SMALL-SCALE FARMERS' PERCEPTIONS TOWARDS CONSERVATION AGRICULTURE AS A MITIGATION STRATEGY FOR CLIMATE CHANGE: MUREWA DISTRICT.

A dissertation submitted in partial fulfilment of the requirements for the Master of Science Degree in Food Security and Sustainable Agriculture

(Policy)

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DECLARATION

I hereby declare that the research project entitled **"Small-scale farmers' perceptions towards conservation agriculture as a mitigation strategy for climate change: Murewa district."** submitted to Bindura University of Science Education, Department of Agriculture Economics, Education and Extension is a record of an original work done by me under the guidance and supervision of **Mrs Manyumwa** and this work is submitted in partial fulfilment of the requirements for the award of a Master of Science Degree in Food Security and Sustainable Agriculture (Policy). The results embodied in this research have not been submitted to any University or Institute for the award of any degree or diploma.

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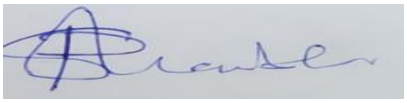
Signature: 

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DEDICATION

I dedicate this study to:

My beautiful wife Fadzai Alison Ruzvidzo and my unborn baby who have been my rock and inspiration throughout this journey. I LOVE YOU!

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ABSTRACT

In order to improve food security, climate resilience, and agricultural output in a sustainable manner, conservation agriculture is essential. The agronomic advantages of conservation agriculture have been the subject of much research on its adoption; however, the role that small-scale farmers' perceptions of CA play has received less attention. In order to bridge this disparity, the purpose of this study was to find out how small-scale farmers in the Murewa district perceived conservation agriculture as a climate change mitigation method. A pre-tested questionnaire was used to gather data from 209 farmers who were chosen at random for the study. Focus group talks, key informant interviews, and first-hand observations were used to triangulate this methodology. Inferential statistics, means, and percentages were used to analyse the data. The findings indicate that while less than 36.4% of the participants had no formal agricultural experience, over 85% of them depended on the industry as their primary source of income. The majority of the respondents did not use crop rotation, although they were well-informed on the economic, social, and environmental benefits of conservation agriculture. The majority of small-scale farmers, however, had a neutral opinion of conservation agriculture and were unwilling to adopt CA. Age, gender, education, and prior experience with conservation agriculture all contributed to the explanation of the farmers' knowledge and perspectives. The findings also indicate that there was no statistically significant relationship between adoption willingness and gender. Conversely, a link was found between gender and CA practice, suggesting that gender affects adoption. Closing the perception gap is essential to improving conservation agriculture's adoption.

KEYWORDS: Climate resilience, small-scale farmers, knowledge, perception, Gender, Zimbabwe

LIST OF ACRONYMS AND ABBREVIATIONS

ACT-N	African Conservation Tillage Network
CA	Conservation Agriculture
CIMMYT	International Maize and Wheat Improvement Centre
DMC	Mulch-based Cropping
FAO	Food and Agricultural Organisation
ICRAF	International Centre for Research in Agroforestry
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IITA	International Institute for Tropical Agriculture
NGOs	Non-Governmental Organisations
SADC	Southern African Development Committee
SPSS	Statistical Package for Social Scientists
SSA	Sub Saharan Africa
USA	United States of America

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INTRODUCTION

1.1 Background of the study

The three major components of conservation agriculture (CA) are crop diversity through rotations, minimum or reduced tillage, and crop residues to maintain soil surface cover (FAO, Climate change and Sustainable Agriculture, 2015). According to FAO (2015) and (Anderson J. A, 2017), CA aims to increase productivity while enhancing environmental sustainability, boosting resistance to climatic extremes, boosting food security, reducing poverty, conserving biodiversity, and protecting the ecosystem.

In developing nations like Zimbabwe, where the majority of smallholder farmers are centered in rural regions, extreme weather events like floods and droughts are predicted to have a negative impact (J.A, 2016). With almost 1.5 million families farming, smallholder farmers in Zimbabwe produce 75% of the nation's agricultural output (FAO, 2016) .

In southern Africa, acceptance of CA is fragmented and restricted, despite over 50 years of research and development (Llewellyn & Chen, 2017). According to (Sharma, 2015), less than 1% of southern Africa's total arable land is covered by CA, however Richards et al.

In Zimbabwe, the majority of the time, the decision to begin conservation agriculture (CA) was not made voluntarily because, according to (Mazvimavi T. a., 2014), nongovernmental organizations (NGOs) identified the farmers who initially took part in CA promotion as vulnerable households facing output restrictions. As incentives, farmers who took part in these initiatives received seeds, fertilizer, and technical assistance (Andersson, 2015) . Because they introduced methods that community members did not think were immediately relevant, development efforts in SSA have frequently failed (Gukurume, 2017). This restricts the acceptability of technology since farmers are crucial information providers for their neighbours and are the ones that start the diffusion and acceptance of technology locally (Dalton, 2014)

Additional barriers to the acceptance of CA in SSA have been documented by other studies as follows: a lack of credit (Maumbe, 2010); a lack of equipment and inputs (Thierfelder C. C., 2019); a lack of information on input sources (Nyanga, 2015); inadequate extension services (Llewellyn & Chen, 2017); and challenges in shifting farmers' mind-sets from

conventional tillage to CA (Nyengerai, 2020). Implementation has been hindered by the prescriptive character of CA marketing (Slegers, 2018) as opposed to offering farmers a variety of technologies that are tailored to their needs (Giller, 2014) . To use the analogy "when you are a hammer, everything is a nail," CA shouldn't be considered the solution to every agricultural problem.

For new agricultural methods to be accepted, information is crucial (Gowing, 2016). According to (Palacios, 2015), socio-demographic factors in Japan affected farmers' attitudes on CA. (Sadati, 2014) found that knowledge played a major role in elucidating attitudes regarding sustainable agriculture based on research conducted in Iran. According (Khalil, 2017), knowledge plays a crucial part in the uptake of agricultural technologies.

Behaviour is dictated by perception (Willis, 2018). Adequate information and a favourable attitude toward sustainable agriculture are necessary for smallholder farmers. It is extremely unlikely that farmers who have unfavourable opinions on sustainable agricultural methods will implement them (FAO, 2017).

Gender is an important social factor that affects agricultural activities in Sub-Saharan Africa in a big way. In the context of farming, gender dynamics influence and are influenced by agricultural tasks, practices, roles, and functions as well as relationships and results (FAO, 2017). One of the most significant social structures and influences on African development is still gender. As of right now, a large portion of the region's CA and gender research and evidence is dispersed, falls short of offering a cohesive view of important problems and lessons, and is mostly unrelated to the information needs of SSA's major agricultural organizations, funders, and decision-makers (Jones, 2019).

The threat posed by climate change and variability, which has resulted in repeated droughts, as well as ecosystem degradation and biodiversity loss, have made food insecurity more acute in the past ten years (Thierfelder C. R., 2015). The most impacted are smallholder farmers in semi-arid areas who are also devoid of inputs like fertilizers and improved seed varieties. Zimbabwean farmers are receiving food help or free agricultural inputs in response to this crisis, allowing them to start their farming businesses (Sims, 2021). Unfortunately, because of poor land and crop management techniques, the majority of farmers have not been able to convert these relief investments into long-term increases in crop productivity and earnings (Nhongonhema, 2014).

This has prompted a request for relief funding with an emphasis on sustainable food production methods that also seek to enhance soil fertility and water management. Conservation agriculture (CA) is one technology option that has been proposed for enhancing soil fertility and water management. Since 2004, CA has been supported in Zimbabwe through a number of relief and recovery initiatives aimed at enhancing the food security of smallholder farmers who are at risk (Soropa, 2015).

(Kirkegaard, 2014) Found that smallholder farmers hardly ever apply the principles of residue retention and crop rotation. Accordingly, CA must be customized to the farmers' specific biophysical and socioeconomic circumstances (Kassam, 2019).

Contradictory views of CA have been documented from other research conducted in Zimbabwe; these studies have dubbed CA "dig and eat" (Diga udye) and "dig and die" (Diga ufe) (Mazvimavi K. a., 2014), highlighting the significant labor needs for CA. Because farmers are more concerned with the security of their livelihood than any other stakeholder, development practitioners may perceive farmers as being unwilling to invest in agricultural innovations that could improve their livelihoods.

Farmers make implement new technology decisions based on their judgments of the new technology' suitability, relevance, and profitability (Thierfelder *et al.* 2015). Subjective in nature, perceptions encompass a variety of attitudes, opinions, and judgments (Dalton et al., 2014). (Slegers, 2008).

There are three main categories of factors that affect farmers' perceptions: information about the technology, traits of the new technology, and traits and conditions of the farmers in the target area (Pannell, 2016). Knowledge makes problems with soil degradation and potential technical solutions, such as CA, easier to understand (Giller, 2014). Information shapes perception because all technologies require some amount of knowledge to operate; therefore, low levels of education and complicated technologies can make learning more expensive (Anderson J. A, 2017). As a result, learning about CA is far less expensive now that it is widely available.

A farmer's goals and circumstances are shaped by their age, gender, experience, farm size, household size, income level, and educational attainment. These factors also affect the farmer's ability to implement CA technology. The technology's characteristics assess the relative advantage, viability, complexity, ability to be divided into different components, and

economic benefits of the new versus the old technology (FAO, 2017). Due to the diversity of factors influencing them, including culture, educational attainment, gender, age, resource endowments, and institutional factors, farmers' perspectives are therefore context- and location-specific (Mavunganidze, 2014).

Perceptions show areas in which knowledge can be enhanced by the presentation of unbiased data (Kunzekweguta, 2016). In order to close knowledge gaps that impede the implementation of CAs, it is crucial to identify misconceptions in order to determine where education, research, and extension programming may be implemented (Jones, 2019). Thus, it's imperative to comprehend farmers' perspectives in order to dispel any misunderstandings regarding CA, customize upcoming CA campaigns to local circumstances, and ultimately increase its uptake (Pittelkow, 2016).

1.2 Statement of the Problem

Significant obstacles to agricultural productivity are posed by climate change, especially in areas like Zimbabwe's Murewa District. The foundations of the agricultural industry, small-scale farmers, are especially susceptible to the negative effects of climate change. Conservation agriculture has been pushed as a sustainable farming method to lessen these effects (Mafongoya, 2020). However, there is still a lack of implementation of conservation agriculture techniques among Murewa District's smallholder farmers. The implementation rate is below 4% in Mashonaland East province (CYMMIT, 2022). Estimated that conservation agriculture practices accounted for about 20% of Zimbabwe's agricultural area (FAO, 2017). Therefore comprehending the attitudes of small-scale farmers regarding the implementation of conservation agriculture is vital in order to devise effective strategies that encourage its adoption and augment climate resilience within the area.

However, acceptance of technologies such as CA is not grounded in objective fact, but rather in subjective perceptions (Pannell, 2016). Although there have been some studies conducted on conservation agriculture in Zimbabwe, more work needs to be done to understand how smallholder farmers in the area see these methods and to create plans for encouraging their adoption in the Murewa District.

Overall, investigating the perceptions of smallholder farmers toward conservation agriculture in Zimbabwe is vital for promoting sustainable agriculture, building climate resilience and addressing the socio-economic challenges faced by smallholder farmers (Mazvimavi T. a., 2014). The findings of this study can inform evidence-based decision making, policy

formulation and targeted interventions to support the adoption of conservation agriculture practices and improve the livelihoods of smallholder farmers Zimbabwe.

1.3 Objectives of the study

1.3.1 The main objective

The broad objective of the study is to assess the perceptions of small-scale farmers towards conservation agriculture practices as a mitigation measure for climate change

1.3.2 Specific objectives

The specific objectives of the study seeks to:

1. To examine farmers' level of knowledge of the principles and the practices of conservation agriculture.
2. To assess men and women farmers perceptions of the obstacles and/or challenges of implementing conservation agriculture
3. To examine farmers' willingness to incorporate or expand conservation agricultural practices on their farms

1.4 Research Questions

1. To what extent are farmers' aware of the principles and practices of conservation agriculture?
2. How do men and women differ in their perceptions of the obstacles and/or challenges of adopting conservation agriculture?
3. To what extent are the farmers willing to incorporate or expand conservation agricultural practices on their farms?

1.5 Significance of the study /Justification

Knowledge and awareness: It's possible that resources and information on climate change and sustainable farming methods are scarce for small-scale farmers. Knowledge and awareness gaps can be found by examining how they perceive things. The results can direct the creation of customized training courses, awareness-raising efforts, and knowledge-sharing portals to improve small-scale farmers' comprehension of conservation agriculture and its possible advantages.

Sustainable development goals: The goals of both national and international development are supported by this study. Zimbabwe has committed to sustainable development,

encompassing the Sustainable Development Goals (SDGs) established by the United Nations. A number of SDGs, such as ending world hunger (SDG 2), promoting decent work and economic growth (SDG 8), and addressing climate change (SDG 13), are directly impacted by the evaluation of sustainable farming methods. This study can help advance progress towards these goals by providing information on the effects of sustainable behaviours, which can drive policy formulation, resource allocation, and program design.

Policy and program development: For rural livelihoods and global food security, small-scale farmers are essential. The needs and viewpoints of these farmers must be taken into consideration when developing policies and program interventions targeted at mitigating and adapting to climate change. The study can offer important information to agricultural extension services, development organizations, and policy makers to help them create focused interventions and support systems that will encourage conservation agriculture.

1.6 Delimitation of the Study

Geographical delimitation: The study only looked at the particular geographic area known as the Murewa District. The district's limits and features were taken into account while compiling information and making decisions. Without additional research, it was not possible to generalize the findings to other districts or locations.

Target population: The Murewa District's small-scale farmers will be the focus of the study. This category comprises people or households that work in small-scale agriculture, usually with restricted resources and land. Large-scale commercial farmers and farmers from other districts will not be included in the study.

1.6.1 Limitation of the study

Time frame: Because the study was taken in a specified time frame, it might be harder to record long-term shifts or patterns in small-scale farmers' attitudes on conservation agriculture. The study's time period was taken into consideration when interpreting the results.

Data collection methods: The research objectives required the use of particular data collection techniques, such as focus groups, interviews, and surveys. Time and resource constraints, were among the main pragmatic concerns, and had an impact on the approaches chosen.

1.7 Outline of Thesis

The remainder of the thesis is as follows:

Chapter Two: previous researches on the smallholder perceptions of CA as a mitigatory measure for climate change are reviewed. The foundation for comparison with research findings is presented in this chapter, which makes it significant.

Chapter Three: The chapter outlines the study's methodology. Research design, sampling, data collection, data analysis, and ethical considerations are the main areas of attention. Please refer to chapters four, five, six, and seven for further details on the analysis conducted for each individual goal.

Chapter Four: The demographics of the small-scale farmers in the Murewa district are outlined in this chapter. Descriptive statistics, including means, frequency tables, standard deviation, and percentages, were used in the quantitative analysis process.

Chapter five: this chapter will determine the level of knowledge small-scale farmers have about the principles and practises of conservation agriculture. The degree of conservation agriculture knowledge among the small-scale farmers in Murewa was assessed using a 3-point Likert decision rule model and multinomial regression. The model decision rule indicated that a score of more than 2.0 is accepted and a score of less than 2.0 is rejected.

Chapter six: the goal was to find out how male and female farmers perceived the difficulties and/or barriers associated with putting conservation agriculture into practice. The degree of perceptions of conservation agriculture held by male and female small-scale farmers in Murewa was assessed using a 3-point Likert decision rule model and multinomial regression. The model's decision rule specified that a score of more than >2.0 is accepted and a score of less than <2.0 is rejected. Chi-square was utilized to examine any relationships between gender and either adoption readiness or CA practice.

Chapter Seven: the objective was examining farmers' willingness to implement or increase conservation agriculture practices on their farms. To ascertain whether the small-scale farmers were willing to introduce or increase CA on their farms or plots, means, frequency tables, and standard deviations were employed.

Chapter Eight: The data, conclusions, and policy recommendations from the preceding chapters are finally combined in chapter eight. The chapter sheds information on how small-scale farmers in the Murewa district view CA.

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CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The literature review offers an overview of previous studies and research pertaining to farmers' perspectives of conservation agriculture as a strategy to mitigate climate change. This review highlights important issues, research gaps, and methodological strategies used in earlier studies by analysing the state of the field.

2.2 Definition of terms

Perception - It is a multifaceted and individualized process that incorporates expectations, prior experiences, knowledge, and the physical senses. It is a dynamic, continuous process that moulds our perception of reality and impacts our attitudes, behaviours, and beliefs. It is a subjective and individualized experience that differs substantially between individuals and is impacted by a variety of elements, such as prior knowledge, life experiences, and the circumstances and surroundings in which we find ourselves (FAO, 2016).

Climate change – long-term changes in temperature and weather brought on by human activity such as burning fossil fuels and natural phenomena such as volcano eruptions and solar activity. The primary cause of climate change is human activity; greenhouse gas emissions from burning fossil fuels, deforestation, and agriculture all contribute to global warming (Sadati, 2014).

Conservation Agriculture – recognized as the collection of soil conservation measures that reduce the influence of soil composition, structure, and natural biodiversity on crop yields (FAO, 2016).

