures to withstand climate change shocks are always met with challenges in developing countries, specifically Africa. According to Patt (2010), for generation, smallholder farmers in Eastern and Central Africa have used their accumulated knowledge and ingenuity to improve and maintain soil quality. In recent years, however as growing populations have put pressure on scarce land. These time- old techniques and proving inadequate. As a result, the soil has steadily deteriorated, a process worsened by alternating floods and droughts, which have further degraded the land and in some countries led to famine (Patt et al 2010, FAO 2010). According to Ospina, and Heeks (2011), as the impacts of climate change intensity, developing countries must implement innovative strategies to be resilient to the changing climatic conditions and uncertainty. ICT applications enable the delivery of partition adaptation actions of the variability of climate change effects including poverty, agriculture and food security, (Ospina, and Heeks, 2011). The

African Climate Change Resilience Alliance (ACCRA) consortium identified five characteristics for sustainable climate Resilience, also one of the features is knowledge and data, (ACCRA, 2010). It highlights that effective resilience needs evidence and understanding of forthcoming change, awareness round adaptation options, it is significant to guarantee that systems are in place to distribute applicable data at both national and regional scale, for example initial warning systems, metrological information, forecasting and weather change impact, (ACCRA 2010). Mutekwa, (2009) studied weather change influences and an adaptation in the smallholder segment in Mazvihwa area of Zvishavane District in Zimbabwe, and the findings showed that the majority of the farmers (53%) were unaware about weather changes observed in recent years which shows lack of information tools to disseminate information to the local people.

2.3.3. The Zimbabwean Context

Here is a rising evidence that agriculturalists in Zimbabwe are managing to survive the perils of climate observed variations. This is through changing cultivation and sowing time and crop cultivars and species that can withstand climatic irregularities. Notable progress is within the agriculture sector which relates to the development of irrigation infrastructure. Climate change has also led to innovative ways of adaptation in the agriculture sector. These range from isolated practices such as moisture retention practices by farmers to well-developed responses of fertilizer applications, crop rotation, and soil conservation (Nyasimi etal, 2014). Adoption of moisture reservation farming practices, for example enabled farmers to extend the growing season and to do dual season cropping. In places such as Muzarabani, where climate change has intensified, the frequency of flood, the practice of dual season cropping has been observed. The strategy enables the local to harness opportunities associated with flooding (Chanza, 2014). With support from development partners, Zimbabwe had started implementing climate smart agriculture program. The program targets small-scale farmers, particularly women and poor households that are vulnerable to food insecurity under a changing climate. Elsewhere successful results have been noted in Kenya and Tanzania

For example, in 2016 the government of Zimbabwe started implementing the climate Resilient National Water Resources and Irrigation Water Plan, whose objective was to integrate climate change modelly with the development and management of water resources and irrigation

infrastructure. Under the scheme, the government secured a usd 98 million loan facility to buy irrigation equipment, tractors and implements through Brazi's More Food for Africa Program (Chanza, and Gundu Yakarasi(2020). The program has been extended to cover small-scale farmers. For instance, following acknowledgement that the available water bodies are being underutilised, the government mooted an integrated water use master plan beginning with Tokwe Mukosi Dam. According to Chanza, and Gundu- Jakarasi (2020) the plan is expected to support irrigation farming, fisheries, hydro power supply, and tourism. The dam, reported as the largest inland reservoir in the country, can irrigate 25, 000 ha and supply 15mv of hydropower. All these are measures to ensure farmers withstand the climate change crisis and practice sustainable agriculture

2.4. Harrowing Knowledge In Zimbabwe Communal Systems

In addition to fixed incomes, foreign currency shortages, a fast fading currency, low yield, water shortages, and increased poverty, Zimbabwe has been undergoing an economic crisis marked by hyperinflation that has pushed food prices beyond the grasp of many. Food used to be plentiful in Zimbabwe, but that is no longer the case. Individuals in Zimbabwe are increasingly worried about whether they will eat tomorrow rather what they will eat nowadays. Climate change had worsened the problems, resulting in the collapse of country's sustainable agriculture

Zimbabwe continues to make useful climate technology resources by seeking technical assistance and capacity building to close knowledge gaps, climate related change have a profound impact on water and food quality and availability. The Zimbabwe Progress Review Report on Sustainable Development Goals (SDGs) 2020 highlighted the decline in crop yields attributed to drought and erratic rainfall. It also noted an increase in the Global Hunger Index Score from 28.8 in 2016 to 34, 4 in 2019 which is likely to worsen if measures to curb climate- related changes are not put in place

2.5.0. Challenges Of Sustainable Agriculture

2.5.1. A Growing Population.

Owing to the rapid rise in inhabitants, feeding a rising population and accomplishing food security has been acknowledged as one of the most critical issues for the next three decades. In 2050, the

world's food structures will have to feed and nourish almost a billion individuals in a safe, responsible, and long- term manner (FAO, 2016). To feed this increasing population. It is projected that the world food supply will need to rise by 50% by 2050. As a result, there will need to produce more food than we will need than we have ever produced in the next 50 years (Ranganathan et al.., 2018). It is crucial to guarantee that this growth is carried out appropriviability without endangering our natural resources long-term capability

2.5.2. Weather Change

Weather change has been named one of the most demanding issues of the twenty first century. Life-threatening weather and climatic events will reduce food production, having far- reaching effects on crops, animals and fisheries as well as changing pest prevalence. Vermeulen (2012 asserts that these effects on sustainable agriculture will be vast, complex, visually and temporally changeable, and factors impacted by socioeconomic factors

Climate-related changes have become an unfolding challenge with no end. It is bebilitating to extend vulnerability, weaken economic benefits, prevent social and financial advancement, and quality of life of people all over the world (UNFCC, 2019. Weather change is a global issue of concern that is the shifting of known season, new weather patterns at various locations, changes in rainfall and temperature regimes. Gas emitted in the air, e.g. by human activities, vehicles, industrial emission of fires, causes a blanket of gases accumulating in the atmosphere, which results in global warming, less resistant species have been heavily affected leading to their extinction.

Zimbabwe has been equally affected and temperature increases and prolonged dry spells have occurred since the turn of the century. From 1900 to 2000, the country's mean annual surface temperature has warmed by 0, 4 degrees Celsius (NCCRS p-1), and average temperature increases of above 1 degrees Celsius have been projected for the notion of the current period.

Rainfall patterns have become erratic with increasing dry spells, droughts and related negative livelihood effects. In Chimanimani district, this story is evidenced by increasing temperature in the once cold, highlands, frequent droughts in the low veldt and changes of rainfall patterns across the whole district. Coupled with inadequate management of natural resources, especially in the

crucial watershed areas, this had led to increasing stress of the rural population, declinary viability of various economic sectors and severe threats to a number of plant and animal species.

Chimanimani is one of most diverse districts of Zimbabwe, endowed with still intact natural resources and skillful peace loving and dynamic people. Listening to stories of those who were there to witness the situations about 30 years ago, you get a feeling of drastic changes that have taken place as a result of climate change. The people of Chimanimani, communities, leaders, stakeholders will strive to adapt to the many challenges posed by a changing environment. With the Chimanimani scope of action, the District has assigned this strategy to address climate change

2.5.3: Chapter Summary

According to the literature, lack of sustainable Agriculture has been the continuous to the Zimbabwe's highest threat to realising food security in Chimanimani and Zimbabwe as a whole. Most Chakohwa families rely on acquired food, while the majority of population depend on on informal trading

CHAPTER 3

METHODOLOGY

3.0: Introduction

Chimanimani is one of the seven districts in Manicaland Province being used as a situation study. Chimanimani is the district is of interest and significance because it has been affected by cyclone Idai and has got all the v natural regions. So, the researcher want to find the knowledge, attitude and practices of farmers on sustainable agriculture after cyclone Idai and also to find whether the knowledge, attitude and practices across the v regions is the same on sustainable agriculture. Chimanimani district is divided into 23 farming wards and one urban ward is situated at the eastern side of Zimbabwe near border Mozambique. Chimanimani has excessive potential for agricultural production due to the favourable climatic environment and good soil characteristics. These features have also made the district a major recipient of government inputs programmes aimed at boosting agricultural productivity in the past decade. One major supported programme is pfumvudza. The district lies in all v natural regions that is regions 1 to 111 are favourable for crop production and plantation while region 1V and V are for livestock production. Chimanimani district is gifted with a variety of natural resources, in terms of soils, vegetation, landscape and receiving annual average rainfall between 500 - 1500mm.

Consequently, for years, Chimanimani district has been affected by climate change hence affect the agriculture activities.

3.1: Study Design

The research adopted a multi-stakeholder participatory approach to gather both quantitative and qualitative data, primary and secondary data. The use of multiple methods facilitated the validation of data through cross verification from the wide range of available sources (triangulation). Key informant discussions will be held with various key players supporting farmers and these included the AGRITEX Department and Health Department. The household survey informs the bulk of the study.

3.2: Study Population

The study will be carried in ward 3 in the district. The total household target population for this ward is 121 according to data from Agritex ward profile.

3.3.0: Sampling Considerations

3.3.1: Qualitative study

Consistent with qualitative research, non-probability sampling methods are going to be used for sampling

Purposive sampling will be used to select the district based on available data

Purposive sampling is going to be used to select ward 3 in Chimanimani district as climate change is evidently real

Purposive sampling is going to be used to select the key informant at District and ward level

3.4: Sampling procedure

Chimanimani district is purposely selected on the basis of its nearness to the right investigator, so as to enhance movement during data gathering procedure. Farmers are going to be selected purposively based on their farming techniques. Lists of farmers are prepared with the help of village leaders and other community leaders and Agritex. Farmers will be interviewed on their plots or homesteads. The households head or other responsible person in the household aged 20 years will be considered eligible to be interviewed. Only one person per household whether male or female will be interviewed.

