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*Knowledge, attitudes, and practices (kap) of smallholder farmers on climate change
adaptation and mitigation measures.*



Muchabaya Jervas Gift

B193394B

**A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS OF A BACHELOR OF ENVIRONMENTAL SCIENCE HONOURS
DEGREE IN SAFETY, HEALTH AND ENVIRONMENTAL MANAGEMENT**

SUBMITTED:

DECLARATION

To be compiled by the student

Registration number B193394B

I, Jervas Gift Muchabaya, hereby certify that the work contained herein is solely the result of my own research and has never been submitted to a scholarly organization. Any mention of previously published material has been made explicit.

Signature of the student.....Date.....

To be compiled by the supervisor

This dissertation is suitable for submission to the faculty and has been checked for conformity with the faculty guidelines.

Signature of the supervisor.....Date.....

ABSTRACT

Background: Climate change is defined as long-term changes in temperature and precipitation trends. The changes are mostly caused by human activities that release greenhouse gases into the atmosphere such as carbon dioxide and methane. Effects of climate change include droughts, water shortages, wildfires, sea level rise, flooding, melting of ice polar regions, and loss of biodiversity. Climate change policies anticipate a rise in the temperature by the end of the century as a result of global emissions despite the need to minimise emission and need to adjust to climate change. The world at large must take action to lessen the worst effects of climate change by cutting emissions, switching to green energy technologies and investing in climate change adaptation strategies.

Materials and methods: Study employed research questionnaires to collect data from 43 participants on their demographic characteristics, knowledge, attitudes, and practices. For data analysis, SPSS version 20 and Microsoft Excel were utilised.

Data analysis: Microsoft Excel and SPS were used. Responses were categorized as 'Good', 'Fair', or 'Poor'. Binary logistic analysis was used to determine factors affecting knowledge, attitudes, and practices. Results were presented with tables and graphs, and the statistical analysis employed a 95% confidence interval and a 5% level of significance.

Results: 41.9% of the sample were male and 58.1% were female. Average scores for knowledge, attitudes, and practices were 51% which was fair, 45% which was poor, and 53% which was fair. The population heavily relies on cell phones/smartphones to access information.

Conclusion: Farmers in Manhenga have a fair knowledge of climate change, but there is confusion about its specific factors. Attitudes towards climate change were poor, but most are willing to learn and take action. Practices were fair but there is room for improvement. Farmers rely heavily on cell phones for accessing information, highlighting the importance of leveraging technology for information dissemination.

Recommendations: include strengthening extension services to provide accurate climate change information, improving the adoption of sustainable agricultural practices through targeted training, and exploring technology to reach and engage with smallholder farmers more effectively.

Key terms

Smallholder farmers, climate change, adaptation mitigation measures

DEDICATION

This study is devoted to my family and my late father (William) and sister (Chipo) who lost their lives during my four-year journey.

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LIST OF ACRONYMS

UN	United Nations
CSA	Community-supported agriculture.
KAP	Knowledge, Attitudes, and Practices
FAES	Faculty of Agriculture and Environmental Science
BRDC	Bindura Rural District Council

CHAPTER 1

1.1 BACKGROUND OF THE STUDY

Long-term changes in temperature and precipitation trends are referred to as climate change, as stated by (Kahn et al. and Yang., 2021). Although natural factors like variations in the solar cycle can contribute to such changes, Since the 1800s, human activity has been the main contributor, particularly the combustion of fossil fuels like petroleum, natural gas, and coal. As a result of the greenhouse gases released through the burning of fossil fuels, the Earth is covered in a layer that traps solar heat. and leading to a rise in temperatures. This information was also noted by (Kevins.,2022).

According to (Kemp et al. and Lenton.,2022), greenhouse gas emissions are still on the rise, and as an outcome, from the end of the 1800s, the planet's surface has become warmer by about 1.1°C. The ten-year period starting in 2011 and ending in 2020 was the hottest on record. While many people consider rising temperatures to be the primary consequence of climate alteration, keep in mind that the effects of changing temperatures are not limited to that alone. The Earth is a complex system, and changes in one area can have far-reaching impacts on other areas due to interconnectedness.

Intense periods of drought, scarce water, damaging fires, rising sea levels, floods, dissolving ice in the polar regions, fatal storms, and a decline in species are just a few of the dire effects of the changing climate. (South African Academy of Science., 2022).