Implementation of Conservation Agriculture - Is the choice made by a farmer to employ three principles-based agricultural technology in order to preserve the environment and boost crop yield. When applied together, soil cover, crop rotation, and zero or minimum tillage create a set of conservation agricultural principles that boost food productivity (Anderson J. A, 2017).

Small-scale farmer – also well known as a smallholder farmer, is a person, family or household that are involved in crop production and or rearing of livestock on a small scale.

They mainly rely on their family members for labour and they farm on small pieces of land or plots. The researcher is going to consider farmers with land less or equal to 5 hectares as small-scale farmers and also producing mainly for subsistence purposes (Slegers, 2018).

Gender – refers to the culturally created and socially defined expectations, behaviours, and roles related with one being a female or a male (FAO, 2017).

2.3 Origin of conservation agriculture

In the Midwest, where a large amount of topsoil was lost by numerous sources, soil erosion was a major issue (Kiptot, 2016). To protect the soil, farmers started planting cover crops, and they rotated their crops to maintain the soil's fertility. Rapid knowledge dissemination allowed for the application of CA on around 60 million hectares of land worldwide by the year 2000 (FAO, 2006). The idea of conservation agriculture (CA) is based on three essential pillars: Reduced soil disturbance, full soil cover; and a new crop rotation strategy (Giller, 2014). In the 1950s, CA got its start in Kenya, with a focus on protecting soil erosion and preserving water reservoirs (Kassam A. F., 2014). Data from previous initiatives show that one of the strictest and most promising ways to adopt sustainable agriculture in the nation is through agriculture conservation (Meijer, 2017).

The International Centre for Research in Agroforestry (ICRAF), the International Maize and Wheat Improvement Centre (CIMMYT), the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), the African Conservation Tillage Network (ACT-N), the Food and Agriculture Organization of the United Nations (FAO), and the International Institute for Tropical Agriculture (IITA) have all consistently promoted conservation agriculture in Africa (Pellegrini, 2014).

2.4 Conservation agriculture principles and practices

2.4.1 Concept of conservation agriculture

Known by many different names, including direct seeding (Rao, 2015), minimum tillage, conservation tillage, zero tillage, and others, the CA production system can ensure sustainability of soil and water conservation. It has been implemented in most agro-ecologies based on the water and soil conservation strategies developed in sustainable intensification (Kassam A. F., 2019). Three fundamental ideas underpin (Naab, 2017):

1. Minimal or no-tillage refers to planting seeds straight into the ground without disturbing it or with only a small amount of soil surface disturbance (less than 25%) (Palacios, 2015).

2. When appropriate, rotate your crops or intercrop with legumes. When utilizing the same crop for extended periods of time, rotation will help prevent insect infestations and preserve biodiversity both above and below ground. Legumes supply N to the system (Kassam A. F., 2014).
3. Year-round mulch covering upkeep, including the use of living or leftover crops (Dalton, 2014).

2.4.2 Key practices used in conservation agriculture

To create sustainable agricultural systems, conservation agriculture is essential. Numerous problems have been plaguing agricultural systems, including soil erosion, a decline in organic soil content, a loss of soil structure, and an increase in input costs (Kassam A. F., 2019). Furthermore, the effects of climate change are being seen in numerous locations (Willis, 2018). When comparing the last 60 years to the last 10 years, there has been a considerable change in both the frequency and volume of rainfall (Derpsch, 2019). Variations in the amount and frequency of rainfall have an effect on agricultural systems, particularly on soil erosion (Wall, 2017). The aquatic growing season has been cut short by about two weeks due to rising temperatures (Corbeels, 2014).

Upland rice was successfully rotated with cowpea and maize in Madagascar (Knowler, 2017). Through the system's biomass cycling and the cowpea plant's delivery of nitrogen, this system greatly improved soil fertility. It also generated more revenue from the crop's harvest. Tillage is necessary when the no-tillage method fails because CA is highly adaptable and may be tailored to local conditions. For instance, in Cambodia, cassava (Manihot esculenta) using stylo (Stylosanthes guianensis) produced less than conventional methods; but, when cassava was planted with a chisel plow, the yield rose by 20–25% in comparison to the traditional approach (Ward, 2018) .

Another instance is in Battambang, Cambodia, where it is quite successful to grow maize alongside cowpea and alternate it with cassava every two years. But compared to standard systems, this technique required more labour, and harvesting cowpea climbing maize was more difficult (Teklewold, 2014). Pigeon pea was substituted for cowpea in the province to aid in the operation of this system. Consequently, farmers have embraced the method and the quality of the soil has increased (Stevenson, 2014).

Early studies conducted in Bac Kan, Vietnam, indicate that because the short-term benefits of CA are not realized, the local population is not prepared to switch from the conventional system (Derpsch, 2019). Although there are no statistics regarding the adoption of CA in Vietnam, the study's target region has done so. The maize cropping methods that were established in Moc Chau and Yen Chau have shown encouraging outcomes in Son La. Provinces of Bac Can, Yen Bai, and Dien Bien have similar outcomes (Yahaya, 2018).

2.4.3 Benefits of conservation agriculture

In terms of agronomy, economy, and the environment, CA can offer a wide range of benefits (Kassam A. F., 2014). Benefits include lower labour costs, lower input costs, and less environmental harm. Using CA boosted the maize yield in Chieng Hac by 13% (Whitfield, 2018).

Mulch absorbs rainfall energy and disperses it, protecting the soil surface and preventing soil erosion (Palm, 2014). Early study conducted in Brazil demonstrated that no-tillage decreased the rate of soil erosion, which is influenced by soil texture and slope (Derpsch, 2019). The first two months of the growing season are when soil erosion might happen the most, and keeping organic cover is the key way to prevent the loss (Oicha, 2015).

A key component of sustainable production systems is carbon storage. Tillage practices cause a significant fall in the carbon index, which is important for storing water and nutrients in the soil. As a result, tillage agriculture is no longer suitable due to negative environmental effects (Kassam A. F., 2014). Significant soil erosion and a decrease in soil organic matter are caused by tillage, which also lowers soil productivity (Anderson J. A, 2017).

Research has demonstrated that CA-based systems can effectively reduce soil erosion and, to a limited extent, increase maize yield (Nyssen, 2017). However, there are a number of challenges and limitations facing direct seeding mulch-based cropping (DMC) systems at the farm and landscape levels. As such, it is necessary to examine the expansion of DMC systems while assuming context-specific geophysical, social, and economic factors (Nyanga P. H., 2014).

2.4.4 Limitations of conservation agriculture

Weed problem under CA system can increase both labour and monetary inputs (mainly herbicides), increasing the number of labourers required (Giller, 2014). In northern Vietnam the labour requirement for weeding increased by up to 37% compared with traditional methods (Kiptot, 2016) and amounts of herbicides required also increased. Some areas of sub-Saharan Africa, it is not affordable for local people to buy herbicides based on the limited market (Andersson, 2015).

Under the CA system, weed problems might result in higher labour and material input costs (mostly pesticides), which raises the labour force requirement (Andersson, 2015). Compared to traditional methods, the labour demand for weeding in northern Vietnam increased by up to 37%, and the quantity of herbicides required also increased (Nkala, 2015). The limited market in certain regions of sub-Saharan Africa makes it unaffordable for the locals to purchase pesticides (Anderson J. A, 2017).

2.5 Demographic factors and perceptions of conservation agriculture

Since age is thought to be a key latent attribute in implementation decisions, it is a significant element that affects the likelihood that new technologies will be adopted (Nyanga P. H., 2016). Farmers' ages are expected to have a significant influence on their likelihood of implementing innovation (Ng'ombe, 2015). The clearly seen negative correlation between age and technology acceptance helps to understand the age factor's negative connotation. In other words, in contrast to their older counterparts, younger planters tend to be more open to embracing technology (Ng'ombe, 2015). Furthermore, elderly farmers may be risk adverse and may suppress their creativity in an effort to minimize the risks associated with taking the initiative and, consequently, their resistance to changes (Mazvimavi K. a., 2014).

Farmers may learn the reasons behind better land management techniques and other social and economic aspects through education (Ndiritu, 2014). A farmer's educational background plays a significant role in determining their preparedness to accept and use technologies appropriately. Conservation agriculture has generally been found to benefit from education. Due to their lack of formal education, Kenyan farmers primarily employ traditional farming methods (Murray, 2016). Repetitive farming errors and decreased productivity result from

this. The likelihood that education will play a significant role in the adoption of technology increases with its complexity.

The implementation of CA is also thought to be influenced by gender. When it comes to how technology is perceived and applied, women are frequently left out. The societal norms that require women to care for their families at home while men look for ways to make ends meet further promote it. Furthermore, women do not have instant access to the essential production components (Mazvimavi K. a., 2014). As a result, this study will examine how men see conservation agriculture as well as the difficulties and roadblocks associated with it.

2.6 Barriers to conservation agriculture unique to women

The evidence at hand indicates that women's participation in CA was often impacted by their reduced ability to make decisions. In general, women are not involved in CA-related household decision-making (Lanckriet, 2016). As was already said, there is a lot of complexity involved in household decision-making when it comes to adopting and using CA in SSA. It is not always the case that men and women participate equally in decision-making related to farming operations, or that they have the same interests and priorities in farming. Decisions on the use of productive assets, including agricultural land, are left to men in households led by men (Lal, 2017).

This complexity was demonstrated in Tanzania by data showing that decisions about minimum tillage and cover crops were made jointly by men and women in Arusha, while men alone made decisions about minimum tillage and planting pits in Dodoma, and men and women jointly decided on cover crops (Kaumbutho, 2014). The reason for the latter scenario is that males were more likely to decide on their own if the CA activities required a lot of work. Compared to women in homes led by males, female heads of household exerted higher decision-making power over CA adoption and practice (Kaumbutho, 2014).

In a study conducted in Kenya, men who opposed CA overturned their wives who supported it, demonstrating the ability of men as the heads of households to accept or reject CA (Kristjanson, 2017). Comparable results were noted in Zambia, where men's negative sentiments toward CA prevented them from being adopted (Kunzekweguta M. R., 2017). On the other hand, adoption was more likely when women participated in CA decision-making

(Kunzekweguta M. O., 2016). The distribution of decision-making authority among households also had an impact on the procurement of farmed input.

Male household heads did not prioritize buying herbicides, preferring to have their wives manually weed the farms in situations where women could not bargain for Gender and Conservation Agriculture in Sub-Saharan Africa: Herbicide Usage (Kassie, 2017). Another issue women had with CA was the labour-intensive nature of no-till farming, especially when it came to weeding and planting basin preparation (Giller, 2014). Important land preparation tasks were shifted from men to women as a result of the CA's implementation. Because of the decreased necessity for men to plough in conventional agriculture due to basin preparation, women are primarily responsible for carrying out the majority of the physical labour involved in CA (Nyanga P. H., 2016).

2.7 Farmers' perception and adaptation strategies towards climate change

A study titled "Farmers' perception and adaptation to climate change: A case study of Sekyedumase district in Ghana" was carried out (Govaerts*, 2014). According to the report, since agriculture is the primary source of income for rural farmers, climate change has a significant effect on them. The degree of awareness and adaption to climate change determines the extent of the impact. 87% of farmers report less rainfall, and 92% of farmers report higher temperatures. Farmers' adaptation techniques include diversification, planting short-season varieties, changing crop species, and shifting planting dates.

But the obstacles are ignorance, poverty, and lack of knowledge. Acquah-de Graft & Onumah's paper, "Farmers' Perception and Adaptation to Climate Change: An Estimation of Willingness to Pay," is another noteworthy one in the context of Ghana (2022). The majority of the farmers in this study reported feeling that the temperature had increased and that the amount of rainfall had decreased. However, they discovered that there is still a fair amount of adaptation, with most farmers using methods such as crop variety switching, soil conservation, altering planting dates, and water collecting as their primary means of mitigating the effects of climate change. This study identifies the following as the main obstacles to adaptation: inadequate information, inadequate knowledge of adaptation, shaky property rights, limited credit availability, restricted access to inputs, restricted access to water, and high adaptation costs. They found that the likelihood of being willing to pay for

programs aimed at mitigating climate change increased with age, years of education, and farmland ownership.

Indigenous adaptation strategies to mitigate severe physical climate risks and disasters, individual farmers implement indigenous like livelihood diversification, construction of hand-dug wells in farms, migration, the building of mounds or ridges, and early marriage of young girls are used in Ghana. In order to overcome protracted droughts, the farming communities also perform animal sacrifices and mystical incantations to call for rain. According to the study, early warning systems about climate threats and their causes will be very beneficial for modifying mitigation plans (Grabowski, 2014).

2.8 Factors influencing farmers' perceptions of conservation agriculture

2.8.1 Perceiving the need for change

Maintaining soil cover is particularly important in soil erosion management. Soil erosion happens in the previous growing season. The removal of top soil leads to loss of humic matter and nutrients such as potassium and nitrogen (Johansen, 2015). Moreover, the runoff also has a detrimental impact on the level of carbon in the soil. Conventional practice can lead to a high rate of soil erosion throughout the growing season and after harvest, when the soil is bare (Hove, 2018). Therefore, sustainable agriculture requires to shift the mode of cultivation from tillage to no-tillage, to use cover crops and rotate crops to preserve soil moisture, prevent soil erosion and increase soil organic material (Corbeels, 2014).

Farmers are concerned in crop output and market, consequently, they over employ inputs and equipment to reach their aim. CA has been found to offer several benefits, both in the short term as well as long-term (Giller, 2014).

Crop rotation and cover crops can assist farmers have more options: Using grass barriers not only decreases soil erosion but also offers food for cattle and harvesting a cover crop can give and additional revenue source (Andersson, 2015).

2.8.2 Lack of knowledge and skills

Lack of system knowledge is one of the primary obstacles to CA implementation in many areas (Witter, 2015). In fact, to successfully proceed to CA from conventional systems the farmer requires time to prepare, knowledge to detect difficulties in the field, the ability to pick appropriate crops, and the managerial skills to aid the change. Further challenges to the

adoption of CA can be policies that do not favour CA, and expensive requirements such as machines or herbicides (Farnworth, 2016).

Farmers choose some of the CA set of techniques, like mulch or small tillage, rather than all of the CA practices, since they have a limited understanding of the CA concepts and practices (Giller, 2014). It takes time to adjust and improve from tillage to no-tillage systems like CA. Hence, the farmer may not employ entire package of CA; it needs to analyse each portion of CA to help strategies in real life production (Anderson J. A, 2017).

"Learning by doing" could be a useful strategy to help with the transition in order to address the lack of knowledge and skills needed to apply CA systems; this support has been given in the Mountain Agrarian Systems Program (SAM) project and ADAM project through collaboration between the project staff and the local government (Johansen, 2015).

2.8.3 Unsuitable technologies

CA is not yet ready for a farmer in the northern Vietnam. The absence of tools and equipment required to support the system, such as seeders, is preventing CA from being implemented in some areas (Affholder, 2014). Furthermore, farmers must learn how to manage the biomass and control the cover crops because many of them are not local (Sharma, 2015).

When introduced initially, CA can reduce yield for a variety of reasons. The current study conducted in Moc Chau revealed a decrease in yield as a result of insufficient support for seeding and mulching management (Affholder, 2014). Inadequate agricultural protection control and a dearth of field trials contributed to the failure of CA implementation (Kassam A. F., 2019).

Certain places restrict moving to CA because it was unsuitable for the local population and environment (Kassam A. F., 2014). There was a particular procedure involved in choosing their land use throughout the transitional era between CA and conventional practice. As of right now, a small farm in a mountainous region cannot use the tools that are thought to be suitable for the CA practice (Hauswirth, 2014). Furthermore, the system's output separates researchers from farmers. Moreover, the dissemination process is also impacted by the knowledge gap in practice (Farnworth C. &., 2015).

2.8.4 Lack of resources

Due to labor needs, mulch establishment, weed management, and additional financial inputs (cover seed, pesticide), CA is not economically attractive for farmers, at least not at first (Affholder, 2014). The first year's weed pressure causes a large increase in labor. CA involves more labor than conventional methods particularly when it comes to weeding and harvesting (Giller, 2014). A recent study conducted in northern Vietnam also supported this finding (Affholder, 2014). More labor is needed in CA, but it is hard to find it because people are moving to the city in search of employment (Lal, 2017).

Due to the resources needed, CA may not be adopted in some areas or farmers may only embrace it partially (Giller, 2014). First, is up to 7t ha-1 of mulching used to manage weeds? Achieving that amount of mulch for efficient weed control is not always simple (Affholder, 2014). The availability of tools, such seeders for no-tillage systems, is the second (Hauswirth, 2014). The farmer may need to employ a cover crop that they are unfamiliar with for the following reason. Finally, low financing availability and higher input prices, including higher pesticide requirements (Derpsch, 2019).