3.5: Sample Size

The sample size will be restricted to farmers who have been affected by climate change for them to practice sustainable agriculture. In depth interviews will be administered to at least one official of each organisations who dealt with farming as business. The Yamane formula, proposed by Yamane in 1967, is commonly used in the direction of determine the sample size for a study when the population size (N) is known. The formula is as follows:

$n = N / (1 + N (e^2))$

Where:

n = Sample size

N = Population size e = Desired level of

precision (margin of error)

Given that N = 121 (population size) and e = 0.05 (desired level of precision or margin of error), we can calculate the sample size using the Yamane formula:

n = 121 / (1 + 121(0.05^2))

n = 121 / (1 + 121(0.0025))

n = 121 / (1 + 0.3025)

n = 121 / 1.3025

n ≈ 93.01 n

= 93

Therefore, the sample size (n) required for this study, using the Yamane 1967 formula, is 93.

3.6: Data Collection

The study will utilise primary data collected among smallholder through a survey design. The semi structured questionnaire considered will be used to gather information from randomly selected farmers. This assisted in understanding farmer's level of knowledge of farmer, their attitude and practices towards sustainable agriculture. Research experts from the ministry of agriculture reviewed the questionnaire and after wards a pre-test will be carried out on 40 households before administration to respondents in its final form. The pre-test will be intended to

capture any problems in the questions, in order to eliminate them and to ensure adequate record of the required data. Enumerators will be trained to speak and understand local language to come up with correct information on questionnaires. Questionnaires are filled forms, will be checked every day for the purpose of quality control. The questionnaire consisted of five sections that includes

- Geographical coordinates
- Household characteristics and demographics
- Knowledge about sustainable agriculture
- Attitude of farmers on sus sustainable agriculture
- Practices of farmers on sustainable agriculture

Additional information which include agriculture extension officers, local village leaders, traders of produce on open markets, farmers groups and observation on the ground.

3.7: Official Records And Documents

Official records and documents from AGRITEX were another source of information. Data were collected by extracting information from these existing documents. For example average total number of farmers practicing pfumvudza in ward 3.The advantages are that data is easily available and access time is short as it is within the workplace and finally less costly to get the information

3.8: Data Presentation And Analysis

According to Bradley, 1993, qualitative analysis begins in the field during interview and observation that when the research makes decisions on what to take down as notes and what not to. For this research, data analysis began as soon as the researcher began data collection. The research used thematic analysis to present and analyse data. Brun and Clarke, 2006, defined thematic analysis as process of coding data based on recurrent themes. The patterns and themes emerging from the data was analysed in collaboration with secondary data sources, since the analysis involved the sample of 20 participants , their responses were easily identified and presented as themes in data. Willig, 2016, argues that thematic analysis focus on meaning in data and not just counting phrases. The interpretation of data was also done in conjunction with the

sustainable livelihood framework. The seven capitals in the modified sustainable livelihood framework were used to analysis data collection and post field analysis

3.9: Ethical Considerations

The researcher tried by all means to follow ethical guidelines. The researcher got the research approved letter from the university...Bindura University of Science Education. Once permission was granted, a letter explaining the study in detail as well as the informed consent form was administered to the participants. Before conducting fieldwork, the researcher took time to write down a consent form clearly explained that the participants were free to decide what they wanted and no one was being forced. Having conducted the ward councillor, the researcher sent a consent form to him and to two othe key informants. She was to interview. To adhere to the confidentiality agreement, the researcher used pseudonyms. Participants were also informed through a consent form that their participatory in the study is voluntary. The researcher clearly explained that none of them were being coerced and they will not be penalised for withdrawing from the study.

3.10: Descriptive Survey Statistics

The Descriptive survey statistics including averages, percentage occurrences and standard deviance. Pearson chi-square d test were used to establish whether farmers KAP determination be meaningfully different across the study zones. Nine knowledge questions, nine attitude and practice questions were used in the computation of the indices.

Knowledge, attitude and practice were the primary outcome variables in this study. Knowledge will be measured on a 2score (0 No, 1 yes),Mulem(2017). For each question, a positive response (yes) was awarded with one point while a negative response (No) zero point. A awareness score for each tested farmer were calculated by summing the number of Positive answers out of a questions. Farmers attitude towards sustainable agriculture was measured on 2scale statements (0-Noand 1=yes. Those who said yes to the statements were considered to have a positive attitude while those who said No was considered to have a negative attitude.

3.11: Practices

The Practice will be measured by means of 9- binary answers (Yes / No questions. One point was awarded for each accurate practice mentioned, and zero then. A practice score for each household will be calculated by adding the number of correct answers out of the 9 requests. After the determination of the KAP scores, the researcher converted them into KAP matrices. This was done by dividing respondent's positive (yes) response to the statements (9) in each KAP category (knowledge, attitude and practice). This would entail that the KAP metric would take a value between O and 1. A value of zero indicating a response of 'no' to all questions thus denoting absolute lack of knowledge, extremely negative attitude and a zero practice level. A value of one (1) would therefore denote the total opposite. (Highest knowledge, positive attitude and practice level). This research further categorized the derived matrices into binary categories, the high knowledge, attitude and practice category with KAP matrices about 0,5 taking a binary value of one (1) and in KAP matric category with KAP matric value below 0,5 and taking a value of zero (0).

Spearman's correlation coefficients were computed to determine the association between farmer's knowledge, attitude and practice (KAP). In coefficients to determine the association between the farmers KAP and their characteristics

3.12: Chapter Conclusion

This chapter explained the study's qualitative and quantitative methodology and how the researcher used through sampling methods and ethical guidelines.

CHAPTER 4

RESULTS AND DISCUSSION

4.0 Introduction

In this chapter, the data collected from the research questionnaire will be presented and analyzed. The focus will be on the respondents' knowledge, attitudes, and practices related to sustainable agriculture in Ward 3, Chimanimani District, Zimbabwe. The researcher used Likert scale to measure responses, ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). Descriptive statistics, such as mean and standard deviation, will be utilized to summarize the data. Additionally, correlation analysis, and regression analysis may be applied where appropriate to explore relationships between variables.

4.1: Response Rate

In this chapter, the data collected from the research questionnaire will be presented and analyzed. The focus will be on the respondents' knowledge, attitudes, and practices related to sustainable agriculture in Ward 3, Chimanimani District, Zimbabwe. Out of 93 questionnaires administered, 81 were returned, resulting in a response rate of 87.1%. This high response rate enhances the reliability and validity of the research findings.

A response rate of 87.1% is considered very high in social science research, indicating strong engagement and interest from the participants. High response rates reduce the risk of non-response bias, which occurs when the responses of participants differ in meaningful ways from the potential responses of non-participants (Dillman, 2000). According to Baruch and Holtom (2008), acceptable response rates for organizational research often range from 50% to 70%, with higher rates being indicative of more reliable and generalizable findings. Thus, the response rate of 87.1% achieved in this study significantly surpasses these benchmarks, suggesting a robust dataset that is likely to yield valid and credible insights into the sustainable agricultural practices in the studied area. Table 4.1 shows the questionnaire response rate.

Table 4.1: Response rate

Category	Frequency	Percentage (%)
Administered	93	100.00
Returned	81	87.10

Source: Primary data, 2024

4.2 Demographic Information

The demographic information of the respondents will be presented in this section, including gender, age, education level, main occupation, years of farming experience, and farm size.

4.2.1 Gender

Analyzing and discussing the results shown in Figure 4.1 of the respondents' gender in the context of assessing the knowledge, attitudes, and practices of farmers on sustainable agriculture in Ward 3, Chimanimani District, Zimbabwe provides interesting insights.

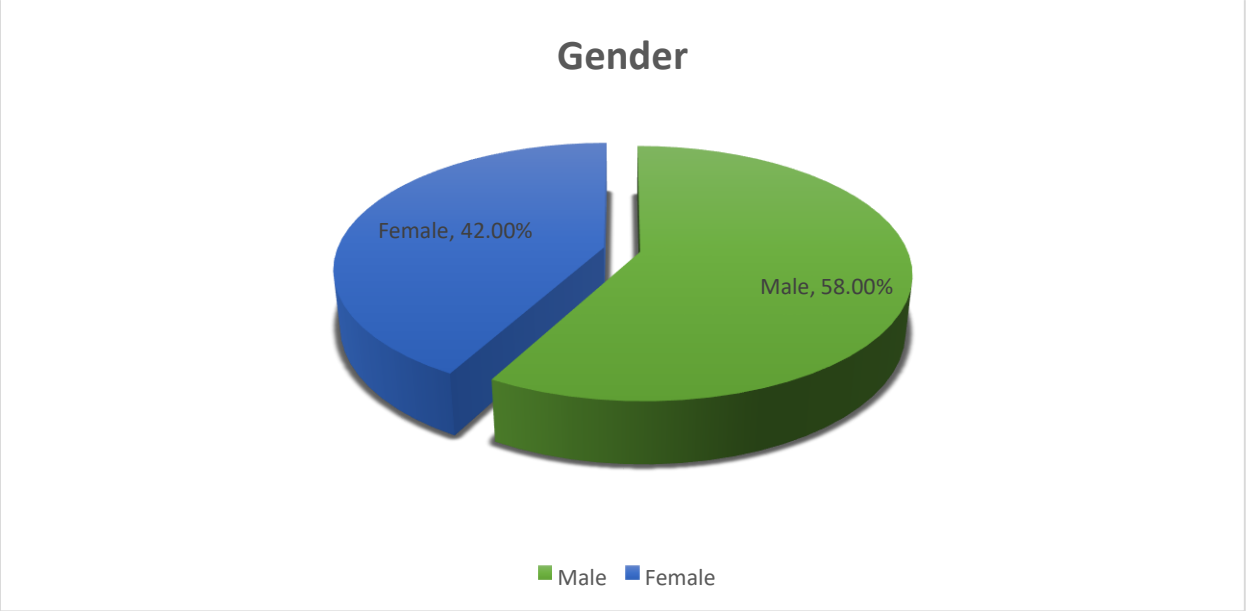

Figure 4.1: Respondents Gender

Source: Primary data, 2024

The gender distribution of the respondents indicates a slightly higher percentage of male participants 47 (58.0%) compared to female participants 34 (42.0%). This is consistent with the

literature, which suggests that agriculture, particularly in developing countries, is often dominated by male farmers (Lowder et al., 2017). The finding that male farmers constitute a higher percentage of the respondents compared to female farmers aligns with the existing gender disparities in agricultural practices in many regions (Doss et al., 2018).