Carbon dioxide and methane are two different kinds of greenhouse gases that are responsible for climate change, (Hui et al and Luo., 2022). These are generated, for example, when coal or petrol is used to heat an object. Carbon dioxide is also sometimes released during the clearance of forests and fields. Landfilling for trash is a significant source of methane leakage, (Guo and Yao.,2022). Key polluters include energy production, industries, transportation, construction, agriculture, and the development of land.

Our well-being, the ability to cultivate crops, our homes, our safety, and our jobs may all be impacted by changes in the climate, (Agostoni and Berti., 2023). Some people, such as dwellers of islands and other developing countries, have increased susceptibility to the consequences of environmental change. Long-term disasters increase the danger of starvation for humans, whereas the evacuation of whole settlements has been prompted by reasons like rising sea levels and the invasion of saltwater. In the upcoming years, more climate refugees are anticipated. (Effah and Blay., 2023).

In a series of UN assessments, numerous researchers, also state reviewers concurred that keeping the increase in worldwide temperatures to 1.5°C could assist to prevent catastrophic climatic effects and preserve a habitable environment. At the end of the millennium, however, current strategies forecast a 2.8°C temperature increase.

Everybody is impacted by worldwide gases that trigger climate change, although some nations generate significantly greater quantities than others, (Shivanna.,2022). The one hundred nations with the least pollution rates contribute approximately three percent of world emissions. The world's top ten emitting countries are responsible for 68% of the pollution. Everyone must take action to prevent climate change, but individuals who contribute the most to the problem, as well as those countries, have a stronger obligation to take action initially, (Jacobs.,2022).

Plenty of climate alteration methods may improve economic growth, enhance the standard of life, and preserve the ecosystem, (Maiurova and Goh.,2022). The UN Framework Convention on Climate Change, the Sustainable Development Goals, and the Paris Agreement constitute merely a few of the global frameworks and accords that act as an agenda for success. The primary categories of initiatives are coping with climate consequences, limiting greenhouse gas emissions, and funding essential adjustments.

Lower emissions through renewable energy sources such as wind and solar energy will aid in the fight against climate change, (Murugesan and Megharaj., 2023). However, there is an urgent need to get started. While an increasing number of countries have vowed to reach zero air pollution by 2050, roughly fifty percent of those reductions by 2030, these goals should be achieved in order to keep temperature increases to 1.5°C or less. During 2020 and 2030, the consumption of fossil fuels must be reduced by 6% each year, (Raimi et al and Singh., 2022).

Adjusting to the impacts of climate change involves safeguarding people, homes, businesses, livelihoods, infrastructure, as well as the environment. (Sahoo et al. and Behera., 2023), covers both the immediate and likely future effects. Adaptation will be required nationwide to get ready for climate dangers, but it has to be prioritised immediately for those who are most at risk with a minimum of resources. A good rate of return is conceivable. Early alert mechanisms, such as those used in natural catastrophes, can provide advantages that are up to ten times the expense of implementation while also saving life and assets. (Esposito et al and Pierleoni., 2022).

Both governments and companies need to make major investments in tackling climate change. However, neglecting environmental issues costs significantly more, (Hang.,2022). A key step is for developed countries to adhere to and follow through on their commit to give the developing world one hundred billion dollars yearly so they may adapt and shift to sustainable economies

(McCoy et al and Cifelli., 2022) The incomes of the poor and the standard of living have been significantly impacted by changes in the climate in the developing world by modifying hydrology patterns and climate patterns, rising incidence and severity of severe weather events, as well as increasing sea levels.

Zimbabwe, like the majority of countries, is experiencing ramifications of the changing climate, (Gwatida et al and Viriri.,2023). According to Zimbabwe's meteorological department, evidence indicates precipitation amounts and trends are changing across the country, as evidenced by alterations to the following variables: precipitation patterns, an initial day of precipitation, the frequency of dry spells, rainfall intensity, and the quantity of rainfall. Flood and cyclone incidences, have risen for example, Cyclones: Idai in 2019, Eloise in 2021, Ana in 2022, Fredy in 2023, and tropical storm Chalane in 2020,

One of the biggest issues facing the globe currently is climate change. Smallholder farmers are especially susceptible to its consequences, because of their limited financial capacities, inaccessible to learning, and inaccessible to credit and other monetary services. Smallholder farmers usually struggle to counteract and lessen the impact of climate change on their living style, (Bekuma et al and Regassa., 2023).