2.8 Perceptions of Farmers on conservation agriculture's effects on drought

Since CA enables farmers to increase their output and profitability while preserving and even enhancing the environment and natural resource base, farmers frequently perceive it as a technology suitable for arid regions (Gowing, 2016). Farmers believe CA does better during drought years (Llewellyn & Chen, 2017) . Farmers' perceive that CA lessens the possibility of crop loss brought on by a moisture deficit. Similarly, (Arslan, 2016) discovered that while CA can preserve soil moisture and increase agricultural productivity, households in regions with significant rainfall unpredictability are more likely to employ it. This lends credence to the theory that farmers perceive CA as a technology that can enhance soil water management efficiency and lessen the impact of erratic rainfall. Acceptance is much higher in locations with high rainfall fluctuation, suggesting that CA may be beneficial for adapting to climate variability (Arslan, 2016).

Numerous academic research provide evidence to support these perceptions. These show that during periods of low rainfall, the water gathering capabilities of CA practices are more advantageous. These studies do, however, also imply that CA may impede water drainage

during periods of significant rainfall, and mulch use may result in water logging, which lowers yields. Most research shows that CA can outperform conventional approaches in semi-arid and arid regions, while a small number of studies (Brown, 2017) reveal that yields under CA decline during drought periods. According to several research (Mafongoya, 2020) CA only boosts agricultural yields in arid regions.

2.9 Theoretical framework

The innovation diffusion theory, economic restrictions, and adopter perceptions perspectives are three distinct theoretical vantage points on technology adoption that have been employed in previous research serve as the foundation for this investigation. The core of innovation diffusion theoretical viewpoints is information distribution, and adoption is seen as a sequence of linear steps starting with knowledge acquisition and moving through persuasion, decision-making, implementation, and confirmation stages. According to the economic limitations theoretical perspective, technology adoption is impacted by one's ability to access financial resources and is also impacted by one's inability to do so. The theory notes that small-scale farmers have a complicated diversity of access to resources, and it suggests that this heterogeneity may be caused by an uneven allocation of these resources. Farmers' perceptions are crucial for the adoption of farming technology, according to the adopter-perceptions theoretical perspective. In order to create a conceptual grasp of the research problem, this study blends the three theories.

2.9.1 Diffusion of innovation theory

It is known as the useful transition model for guiding technological creativity, where innovation is modified and presented to meet the needs of each and every application. Diffusion of innovation, then, is defined as the process by which customers accept a novel concept, well, or activity, among other things. In describing this process, (Rodgers, 2013) emphasized that not everyone adopts the newest concept and applies it. Farmers gradually adopted the novel idea, spreading it until it reached a saturation point. Five categories of adopters were distinguished by (Rodgers, 2013): laggards, early majority, late majority, and early adopters.

Diffusion of innovation, according to (Rodgers, 2013), is the process by which an invention spreads over time via specific networks. Investigating the reasons behind certain inventions' effectiveness and others' ineffectiveness is crucial. Rogers has identified a number of innovations to help explain this puzzle. Observability, trialability, relative advantage, and

complexity compatibility are a few of them. They provide technical project leaders with a fundamental assessment list to utilize when factoring creative transformation.

Administrators and IT specialists, among other expertise, benefit greatly from the Diffusion of Innovation hypothesis (Dalton, 2014). According to the model, the most important factor influencing adoption decisions is information accessibility (Rodgers, 2013). The idea divides decision-making into five phases: knowledge, persuasion, decision-making, implementation, and confirmation. From the perspective of the diffusion of inventions, the application of agricultural creativity among planters and the resulting societal change in the industrialized countries have been thoroughly understood. As a result, the paradigm states that farmers are the recipients of creativity, extension personnel serve as communicators, and agricultural research is the source of innovation (Maumbe, 2010).

2.9.2 The adopter-perception model

According to this theory, adopters' perceptions have a significant influence on adoption decisions (Brown, 2017). The model takes into account the perspectives of users while putting a specific idea into practice. Private characteristics, the land's physical features, and institutional factors all had an impact. Therefore, adopting innovations is portrayed from an individualistic perspective as belonging to an individual without considering how interdependent players are managed. However, these personal perspective-based schools of thinking fall short in addressing the role that social learning plays in applying innovations.

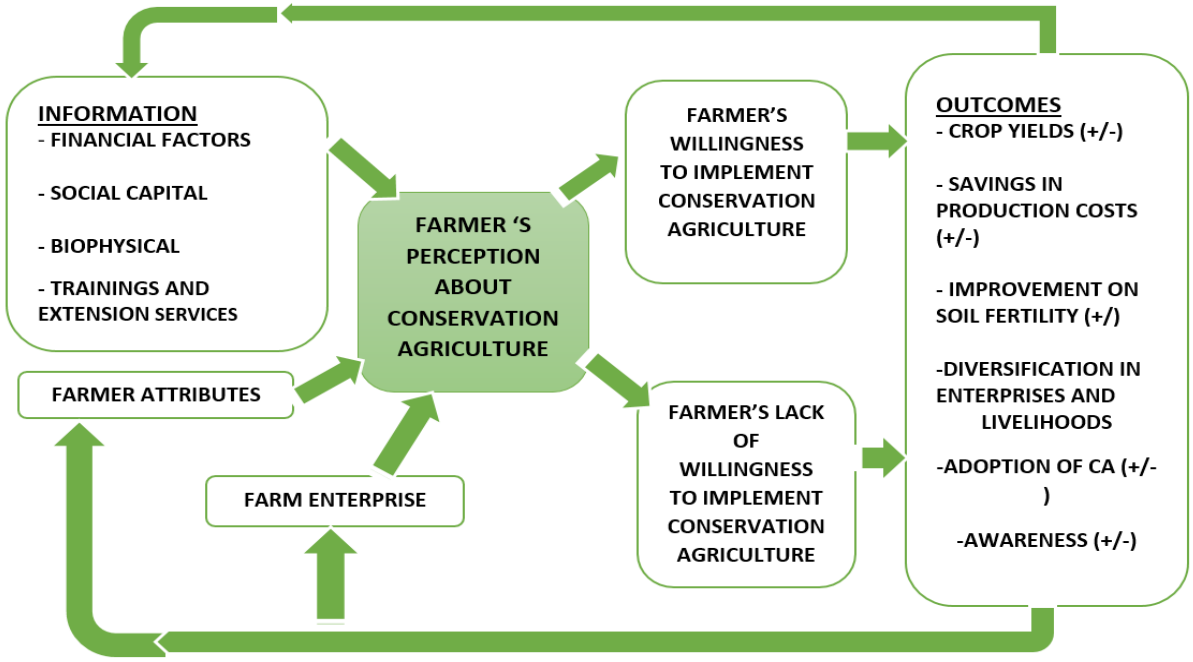
Various scholars (Nyanga P. J., 2015) have adopted the model to describe the factors influencing the use of technology in agriculture. The model is pertinent to the research since it highlights individual viewpoints on CA. In this case, the study seeks to understand small-scale farmer's perceptions of conservation agriculture as a mitigation measure of climate change.

2.10 Conceptual framework

Conceptually, Lugandu indicated that the main drive to implement or not implement CA by small holder farmers is a direct function of farmers' perceptions of Conservation Agriculture as compared to other farming practices and/or technologies. There are numerous explanations why farmers may be willing to implement CA on their farms as a novel farming technology

(FAO, 2016). Some farmers may be rational in their behaviour and their perceptions may be influenced by the information available to them, their socioeconomic situation and farm enterprises. Adoption is defined by Feder et al. as the extent to which farmers put into practice a new innovation in the future, given adequate information about the technology and the potential benefits. Several variables have been identified in the literature as determining the willingness to implement CA. These include human capital, credit constraints, risk, farm size, labour availability, land tenure, livestock assets, agricultural training, interactions with extension and input supply. Understanding these variables and how they influence Perceptions and are important in developing strategies for promoting the use of CA.

Figure 1: Conceptual Framework: Source: Adopted from Lugandu (2013)



2.11 Summary of literature review

The empirical review of the conservation agricultural literature that was available from different sources was examined in the literature review conducted for this study. The majority of the studies focused on the advantages and economics of adoption, hence not much research has been done on farmers' perceptions of conservation agriculture. Numerous studies have been carried out throughout Africa, particularly in Zimbabwe and Zambia, where conservation agriculture was originally introduced to the continent. On the other hand, little to none is known about farmers' perceptions of conservation agriculture as a mitigation

measure for climate change. This chapter also covered the theoretical framework that provides theories supporting the research. A large body of research on the implementation of conservation agriculture was examined.

The purpose of this study was to investigate and comprehend farmers' perceptions of CA as a climate change mitigation strategy. This is important since perceptions affect how widely accepted technologies like CA are. In order to potentially increase the acceptance of CA, it would be possible to adjust CA and customize future CA marketing to local conditions by knowing farmers' perspectives. Furthermore, identifying potential misconceptions among farmers about CA influences policy development by dictating the course of extension and training initiatives.

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CHAPTER 3

METHODOLOGY

3.1 Introduction

The research design, sample size, sampling techniques, data collection, data processing, ethics, and reliability testing will all be covered in this chapter.

3.2 Description of study area

3.2.1 Study area

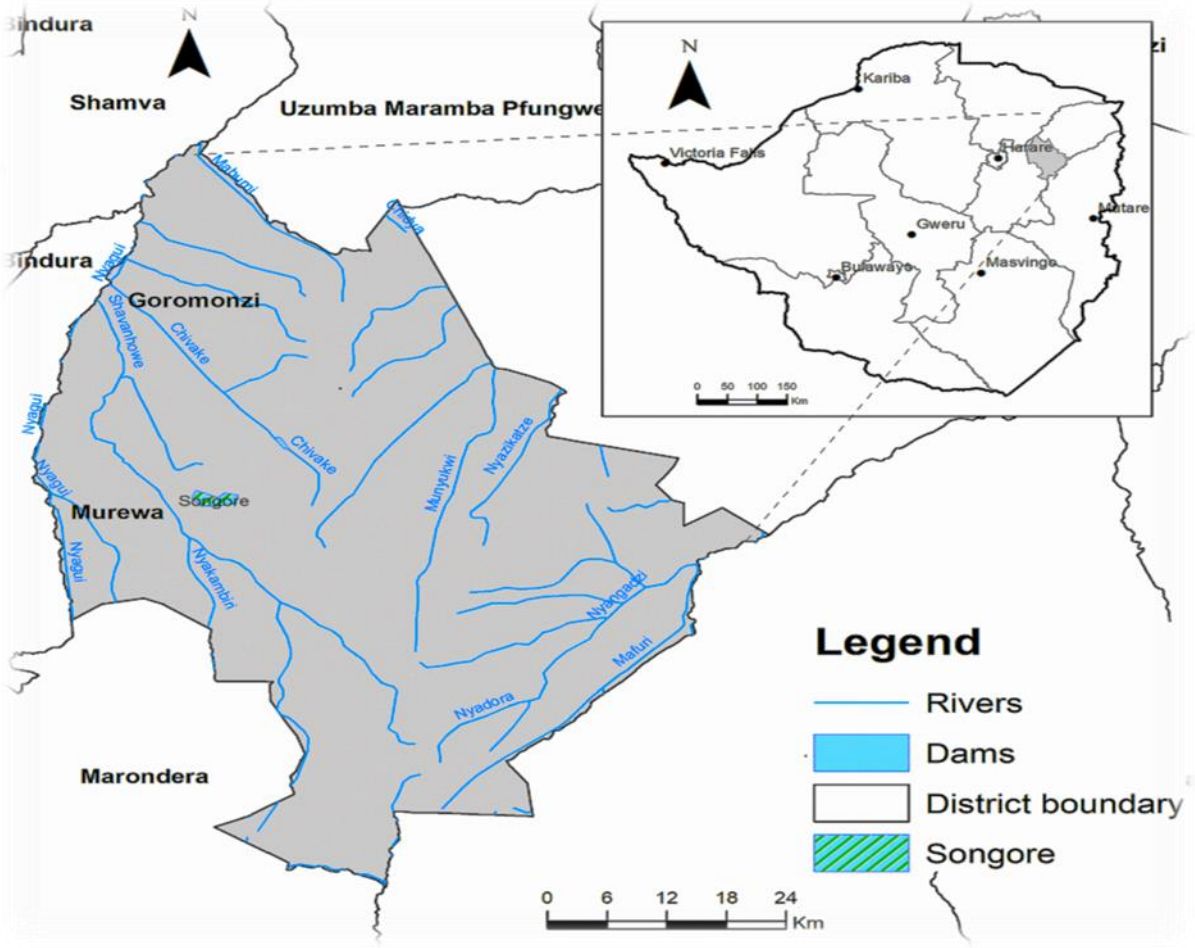
There are 30 wards in the Murewa District of Zimbabwe (Agency, 2022). Situated in Zimbabwe's Mashonaland East Province, Murewa District is roughly 75 kilometres northeast of Harare, the country's capital. It is located in the agro-ecological Region II, which is distinguished by semi-arid weather and a unimodal rainfall pattern that usually happens from November to March. The district, which has a population primarily from rural areas with agriculture as their primary source of income, is roughly 3,077 square kilometres in size.

In the Murewa District, small-scale farming is the major agricultural system, and agriculture is primarily rain-fed. The main crops farmed in the region include groundnuts, sorghum, millet, maize, and other types of legumes. Raising livestock especially cattle, goats, and poultry is essential to the district's agricultural economy. The Murewa District's landscape is made up of undulating hills and rich soils that are ideal for growing crops. However, because of unsustainable farming methods and irregular rainfall patterns, which are made worse by the effects of climate change, soil erosion and degradation are major problems.

Murewa District's socioeconomic structure is predominantly rural, with communities structured around conventional family units and local government frameworks. Gender roles are important since both men and women actively work in agriculture, even though they may not have equal access to resources or decision-making power. Some parts of the district have

limited access to agricultural extension services and inputs, which might hinder farmers' capacity to embrace contemporary agricultural practices. These inputs include improved seeds, fertilizers, and automation. Small-scale farmers continue to use traditional farming techniques, which are defined by traditional tillage and few soil protection measures. Murewa District offers a pertinent backdrop for examining small-scale farmers' attitudes about conservation agriculture as a climate change mitigation strategy because of its agricultural importance and susceptibility to the changing climate.

Figure 2 Map showing the geographical position of Murewa district from the map of Zimbabwe



Source*: www.en.wikipedia.org/wiki/Murewa-district*

3.3 Research Design

The research design of the study employs a mixed-methods approach, integrating both quantitative and qualitative methodologies. Surveys were one of the quantitative tools used to find out how small-scale farmers felt about conservation agriculture techniques as a way to slow down climate change. To learn about the viewpoints and experiences of farmers and other stakeholders, focus groups and interviews were conducted using qualitative methodologies. This method would give both quantitative and qualitative evidence to back up the study findings and enable a thorough grasp of the subject.

3.4 Target population.

The study concentrated on small-scale farmers in the Murewa District. The research conducted his research in wards 1, 3, 8,10,13,15. 19, 21, 27 and 29. People or households that engage in small-scale agriculture fall into this group; they typically have limited resources and land. The study did not include farmers from neighbouring districts or large-scale commercial growers.

3.5 Sampling Procedures and Sample size

The researcher chose a representative sample of small-scale farmers from three randomly chosen wards in the Murewa District using a random sampling technique. This lowers the possibility of sampling bias by guaranteeing that every farmer in the population has an equal chance of being chosen. To find and choose participants for focus group talks, deliberate sampling was used to make sure that the participants were diverse in terms of gender, age, agricultural experience, and location within Murewa District.

For each focus group discussion session, homogeneous groups of eight to twelve members were created in order to promote meaningful interaction and a range of viewpoints. Using semi-structured guides, the researcher led focus group conversations to investigate farmers' attitudes, experiences, and views about conservation agriculture. The facilitators made sure everyone got a chance to speak while promoting candid communication.

Agricultural extension officers, local community leaders, and seasoned farmers are examples of key informants with extensive knowledge and expertise in conservation agriculture that were first identified in Murewa District through the use of snowball sampling.

3.5.1 Sample size

a. Samples should not be too large in which case, it will not conserve resources, which are usually limited (Araoye 2003, pp. 115, 116). The formula for the sample size determination: When the population is less than 10,000, sample size was calculated using

$$n = z^2 \frac{(1-p)}{p}$$
$$d^2$$

Where:

z = the standard normal deviate set at 1.644, which corresponds with the 90% confidence interval.

p = the proportion in the target population estimated at 0.5 (Sathyamangalam et al 2009, p.335). Therefore p = 0.5 to obtain the maximum possible sample size with power.

Therefore, $n = (1.4)^2 * \frac{(0.5)(0.5)}{(0.05)^2} = 195$

Considering 95% response rate (14 participants)

Hence n = 195+14=209

b. Point of saturation was employed for KII 20 participants and FGD 2 groups male and female of 15 people.

3.6 Data collection methods

To strengthen the study's validity and reliability, triangulate data from surveys, focus groups, and key informant interviews. This will help to confirm findings. Cross-Verification: Look for similarities, differences, or areas of convergence by contrasting and comparing viewpoints and themes that emerge from several data sources. The process of locating respondents and the exact, methodical acquisition of information pertinent to a study's specific goals, purpose, or research topic is known as data collection (Burns, 2015). A key informant study guide and a structured questionnaire were used to gather data.

3.6.1 Validity and reliability

Since they have an impact on every step that leads to the credibility of research findings, validity and reliability are essential components of research. These are crucial standards for assessing the suitability and quality of a research instrument.