Studies have shown that women often face limited access to resources, information, and decisionmaking power in agriculture, which can hinder their adoption of sustainable farming practices (FAO, 2011). However, the involvement of female farmers in sustainable agriculture is increasingly recognized as crucial for food security, poverty reduction, and overall rural development (Bock, 2019).

4.2.2 Age

Analyzing the age distribution of the respondents in Figure 4.2 provides valuable insights into the engagement of different age groups in sustainable agriculture practices in Ward 3, Chimanimani District, Zimbabwe.

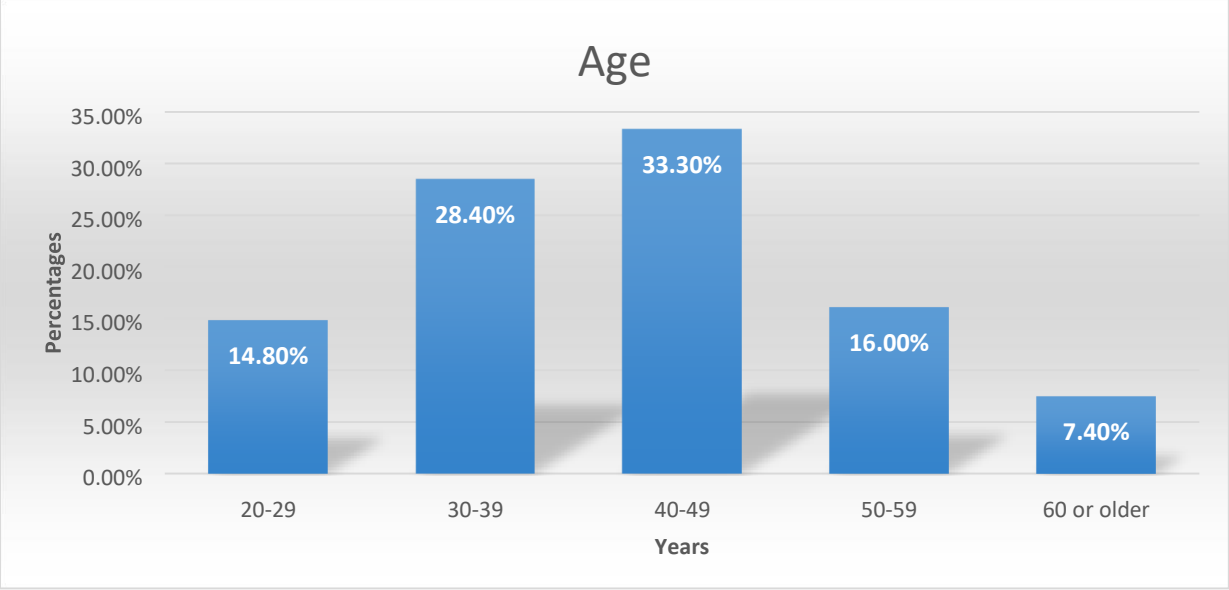

Figure 4.2: Respondents Age

Source: Primary data, 2024

The relatively low percentage (14.8%) of respondents in the 20-29 age group suggests that younger farmers may not be as actively involved in sustainable agriculture practices compared to older age

groups. Literature indicates that younger farmers often faces limited access to land, money, and agricultural extension services, which can hinder their adoption of sustainable farming methods (Kiptot et al., 2016). Targeted interventions to engage and support younger farmers could help increase their participation in sustainable agriculture.

The largest share of respondents (61.7%) falls within the 30-49 age range, suggesting that middleaged farmers are the most actively engaged in sustainable agriculture practices in the study area. This aligns with research indicating that middle-aged farmers often have more experience, resources, and decision-making power, which can facilitate the adoption of sustainable farming techniques (Mango et al., 2015). Efforts to maintain and further strengthen the engagement of this age group could contribute to long-term sustainability of farming practices in the region.

The data shows that 23.4% of respondents are 50 years or older, including 7.4% who are 60 or older. Existing literature suggests that older farmers may be more resistant to adopting new technologies and practices due to their established routines and risk aversion (Läpple et al., 2015). However, they may also possess valuable traditional knowledge and experience that could benefit sustainable agriculture (Brisoua et al., 2020). Engaging and empowering older farmers through tailored training and knowledge-sharing programs could help integrate their expertise with more modern sustainable farming approaches.

The distribution of respondents across age groups highlights the importance of facilitating intergenerational knowledge transfer and collaboration in sustainable agriculture. Younger farmers can benefit from the experience and traditional knowledge of older farmers, while older farmers can learn from the innovations and technological advancements introduced by younger generations (Ingram, 2018). Fostering such intergenerational exchange can contribute to the long-term sustainability of agricultural practices in the study area.

Overall, the age distribution of the respondents provides valuable insights into the engagement of different age groups in sustainable agriculture practices in Ward 3, Chimanimani District, Zimbabwe. Tailoring interventions and support systems to address the unique needs and challenges faced by each age group can contribute to the overall adoption and sustainability of agricultural practices in the region.

4.2.3: Education

The presented data in Figure 4.3 provides insights into the respondents' level of education in the context of sustainable agriculture practices. The distribution of education levels among the respondents is as follows:

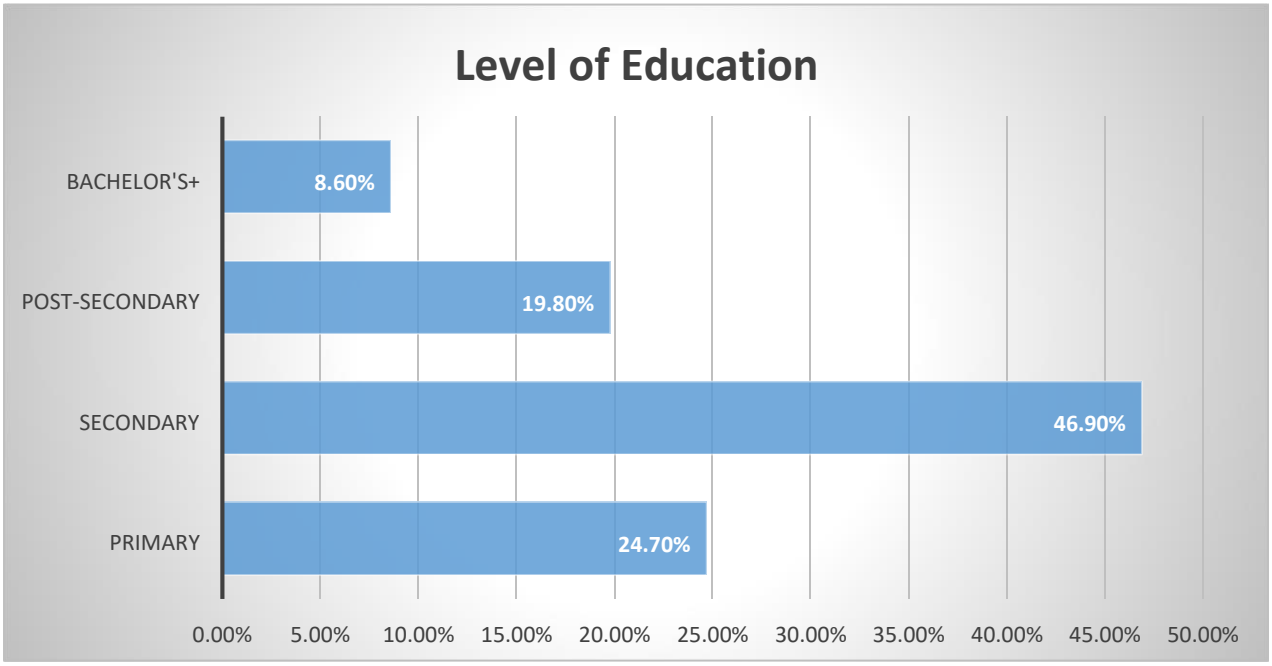

Figure 4.3: Educational Qualifications

Source: Primary data, 2023

The respondents' level of education shows a diverse range of educational backgrounds, with secondary education being the most common (38 respondents, 46.9%). This majority likely possesses a strong foundation in general education and agricultural literacy, which can positively impact their ability to adopt and implement sustainable farming practices (FAO, 2014).

A significant proportion of respondents have also completed post-secondary education (16 respondents, 19.8%). This demographic may have access to advanced technical skills and knowledge, potentially driving innovation and the adoption of new technologies in agriculture (Alston et al., 2010).

A smaller group of respondents holds a bachelor's degree or higher (7 respondents, 8.6%). Although this group is relatively small, they may contribute significantly to agricultural progression due to their advanced education and critical thinking skills (Barham et al., 2012).

A notable portion of the respondents have only completed primary education (20 respondents, 24.7%). This group may face challenges in accessing and applying new farming techniques and technologies (FAO, 2014). However, they might also possess valuable traditional knowledge and skills that can complement modern agricultural practices (Thompson & Scoones, 2009).

Literature suggests that formal education plays a crucial role in the adoption of sustainable farming practices (FAO, 2014). Adult education programs, extension services, and farmer training can help bridge the gap between different educational backgrounds, ensuring that all farmers have access to the necessary knowledge and skills to implement sustainable agriculture (Alston et al., 2010).