To better understand how smallholder farmers might address the climate problem, a research project called KAP (Knowledge, Attitude, and Practices) of smallholder farmers on adaptation and mitigation measures were launched. When paired with ways for reducing and adapting to climate change, the research try to define what smallholder farmers know (knowledge), believe (attitudes), and do (practices). Using a standardized form that may include both qualitative and quantitative questions, interviewers collect data. (Verd., 2023).

1.2 JUSTIFICATION

Climate Change's effects on peasant agricultural businesses worldwide have provided evidence to support conducting a research project called Knowledge, Attitude, and Practices of smallholder farmers on climate change adaptation and mitigation measures. Due to their restricted resource availability, technology, and their dependence on resources from nature for

their livelihoods, smallholder farmers are especially subject to the adverse impacts of climate change. Therefore, understanding the knowledge, attitudes, and practices of smallholder farmers is crucial for developing effective measures for adaptation and mitigation as the agricultural industry continues to suffer the effects of climate change.

It will entail surveying smallholder farmers to evaluate their understanding, attitudes, and practices regarding resilience and mitigation of climate change. The goal of the survey will be to better comprehend the current state of events and to pinpoint potential areas for improvement. The survey will be made to find any knowledge or resource gaps that might be filled by training or education.

The survey's findings will be applied to the creation of policies and programs that will assist smallholder farmers in coping with and mitigating the consequences of the changing climate. The findings are going to help comprehend the current state of affairs and point out areas where programs and policies could be strengthened. Additionally, the outcomes will contribute to the creation of educational and training initiatives aimed at improving the understanding and expertise of smallholder farmers in the relevant fields.

1.3 STATEMENT OF THE PROBLEM

The universal issue of climate change is significantly affecting agricultural productivity and food security, with smallholder farmers being particularly defenceless as a result of their reliance on crops supported by rain and limited supplies for adaptation. To effectively address this issue, it is crucial to comprehend the knowledge, attitudes, and practices (KAP) of smallholder farmers towards measures for adapting to and reducing the consequences of climate change. Therefore, the problem statement for the study is to determine the KAP of smallholder farmers regarding climatic change adaptation and mitigation measures. The study specifically aims to identify the smallholder farmers' level of knowledge on climate change, their attitudes towards how it affects agricultural productivity, and their practices for reducing the effects of climate change as well as adjusting to it.

1.4 AIM

The study seeks to determine what is known, thought, and done by smallholder farmers in relation to climate change adaptation and mitigation measures.

1.5 OBJECTIVES

1. To determine the knowledge of smallholder farmers on climate change adaptation and

mitigation measures.

2. To evaluate the attitudes of smallholder farmers on climate change adaptation and mitigation measures.

3. To determine the practices of smallholder farmers on climate change adaptation and mitigation measures.

1.6 RESEARCH QUESTIONS

1. To what extent do smallholder farmers possess knowledge of measures for reducing the effects of climate change and adapting?

2. What are the prevailing attitudes of smallholder farmers towards measures for reducing the effects of climate change and adapting?

3. What are the common practices adopted by smallholder farmers for reducing the effects of climate change and adapting?

1.7 LIMITATIONS

The research project may be limited by its geographical scope, as some smallholder farmers may be located in remote areas that are difficult to access. Also limited by the accessibility of smallholder farmers, as some may be reluctant to share information or may not be easily accessible. Lastly may be limited by its representativeness, as the sample of smallholder farmers may not represent the general population of smallholder farmers.

CHAPTER 2: LITERATURE REVIEW

2.1 INTRODUCTION

This chapter's goal is to go over the body of research on the knowledge, attitudes, and practices of smallholder farmers regarding measures for adapting to and mitigating the impacts of climate change, while also identifying factors that may influence their knowledge, attitudes, and practices in this regard.