3.6.1.1 Validity

The multiple choice questions in this study were formulated in accordance with the studies aims and drew from a variety of instruments that have been used in previous studies of a similar nature, ensuring the validity of the questionnaire.

Content validity explores the issue of how suitable or representative the multiple-choice questions created are for the concept being tested (Trapp, 2010). The statistician and the study supervisor's help made sure of this.

External validity is the extent to which study findings may be extrapolated to environments or samples other than the one under examination, according to . This affects how respondents are chosen, since they need to be a good representation of the study population.

3.6.1.2 Reliability

A measurement tool's dependability indicates the degree of random error in the measurement instrument approach as well as the consistency of measurements produced when using that particular instrument (Burns, 2015). The absence of random and unsystematic measurement error is what makes it such (Creswell, 2012). A reliability coefficient of 0.70 is adequate for a recently developed psycho-social instrument, while 0.80 is thought to be the lowest acceptable value for a well-established psycho-social instrument (Burns, 2015).

3.7 Pilot study

A smaller-scale survey of 25 urban farmers in ward 6 called Murewa was used as a pilot project. It was possible to improve the study topics, survey tools, and sample plan thanks to this pilot survey. It also made it possible to evaluate the study's viability and identify any

further difficulties that arose throughout the primary investigation. Before the main survey was implemented, the results of the pilot survey were used to make adjustments.

3.8 Organization and implementation of the fieldwork

Survey Administration:

Face-to-face interviews with small-scale farmers were conducted in Murewa District by the researcher and seven trained enumerators during visits to specific families. Farmers' opinions of conservation agriculture, their familiarity with its tenets and methods, and their inclination to implement or broaden conservation agricultural techniques on their farms were among the topics included in the survey questionnaire. Enumerators ensured comprehension and accuracy of replies by explaining the study's goal, obtaining informed consent, and administering the survey questionnaire in the local language. Questions regarding farming practices, climate change experiences, access to extension services and agricultural resources, and perceived opportunities and obstacles for implementing conservation agriculture were posed to farmers. Enumerators ensured data integrity and confidentiality by recording responses either electronically or on paper forms.

Focus Group Discussions (FGDs):

FGD workshops were held in Murewa District community centers or other handy venues. To encourage meaningful debate and the sharing of viewpoints, participants were sorted uniformly according to factors like gender, age, prior agricultural experience, and geographic area. Using semi-structured discussion guides, trained facilitators led the FGDs on subjects including farmers' opinions of conservation agriculture, adoption potential and barriers, and the impact of community dynamics on agricultural practices. While moderators maintained equitable participation and courteous discourse among all participants, participants were encouraged to express their experiences, thoughts, and proposals regarding conservation agriculture. With the participants' permission, audio recordings of the FGD sessions were made, and thorough notes were taken to document the main ideas, revelations, and new concerns that came up throughout the discussions.

Key Informant Interviews:

Selected key informants, such as agricultural extension agents, local community leaders, seasoned farmers, and other stakeholders with pertinent experience, were interviewed in a semi-structured manner. Interviews were arranged at appropriate times and locations for both

parties, and they might take place in person or virtually over the phone or video conference. The interviewers employed a prearranged interview protocol to facilitate the conversation, which included subjects including the state of conservation agriculture programs at the moment, difficulties small-scale farmers confront, and prospective tactics for advancing sustainable farming methods. Key informants were urged to share in-depth analyses, illustrations, and suggestions based on their expertise, and interviewers actively sought out clarity and further details as needed. With the participants' permission, audio recordings of the interviews were made, and thorough notes were made to collect important details and quotations for a future analysis.

Data Quality Assurance:

Strict quality control procedures were followed all during the data gathering process to guarantee the authenticity, correctness, and reliability of the information gathered. To keep an eye on data collecting processes and protocol adherence, trained supervisors regularly performed spot checks, observations, and reviews of enumerator performance. Data input and management practices, such as validation checks, double data entry, and secure storage of paper and electronic records, were put in place to protect data integrity. Following up with field workers and participants, any inconsistencies or problems found during data collection were swiftly addressed and fixed through corrective measures.

This data collection process aims to capture diverse perspectives and insights regarding conservation agriculture and its implications for sustainable farming practices and climate change adaptation from small-scale farmers and stakeholders in Murewa District by using a multi-method approach that includes surveys, focus groups, and key informant interviews. We gathered secondary data on food security and agricultural productivity from the Zimbabwe Vulnerability Assessment Committee, the Ministry of Agriculture, and other pertinent agencies. Through the use of questionnaires and in-depth interviews, primary data was obtained. Both content analysis and descriptive statistics were used to analyse the primary data. To fully comprehend the research topic, triangulating the quantitative and qualitative data was necessary.

3.9 Data analysis methods

The Statistical Package for the Social Sciences (SPSS) was utilized for the analysis of the quantitative data. The information was described using R and descriptive statistics, including means, frequencies, and percentages. A multinomial regression model and inferential statistics, such as chi-square and t-tests, were utilized to assess for group differences. Thematic analysis and content analysis were used to examine the qualitative data. Themes were found after reading and categorizing the transcripts. Integration of the quantitative and qualitative data allowed for a comprehensive grasp of the study's subject. The results were given in tabular and narrative form.

Methods for reducing, organizing, and providing meaning to data are referred to as data analysis (Burns, 2015). Tools for statistical analysis play a major role in data analysis in quantitative investigations. A summary of the findings and an interpretation are the two processes that data analysis always entails, regardless of the kinds of data gathered or the researchers' attitude (Wills, 2004).

Information was gathered about the respondents' socioeconomic characteristics as well as their knowledge and perceptions (K&Ps) regarding CA. Based on the pre-testing experience, the researcher ultimately switched to a 3-point Likert scale from the original 5-point one. 3, 2, and 1 (Agree, Neither Agree nor Disagree, and Disagree, respectively) were the assigned ratings.

Farmers' answers to knowledge (perception) questions were used to calculate the knowledge (perception) score following data analysis with the Statistical Package for Social sciences.

Kobo Collect was used to download data, which was then entered into SPSS. SPSS was used to clean and analyse the data. The data analysis and interpretation process made use of figures, frequency tables, percentages, and descriptive statistics. The strength of the links is displayed by the chi-square analysis test for correlation and association. Statistical significance was defined as a two-tailed p-value of less than 0.05.

3.10 Ethical Considerations

In research ethics, scientific integrity is upheld along with the rights of participants and the organizations conducting the study (Burns, 2015). There are no hazards associated with the study physical or psychological.

In order to preserve and ensure the welfare of participants in the study on small-scale farmers' attitudes toward conservation agriculture in Zimbabwe's Murewa District, strict ethical guidelines were followed at every stage of the investigation. All participants gave their informed consent after receiving thorough descriptions of the study's goals, methods, risks, and advantages. The participants' cultural beliefs, privacy, and dignity were valued, and precautions were taken to keep their personal information private. Prioritizing voluntary involvement gave participants the flexibility to leave the study whenever they wanted to without incurring any penalties.

Input and cooperation from local communities and stakeholders were solicited in a transparent and cooperative manner with the aim of advancing cultural sensitivity and inclusivity. To protect the rights and dignity of each and every participant, ethical precepts including beneficence, non-maleficence, and fairness were respected. To guarantee adherence to ethical principles and regulations regulating research involving human subjects in Zimbabwe, the project underwent ethical review and oversight by pertinent institutional organizations.

3.11 Chapter Summary

The research design and methodology were covered in this chapter, along with talks of the population, sampling and sampling procedure, data collecting, instrument validity and reliability, data analysis, and ethical considerations.

3.12 References

Agency, Z. N. (2022). *Census Report.* Harare: Zimbabwe National Statistics Agency. (2012).

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CHAPTER 4
SOCIO DEMOGRAPHICS OF FARMERS

ABSTRACT

This study looks at how small-scale farmers in Zimbabwe's Murewa District perceive conservation agriculture (CA). The research investigates the socio-demographic traits of farmers, their agricultural practices, and the variables influencing the adoption of CA using a combination of quantitative and qualitative methodologies. According to the results, a sizable majority of farmers mostly those who cultivate small plots practice CA with the expectation that it will improve soil health and crop stability. Knowledge gaps and restricted access to resources are major obstacles. Policymakers and agricultural extension agencies can use the study's conclusions to assist sustainable farming practices in the area.

4.1 Introduction

This chapter explains the research methods used in the study and gives the research findings. The findings are arranged in accordance with the goal of the study, starting with a summary of the respondents' socio-demographic traits.

4.2 Material and Methodology

The materials and techniques utilized to carry out the research are described in this section, along with the study area's description, research design, sampling strategy, data gathering process, data analysis techniques, and difficulties encountered during data collection.

4.2.1 Description of Study Area

The Zimbabwean Province of Mashonaland East contains the Murewa District (Agency, 2022). It is distinguished by a diverse agro-ecological setting that supports horticulture crops, small grains, legumes, and maize, among other forms of agriculture (CYMMIT,

2022). The majority of the district's farmers are small-scale operators that mostly rely on rain-fed agriculture. Conservation agriculture is a potentially helpful approach in the area because of the substantial obstacles posed by soil degradation and irregular rainfall patterns (FAO, 2017).

4.2.2 Research Design

A cross-sectional research design that included quantitative and qualitative methods was used in the study. Comprehensive data on farmers' attitudes, behaviours, and socio-demographic traits at one particular moment in time could be gathered appreciations to this method.

4.2.3 Sampling Procedure

To choose the participants, a stratified random selection procedure was employed. Small-scale farmers from several Murewa District wards were the study's target population. To guarantee a representative sample, stratification was based on variables such farm size, crop type, and farming experience. Two hundred and nine farmers in all were questioned.

4.2.4 Data Collection Procedure

Semi-structured interviews and structured questionnaires were used to gather data. Sections on socio-demographic data, farming methods, revenue streams, agricultural education, the state of food security, and attitudes about CA were all included in the questionnaire. The semi-structured interviews gave more detailed information about the difficulties and advantages farmers saw using CA.

4.2.5 Data Analysis Procedure and Methods

Descriptive statistics, such as frequencies, percentages, means, and standard deviations, were used to examine quantitative data. The results were presented using tables and graphs. Thematic analysis was employed to uncover recurring themes and insights pertaining to farmers' perspectives and experiences with CA from qualitative data obtained from interviews.

4.2.6 Challenges Encountered During Data Collection

Several difficulties were faced when gathering the data, such as:

Logistical Issues: Bad road conditions made it difficult to access several sites.

Respondent Availability: It was difficult to organize interviews with farmers since they were frequently preoccupied with farming and other social activities.

Resource Constraints: The data collection procedure was hampered by limited resources, such as financing and transportation, which made effective planning and utilization of available resources necessary.

4.3 Results and discussion

The study's findings are reviewed in this section. The sequence of the objectives was followed while presenting the results in tables and graphs, but the demographics were displayed first.

4.3.1 Social and Demographic characteristics

Table 4.1: Socio-Demographics of small-scale farmers in Murewa District

Marital status	**Values**	**Frequency**	**Percentages**
	married	174	83.3
	single	32	15.3
	widowed	3	1.4
Gender	male	91	43.5
	Female	118	65.5
Education	informal	48	23.0
	primary	31	14.8
	secondary	92	44.0
	tertiary	38	18.2

This table show that 83.3% are married and 15.3 % are single while 1.4% are widows. Considering gender, 43.5 % are male and majority 65.5% are female. In terms of education, 14.8% went to primary school and 44% went to secondary, only 18.2 % went for tertiary education and 23% are informally educated.

Table 4.2: Farming items of the small-scale farmers in Murewa District

Items	Values	Percentages
Crops	Maize	45.9
	Cash crop	11.0
	Small grains	19.1
	Horticultural crop	5.3
	Legumes	18.7
Income source	agriculture off	85.2
	farm employment	9.6
	Remittances/Monetary Gifts	5.3
Farming experience	Less than 5 years	23.0
	5-10 years	38.8
	11-20 years	25.4
	More than 20 years	12.4
Agriculture education	none	36.4
	Certificate in Agriculture	12.4
	Diploma in Agriculture	23.9
	Degree or Higher Degree in Agriculture	8.6
	Master Farmer Certificate	12.9
	Advanced Master Farmer Certificate	4.8
Food source	Own crop production	Ranked 1 (100)
	Purchase	Ranked 2 (91.3)

	relatives/friend	Ranked 2 (8.7)
	Food aid	Ranked 3 (31.3)
	Own livestock products	Ranked 3(5.3)
	Food for work	Ranked 3 (10.1)
Food secure	no	45.5
	yes	54.5
Practicing CA	no	16.3
	yes	83.7
CA area	0-0.5 ha	23.9
	0.6-1 ha	65.1
	>1 ha	10.5

Maize ranks 45.9% as the most important primary crop, followed by minor grains like sorghum (19.1%), legumes (18%), and cash crops (11%). According to 85% of farmers, agriculture generates the majority of their income. 38.8% of respondents have five to ten years of experience, while almost 23 percent have less than five years. Roughly 36 percent of farmers lack formal agricultural education. Self-produced food is the most highly ranked food source. 54.5% of people are food secure. Approximately 83.7% say they are CA practitioners. The majority use 0.6 to 1 hector for CA practice.

Table 4.3: Results: Descriptive statistics of age and family size

	N	Minimum	Maximum	Mean	Std. Deviation
A2_Age	209	25	63	44.69	8.548
Household size	209	2.00	11.00	5.0000	1.90142
Valid N (listwise)	209				

The above table 4.3 show that the mean age is 44.69 years with standard deviation of 8.548 and the average family size is 5 with standard deviation of 1.9.

4.4 Conclusion

The views and practices of small-scale farmers in Zimbabwe's Murewa District on conservation agriculture (CA) are thoroughly examined in this study. The results show that most farmers have a generally good attitude regarding CA and that they practice it on small plots. Adoption of CA methods is strongly influenced by important socio-demographic characteristics, including gender, education level, agricultural experience, and marital status.

According to the study results, 83.7% of the farmers who participated are using CA, mostly on 0.6–1 hectare plots. Small grains, legumes, and maize are the main crops farmed; maize is the most common crop. Even with the high adoption rate, major obstacles to the successful implementation of CA were found to include inadequate technical support, resource limitations, and a lack of agricultural education.

The study highlights the potential of CA to improve food security and sustainable farming practices in the Murewa District overall. To fully reap the benefits of CA, however, certain interventions are required to overcome the difficulties farmers confront.

4.5 Recommendations

The study's conclusions lead to the following suggestions to improve small-scale farmers in Murewa District's adoption and efficiency of conservation agriculture:

- Improved Training and Education for Agriculture: Expand access to agricultural education by means of field demonstrations, training courses, and workshops that centre on CA methods and principles.
- Create and disseminate CA instructional resources in the Shona local tongue to guarantee improved comprehension and application of CA methodologies.
- Increasing the ability of agricultural extension personnel to offer technical assistance and direction on CA practices is one way to strengthen extension services.
- Enable extension officers to visit and follow up with farmers on a regular basis to track and assist their progress with CA.

4.6 References

Agency, Z. N. (2022). *Census Report.* Harare: Zimbabwe National Statistics Agency. (2012).

CYMMIT. (2022). *Conservation Agriculture Adoption in Zimbabwe.* Haare.

FAO. (2017). *National gender profile of agriculture and rural livelihoods.*, 21-34.

CHAPTER 5

FARMERS' LEVEL OF KNOWLEDGE OF THE PRINCIPLES AND THE PRACTICES OF CONSERVATION AGRICULTURE.

ABSTRACT

The purpose of this study is to assess farmers' knowledge of conservation agriculture (CA) principles and practices. The results show that although 83.3% of farmers are involved in farming organizations that support CA techniques, only 16.7% of farmers have taken a formal course in CA, even though 64.6% of farmers are aware of the practice. Farmers' knowledge varies greatly; 64.6% show a high level of acquaintance with CA, 10.5% show a low level of understanding, and 24.9% show no information at all. These findings point to a significant deficiency in formal education and training in CA

, indicating the necessity of focused educational programs to enhance the acceptance and application of CA.

5.1 Introduction

Gaining a solid understanding of the ideas and practices of CA is necessary for both willingness and successful implementation. Your expertise and comprehension of CA as a farmer are essential to the implementation's success. This chapter attempts to evaluate farmers' knowledge of the three core CA concepts and practices, including crop rotation, minimum tillage, and cover crops. Furthermore, farmers' comprehension of these techniques will be evaluated.

5.2 Material and Methodology

5.2.1 Description of Study Area

The Zimbabwean Province of Mashonaland East contains the Murewa District. It is distinguished by a diverse agro-ecological setting that supports horticulture crops, small grains, legumes, and maize, among other forms of agriculture. The majority of the district's farmers are small-scale operators that mostly rely on rain-fed agriculture. Conservation agriculture is a potentially helpful approach in the area because of the substantial obstacles posed by soil degradation and irregular rainfall patterns.

5.2.2 Research Design

A cross-sectional research design that included quantitative and qualitative methods was used in the study. Comprehensive data on farmers' attitudes, behaviours, and socio-demographic traits at one particular moment in time could be gathered thanks to this method.

5.2.3 Sampling Procedure

Snowball Sampling was employed to identify initial key informants within Murewa District who possess in-depth knowledge and experience related to conservation agriculture, such as agricultural extension officers, local community leaders, and experienced farmers.