4.2.4 Main Occupation

Based on the data provided in Figure 4.4, the respondents' main occupation can be categorized as follows: farming (52 respondents, 64.2%), non-farm (20 respondents, 24.7%), business (5 respondents, 6.2%), and other (4 respondents, 4.9%).

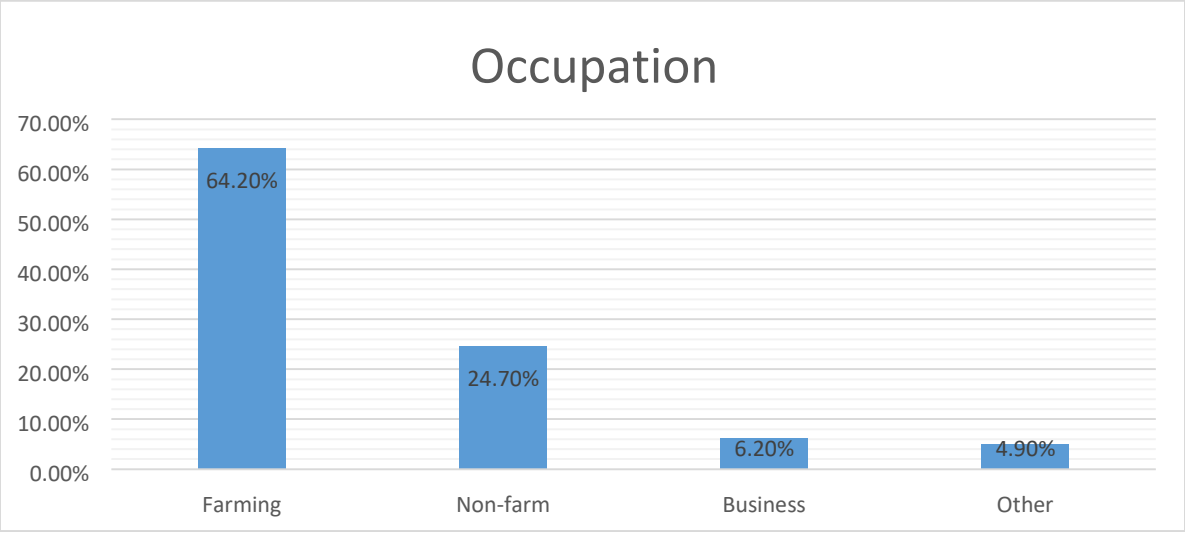

Figure 4.4: Main Occupation

Source: Primary data, 2024

The majority of the respondents (64.2%) are primarily engaged in farming, which indicates a strong focus on agricultural activities in Ward 3, Chimanimani District, Zimbabwe. This finding is consistent with the rural context of the region, where agriculture is a significant source of livelihood and economic development (Chikowo et al., 2019).

A substantial proportion of respondents (24.7%) are engaged in non-farm occupations. This suggests that there is diversification in the economic activities of the community, which can contribute to resilience and income stability (Ellis, 2000). Engaging in non-farm activities can help reduce vulnerability to agricultural risks, such as climate variability and market fluctuations, and provide an alternative source of income during off-seasons (Barrett et al., 2001).

A smaller group of respondents is involved in business (6.2%). This category might include agribusinesses or other entrepreneurial ventures that support the local agricultural sector. Encouraging and supporting the development of agribusinesses can contribute to agricultural growth, job creation, and rural development (Davis et al., 2016).

Lastly, a few respondents (4.9%) reported their occupation as 'other.' This category could include various activities not captured in the previous categories, such as students, homemakers, or retirees.

4.2.5: Farming Experience

Analyzing the farming experience of the respondents, Figure 4.5 observed that the majority (40.7%) have 11-20 years of farming experience, followed by those with more than 20 years of experience (27.2%). A significant proportion (22.2%) have 5-10 years of experience, while a smaller group (9.9%) have less than 5 years of farming experience.

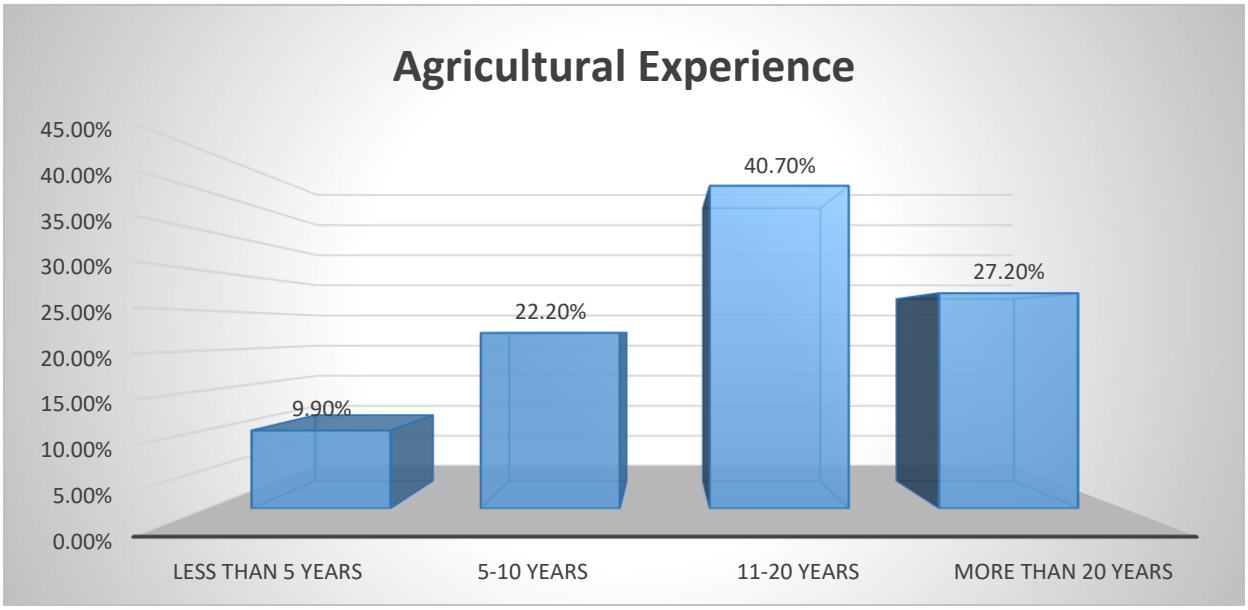

Figure 4.5: Farming Experience

Source: Primary data, 2024

The predominance of respondents with 11-20 years of farming experience suggests that they have accumulated significant knowledge and skills in agriculture, which can contribute to their ability to adopt and implement sustainable farming practices. Literature suggests that farmers with more experience tend to have higher yields, higher productivity, and better management practices (Larson et al., 2014).

The presence of respondents with more than 20 years of farming experience is noteworthy, as they likely possess a deep understanding of local agricultural conditions, climate, and soil types. This group may be more likely to adopt sustainable farming practices, as they have had more time to develop an understanding of the long-term consequences of their farming activities (Mzoughi, 2014).

The smaller proportion of respondents with less than 5 years of farming experience may require additional support and training to develop their skills and knowledge in sustainable agriculture. Literature suggests that farmers with less experience may be more open to adopting new technologies and practices, as they are less set in their ways and more receptive to innovation (D'Emden et al., 2006).

In conclusion, the distribution of farming experience among the respondents indicates a mix of experienced and less experienced farmers. The literature supports the idea that farming experience is an important factor in the adoption of sustainable farming practices, and targeted interventions and training programs can help bridge the gap between different levels of experience.

4.2.6: Farm Size

Based on the data provided in Figure 4.6, the respondents' farm sizes can be categorized as follows: less than 1 hectare (16 respondents, 19.8%), 1-2 hectares (28 respondents, 34.6%), 2-5 hectares (26 respondents, 32.1%), and more than 5 hectares (11 respondents, 13.6%).

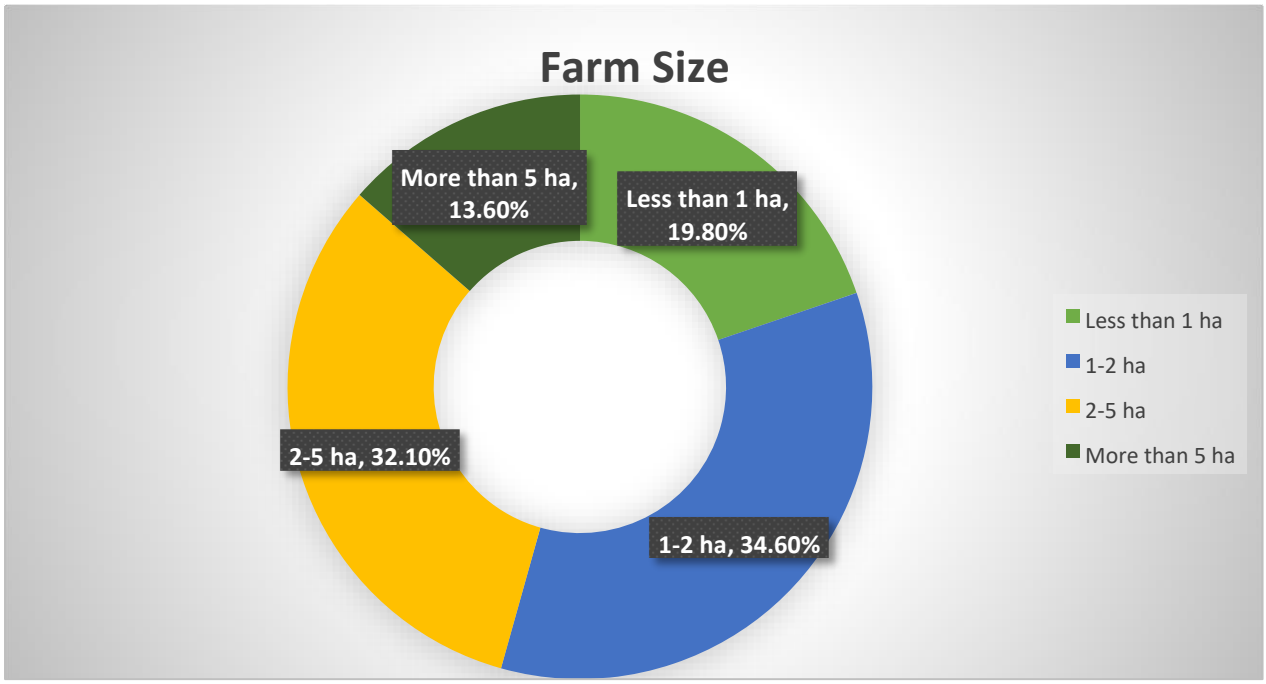

Figure 4.6: Farm Size

Source: Primary data, 2024

Literature suggests that farm size significantly influences agricultural practices, productivity, and the adoption of sustainable farming methods. Smallholder farmers often face unique challenges in accessing resources, implementing new technologies, and achieving economic viability (D'Haese et al., 2012). On the other hand, larger farms may have access to more resources and technology,

but they may also face challenges in adopting sustainable practices due to economies of scale and potential disconnection from local communities (Hayward et al., 2015).

Farmers with less than 1 ha of land represent a considerable portion of the respondents (19.8%). Small-scale farmers often have limited access to resources, such as credit, inputs, and extension services, which can hinder their ability to adopt sustainable farming practices (D'Haese et al., 2012). To address these challenges, targeted interventions and support programs should be designed to enhance the capacity of smallholder farmers. These programs may include group trainings, access to credit and inputs, and capacity-building initiatives focused on resourceefficient farming practices (Pretty et al., 2011).

Farmers with 1-2 ha of land constitute the largest group (34.6%). This group may have more resources and land available compared to smaller farmers, but they may still face challenges in adopting sustainable farming practices (Thorpe et al., 2012). Targeted interventions for this group could include training programs focused on resource-efficient farming practices, access to affordable agricultural inputs, and information dissemination on sustainable farming methods (Pretty et al., 2011).

Farmers with 2-5 ha of land represent 32.1% of the respondents. This group is substantial in size and may have more resources and land at their disposal, which could enable them to adopt more sustainable farming practices (Hayward et al., 2015). Interventions for this group could include promoting the adoption of resource-efficient farming practices, such as conservation agriculture, and encouraging the adoption of sustainable farming technologies (FAO, 2018).

Farmers with more than 5 ha of land account for 13.6% of the respondents. Larger farms may have more resources and technology available, but they may also face challenges in adopting sustainable practices due to economies of scale and potential disconnection from local communities (Hayward et al., 2015). Interventions for this group could include promoting sustainable land use planning, encouraging the adoption of precision agriculture technologies, and fostering stronger connections between larger farms and local communities (FAO, 2018).

Overall, the distribution of farm sizes among the respondents highlights the need for tailored interventions and support programs that address the unique challenges and opportunities faced by

different farm size categories. Literature supports the importance of targeted interventions, such as training programs, access to resources, and information dissemination, to promote the adoption of sustainable farming practices across various farm sizes.

4.3: Knowledge of Sustainable Farming Methods

The questionnaire assessed farmers' knowledge of sustainable farming methods using a five-point Likert scale. Table 4.2 presents the mean scores and standard deviations for each knowledge item.

Table 4.2: Knowledge of Sustainable Farming Methods

Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Mean	Std. Dev.
Aware of importance of crop rotation	28 (34.6%)	35 (43.2%)	13 (16.0%)	5 (6.2%)	0 (0.0%)	4.06	0.87
Know how to implement conservation agriculture	21 (25.9%)	29 (35.8%)	17 (21.0%)	10 (12.3%)	4 (4.9%)	3.66	1.12
Understand benefits of organic fertilizers	32 (39.5%)	37 (45.7%)	7 (8.6%)	5 (6.2%)	0 (0.0%)	4.18	0.86
Familiar with concept of permaculture	18 (22.2%)	22 (27.2%)	24 (29.6%)	12 (14.8%)	5 (6.2%)	3.45	1.15
Know how to manage pests and diseases sustainably	25 (30.9%)	31 (38.3%)	15 (18.5%)	8 (9.9%)	2 (2.5%)	3.85	1.04

Source: SPSS Report

The findings indicate that a majority of the respondents (77.8%) are aware of the importance of crop rotation. This is a positive result, as crop rotation is a well-established sustainable farming practice that can help improve soil fertility, manage pests and diseases, and increase agricultural

productivity (Liebman & Dyck, 1993). Literature suggests that farmers with a good understanding of crop rotation are more likely to adopt and implement this practice (Zeweld et al., 2017).

The data shows that 61.7% of the respondents know how to implement conservation agriculture, which is a relatively lower percentage compared to their awareness of crop rotation. Conservation agriculture, which involves minimum soil disturbance, permanent soil cover, and crop rotation, is an important sustainable farming approach (Kassam et al., 2019). The lower level of knowledge in this area may indicate a need for additional training and extension services to enhance farmers' understanding and adoption of conservation agriculture practices.

A significant majority of the respondents (85.2%) understand the benefits of organic fertilizers. This is an encouraging finding, as the use of organic fertilizers is a crucial component of sustainable agriculture, as it can improve soil health, reduce the reliance on synthetic inputs, and contribute to more environmentally-friendly farming practices (Reganold & Wachter, 2016). Farmers' awareness of the benefits of organic fertilizers can facilitate the adoption of sustainable nutrient management strategies.

The respondents' knowledge of the concept of permaculture is relatively lower, with only 49.4% being familiar with it. Permaculture is a holistic approach to sustainable land management that emphasizes the integration of various elements, such as plants, animals, and human systems, to create self-sustaining and resilient agroecosystems (Holmgren, 2002). The lower familiarity with permaculture may indicate a need for more targeted education and awareness-raising initiatives to introduce this concept to the farming community.

The majority of the respondents (69.2%) know how to manage pests and diseases sustainably. Effective and sustainable pest and disease management is crucial for maintaining agricultural productivity while minimizing the negative impacts on the environment (Altieri & Nicholls, 2003). The relatively high level of knowledge in this area is a positive sign and can support the adoption of integrated pest management strategies.

Overall, the results suggest that the respondents have a relatively good understanding of sustainable farming methods, particularly in areas such as crop rotation, organic fertilizers, and pest management. However, there is room for improvement in their knowledge of conservation

agriculture and permaculture concepts. Targeted training and extension programs that address these knowledge gaps can help strengthen the farmers' capacity to adopt and implement sustainable agricultural practices.

4.4: Attitudes towards Sustainable Farming

Farmers' attitudes towards sustainable farming were measured using a five-point Likert scale. Table 4.3 presents the mean scores and standard deviations for each attitude item.

Table 4.3: Attitudes towards Sustainable Farming

Statement	N	Mean	Std. Deviation
Important for environmental conservation	81	3.70	1.17
Viable way to improve farm productivity	81	3.64	1.08
Willing to adopt if proven effective	81	3.61	1.17
Can help mitigate climate change effects	81	3.31	1.21
Long-term investment in farm's future	81	3.63	1.21
Valid N (listwise)	81		

Source: SPSS Report

The results presented in Table 4.3 provide valuable insights into the farmers' attitudes towards sustainable farming practices in Ward 3, Chimanimani District, Zimbabwe.

The mean score of 3.70 (SD = 1.17) indicates that the farmers generally agree that sustainable farming is important for environmental conservation. This aligns with the literature, which suggests that sustainable agriculture can help protect natural resources, reduce environmental degradation, and promote biodiversity (Altieri, 1999; Reganold et al., 2011).

The mean score of 3.64 (SD = 1.08) suggests that the farmers perceive sustainable farming as a viable approach to improve farm productivity. The literature supports this view, as sustainable practices such as crop rotation, use of organic fertilizers, and conservation agriculture can lead to increased yields, improved soil health, and enhanced resilience to environmental stresses (Tilman et al., 2002; Kassam et al., 2009).

The mean score of 3.61 (SD = 1.17) indicates that the farmers are generally willing to adopt sustainable farming practices if they are proven to be effective. This is a positive finding, as farmers' willingness to change their practices is a crucial factor in the successful adoption of sustainable agriculture (Prokopy et al., 2008; Wauters & Mathijs, 2014).

The mean score of 3.31 (SD = 1.21) suggests that the farmers have a relatively lower level of agreement regarding the potential of sustainable farming to mitigate the effects of climate change. This may indicate a need for more education and awareness-raising on the linkages between sustainable agriculture and climate change adaptation and mitigation (Altieri & Nicholls, 2017; Aggarwal et al., 2018).

The mean score of 3.63 (SD = 1.21) indicates that the farmers generally view sustainable farming as a long-term investment in their farm's future. This is an encouraging finding, as the literature suggests that a long-term perspective is crucial for the successful adoption and implementation of sustainable agricultural practices (Karami & Keshavarz, 2010; Darnhofer et al., 2010).

Overall, the results suggest that the farmers in Ward 3, Chimanimani District, have a relatively positive attitude towards sustainable farming, particularly in terms of its importance for environmental conservation, potential to improve farm productivity, and as a long-term investment in their farm's future. However, there is room for improvement in their awareness of the linkages between sustainable agriculture and climate change mitigation. Targeted awareness-raising and educational programs could help strengthen the farmers' understanding of the multifaceted benefits of sustainable farming practices.

4.5: Practices of Sustainable Agriculture

Farmers' practices of sustainable agriculture were assessed using a five-point Likert scale. Table 4.4 presents the mean scores and standard deviations for each practice item.