5.2.4 Data Collection Procedure

The researcher chose a representative sample of small-scale farmers from ten randomly chosen wards in the Murewa District using a random sampling technique. This lowers the possibility of sampling bias by guaranteeing that every farmer in the population has an equal chance of being chosen. To find and choose participants for focus group talks, deliberate sampling was used to make sure that the participants were diverse in terms of gender, age, agricultural experience, and location within Murewa District. For each focus group discussion session, homogeneous groups of eight to twelve members were created in order to promote meaningful interaction and a range of viewpoints. Using semi-structured guides, the researcher led focus group conversations to investigate farmers' attitudes, experiences, and views about conservation agriculture. The facilitators made sure everyone had a chance to speak while promoting candid conversation.

Semi-structured interviews and structured questionnaires were used to gather data. Sections on socio demographic data, farming methods, revenue streams, agricultural education, the

state of food security, and attitudes about CA were all included in the questionnaire. The semi-structured interviews gave more detailed information about the difficulties and advantages farmers saw using CA.

5.2.5 Data Analysis Procedure and Methods

Thematic analysis was employed to uncover recurring themes and insights pertaining to farmers' perspectives and experiences with CA from qualitative data obtained from interviews. Farmer knowledge about CA was assessed using multinomial regression as well as descriptive statistics in the form of bar graphs

5.2.6 Challenges Encountered During Data Collection

Resource Constraints: The data collection procedure was hindered by limited resources, such as financing and transportation, which made effective planning and utilization of available resources necessary.

5.3 Results and discussion

Table 5.1 Knowledge, model reliability and mean score of farmer knowledge about CA

ITEM	MEAN	SE	DECISION	FACTOR LOADING
Social viability of CA				
Performance improves over time	2.42	0.045	Accepted	0.69
Results in observable yield increments	2.39	0.043	Accepted	0.685
Easy to practice	2.17	0.049	Accepted	0.593
overall	2.33	0.046	Accepted	
Environmental viability of CA				
Reduces soil erosion	2.64	0.037	Accepted	0.821

Can restore degraded lands	2.46	0.042	Accepted	0.721
Environmentally friendly	2.60	0.037	Accepted	0.841
Controls pests and diseases	2.43	0.043	Accepted	0.723
Overall	2.53	0.040		
Economic viability of CA	2.29	0.048		
Reduces costs of labour	2.51	0.039	Accepted	0.708
Reduces cost of inputs	2.58	0.041	Accepted	0.819
Improves yields	2.54	0.041	Accepted	0.837
Improves income	2.48	0.042	Accepted	0.838
Overall Knowledge score	2.46	0.043	Accepted	

Note: Standard error; AVE = 0.564; α = *0*.947 and IME = 0.103; score: 3 = agree, and 1 = disagree.

5.3.1 Respondent knowledge on viability of CA

According to the responders, CA is economically, ecologically, and socially viable. This analysis is crucial for determining which technologies farmers can embrace under various circumstances since it adopts a systems approach, which stands in stark contrast to the agronomic approach (Giller, 2014). Every one of these concerns is examined in-depth in the section that follows.

5.3.1.1 Social viability of CA

According to the respondents, CA is socially feasible in every way.

5.3.1.1.1 Performance improves over time

According to the responses, CA's performance becomes better with time. The benefits of CA are not being realized right now for a number of reasons. Farmers must acquire new agronomic and land management techniques when switching from conventional to CA systems, which could postpone the benefits of CA systems. In the short term, if the mulching material brings pests and diseases with it, switching to no-tillage systems with residue retention may result in an increase in the intensity and dynamics of weeds as well as a possible outbreak of some pests and diseases. These difficulties can be overcome, though, as farmers get more accustomed to CA.

5.3.1.1.2 Yield increments

The respondents reported seeing increases in crop production following the use of CA. According to a number of regional studies, adopting CA in place of conventional agriculture can increase yield, particularly in situations when rainfall is inconsistent and low (Rusinamhodzi, 2018).

5.3.1.1.3 Easy to practice

According to the respondents, practicing CA was simple. This surprised me because there have been a lot of issues with CA implementation in the smallholder farming sector. Increasing weed frequency in the early years of adoption and producing sufficient crop residues are two of these issues (Thierfelder C. C., 2019).

5.3.1.2 Environmental viability of CA

5.3.1.2.1 Reduces soil erosion

According to the responders, CA manages soil erosion. According to earlier research, CA is effective at reducing soil erosion (Rusinamhodzi, 2018).

5.3.1.2.2 CA can restore degraded lands

The respondents give CA credit for restoring degraded areas of land. Crop rotations and the preservation of permanent soil cover through crop leftovers have the potential to increase soil fertility by increasing the amount of organic matter in the soil (Lal, 2017), lowering soil

erosion, promoting biological activity (Gukurume, 2017), cycling nutrients, and diversifying soil organisms. Conversely, limited soil tillage increases soil porosity and structural stability while minimizing the loss of soil organic matter.

5.3.1.2.3 environmentally friendly

The research area's respondents are highly knowledgeable about the advantages of CA for the environment. Groundwater pollution is decreased by CA's increased biological variety and decreased use of chemical fertilizers, pesticides, and herbicides (Arslan, 2016).

5.3.1.2.4Controls pests and diseases

According to the study, CA manages illnesses and pests. Crop rotation disrupts insect pests' and diseases' life cycles (Thierfelder & Wall, 2010). Furthermore, a larger biotic diversity of possible pest predators is implied by the enhanced biological diversity under CA (Kassam A. F., 2014).

5.3.1.3 Economic viability of CA

5.3.1.3.1 Reduces costs of labour

Farmers claimed that CA lowers labor expenses (Mazvimavi K. a., 2014), however, noted a rise in labor expenses in Zimbabwe, and where planting basins is a crucial part of CA. However, on heavy-textured soils where basins can be maintained throughout the winter, the labor demand under this technique will decrease (Mazvimavi T. a., 2014). Since sandy soils formed from granite predominate in the majority of Zimbabwe's smallholder farming areas, basins cannot be maintained during the winter months when animals are free to roam.

5.3.1.3.2 Reduces costs of inputs

According to the respondents, CA lowers input costs. The basin type of CA is used by the farmers in Murewa. In the basins, water and nutrients are concentrated throughout the year. Furthermore, under CA, a greater biological variety improves soil fertility and pest and disease control. Conversely, in cropping systems, legume-based rotations improve the soil nitrogen status (Mafongoya, 2020).

5.3.1.3.3 Improves yields

According to the responders, CA results in higher yields. Increases in yield are ascribed to better soil physical, biological, and chemical characteristics. Nevertheless, three to five seasons following CA implementation, yield gains become apparent (Thierfelder C. C.,

2019). Some farmers observed short-term yield benefits under CA, which they attributed primarily to early planting.

5.3.1.3.4 Improves income

According to the responders, CA systems boost farm revenue. Most research has shown that CA lowers machinery repair and maintenance expenses (Kassam A. F., 2014). This is on top of the additional input cost savings resulting from crop diversification and rotation under CA. Over time, farm revenue rises overall when yield gains of CA are combined with cost savings.

Table 4.2 Knowledge level of CA using multinomial regression model

Variable	Chi-Square	p Value
Age	16.072	0.014*
Gender	10.335	0.012*
Marital status	12.385	0.135
Education level	E 35.416	<0.0001*
Formal agricultural training	0.303	0.859
Master farmer training	5.946	0.051
Experience in agriculture	8.387	0.211
Belonging to a social group	0.705	0.703
Visit to demo sites	6.968	0.023*
Attendance at conferences	3.42	0.843
Years of practicing CA	132.604	<0.0001*

Note: Likelihood Ratio Chi2 = 284.125; Pseudo *R*2 = 0.453; Log Likelihood = −158.6825.
*Significant at 5% probability level.

5.3.2 Factors determining respondents' knowledge on conservation agriculture

To identify the socio-economic variables that influenced the perception of those farmers not willing to accept CA. The researcher performed a multinomial regression where perception was the dependent variable and the socio-economic attributes were the independent

variables. The overall perception of the farmers towards CA was influenced by age, gender, education, visit to demonstration sites and experience in CA and agriculture. This goes to stress the importance of knowledge in shaping the perception of farmers towards CA as shown by the following explanations.

5.3.2.1 Age

The findings show that the age of the head of the home had a statistically significant impact on the acceptance of CA and the degree of knowledge about it. Zimbabwe, adopting integrated pest management strategies is significantly influenced by age (Anderson J. A, 2017). Zimbabwe, the adoption of CA is significantly influenced by knowledge (Hove, 2018).

5.3.2.2 Gender

The findings indicate that a respondent's understanding of CA is significantly influenced by their gender. While extension plays a crucial role in disseminating agricultural information, knowledge is essential for the acceptance of new agricultural advancements. Nonetheless, male farmers receive priority visits from Zimbabwe's agricultural extension service providers (Mavunganidze, 2014). Women in the SSA have little interaction with extension service providers, and most public events are off-limits to women due to cultural beliefs around the world (Kunzekweguta M. O., 2016).

5.3.2.3 Education

Knowledge of CA is greatly influenced by education. One important way to quantify human capital is via education (Nyengerai, 2020). In Zimbabwe, the adoption of integrated pest management strategies is significantly influenced by education (Brown, 2017). Nonetheless, the variable may yield inconsistent outcomes, particularly in cases when educated farmers do not primarily rely on agriculture as their source of income.

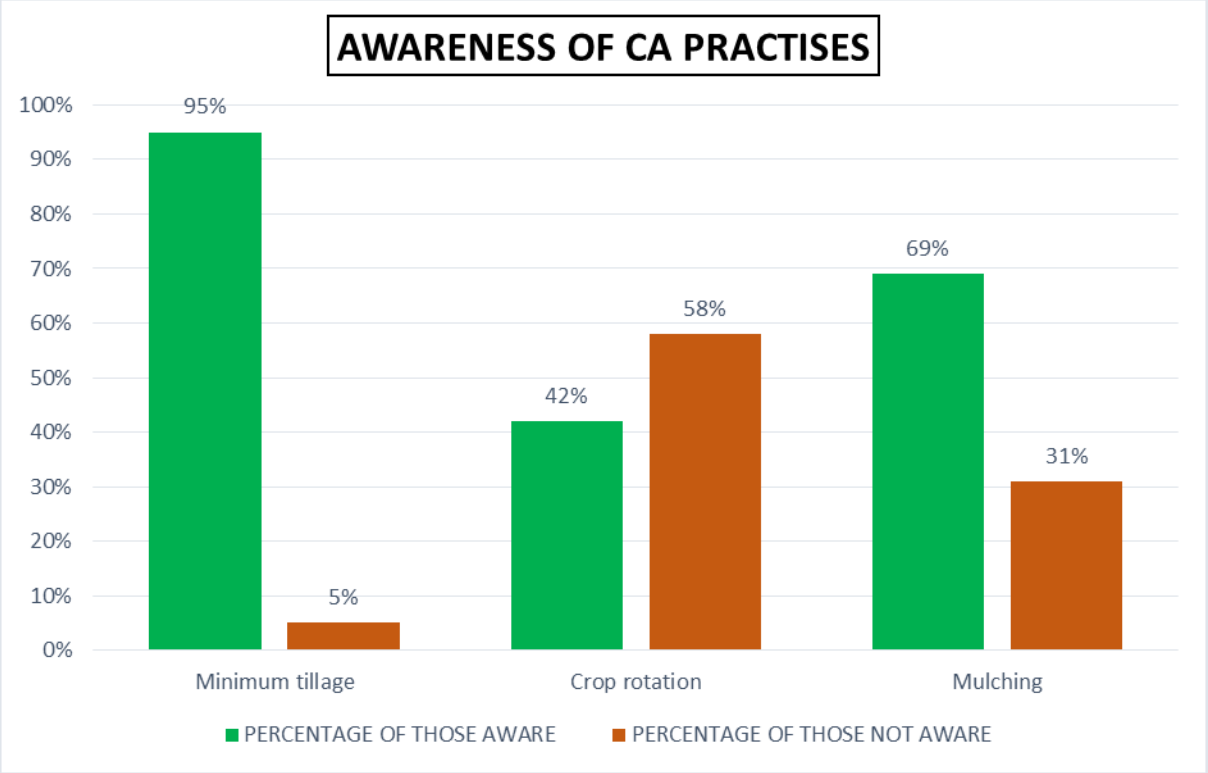
5.3.2.4 Attendance to demonstration sites

The findings indicate that the degree of CA knowledge is significantly impacted by demonstration site attendance. This is explained by the power of observation and hands-on learning, as well as the demonstrations' capacity to lower risk aversion in Zimbabwe (FAO, 2017). Since experience is the most effective way for older people to learn, it also had a substantial impact on the amount of knowledge regarding CA. Farmers with greater CA

experience can benefit from the amount of information discovered by trial and error (Kunzekweguta M. R., 2017).

5.3.3 Awareness of CA practises

Figure 3 Awareness of CA practises

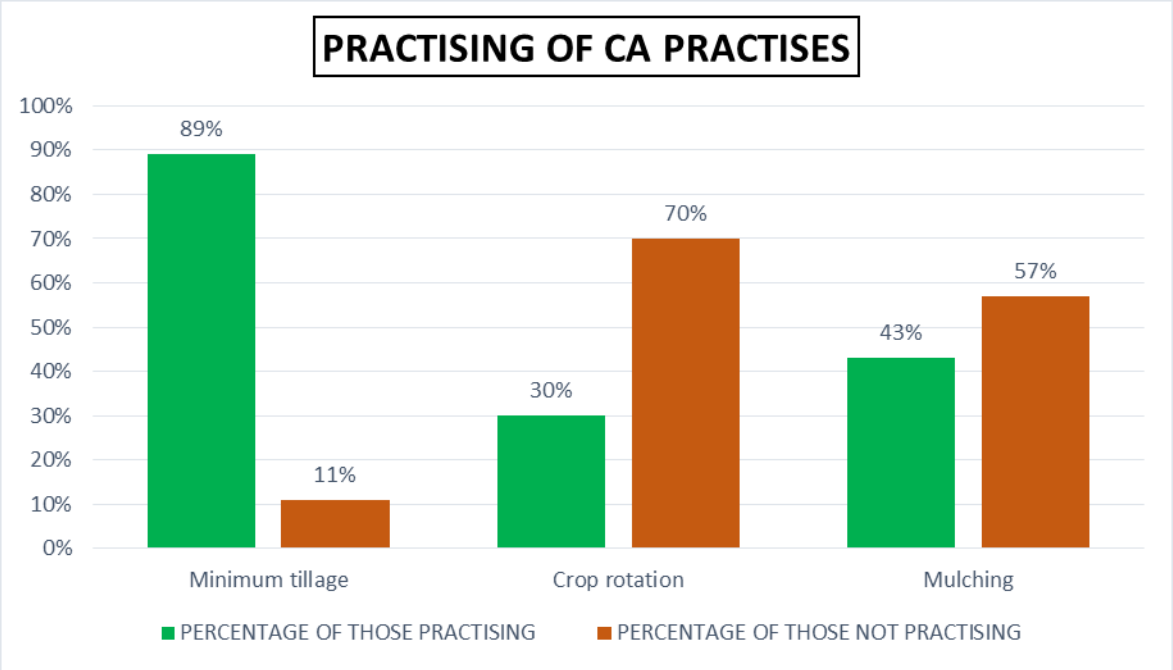


The above graph is showing that most of the small scale farmers in Murewa indicated that they were aware of the three practises of conservation agriculture that's minimum tillage,

crop rotation and mulching. Minimum tillage had the highest percentage (95%) of those who were aware of the practise. Mulching also had a higher percentage of those who were aware (69%) as compared to 31% of those who were not aware. The graph shows that most people indicated that they were not so familiar with crop rotation evidenced by a higher percentage of 58% of those aware as compared to 42% of those who were aware.

5.3.4 Practising of conservation agriculture practises

Figure 4 Practising of CA practises



The above graph is showing the percentage of those actually practising the CA practises. The graphs are showing that the main practise being implemented by the small-scale farmers is minimum tillage thus there is 89% participation. Crop rotation and mulching produced higher percentages of those not practising thus 70% and 57% respectively.

The two CA principles, crop rotation and maintaining a permanent soil cover, were observed to be limited amongst the farmers. This supports the claim made by (Nyssen, 2017) that smallholder farmers with limited resources find it difficult to apply these two concepts. The main causes of the difficulties applying permanent soil cover were the ongoing poor yields brought on by droughts brought on by climate change, which left little residue, and communal grazing systems, which demolished the residues that were left during the dry season (Mazvimavi T. a., 2014).

Limited availability of legume seeds and farmers' inclination towards cereals for food security have been associated with obstacles in the execution of crop rotation plans. These limitations were made worse by farmers' inclination to grow legumes in furrows rather than basins and the disparity in crop spacing between cereals and legumes. Other crop rotation studies conducted in sub-Saharan Africa have shown similar problems (Thierfelder C. R., 2015). The promotion of CA in the semi-arid agro-ecological region of Murewa is significantly impacted by these difficulties in putting the other two CA principles into practice.