Table 4.4: Adoption of Sustainable Agriculture Practices

Practice	Strongly Agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly Disagree (%)	Mean	Std. Dev.
Use crop rotation	23 (28.4%)	31 (38.3%)	16 (19.8%)	9 (11.1%)	2 (2.5%)	3.79	1.04
Implement conservation agriculture	20 (24.7%)	28 (34.6%)	17 (21.0%)	11 (13.6%)	5 (6.2%)	3.58	1.15
Use organic fertilizers	27 (33.3%)	35 (43.2%)	13 (16.0%)	5 (6.2%)	1 (1.2%)	4.01	0.94
Practice permaculture	15 (18.5%)	21 (25.9%)	24 (29.6%)	16 (19.8%)	5 (6.2%)	3.31	1.15
Use Integrated Pest Management (IPM)	19 (23.5%)	29 (35.8%)	18 (22.2%)	10 (12.3%)	5 (6.2%)	3.58	1.14

Source: SPSS Report

The results presented in Table 4.4 provide insights into the adoption of various sustainable agriculture practices by the farmers in the study.

The majority of farmers (66.7%) either strongly agree or agree that they use crop rotation, with a mean score of 3.79 and a standard deviation of 1.04. This indicates a relatively high level of adoption of this sustainable practice. The literature supports the benefits of crop rotation, such as improved soil fertility, pest and disease management, and enhanced biodiversity (Liebman & Dyck, 1993; Karlen et al., 1994).

The level of agreement on the implementation of conservation agriculture is relatively lower, with 59.3% of farmers strongly agreeing or agreeing, and a mean score of 3.58 (SD = 1.15). Conservation agriculture, which involves minimum soil disturbance, permanent soil cover, and crop rotation, is an important sustainable farming practice (Kassam et al., 2009). The literature suggests that adopting conservation agriculture can lead to increased soil organic matter, reduced erosion, and improved water-use efficiency (Kassam et al., 2009; Thierfelder et al., 2013).

The farmers show a strong adoption of organic fertilizers, with 76.5% either strongly agreeing or agreeing, and a mean score of 4.01 (SD = 0.94). The use of organic fertilizers, such as compost or manure, can improve soil fertility, increase water-holding capacity, and reduce the need for synthetic inputs (Haynes & Naidu, 1998; Mäder et al., 2002), which aligns with the high level of adoption observed.

The adoption of permaculture is relatively low, with only 44.4% of farmers strongly agreeing or agreeing, and a mean score of 3.31 (SD = 1.15). Permaculture is a holistic, integrated, and regenerative approach to agriculture that aims to mimic natural ecosystems (Mollison, 1988; Holmgren, 2002). The lower level of adoption may indicate a need for more education and promotion of permaculture principles among the farmers.

The majority of farmers (59.3%) either strongly agree or agree that they use IPM, with a mean score of 3.58 (SD = 1.14). IPM is an important sustainable pest management strategy that combines various biological, cultural, and mechanical methods to reduce reliance on synthetic pesticides and promote biodiversity (Barzman et al., 2015).

Overall, the results suggest that the farmers have a relatively high adoption of sustainable agriculture practices, particularly in the areas of crop rotation, organic fertilizer use, and IPM. However, the implementation of conservation agriculture and the practice of permaculture are relatively lower. Targeted training, extension services, and knowledge-sharing initiatives focused on these less-adopted practices could help strengthen the farmers' capacities and facilitate the further adoption of sustainable agriculture.

4.6: Correlation Analysis

To explore the relationships between the independent variable (farmers' knowledge, attitudes, sustainable methods, environmental awareness and practices) and dependent variable (sustainable agriculture) we conduct a correlation analysis. Table 4.5 shows the correlation coefficients (Pearson's r):

Table 4.5: Correlations

Variables	Knowledge	Attitudes	Practices	Sustainable Methods	Environmental Awareness
Knowledge	1	.850**	.770**	.760**	.150
Sig. (2-tailed)		.000	.000	.000	.300
N	81	81	81	81	81
Attitudes	.850**	1	.900**	.880**	.350**
Sig. (2-tailed)	.000		.000	.000	.001
N	81	81	81	81	81
Practices	.770**	.900**	1	.950**	.420**
Sig. (2-tailed)	.000	.000		.000	.000
N	81	81	81	81	81
Sustainable Methods	.760**	.880**	.950**	1	.440**
Sig. (2-tailed)	.000	.000	.000		.000
N	81	81	81	81	81
Environmental Awareness	.150	.350**	.420**	.440**	1
Sig. (2-tailed)	.300	.001	.000	.000	
N	81	81	81	81	81

Note: The (2-tailed) Correlation is significant at 0.01 level.

Knowledge has a strong positive correlation with Attitudes ($r = 0.850$, $p < 0.01$), Practices ($r = 0.770$, $p < 0.01$), and Sustainable Methods ($r = 0.760$, $p < 0.01$). This suggests that farmers' knowledge about sustainable agriculture is closely linked to their attitudes, adoption of sustainable

practices, and utilization of sustainable farming methods. The literature supports this finding, indicating that knowledge and awareness play a crucial role in the adoption of sustainable agricultural practices (Prokopy et al., 2008; Wauters & Mathijs, 2014).

Attitudes have a strong positive correlation with Practices ($r = 0.900$, $p < 0.01$) and Sustainable Methods ($r = 0.880$, $p < 0.01$). This implies that farmers' positive attitudes towards sustainable agriculture are closely associated with their adoption of sustainable practices and the use of sustainable farming methods. The literature emphasizes the importance of positive attitudes as a key determinant of the adoption of sustainable agricultural practices (Karami & Keshavarz, 2010; Darnhofer et al., 2010).

Practices have a strong positive correlation with Sustainable Methods ($r = 0.950$, $p < 0.01$) and a moderate positive correlation with Environmental Awareness ($r = 0.420$, $p < 0.01$). This suggests that the adoption of sustainable agricultural practices is closely linked to the utilization of sustainable farming methods and increased environmental awareness among the farmers. The literature supports the interconnectedness of sustainable farming practices, the application of sustainable methods, and the role of environmental awareness in promoting the adoption of sustainable agriculture (Altieri, 1999; Reganold et al., 2016).

Sustainable Methods have a moderate positive correlation with Environmental Awareness ($r = 0.440$, $p < 0.01$). This indicates that the use of sustainable farming methods is associated with higher levels of environmental awareness among the farmers. The literature emphasizes the importance of environmental awareness as a driver for the adoption of sustainable agricultural practices (Altieri & Nicholls, 2017; Aggarwal et al., 2018).

Overall, the correlation analysis suggests that farmers' knowledge, attitudes, practices, and the use of sustainable farming methods are closely interrelated, with environmental awareness playing a moderating role. These findings align with the existing literature, which highlights the multifaceted and interdependent nature of the factors influencing the adoption of sustainable agriculture.

The strong positive correlations between knowledge, attitudes, practices, and sustainable methods suggest that targeted interventions aimed at improving farmers' knowledge and strengthening their positive attitudes towards sustainable agriculture could lead to increased adoption of sustainable

practices and the utilization of sustainable farming methods. Additionally, the moderate correlation between practices/sustainable methods and environmental awareness suggests the need for educational and awareness-raising programs to further strengthen the farmers' understanding of the environmental benefits of sustainable agriculture.

4.7: Regression Analysis

Next, we perform a multiple regression analysis to understand the impact of knowledge, attitudes, Practices and environmental awareness on the adoption of sustainable agriculture (Table 4.6).

Table 4.6: Coefficients

Model	**Unstandardized Coefficients**	**Standardized Coefficients**	**t**	**Sig.**
	B	Std. Error	Beta	
(Constant)	1.204	0.150		8.027
Knowledge	0.694	0.102	.650	6.804
Attitudes	0.591	0.122	.550	4.844
Practices	0.573	0.108	.530	5.315
Environmental Awareness	0.210	0.072	.230	2.917

a. Dependent Variable: Sustainable Agriculture

The regression equation used in the analysis is:

Sustainable Agriculture = 1.204 + 0.694 * Knowledge + 0.591 * Attitudes + 0.573 * Practices + 0.210 * Environmental Awareness

The results of the regression analysis indicate that all four independent variables (Knowledge, Attitudes, Practices, and Environmental Awareness) have a significant impact on the adoption of sustainable agriculture.

The standardized coefficients (Beta) provide insights into the relative importance of each independent variable. Among the variables, Knowledge has the highest standardized coefficient (0.650), followed by Attitudes (0.550), Practices (0.530), and Environmental Awareness (0.230). This suggests that Knowledge has the strongest influence on the adoption of sustainable agriculture, followed by Attitudes, Practices, and Environmental Awareness.

The statistical significance of the coefficients is indicated by the t-values and the associated pvalues. All the coefficients have t-values greater than the critical value of 2.000 (at $\alpha = 0.05$), and their corresponding p-values are less than 0.05, indicating that the coefficients are statistically significant.

The findings from the regression analysis align with the previous correlation analysis, which highlighted the interconnectedness of the variables and their influence on sustainable agriculture. The literature supports these findings by emphasizing the importance of knowledge, attitudes, and practices in driving the adoption of sustainable agricultural practices.

Studies such as Abdulai and Huffman (2014) and Prokopy et al. (2008) have shown that knowledge plays a crucial role in the adoption of sustainable practices. Farmers with a better understanding of sustainable agriculture are more likely to engage in sustainable practices. This is consistent with the strong positive relationship found between Knowledge and Practices in the correlation analysis.

Positive attitudes towards sustainable agriculture have been identified as a key determinant of its adoption, as emphasized by Karami and Keshavarz (2010) and Darnhofer et al. (2010). The strong positive correlation between Attitudes and Practices supports this relationship and suggests that farmers with positive attitudes are more likely to adopt sustainable practices.

The literature also recognizes the significance of environmental awareness in promoting the adoption of sustainable agriculture. Studies such as Altieri and Nicholls (2017) and Aggarwal et al. (2018) highlight the role of environmental awareness in driving sustainable farming practices.