Therefore, the single principle that should be the focus of CA promotion in smallholder farming systems that are fragile and low on resources should be the minimum soil disturbance principle, with research efforts aimed at tailoring the other principles to smallholder settings. This is important because, in some cases, partial adoption of the CA (of just one principle) can be preferable to full adoption (Pannell, 2016). For example, adding mulching materials can lower crop yields (Mazvimavi T. a., 2014). Therefore, further study is required to ascertain whether CA partial adoption for small-scale rain-fed agriculture is sustainable.

5.4 Discussion

Murewa farmers have positive perceptions of CA since they believe it to be the most effective farming method in areas vulnerable to drought and lacking in draught power. The advantages of CA that people see could be the cause of this favourable opinion. The farmers' willingness to experiment with new technology to increase crop yields which have continuously been low under the traditional hand-hoeing tillage method was associated with the favourable perception.

Furthermore, since formal education is crucial in fostering a positive perceptions regarding the adoption of agricultural advances, the majority of farmers may have been more responsive to better technologies like CA as a result (Knowler, 2017). On the other hand, ward 3 residents felt that CA was a laborious program that was not worth the time and effort invested in it. This discrepancy is most likely the result of variations in the traditional farming methods used in the Murewa District, which include hand hoeing and mouldboard ploughing.

Farmers who practice CA generally have a positive perception of it (Kassam A. F., 2019). Positive perception also frequently encourages learning through experimentation, which increases adoption. Farmers are crucial sources of information for the adoption and dissemination of technology, therefore the fact that they are experimenting with CA is important because a lack of experiential knowledge frequently prevents acceptance (Farnworth C. &., 2015).

The water-harvesting properties of CA basins and the careful application of fertility amendments inside basins are responsible for the apparent better yields with CA. Evidence from previous research (Mafongoya, 2020) supports the stated enhanced yield. Because farmers were persuaded of CA's relative benefits and that it raises yields, enhancing their food security, adoption prospects were thus favourable.

Farmers knew when and how to dig planting basins. Every farmer felt that soil erosion was an issue and that the least amount of soil disturbance possible could be achieved by planting basins. Farmers also mentioned the water-harvesting potential of basins. If permanent planting basins are maintained, labor requirements for digging basins were thought to decrease seasonally.

Perceived advantages of Conservation agriculture

Farmers surveyed believed that CA offered financial advantages, which improved the state's chances of being accepted. When comparing the short-term yield benefits of CA to hand-hoeing, farmers claimed that the differences were at least 100%. Furthermore, producers felt that the first season following CA implementation is when this yield gain is realized. In dry Murewa districts, farmers thought CA was a better solution to low crop output than the conventional hand-hoeing method. It was once believed that conservation agriculture was a method of harvesting water that lessened moisture stress and raised crop yields. According

to farmers, there are three distinct principles within CA that they can implement independently in their respective fields.

Farmers in the Murewa district believe that CA is an easy-to-use device with little learning curve. Farmers thought it was simple to comprehend and apply CA as advised by the AGRITEX extension officers.

5.5 Conclusion

The level of knowledge and awareness of principles and practises of CA were high. Even though there is need for the full adoption of the practises so that they can be able to obtain the full benefits associated with CA in trying to curb the effects of Climate change. Farmers were given access to information about CA through field visits, field days, and CA training. One AGRITEX officer provided CA training and extension in each ward. Farmers believed that CA might increase crop yields by addressing these issues by conserving soil moisture and applying fertility additions precisely. Three concepts were identified as the foundation of conservation agriculture: minimum soil disturbance, crop rotation, and mulching. Nonetheless, the vast majority of farmers surveyed simply adhered to the minimal soil disturbance concept. Planting basins were used to cause the least amount of soil disturbance possible.

5.6 Recommendations

- Encourage farmer-to-farmer information exchange by starting CA clubs or organizations where farmers can discuss experiences and best practices. This will promote peer learning and community involvement.
- Arrange awards ceremonies or contests in the community to honour and inspire accomplished CAs.
- Research and Development: Taking into account the soil types, climate, and crop preferences, conduct localized research to adapt and improve CA methods to the unique circumstances of Murewa District.
- Work together with academic institutions to create and disseminate cutting-edge CA methods that tackle regional issues.

- To encourage the adoption of crop rotation and the preservation of a permanent soil cover, such as through intercropping and cover cropping, more innovations or adaptations are required.
- It is also conceivable to test the use of fence as a potential barrier against free-ranging animals in CA fields.
- To solve concerns with crop spacing and plant population, it may also be tried to reduce the in-row basin spacing by adding one additional basin between two basins when rotating with legumes.

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CHAPTER 6

MEN AND WOMEN FARMER'S PERCEPTIONS OF THE OBSTACLES AND CHALLENGES OF ADOPTING CONSERVATION AGRICULTURE

ABSTRACT

This study explores the attitudes, barriers, and difficulties that male and female farmers have when implementing conservation agriculture (CA). The study intends to shed light on the intricacies of CA adoption by a thorough analysis of the study area, a thorough research design, careful sampling procedures, specific data gathering methods, and rigorous data analysis approaches. There is documentation of the difficulties encountered during the data collection procedure. The findings indicate that most respondents about 95.7% agree that the main obstacle to practicing CA is a lack of appropriate equipment. The report also lists the main advantages of CA, including higher yields, lower costs, more crop diversity, and improved food security. Prominent obstacles encompass inadequate instruction, restricted expertise, limitations in resources, and labor intensity. A statistical analysis reveals interesting differences in real adoption rates across the sexes and the relationship between gender and CA adoption. The results highlight the necessity of focused initiatives to close this disparity and promote more equitable farming methods.

6.1 Introduction

Preservation Agriculture has received a lot of attention as a sustainable farming method that boosts soil health, raises soil yields, and conserves the environment. But there is still a lack of acceptability of CA, especially among smallholder farmers in poorer nations. To address the issues and roadblocks preventing the widespread adoption of CA, it is essential to comprehend the perspectives and experiences of farmers, particularly men and women.

6.2 Material and Methodology

6.2.1 Description of Study Area

Zimbabwe's Mashonaland East Province is home to the Murewa District. Its varied agro-ecological conditions are ideal for horticulture crops, minor grains, legumes, and maize, among other forms of agriculture (CYMMIT, 2022). Rain-fed agriculture plays a major role in the district's small-scale farming community. Due to the region's serious problems with soil degradation and irregular rainfall patterns, conservation agriculture may be advantageous.

6.2.2 Research Design

Using a cross-sectional research methodology, the study combined qualitative and quantitative methods. This approach made it possible to gather in-depth information on farmers' attitudes, behaviours, and socio-demographic traits at one particular moment in time.

6.2.3 Sampling Procedure

Snowball Sampling was employed to identify initial key informants within Murewa District who possess in-depth knowledge and experience related to conservation agriculture, such as agricultural extension officers, local community leaders, and experienced farmers.

6.2.4 Data Collection Procedure

The researcher utilized a random sampling technique to select a representative sample of small-scale farmers from different wards randomly selected 10 wards within Murewa District. This ensures that each farmer in the population has an equal chance of being selected, reducing the risk of sampling bias. Purposeful sampling was employed to identify and recruit participants for focus group discussions, ensuring diversity in terms of gender,

age, farming experience, and geographical location within Murewa District. Formulated were homogeneous groups of 8-12 participants for each focus group discussion session to facilitate meaningful interaction and diverse perspectives. Researcher conducted a focus group discussions using semi-structured guides to explore farmers' perceptions, attitudes, and experiences related to conservation agriculture. Facilitators encouraged open dialogue while ensuring all participants had an opportunity to contribute.

Structured questionnaires and semi-structured interviews were used to gather data. The questionnaire covered topics such as socio-demographic data, farming methods, revenue streams, agricultural education, level of food security, and attitudes toward CA. Deeper understanding of the difficulties and advantages farmers saw with CA was made possible by the semi-structured interviews.

6.2.5 Data Analysis Procedure and Methods

Following data analysis using the Statistical Package for Social Scientists (SPSS) version 16.0, the knowledge (perception) score was derived from the answers provided by farmers to knowledge (perception) questions. Frequency tables were also used to determine the benefits and demerits of CA. A test for association was also carried out to determine the association between gender and practising CA and also the association between gender and willingness to adopt CA. Those who were not willing to adopt were analysed using multinomial regression and 3-point Likert decision rule model. Likert Model decision rule states that a score of > 2.0 is accepted and a score of <2.0 is rejected (Burns, 2015).

6.2.6 Challenges Encountered During Data Collection

Availability and accessibility: Accessing isolated farming communities is challenging, because respondents' availability is constrained by their schedules and other obligations

Gender dynamics: When it came to expressing their ideas, some men and women felt uncomfortable, particularly if they went against conventional roles and expectation

6.3 Results and discussion

6.3.1 Small-scale farmer’s perceptions of CA

Table 5.1: Perception, model reliability and mean score of men and women not willing to adopt CA

ITEM	MEAN	SE	DECISION RULE	FACTOR LOADING
Lack of equipment	2.12	0.031	Accepted	0.835
Decline in yields	2.10	0.031	Accepted	0.944
May lead to serious problems	2.10	0.030	Accepted	0.885
Overall perception	**2.11**	0.031		

Note: AVE = 0.791; *α* = *0*.946 and IME = 0.105. Bold value indicates overall average perception score.

The perception variable's mean value, which varied from 2.10 to 2.12, showed that respondents agreed with the measure to a great degree. Respondents supported each of the construct's statements. A reasonable range of answers is shown by the standard error values, which fall between 0.030 and 0.031 in the above table. The findings showed that the lack of CA equipment (mean score of 2.12; standard error, 0.57), the fall in yields under CA (mean score of 2.10; standard error, 0.57), and unmanageable difficulties (mean score of 2.10; standard error, 0.56), influenced those not willing to adopt perceptions of CA. Table above demonstrates that the majority of women and men not willing to adopt had neutral opinions on CA. Using a multinomial regression model, the researcher additionally evaluated the socioeconomic factors of the perception construct.

6.3.2 Respondent perceptions of CA

The findings show that there was a low perception of individuals who were unwilling to accept CA. The low level of perception was ascribed to unmanageable issues under CA, crop productivity declines, and a shortage of CA equipment. These topics are covered in more detail below.

6.3.2.1 Lack of equipment

Those who were unwilling to accept CA stated that a major contributing reason to their disinterest in CA was a lack of equipment. In Murewa, the majority of farmers use the basin kind of CA. In these wards, farmers that use CA are required to prepare the basins each season. Some have invented the phrase "dhiga ufe" (dig and die), due to labor needs in the preparation of basins, whereas proponents of CA have referred to it as "dhiga udye" (dig and eat) in Zimbabwe (Anderson J. A, 2017).

6.3.2.2 Decline in crop yields

According to the respondents, a major contributing element to the bad opinion of CA among non-adopters is the potential for a decrease in crop output under CA. When all of the CA's principles are used simultaneously, benefits are attained (Giller, 2014). However, Zimbabwe's smallholder farming systems hardly ever employ optimal CA (Pedzisa, 2015b).

6.3.2.3 CA may lead to serious problems

The probability of running into major issues was cited by those who were unwilling to put CA into practice as a major contributing element to their unfavourable opinion of it. Our key informant interviews and focus group discussions helped us to clarify why those who were unwilling to adopt CA believed it would cause them to run into major issues. The primary obstacle was identified as the weed problem in accordance with (Mashingaidze, 2014). Considering that other writers have noted an increase in weed intensity under CA, this is not shocking (Thierfelder C. R., 2015).

While mulching and herbicide application are effective ways to control weeds (Kunzekweguta M. R., 2017); resource-poor farmers in Zimbabwe (Thierfelder C. C., 2019); and southern Africa in general (Gowing, 2016) cannot afford the expense of herbicides.

Table 6.2 Perception of CA using multinomial regression analysis model

Variable	Chi-Square	p Value
Age	16.199	0.04*
Gender	0.336	0.038*
Marital status	9.708	0.280
Education level	12.851	0.017*
Formal agricultural training	4.191	0.123
Master farmer training	4.016	0.134
Experience in agriculture	9.679	<0.0001
Belonging to a social group	0.455	0.797
Visit to demo sites	5.528	0.003*
Attendance at conferences	6.252	0.004*

Years of practicing CA	3.342	0.032*

Note: Likelihood Ratio Chi2 = 289.602; Pseudo *R*2 = 0.485; Log

Likelihood = −140.584.

6.3.3 Factors influencing men and women opinions of conservation agriculture

The researcher conducted a multinomial regression with perception as the dependent variable and socioeconomic characteristics as the independent factors to determine the socioeconomic variables that affected the non-adopters' perception of CA. The farmers' general opinion of CA was impacted by their age, gender, level of education, visits to demonstration locations, and prior agricultural and CA experiences. Most of them are also the same elements that have a huge impact on farmers' understanding about CA. This emphasizes the role that information plays in influencing farmers' perceptions of CA, as evidenced by the explanation provided about gender and agricultural experience.

6.3.3.1 Knowledge about CA

Respondents' perceptions of CA are significantly influenced by their experience with the field. Since experience is the best teacher, a positive perception should be generated by this encounter.

6.3.3.2 Gender

The respondent's opinion of CA is significantly influenced by their gender. Given that women in Zimbabwe face obstacles to their mobility that prevent them from attending agricultural meetings, gender is predicted to explain how people perceive the danger associated with CA. Farmers' first perceptions may have been influenced by the manner in which CA was originally introduced in the Murewa districts. Targeting socioeconomically empowered farmers who were already marketing maize, the Food and Agricultural Organization (FAO) and three Farmers Unions of Zimbabwe introduced CA in Murewa in 2004/2005. The purpose of CA was to address food insecurity among the community's most disadvantaged households. However, as CA aims to solve lack of access to draft power, a key barrier to cropping by the poor in Zimbabwe's rural areas, focusing on the poor was more suitable and appealing (Nhongonhema, 2014).

***Significant at 5% probability level.**

Table 6.3 Adopting CA is a challenge if there is lack of equipment

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Neutral	9	4.3	4.3	4.3
	Agree	66	31.4	31.6	35.9
	Strongly Agree	134	63.8	64.1	100.0
	Total	209	99.5	100.0	
Missing	System	1	.5		
Total		210	100.0		

About 95.7% majority confirm that it's a challenge to practice CA if no equipment's

Table 6.4 Perceived Benefits of Conservation Agriculture

	Frequency	Percent	Valid Percent	Cumulative Percent

Valid	Increased yields	59	28.2	28.2	28.2
	reduce costs	54	25.8	25.8	54.1
	crop divesity	53	25.4	25.4	79.4
	Food security	28	13.4	13.4	92.8
	improve soil	15	7.2	7.2	100.0
	Total	209	100.0	100.0	

Increased yields 28.2%, reduce costs 25.8 %, crop diversity 25.4% and food security 13.4 % are the most mentioned benefits of the CA

Table 6.5 Additional Challenges of implementing conservation agriculture

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Lack of training	62	29.7	29.7	29.7
	less knowledge	56	26.8	26.8	56.5
	limited resources to implement	52	24.9	24.9	81.3
	too much labour	26	12.4	12.4	93.8
	less motivation in farming	13	6.2	6.2	100.0
	Total	209	100.0	100.0	

The most mentioned challenges are less trainings 29.7%, 26.8% less knowledge, 24.9 % limited resources to implement and 12.4 % said it's too much labour.

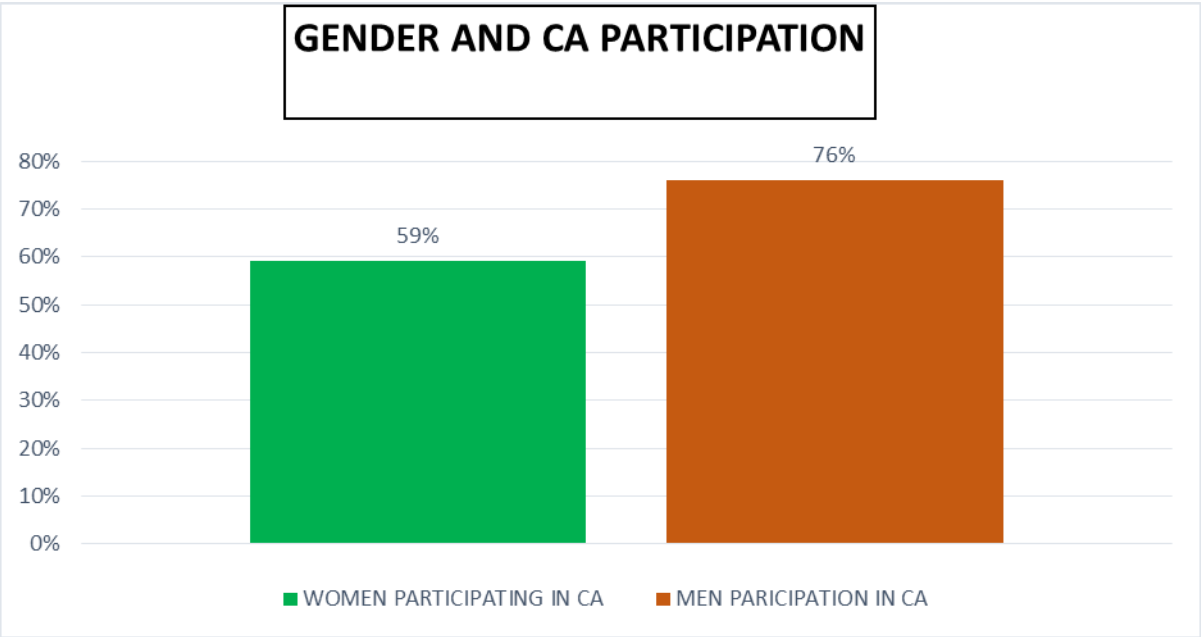
Table 6.6 Chi-square test of association between gender and willingness to implement conservation agriculture

Items	Chi square	Crammer v	P value	Status	OR
Gender and	2.34	0.106	0.259	No	-

willingness				association	
Gender and practicing CA	3.82	0.133	0.037	association	2.17

The data shown in this table indicates that there is no statistically significant correlation between gender and willingness to adopt CA, indicating that willingness is not influenced by gender. Nonetheless, a statistically significant correlation has been found between gender and the practice of CA, indicating that gender influences adoption or practice. In this instance, men are 2.1 times more likely than women to acquire CA.