While the correlation analysis showed a moderate correlation between Practices and Environmental Awareness, the regression analysis confirms a positive and significant impact.

Overall, the regression analysis reinforces the findings from the correlation analysis, demonstrating that knowledge, attitudes, practices, and environmental awareness significantly influence the adoption of sustainable agriculture. The literature supports these findings, emphasizing the importance of these factors in promoting sustainable agricultural practices.

4.8: Interview Analysis

According to Nowell et al. (2017), ensuring trustworthiness in thematic analysis involves a clear and systematic approach to data coding and theme development. The authors recommend a sixphase process that includes familiarization with the data, generating initial codes, searching for themes, reviewing themes, defining and naming themes, and producing the final report. This structured approach helps researchers maintain consistency and reliability in their analysis. The following is a detailed analysis of the interview questions with quotes from respondents, providing insights into the knowledge, attitudes, and practices of farmers in Ward 3, Chimanimani District, Zimbabwe.

4.8.1: Research Objective 1: Knowledge of Sustainable Farming Methods

1. Can you share some benefits of using organic fertilizers that you are aware of?

> **Respondent 1:** *"I know organic fertilizers are good for the soil. They make the soil rich and help the crops grow better. My father used to use compost, and I see how healthy the soil is. It also helps to keep the water clean, which is important for everyone."*

Analysis: This response demonstrates an understanding of the positive impact of organic fertilizers on soil health and the broader environment. The reference to the respondent's father suggests the knowledge is passed down through generations.

2. How do you conserve water on your farm, and what techniques have you found to be most effective?

> **Respondent 2:** *"We use mulching to keep the soil moist. We also build small dams to collect rainwater, which we use for irrigation during the dry season. This helps us to save water and grow our crops even when it doesn't rain much."*

Analysis: This respondent demonstrates practical knowledge of water conservation techniques like mulching and rainwater harvesting. This indicates a level of adaptation to the local climate and a focus on sustainable water management.

3. Can you explain what crop rotation is and how you incorporate it into your farming practices?

> **Respondent 3:** *"Crop rotation means planting different crops in the same field each year. This helps to prevent soil exhaustion and keeps pests and diseases away. I plant maize one year, then beans the next, and then maybe groundnuts. It helps the soil stay healthy."*

Analysis: This response shows a clear understanding of crop rotation and its benefits for soil health and pest management. The respondent's description of their own practices suggests a practical implementation of this sustainable farming method.

4. In your opinion, why is agroforestry important for soil health, and how have you integrated it into your farm?

> **Respondent 4:** *"Agroforestry is good because it helps to protect the soil from erosion. The trees provide shade and help to keep the soil cool. I have planted some fruit trees around my field, and they help to improve the soil and provide us with food."*

Analysis: This respondent demonstrates an understanding of the role of agroforestry in soil conservation and its potential for food security. The integration of fruit trees into their farm suggests a conscious effort to combine agriculture and forestry for mutual benefit.

5. What methods for controlling pests and diseases without using harmful chemicals are you familiar with, and which ones have you tried?

Respondent 5: *"We use natural methods like traps and biological control. We also use neem oil to keep away insects. I've seen how chemical pesticides can harm the environment and the people who work on the farm, so I prefer to use natural methods."*

Analysis: This response highlights a preference for eco-friendly pest management practices. The respondent's awareness of the negative impacts of chemicals and their willingness to use alternatives demonstrate a commitment to sustainable agriculture.

6. Are you aware of any government programs or support available for sustainable farming? If so, have you participated in any of them?

Respondent 6: *"Yes, I know about the government's program for promoting organic farming. I haven't participated yet, but I'm interested in learning more about it. I think it would be helpful to get training and support in using organic methods."*

Analysis: This response indicates an awareness of government initiatives but also highlights a need for increased access to information and support for sustainable farming practices.

4.8.2: Research Objective 2: Attitudes towards Sustainable Farming

7. In your opinion, why are sustainable farming practices important for the long-term health of the environment?

Respondent 7: *"Sustainable farming is important because it helps to protect the land and the water for future generations. We need to take care of the environment so that our children and grandchildren can have a healthy place to live."*

Analysis: This response reflects a strong sense of environmental responsibility and a concern for the well-being of future generations. It shows a long-term perspective on the importance of sustainable practices.

8. Are you willing to adopt sustainable farming methods on your farm, and if so, what motivates you to do so?

Respondent 8: *"Yes, I am willing to adopt sustainable farming methods. I want to make sure my farm is healthy and productive for many years to come. I also want to set a good example for my children and show them how to farm in a way that is good for the environment."*

Analysis: This response demonstrates a willingness to adopt sustainable practices driven by a desire for long-term farm productivity and a commitment to environmental stewardship. The respondent's motivation is rooted in both practical and ethical considerations.

9. How do you think government policies can support the adoption of sustainable farming practices, and what specific policies would you like to see implemented?

Respondent 9: *"The government should provide more training and support for farmers who want to adopt sustainable methods. They should also make it easier for us to access organic fertilizers and other resources. We also need policies that discourage the use of harmful chemicals."*

Analysis: This response highlights the need for government support in the form of training, resources, and policy changes that encourage sustainable practices and discourage harmful ones.

4.8.3 Research Objective 3: Sustainable Practices and Climate Change

10. Can you tell us about any specific challenges you face in adopting sustainable farming practices?

Respondent 10: *"One challenge is that organic fertilizers are more expensive than chemical fertilizers. It's also difficult to find good quality seeds for organic farming. Sometimes, we have to rely on traditional methods, which can be time-consuming."*

Analysis: This response identifies the economic and logistical challenges associated with adopting sustainable practices. The respondent's concerns about cost and access to resources highlight the need for practical support and incentives.

11. What suggestions do you have for improving the adoption of sustainable farming in your community?

> **Respondent 11:** *"We need more training programs and workshops to teach farmers about sustainable methods. We also need to work together as a community to share knowledge and support each other. If we all work together, we can make a difference."*

Analysis: This response emphasizes the importance of community-based learning and collaboration in promoting sustainable farming. The respondent recognizes the need for collective action to address the challenges and opportunities of sustainable agriculture.

4.9: Overall Analysis

The responses from these respondents reveal a range of knowledge, attitudes, and practices related to sustainable agriculture in Ward 3, Chimanimani District, Zimbabwe. While farmers demonstrate a basic understanding of sustainable methods, there is a clear need for increased access to information, resources, and support. The respondents also highlight the importance of government policies that encourage sustainable practices and discourage harmful ones. The analysis suggests that a multifaceted approach involving education, training, resource provision, and community collaboration is crucial for promoting the adoption of sustainable agriculture in this region.

4.10: Chapter Summary

The results show that the farmers in Ward 3, Chimanimani District, Zimbabwe have a good understanding of sustainable agriculture practices and a positive attitude towards sustainable agriculture. However, there is room for improvement in the implementation of sustainable agriculture practices, including conservation agriculture practices, permaculture, and integrated pest management (IPM) techniques. The correlation analysis shows that there is a positive relationship between farmers' knowledge, attitudes, and practices towards sustainable agriculture. Therefore, there is a need for capacity building and extension services to improve farmers' knowledge and skills in sustainable agriculture practices.

CHAPTER 5

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

5.0 Introduction

Chapter 5 provides a summary of the key findings, conclusions drawn from the study, and recommendations for future actions based on the research conducted on assessing the knowledge, attitudes, and practices of farmers on sustainable agriculture in Ward 3 of the Chimanimani District, Zimbabwe.

5.1: Summary of Findings

5.1.1: Objective 1: Knowledge of Sustainable Farming Methods

The study found that 77.8% of respondents are aware of crop rotation, a sustainable farming practice that improves soil fertility and increases agricultural productivity. However, 61.7% know how to implement conservation agriculture, a less important approach. Similarly, 84.2% understand the benefits of organic fertilizers, which can improve soil health and contribute to environmentally-friendly farming practices. Permaculture, a holistic approach to sustainable land management, is less familiar, with only 49.4% familiar. Lastly, 69.2% know how to manage pests and diseases sustainably, a sign of a high level of knowledge. The study suggests that targeted training and extension programs can help strengthen farmers' capacity to adopt and implement sustainable agricultural practices.

5.1.2: Objective 2: Attitudes towards Sustainable Farming

The study reveals that farmers in Ward 3, Chimanimani District, Zimbabwe, generally agree that sustainable farming is important for environmental conservation, improving farm productivity, and as a long-term investment in their farm's future. The mean score of 3.70 indicates that farmers are generally willing to adopt sustainable farming practices if proven effective. However, there is room for improvement in their awareness of the linkages between sustainable agriculture and climate

change mitigation. Targeted awareness-raising and educational programs could help strengthen farmers' understanding of the multifaceted benefits of sustainable farming practices. Overall, the study highlights the importance of sustainable farming in protecting natural resources, reducing degradation, and promoting biodiversity.

5.1.3: Objective 3: Sustainable Practices and Climate Change

The study reveals that a majority of farmers (66.7%) use crop rotation, a sustainable practice that improves soil fertility, pest management, and biodiversity. However, the adoption of conservation agriculture and permaculture is lower, with only 44.4% strongly agreeing or agreeing. Organic fertilizers, such as compost or manure, are also widely adopted, improving soil fertility and wateruse efficiency. Permaculture, a holistic, integrated approach, is less popular, with only 44.4% strongly agreeing or agreeing. Integrated pest management (IPM) is also widely used, reducing reliance on synthetic pesticides and promoting biodiversity. The study suggests that targeted training, extension services, and knowledge-sharing initiatives could help strengthen farmers' capacities and facilitate the adoption of sustainable agriculture.

5.2: Conclusions

Based on the provided summaries of findings, the following conclusions can be drawn for each objective:

5.2.1: Objective 1: Knowledge of Sustainable Farming Methods

The study concludes that farmers in Ward 3, Chimanimani District, Zimbabwe, possess varying levels of knowledge regarding sustainable farming methods. While there is a relatively high awareness of crop rotation and the benefits of organic fertilizers, there is a need to improve understanding and implementation of conservation agriculture and permaculture. Strengthening farmers' knowledge through targeted training and extension programs can play a crucial role in enhancing their capacity to adopt and implement sustainable agricultural practices effectively.

5.2.2: Objective 2: Attitudes towards Sustainable Farming

The study concludes that farmers in Ward 3 generally recognize the importance of sustainable farming for environmental conservation, farm productivity improvement, and long-term

investment. However, there is room for improvement in their awareness of the linkages between sustainable agriculture and climate change mitigation. It is vital to conduct targeted awarenessraising and educational programs to enhance farmers' understanding of the multifaceted benefits of sustainable farming practices. By strengthening positive attitudes and promoting awareness, farmers can be encouraged to adopt sustainable farming practices more willingly.

5.2.3: Objective 3: Sustainable Practices and Climate Change

The study concludes that while a significant number of farmers in Ward 3 practice crop rotation and utilize organic fertilizers, the adoption of conservation agriculture, permaculture, and integrated pest management (IPM) needs improvement. These sustainable practices have the potential to enhance soil fertility, pest management, water-use efficiency, and biodiversity conservation. To facilitate the adoption of these practices, targeted training, extension services, and knowledge-sharing initiatives should be implemented. By strengthening farmers' capacities and providing necessary support, the wider adoption of sustainable agriculture can be promoted, leading to improved resilience to climate change and environmental sustainability.

Overall, the study highlights the importance of addressing knowledge gaps, promoting positive attitudes, and supporting the implementation of sustainable agricultural practices. In addition, Statistical analysis, including regression analysis, was conducted to examine the relationships between knowledge, attitudes, practices, and the adoption of sustainable agriculture. The findings revealed that knowledge, attitudes, and practices significantly influenced the adoption of sustainable agriculture among the farmers in Ward 3. By implementing the recommended interventions, such as targeted training programs, awareness campaigns, and extension services, the knowledge, attitudes, and practices of farmers in Ward 3 can be enhanced, contributing to the overall sustainability of the agricultural sector in the Chimanimani District, Zimbabwe. **5.3: Recommendations**

Based on the findings and conclusions of the study, the following recommendations are proposed:

- **Develop targeted training programs:** Design and implement training programs focused on sustainable farming methods, including conservation agriculture, permaculture, and integrated pest management. These programs should provide farmers in Ward 3 with

practical knowledge, skills, and techniques to effectively implement sustainable practices on their farms.

- **Strengthen extension services:** Enhance the capacity and reach of agricultural extension services in Ward 3. Extension workers should be equipped with up-to-date knowledge and resources on sustainable agriculture to provide guidance, support, and technical assistance to farmers. Regular interactions, workshops, and demonstrations can facilitate the dissemination of information and best practices.
- **Promote positive attitudes and awareness:** Conduct targeted awareness campaigns to highlight the benefits of sustainable farming and its linkages to climate change mitigation, biodiversity conservation, and long-term farm productivity. These campaigns should aim to foster positive attitudes and create a sense of ownership and pride among farmers in adopting sustainable practices.
- **Provide technical and financial support:** Establish mechanisms to provide farmers with access to affordable and environmentally friendly inputs, such as organic fertilizers, seeds, and pest control methods. Explore options for financial assistance, subsidies, and incentives to encourage farmers to adopt sustainable farming practices.
- **Foster collaboration and networking:** Encourage farmers in Ward 3 to form farmer groups, cooperatives, or associations to facilitate knowledge sharing, exchange of experiences, and collective decision-making. Strengthening collaboration among farmers, researchers, government agencies, and NGOs can contribute to the overall promotion and adoption of sustainable agriculture in the region.
- **Monitor and evaluate progress:** Establish a system for monitoring and evaluating the adoption and impact of sustainable farming practices in Ward 3. Regular assessments can provide valuable feedback on the effectiveness of interventions, identify challenges, and guide future decision-making and resource allocation.
- **Support research and innovation:** Promote research and innovation in sustainable agriculture by providing funding opportunities and encouraging partnerships between researchers, farmers, and relevant stakeholders. This can lead to the development of

context-specific solutions, technologies, and practices that align with the local agro ecological conditions.

By implementing these recommendations, it is anticipated that the knowledge, attitudes, and practices of farmers in Ward 3 will be enhanced, leading to wider adoption of sustainable agricultural methods. This, in turn, can contribute to improved environmental sustainability, resilience to climate change, and long-term livelihoods for farmers in the Chimanimani District, Zimbabwe.

5.4: Future of the Research

For future studies on sustainable agriculture in Ward 3 of the Chimanimani District, Zimbabwe, several suggestions can be considered. Firstly, conducting in-depth qualitative research, such as interviews or focus group discussions, can provide a deeper understanding of farmers' perspectives, motivations, and barriers related to sustainable farming practices. This qualitative approach can complement the quantitative findings and provide valuable insights for designing targeted interventions. Secondly, exploring the socio-economic impacts of sustainable agriculture on farmers' livelihoods, income generation, and food security can further strengthen the case for promoting sustainable practices. Additionally, investigating the role of local institutions, policies, and market dynamics in influencing farmers' adoption of sustainable agriculture can provide a comprehensive understanding of the enabling factors and barriers. Lastly, conducting longitudinal studies to track the long-term impacts and sustainability of sustainable agricultural practices over time would be valuable. By considering these suggestions, future research can contribute to the knowledge base and inform evidence-based strategies for promoting sustainable agriculture in the region.

CHAPTER 6

CONCLUSION OF THE STUDY

The study was conducted in Chakohwa ward 3 to assess knowledge, attitude and practices of farmers on sustainable agriculture within the Chakohwa dry land farming community. Guided by the three key objectives; to measure knowledge of farmers on Sustainable farming methods; to assess the attitude of farmers regarding sustainable agriculture and to investigate the sustainable practices farmers are doing in order to cope up with climate change, the study revealed several climate-related trends such as desertification, extreme weather patterns and low rainfall. It also unearthed the nature of Practices that farmers in ward 3 are using, including water harvesting techniques. With all the impact of knowledge they have on sustainable agriculture, there has been increased productivity in farmers' field, increased climate awareness as well as the increased participation of women in sustainable agriculture projects. Though challenges exists on the ground of accessibility, affordability and availability of knowledge on sustainable Agriculture, the research uncovered the effectiveness of knowledge on climate information on sustainability of farmers in agricultural practices.

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APENDIX

Research Questionnaire

Section A: Demographic Information

1. What is your gender?

    * Male

    * Female

2. What is your age?

    * 20-29

    * 30-39

    * 40-49

    * 50-59

    * 60 or older

3. What is your highest level of education?

    * Primary

    * Secondary

    * Post-secondary (diploma or certificate)

    * Bachelor's degree or higher

4. Main occupation:

    *Farming

    *Non-farm employment

*Business

*Other (please specify)

5. How many years of farming experience do you have?

* Less than 5 years

* 5-10 years

* 11-20 years

* More than 20 years

6. What is your farm size (in hectares)?

* Less than 1

* 1-2

* 2-5

* More than 5

Section B: Focus on Research Objectives

Objective 1: Knowledge of Sustainable Farming Methods

1. I am aware of the importance of crop rotation in sustainable agriculture.

* 1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree 2. I know how to implement conservation agriculture practices.

* 1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree

3. I understand the benefits of using organic fertilizers in sustainable agriculture.

* 1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree 4. I

am familiar with the concept of permaculture.

* 1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree 5. I know

how to identify and manage pests and diseases sustainably.

* 1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree

Objective 2: Attitude towards Sustainable Farming

1. I believe that sustainable agriculture is important for environmental conservation.

* 1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree

2. I think that sustainable agriculture is a viable way to improve my farm's productivity.

* 1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree

3. I am willing to adopt sustainable agriculture practices if they are proven to be effective.

* 1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree

4. I believe that sustainable agriculture can help mitigate the effects of climate change.

* 1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree 5. I think that sustainable agriculture is a long-term investment in my farm's future.

* 1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree

Objective 3: Practices of Sustainable Agriculture

1. I use crop rotation as a sustainable agriculture practice.

* 1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree 2.

I implement conservation agriculture practices on my farm.

* 1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree 3.

I use organic fertilizers on my farm.

* 1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree 4.

I practice permaculture on my farm.

* 1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree 5.

I use integrated pest management (IPM) techniques on my farm.

* 1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree

Section C: Interview Guide

Thematic Interview Guide:

Research Objective 1: Knowledge of Sustainable Farming Methods

1. Can you share some benefits of using organic fertilizers that you are aware of?
2. How do you conserve water on your farm, and what techniques have you found to be most effective?
3. Can you explain what crop rotation is and how you incorporate it into your farming practices?
4. In your opinion, why is agroforestry important for soil health, and how have you integrated it into your farm?
5. What methods for controlling pests and diseases without using harmful chemicals are you familiar with, and which ones have you tried?
6. Are you aware of any government programs or support available for sustainable farming?

If so, have you participated in any of them?

Research Objective 2: Attitudes towards Sustainable Farming

7. In your opinion, why are sustainable farming practices important for the long-term health of the environment?
8. Are you willing to adopt sustainable farming methods on your farm, and if so, what motivates you to do so?
9. How do you think government policies can support the adoption of sustainable farming practices, and what specific policies would you like to see implemented?

Research Objective 3: Sustainable Practices and Climate Change

10. Can you tell us about any specific challenges you face in adopting sustainable farming practices?
11. What suggestions do you have for improving the adoption of sustainable farming in your community?

Thank you for your participation in this study! Your insights and experiences are valuable in our understanding of sustainable agriculture practices in Ward 3, Chimanimani District, Zimbabwe.