Figure 5: Gender and CA participation



The bar graph above is showing that of the 118 women who responded only 59% of them took active part in CA and on the other hand of the 91 men who responded those who were practising CA was 76%. This indicates that men participate more in conservation agriculture compared to their female counterparts.

6.3.4 Challenges to CA Distinctive to Women

The biggest issue facing women in Murewa with regard to CA was the labour-intensive aspect of no-till farming, especially when it came to weeding and planting basin preparation.

Important land preparation tasks were shifted from men to women as a result of the CA's implementation. The requirement for traditional ploughing, which men perform in traditional agriculture, was lessened by basin preparation. Therefore, the majority of the physical labor needed in CA is carried out by women (Nyanga, *et al.*, 2012). The ladies also mentioned that they were pressed for time, that they were hesitant to conduct CA in the beginning, that they only practiced CA on limited areas of land, or that they had violated CA principles by ploughing their property in order to expedite and simplify CA basin preparation.

It has also been demonstrated that women's ability to perform CA in Murewa is hindered by the lack of hired labor or their inability to pay for it. For instance, women find it difficult to carry heavy backpack sprayers for herbicides. Because of this, a lot of women farmers hired males to do the spraying, which raised the price of producing crops. When they believed that the labor inputs of CA outweighed the yield benefits, several women abandoned it.

The CA's crop rotation laws were also perceived as a barrier for female farmers in the state. For example, women CA farmers chose intercropping over crop rotation because a healthy maize stock is regarded as a gauge of the nation's food security. This allowed them to have maize all year round, which is why crop rotation was not widely practiced in Murewa District.

Women in Murewa had less access to social capital, pertinent farming information, and financing facilities. Another obstacle women in Murewa encountered with CA was limited engagement with extension services. According to research conducted in Zambia, men were more likely than women to be contacted by CA extension service providers (Ng'ombe, *et al.*, 2017). Most women in Murewa district had lower levels of education and literacy and because they lack access to land because most of the land is owned by their male counterparts. Beuchelt and Badstue (2013) list cultural limitations on male-female relationships as well as the cultural marginalization of women in non-public settings as other causes. On the other hand, more women heads of households than males attended agricultural training events when they were contacted and invited to training sessions on CA.

6.4 Conclusion

The results show that there are comparable obstacles that men and women must overcome, such as restricted resource availability. Nonetheless, there are other gender-specific issues

that women farmers must deal with, like their restricted authority over land and resources and social and cultural hurdles like the fact that males predominately attend events where CA is taught.

6.5 Recommendations

- Research institutions should carry out additional studies to examine gender dynamics in CA adoption.
- Policy makers and extension services should prioritize gender-sensitive measures to encourage CA adoption. Development organizations and NGOs could offer tailored support to women farmers.
- More research on the social mechanism of CA adoption and how access to markets effects adoption of CA given that the majority of households are headed by females. Farmers' groups should encourage men to support women in adopting CA.
- **Better Access to Resources for Men and Women:** Offer financial aid or subsidies for the purchase of CA-related inputs, such as specialized equipment, mulching materials, and cover crop seeds.
- Fortify supply chains to guarantee timely and reasonably priced availability of essential agricultural inputs.

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CHAPTER 7

FARMERS' WILLINGNESS TO INCORPORATE OR EXPAND CONSERVATION AGRICULTURAL PRACTICES ON THEIR FARMS

ABSTRACT:

A viable method for sustainable farming, conservation agriculture (CA) aims to improve soil fertility and health, minimize the negative effects of climate change, minimize labor demands, and maximize resource utilization. This study examined farmers' opinions about the applicability and effectiveness of CA methods, as well as their desire to implement or extend them on their farms. 98.5% of responders to the poll said they would be open to implementing CA practices on their farms. The study found that knowledge and attitudes on environmental conservation as well as socioeconomic characteristics like age and wealth were important determinants of willingness to adopt CA. According to the results, farmers may implement CA more successfully with the help of focused extension services, training, and policy support, which will support both environmental preservation and sustainable agriculture.

7.1 Introduction

Despite the potential advantages, farmers continue to adopt CA practices at a low rate. It is vital to comprehend the determinants that impact farmers' inclination to adopt or enhance conservation agriculture practices in order to foster sustainable development and environmental preservation. This objective's primary goal is to pinpoint the major forces

behind and obstacles to farmers' adoption of CA practices. This objective looks at the various elements that affect farmers' desire to adopt CA practices in order to help design methods that will effectively promote environmental conservation and sustainable agriculture.

7.2 Material and methodology

7.2.1 Description of study area

The Mashonaland East Province of Zimbabwe contains the Murewa District. The diverse agro-ecological conditions that are favourable to horticulture crops, small grains, legumes, and maize are among the agricultural practices that define it. Largely dependent on rain-fed agriculture, the area is home to small-scale farmers. A potentially helpful approach in the area is conservation agriculture because of the substantial issues of soil degradation and irregular rainfall patterns.

7.2.2 Research Design

Using a cross-sectional research methodology, the study combined qualitative and quantitative methods. This approach made it possible to gather in-depth information on farmers' attitudes, behaviours, and socio-demographic traits at one particular moment in time.

7.2.3 Sampling Procedure

Snowball Sampling was employed to identify initial key informants within Murewa District who possess in-depth knowledge and experience related to conservation agriculture, such as agricultural extension officers, local community leaders, and experienced farmers.

7.2.4 Data Collection Procedure

The researcher chose a representative sample of small-scale farmers from ten randomly chosen wards in the Murewa District using a random sampling technique. This lowers the possibility of sampling bias by guaranteeing that every farmer in the population has an equal chance of being chosen. To find and choose participants for focus group talks, deliberate sampling was used to make sure that the participants were diverse in terms of gender, age, agricultural experience, and location within Murewa District. For each focus group discussion session, homogeneous groups of eight to twelve members were created in order to promote meaningful interaction and a range of viewpoints. Using semi-structured guides, the researcher led focus group conversations to investigate farmers' attitudes, experiences, and

views about conservation agriculture. The facilitators made sure everyone had a chance to speak while promoting candid conversation.

Semi-structured interviews and structured questionnaires were used to gather data. Sections on socio-demographic data, farming methods, revenue streams, agricultural education, the state of food security, and attitudes about CA were all included in the questionnaire. The semi-structured interviews gave more detailed information about the difficulties and advantages farmers saw using CA.

7.2.5 Data Analysis Procedure and Methods

The Statistical Package for Social Scientists (SPSS) version 16.0 was used to analyse the data and derive the knowledge (perception) score from the answers provided by farmers to the knowledge (perception) questions. In order to find recurring themes and insights into farmers' perspectives and experiences with CA, qualitative data from interviews underwent thematic analysis. Frequency tables, means and standard deviations were used to analyse the willingness of small-scale farmers in Murewa to implement or expand CA on their farms.

7.3 Results and discussion

Table 7.1 Willingness to adopt conservation agriculture

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	3	1.4	1.4	1.4
	Yes	206	98.1	98.6	100.0
	Total	209	99.5	100.0	
Missing	System	1	.5		
Total		210	100.0		

A massive number of 98.5 % are willing to adopt to CA given benefits.

Table 7.2 Conservation agriculture perceptions

Items	Mean	Std. Deviation
D2.Do you believe that conservation agriculture practices can help mitigate the effects of climate change?	4.5550	.64158
D3.Conservation agriculture practices are effective in improving soil health and fertility.	4.4689	.64319
D4.Conservation agriculture practices require less labor compared to conventional farming methods.	4.4067	.63712
D5.I believe that adopting conservation agriculture practices would lead to cost savings on my farm	4.4593	.64265
D6.Conservation agriculture practices contribute to water conservation and efficient use of irrigation resources.	4.4689	.64319
D7.I feel confident in my ability to implement and manage conservation agriculture practices on my farm	4.4593	.64265
E1 CA is appropriate for your agriculture area	4.4976	.72804
E2 CA is beneficial to women headed households who may not have labour and draught power	4.5215	.69391
E3 CA is appropriate to households with chronic illnesses	4.5359	.67218
E4 As a farmer you are satisfied with the benefits of CA	4.5215	.69391
E5 CA is more yielding than conventional farming	4.5215	.69391
E6 Moisture stress and soil degradation are the major cause of crop failure in your area	4.4976	.72804
E7 Labour concerns have affected my decision to adopt/not to adopt	4.5550	.64158
E8 Labour concerns have affected my decision to increase/not to increase area under CA from the recommended 0.25 ha	4.5407	.66472
E9 Farmers in general have sufficient knowledge on CA	4.5215	.69391

The aforementioned table displays the average rating mean over 3, indicating that the majority of farmers hold the belief that conservation agriculture techniques may effectively

improve soil health and fertility while also helping to minimize the consequences of climate change.

7.3.2 Discussion

When comparing conservation agriculture strategies to traditional farming techniques, less labor is needed. They affirmed that they think using conservation agriculture techniques will help my farm save money, that they help conserve water and make effective use of irrigation resources, and that they have faith in my ability to put conservation agriculture techniques into practice and oversee them.

Additionally, they believe that CA is suitable for your agricultural region, helpful for households headed by women who could lack labor and draught power, and suitable for households with long-term medical conditions. Farmers concurred that while CA farming yields higher yields than conventional farming, they are still happy with the benefits. They do think that the main reasons for crop failure in your area are soil deterioration and moisture stress. The majority agreed that labor issues had an impact on my decision to adopt or not adopt, as well as whether or not to enlarge the area under CA from the suggested 0.25 since they didn't think they knew enough about CA to decide whether or not to use the method.

The majority of farmers in the district reported being willing to expand the area under CA in subsequent seasons, most likely because the benefits of CA output were evident in all ten wards, even for those who were just starting out. Some farmers had unfavourable opinions about the percentage of farmers planning to expand the area under conservation agriculture (CA) because they emphasized the high risk of such an investment given the decline in rainfall caused by droughts brought on by climate change. These findings concur with those of (Lanckriet, 2016), who found that high rainfall regions adopted CA more frequently than low rainfall regions.

The flexibility of the adoption pattern by season appears to contradict findings from a study conducted in Zambia by (Affholder, 2014), who found that the locations with low and distributed rainfall had the highest adoption rates of CA employing hand-hoe basins, demonstrating the location specificity of CA. Some farmers did, however, mention that they are currently experimenting with CA and that adoption trends may alter over time.

Farmers continue to strongly believe in the benefits of CA, but the average land area under CA is still small. Farmers who are persuaded of the benefits of conservation agriculture (CA) but infrequently expand their CA plots have been documented in the literature (Grabowski, 2014), and they have been associated with prejudice because of the promotional environment of CA projects that offers input incentives (Anderson J. A, 2017). Lack of inputs was stated as the main barrier to expanding CA plots by a larger margin. This is significant because, in order to achieve sufficient biomass and grain yields, CA cropping systems are likely to perform best when adequate weed control and fertility amendments both organic and inorganic are applied (Thierfelder and Wall, 2012).

This is consistent with the advice given by (Gowing, 2016), who suggested that farmers switching from conventional to CA cropping systems should focus their resources on smaller areas in order to improve soil quality and crop productivity before growing their CA plots. This is consistent with findings from previous research in which plot size was shown to be mostly determined by access to inputs (Mazvimavi T. a., 2014). But as has been the case from previous CA promotion in SSA (Mazvimavi T. a., 2014), this may also predict dis-adoption when input incentives are no longer supplied. This has also been the reason for not increasing CA plots in prior studies.

Additionally, in low productivity rain fed agriculture, additional study and adaptation are required to make crop rotation and permanent soil care feasible. This supports the theory that the CA strategy, which is based solely on the application of the three principles, is ineffective in the varied smallholder systems of the SSA, and that its deployment requires a great deal of adaptability and flexibility (Thierfelder C. R., 2015). The noted significance of inputs implies that the government's input program or contract farming by private businesses might provide a timely and sufficient supply of inputs, hence sustaining the adoption of CA.

Information increases farmers' chances of adopting the technology by making it more widely known and demonstrating its usefulness. Since there is just one dominant cultural group in the Murewa district (the Mazezuru) similar perceptions were likewise linked to comparable farmer features and conditions. This refutes claims made by Posthumus et al. (2010) that perceptions vary depending on the context and place. This was connected to perceived homogeneity, which is influenced by things like education, access to information, and resource endowments.

According to published reports, farmers test out any promising approach, and full adoption cannot be documented until the advantages of CA are seen as improving individual objectives (Dalton, 2014). There are no universally significant determinants affecting CA adoption, are consistent with the aforementioned factors' failure to influence adoption decisions (Andersson, 2015). That is, farmers' favourable opinions of CA are the sole factor that can account for their decision to practice it. However, CA input incentives may be the cause of these favourable impressions (Anderson J. A, 2017).

7.4 Conclusion

Ultimately, the results highlight farmers' strong desire to implement CA techniques due to their awareness of the many advantages that come with this strategy. The study emphasizes how critical it is to promote and encourage CA adoption programs in order to improve agricultural resilience and sustainability in the face of changing environmental and socioeconomic stressors.

7.5 Recommendations

Recommendations are made to politicians, agricultural extension agencies, and pertinent stakeholders based on the study's findings in order to promote the integration of CA methods into agricultural systems and their broad acceptance. These suggestions cover capacity-building programs, policy interventions, and awareness-raising efforts meant to encourage the use of sustainable farming methods.

Increasing the amount of CA on-farm demonstration trials, giving agricultural extension agents proper training on what constitutes full CA, and improving availability to reasonably priced CA equipment and herbicides are all necessary.

Moreover, during the early stages of adoption, farmers must receive the necessary inputs and extension assistance. The interventions might lessen the farmers' unfavourable opinions of CA.

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CHAPTER 8:
SUMMARY, CONCLUSION AND RECOMMENDATIONS

8.1 Introduction

This chapter provides an overview of the study's findings regarding small-scale farmers' perceptions of conservation agriculture (CA) as a climate change mitigation strategy. Based on the data analysis, we make inferences and offer suggestions for future research directions, stakeholders, and policymakers.

8.2 Research Summary

The study examined how farmers perceived conservation agriculture (CA) as a mitigatory strategy for climate change, important conclusions obtained from each objective consist of:

Socio-demography

Gender and Status of Marriage: A considerable segment of farmers are wed, with a greater proportion of women than men. The adoption of CA has been found to be significantly correlated with gender, with men being more likely than women to do so.

Education Level: While a sizeable portion of farmers have informal education, the majority have completed secondary school. But a significant percentage don't have a formal agricultural education.

Agricultural Practices: The most often grown crop is maize, which is followed by legumes and minor grains. For most farmers, agriculture continues to be their main source of income, and most have some level of farming experience.

Farmers have a good awareness and understanding of CA, and most of them are aware of its advantages, which include higher yields, lower costs, and better food security. However, obstacles like inadequate training and scarce resources prevent adoption from becoming widely accepted.

To examine farmers' level of knowledge of the principles and the practices of conservation agriculture.

The level of knowledge of the principles and the practises of conservation agriculture was on the high side. Farmers in the Murewa region view CA positively since they think it's the best farming technique for regions that are susceptible to drought and lack draught power. This positive view of CA may have its roots in the benefits that people perceive. The positive perception was linked to farmers' readiness to try new technologies in an effort to boost crop yields, which have consistently been low while using the conventional hand-hoeing tillage method. Farmers thought that by solving these problems namely, maintaining soil moisture and applying nutrient additives precisely CA can boost crop yields. The cornerstones of conservation agriculture have been determined to include mulching, crop rotation, and minimal soil disturbance. However, the great majority of farmers who responded to the study merely followed the minimal disturbance theory. With planting basins, the least amount of soil disturbance was achieved.

To assess men and women farmers perceptions of the obstacles and/or challenges of implementing conservation agriculture

Although the study highlighted obstacles that are usually faced by both females and males the adoption rate is higher in men than in women which means there are some challenges that are more tailored to women more than men. Male smallholder farmers are more likely to adopt CA than are impoverished smallholder farmers, who are frequently female. The majority of

women CA farmers in the Murewa district face obstacles like inadequate access to credit facilities, limited access to land (since most must assess it through patrilineal relations), insecure land tenure, and a lack of machinery and inputs or knowledge of where to get them from low or non-existent extension service provision. Women's capacity to make decisions about CA is influenced by a number of factors, including their marital status, sense of agency, understanding of CA, and access to, ownership of, and control over productive resources, such as land.

Farmers' willingness to adopt or expand CA on their farms

Because the benefits of CA output were visible in all ten wards, even for those who were just starting out, most farmers in the district reported being willing to expand the area under CA in coming seasons. The percentage of farmers who planned to increase the area under conservation agriculture (CA) was seen negatively by few other farmers, who highlighted the significant risk of this investment in light of the decrease in rainfall brought on by climate change-related droughts**.**

8.3 Conclusion

The study comes to the conclusion that although farmers are highly aware of and willing to embrace CA, its acceptance is influenced by a number of socioeconomic factors. The adoption and use of CA methods are significantly influenced by factors such as gender, educational attainment, and resource accessibility. Notwithstanding the perceived advantages, obstacles including inadequate funding and inadequate training impede extensive implementation.

8.4 Policy Implications and Recommendations

Several policy implications and recommendations arise from the findings:

- Adequate training and resources for farmers should be the main goals of policy initiatives, with an emphasis on those with less resources and knowledge.
- To achieve fair access and adoption, gender-sensitive methods should be included in CA promotion campaigns.
- To effectively provide technical support and promote CA practices, collaborative initiatives including government agencies, non-governmental organizations, and agricultural extension services are necessary.

- To encourage farmers to adopt CA and make the necessary equipment investments, incentive programs and subsidies might be implemented.
- Push for local and national laws that encourage the adoption of Conservation Agriculture (CA) and offer financial incentives for the use of sustainable farming practices.
- Interact with legislators to emphasize the advantages of CA and the demand for specialized financing and resources to assist its implementation.

8.5 Area for Further Study

Even though the current study offers insightful information, more investigation is required to fully comprehend CA adoption and its effects. Future research could examine the following topics:

- The long-term consequences of CA adoption on agricultural productivity, soil health, and farmers' socioeconomic well-being.
- A comparative examination of the implementation of CA in various agro-climatic zones and geographical areas.
- Assessing other strategies, like farmer-to-farmer information sharing programs and community-based efforts, to get around obstacles to the adoption of CA.
- Evaluating how climate-smart farming methods might improve climate change resilience and lessen the impact of the changing climate on agricultural output.

The study's conclusions highlight the significance of tackling socioeconomic inequalities and advocating for inclusive policies in order to encourage smallholder farmers to widely implement conservation agriculture methods. Policymakers can improve livelihoods, minimize the negative effects of climate change on farming communities, and enhance agricultural sustainability by integrating targeted actions and utilizing available resources.

APPENDICES

Household Questionnaire

Small-Scale Farmers' Perceptions towards Conservation Agriculture Questionnaire

Introduction: Thank you for participating in this survey. The information you provide will help us understand small-scale farmers' perceptions towards conservation agriculture in Murewa District, Zimbabwe. Your responses are valuable, and all information will be kept confidential. Please answer each question to the best of your ability.

Section 1: Demographic Information

1. Gender:
   - Male
   - Female

2. Age:
   - Under 30 years
   - 30-40 years
   - 41-50 years
   - Over 50 years

3. Educational Level:
   - No formal education
   - Primary education
   - Secondary education
   - Tertiary education

4. Household Size:
   - Number of adults……
   - Number of children……

5. State your marital status
   - Single
   - Married
   - Separated
   - Divorced
   - Widowed

6. Farm size (ha)
   - Less than 1 ha
   - 1-2
   - 2-5
   - More than 5

Section 2: Farming Practices and Experience

1. What is your main income source?
   - Agriculture Off
   - Farm Employment
   - Remittances/Monetary Gifts

2. .How many years have you been engaged in farming?
   - Less than 5 years
   - 5-10 years
   - 11-20 years
   - More than 20 years

3. What is the major crop grown at your farm? (Tick all that apply)
   - Maize
   - Cash crops
   - Small grains
   - Horticultural crops

4. Number of livestock on your farm? (tick all that apply)
   - Cattle…….
   - Goats…….
   - Poultry (chickens, ducks, etc.)…….
   - Sheep……
   - Other (please specify)…….

5. What Agricultural Training do you have?
   - None
   - Certificate in Agriculture
   - Diploma in Agriculture

- Degree or Higher Degree in Agriculture
- Master Farmer Certificate
- Advanced Master Farmer Certificate

6. What is the approximate distance and or time spent travelling to the nearest place to get CA equipment and other agricultural inputs?
   - <4 hours
   - 4–8 hours
   - 8–12 hours
   - >12 hours

7. What is the approximate distance and or time spent travelling to the nearest place to sell agricultural outputs?
   - <4 hours
   - 4–8 hours
   - 8–12 hours
   - >12 hours

Section 3: Knowledge of Conservation Agriculture

1. Have you heard of conservation agriculture before?
- Yes
- No

2. Please indicate your level of knowledge about conservation agriculture:
   - Very familiar
   - Somewhat familiar
   - Not familiar at all
3. What do you know about Conservation Agriculture?

   ……
   ……
   …..
4. Do you belong to any farming group?
   - Yes
   - No
5. Did you participate in any Conservation Agriculture course in the past five years?
   - Yes
   - No
6. Have you visited experimental/demonstration plots on CA?
   - Yes
   - No
7. Do you practice crop rotation?
   - Yes
   - No
8. What is your total arable area?
   - <1 ha

- 2–5 ha
- 5–10 ha
- >10 ha ○

9. How much area is under CA?
    - 0
    - 0.5 ha
    - 0.6–1 ha
    - >1 ha
10. How many years have you been practicing CA?
    - Zero years
    - Less than 5 years
    - 5 – 10 years
    - Greater than 10 years ○
11. What is the major cost associated with CA?
    - Cost of equipment
    - Cost of fertilizers
    - Cost of herbicides

Please indicate your level of agreements with statements listed below by choosing from these answers: Strongly Disagree (SD), Disagree (D), Neither (N), Agree (A), and Strongly Agree (SA).Just put a circle on your preferred answer. Please note that there is no wrong or right answer. These questions are meant to find out your level of KNOWLEDGE on CA

	Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
Performance of CA improves over time	SD	D	N	A	SA
Results in noticeable increase in yield	SD	D	N	A	SA
CA is easy to practice	SD	D	N	A	SA
CA reduces soil erosion	SD	D	N	A	SA
CA restores degraded lands or areas	SD	D	N	A	SA
CA is environmentally friendly	SD	D	N	A	SA
CA controls pests and diseases	SD	D	N	A	SA
CA reduces costs of labour	SD	D	N	A	SA
CA reduces costs of inputs	SD	D	N	A	SA
CA improves income	SD	D	N	A	SA

Section 4: Perceptions and Attitudes towards Conservation Agriculture

1. Are you practicing conservational farming (e.g. Mulching, cover cropping, crop rotation)?

- Yes

- no

2. Do you believe that conservation agriculture practices can help mitigate the effects of climate change?
   - Strongly agree
   - Agree
   - Neutral
   - Disagree
   - Strongly disagree
3. Conservation agriculture practices are effective in improving soil health and fertility.
   - Strongly agree
   - Agree
   - Neutral
   - Disagree
   - Strongly disagree
4. Conservation agriculture practices require less labor compared to conventional farming methods.
   - Strongly agree
   - Agree
   - Neutral
   - Disagree
   - Strongly disagree
5. I believe that adopting conservation agriculture practices would lead to cost savings on my farm.
   - Strongly agree
   - Agree
   - Neutral
   - Disagree
   - Strongly disagree
6. Conservation agriculture practices contribute to water conservation and efficient use of irrigation resources.
   - Strongly agree
   - Agree
   - Neutral
   - Disagree
   - Strongly disagree
7. I feel confident in my ability to implement and manage conservation agriculture practices on my farm.
   - Strongly agree
   - Agree
   - Neutral
   - Disagree
   - Strongly disagree
8. What do you perceive as the main benefits of conservation agriculture? (Open-ended)……
   ……
   ……
   ……
9. What do you perceive as the main challenges or obstacles to adopting conservation agriculture practices? (Open-ended)……
   ……

……
……
……

Section 5: Gendered Perceptions of CA

PERCEPTION STATEMENT	AGREE	DISAGREE
CA is appropriate for your agriculture area		
CA is beneficial to women headed households who may not have labour and draught power		
CA is appropriate to households with chronic illnesses		
As a farmer you are satisfied with the benefits of CA		
CA is more yielding than conventional farming		
Moisture stress and soil degradation are the major cause of crop failure in your area		
Labour concerns have affected my decision to adopt/not to adopt		
Labour concerns have affected my decision to increase/not to increase area under CA from the recommended 0.25 ha		
Farmers in general have sufficient knowledge on CA		

Section 6: Willingness to Adopt Conservation Agriculture

1. Are you willing to incorporate or expand conservation agriculture practices on your farm?
    - Yes
    - No
    - Unsure
2. What factors would influence your decision to adopt conservation agriculture practices? (Open-ended)……
……
……
……

The following questions are meant to identify the perceived risk factors in CA adoption.

PERCEPTION PERCEIVED RISK	STRONGLY DISAGREE	DISAGREE	NEUTRAL	AGREE	STRONGLY AGREE
NON ADOPTER: Adopting CA is a challenge if there is no equipment	SA	D	N	A	SA
NON ADOPTER: Adopting CA will result in reduction in yield	SA	D	N	A	SA
NON ADOPTER: Adopting	SA	D	N	A	SA

CA may lead to serious problems					

Section 6. HOUSEHOLD INCOME AND FOOD SECURITY STATUS			
3. What are your sources of food? (Rank 1 as the most important source of food)			
Own crop production	Purchase	Wild food collection	Food aid
Own livestock products	Barter	Food for work	Steal
Food at work	Gifts of food	Loans	Stocks
Food at school	Fishing	Hunting	Friends/relatives
Other sources of food(Specify):			

4. What types of foods did you or anyone else in your household ate yesterday during the day and night at your home.(didn't eat=0 and ate=1)	
Any foods made from maize, wheat, rice or any other locally available grain e.g samp, pap, bread	
Any potatoes or any other food made from roots or tubers,	
Any vegetables	
Any fruits	
Any meat, poultry or offal	
Any eggs	
Any fresh or dried fish and seafood	
Any foods made from beans, peas or nuts	
Any cheese, yogurt, milk or other milk products	
Any food made from oil, fat or butter	
Any sugar or honey	
Any other foods such as coffee, tea and condiments	

5. On average, how many meals do you have per day?		
6. Do you think you have access to enough food?	Yes	No

7. How do you rate your level of access to food nowadays as compared to last year?			
No change	Better	Fair	Worse off

Please note:
Question 6 is about food accessibility in the past 4 weeks (1 month)

8. **If yes to the following questions, How often did this happen?**
0= Never**; 1** = Rarely (once or twice in the past four weeks); **2** = Sometimes (three to ten times in the past four weeks); **3**= Often (more than ten times in the past four weeks)

a.Did you worry that your household would not have enough food?	
b.Were you or any household member not able to eat the kinds of foods you preferred because of a lack of resources?	
c.Did you or any household member have to eat a limited variety of foods due to a lack of resources?	
d. Did you or any household member have to eat some foods that you really did not want because of a lack of resources to obtain other types of food?	
e. Did you or any household member have to eat a smaller meal than you felt you needed because there was not enough food?	

f. Did you or any household member have to eat fewer meals in a day because there was not enough food?	
g. Was there ever no food to eat of any kind in your household because of lack of resources to get food?	
h. Did you or any household member go to sleep at night hungry because there was not enough food?	
i. Did you or any household member go a whole day and night without eating anything because there was not enough food?	

9. When do you encounter food shortages?(you may tick more than once)

Any time of the month	Just before month end	Before harvesting	After drought	**Other times:**

10. What is causing food shortages in your household? (Rank1 as the first)

	Poor harvest due to drought	
	Poor harvest due to high temperatures	
	Poor harvest due to low temperatures (snow)	
	Poor harvest due to pests and diseases	
	Poor harvest due to hail storm	
	Poor harvest due to late rainfall	
	Loss of livestock due to pests and diseases	
	Loss of livestock due to drought	
	Loss of livestock due to high temperatures	
	Lack of water sources/reservoirs	
	Lack of agricultural inputs	
	Increase in household size	
	Other (specify)	

11. What adjustments or possible solutions have you made to avoid food shortages if any or improve your diet? (you may tick more than one option)

---

12. On average, what percentage of your income did you spend on food?

<25%	25%-50%	51%-75%	>75%

13. What is your source of income	**Source**	**Rank**
	Crops	
	Vegetables	

	Livestock	
	Poultry	
	Salary/wages	
	Pension/grants	
	Trade (transport, resale of goods)	
	Sale of wild foods	
	Craftwork (mats, baskets, pots)	

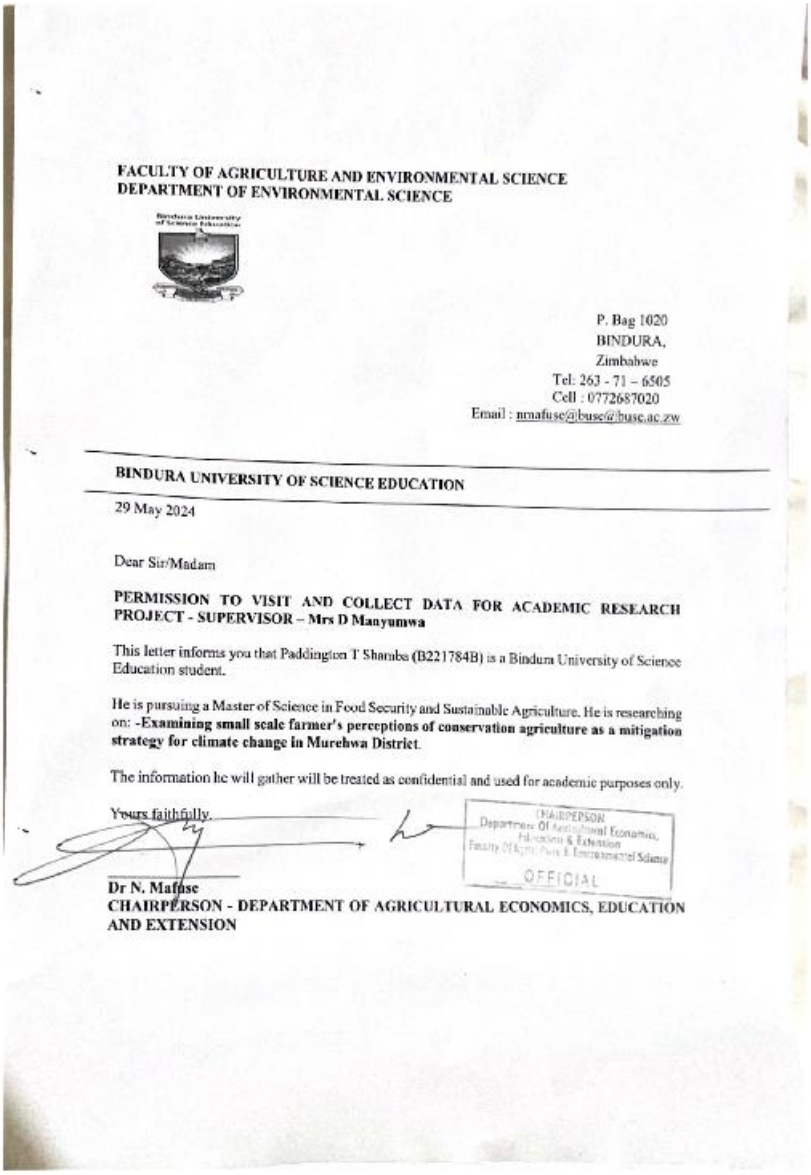
14. What is the average top 3 crop yield per /ha	
Crop	Yield

Section 7: Additional Comments

1. Do you have any additional comments or suggestions regarding conservation agriculture or this survey?.....
.....
.....
.....
.....

Thank you, Tatenda, Siyabonga for completing this questionnaire. Your input is invaluable in helping us understand the perceptions and attitudes of small-scale farmers towards conservation agriculture in Murewa District, Zimbabwe.

Ethics Letter



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BINDURA UNIVERSITY OF SCIENCE EDUCATION

29 May 2024

Dear Sir/Madam

PERMISSION TO VISIT AND COLLECT DATA FOR ACADEMIC RESEARCH PROJECT - SUPERVISOR – Mrs D Manyumwa

This letter informs you that Paddington T Shamba (B221784B) is a Bindura University of Science Education student.

He is pursuing a Master of Science in Food Security and Sustainable Agriculture. He is researching on: -**Examining small scale farmer's perceptions of conservation agriculture as a mitigation strategy for climate change in Murehwa District**.

The information he will gather will be treated as confidential and used for academic purposes only.

Yours faithfully,

CHAIRPERSON
Department Of Agricultural Economics,
Education & Extension
Faculty Of Agric, Pure & Environmental Sciences
OFFICIAL

Dr N. Mafuse
CHAIRPERSON - DEPARTMENT OF AGRICULTURAL ECONOMICS, EDUCATION AND EXTENSION