2.2 KNOWLEDGE OF SMALLHOLDER FARMERS TOWARDS CLIMATE CHANGE ADAPTATION AND MITIGATION MEASURES.

STUDY PARTICIPANTS	KEY FINDINGS	REFERENCES
Evaluation of Southern Ethiopian Smallholder Farmers' understanding and Adaptation to Climate Change	<p>The study's results indicate that a significant proportion of smallholder farmers (81.8%) in the southern part of Ethiopia recognize changes in the local environment, with 71.9% of them reporting higher temperatures and 53.15% reporting reduced rainfall. Moreover, the majority of respondents (81.8%) believed that the climate has undergone changes within the past thirty years. Similarly, 71.95% of growers observed a rise in temperature, while 53.15% of them reported a reduction in precipitation.</p> <p>Smallholder farmers attributed the decrease in crop output (85.85%), reduction in household income (89.57%), the decline in agricultural land productivity (82.5%), increase in food prices (92.94%), a spike in shortages of food and hunger (79.47%), and rise in the expense of agricultural inputs (74.26%) to the implications of climate change.</p> <p>The study results showed smallholder farmers' age, educational level, agricultural knowledge, and access to climatic data significantly influenced their perception of climate change and its unpredictability.</p>	(Belay.,2022)
Small-scale farmers' perceptions of climate change along with the choice of adjusting measures in	The findings showed that approximately 49.41% of respondents perceived a decrease in rainfall amounts, while only about 4.71% perceived an increase. Additionally, around 18.53% of respondents did not observe a clear trend, and approximately 27.35% believed	Addis and Abirdew.,2021)

Central Ethiopia	<p>that the rainfall amount had remained unchanged over the past two decades.</p> <p>They also showed problems with rain that started before the perceived time (61.18%), stopped after the perceived time (42.06%), and ended before the time (61.18%).</p>	
South Africa's olifants watershed evaluation of smallholder farmers' perceptions of and adaptations to climate change	<p>The descriptive analysis, based on their perceptions of shifts in temperature and rainfall, the study found that 98% of the participants were conscious of changes in the climate.</p> <p>Crop growers in the region reported experiencing warmer temperatures (87%), decreased rainfall periods (76%), and earlier cessation of rainfall.</p> <p>Additionally, respondents reported a drop in temperature (37%) and precipitation (65%).</p> <p>The study revealed that 35% of the participants were involved in farming for between 30 and 39 years, whereas 28% had been involved for more than 50 years, and 38% had 40 to 49 years of experience in agriculture. This indicates that years of farming experience could potentially influence smallholder farmers' perceptions also comprehension of climatic change, farmers with more expertise are more probable to pay attention to long-term changes in the climate.</p>	(Olabanji et al.,2021)
South African smallholder farmers' opinions and responses to support systems and initiatives for combating climate change	<p>In contrast to 56% of male farmers, over 65% of female farmers reported having limited knowledge regarding climate change.</p>	Ubisi., 2016)

Knowledge, beliefs, and adaptation strategies of smallholder farmers to climate change in Kenya	The surveyed farmers displayed high sensitivity to temperature and rainfall variations patterns, with 81% of them reporting that they have seen modifications in their immediate location and regarded as evidence of climate change. Additionally, they had taken specific measures in order to lessen the effects of rising temperatures on their agricultural outputs.	(Ochieng., 2015).
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Table 2.1: literature review, knowledge of smallholder farmers towards climate change adaptation and mitigation measures.

2.3 ATTITUDES TOWARDS CLIMATE CHANGE ADAPTATION AND MITIGATION MEASURES.

STUDY PARTICIPANTS	KEY FINDINGS	REFERENCES
The role of small seeds in Zimbabwe's effort to adjust to changing climates.	(81.5%) farmers who responded to the survey's question about adaptation tactics said they were interested in using new agricultural techniques in order to combat climate change.	(Nciizah.,2021)
Elements that have an effect on how well smallholder farmers can adjust to the impacts of climate change in Zimbabwe.	The survey conducted in the Chiredzi District of Zimbabwe showed that 65% of the participating households used several methods to mitigate negative effects of climate change. These results underscore the need to address and increase the capability of smallholder farmers to overcome challenges that hinder their ability to improve their living standards. The study further revealed that, In contrast to their elderly counterparts, younger farmers proved more likely to adjust to variations in the climate, whereas bigger households were more probable to do so	(Muzamhindo., et al 2015)
The views of smallholder farmers and the elements	The findings indicated that farmers' attitudes were in favor of altering planting decisions, such as introducing new crops or crop varieties or altering the timing of site preparation or	(Shikuku., 2017)

affecting their ability to respond to climate hazards in East Africa	planting. Farmers wanted to use irrigation and agroforestry, but these solutions required more money.	
The purpose of this study was to look into how Tanzanian smallholder farmers may acquire and use agricultural knowledge to adapt to climate change.	The study had a higher percentage of men (60.9%) than women (39.1%) participated. The results suggest that most respondents had adequate farming experience to recognize the importance of accessing and utilizing information for adapting to changing climate. However, the findings also revealed that farmers faced certain obstacles in using agricultural information, including language barriers, unfavorable radio and television schedules, and insufficient funding for agricultural extension personnel.	(Sawe., 2022)
Knowledge and adaptation practices of smallholder farmers regarding climate change in Ethiopia.	39.1% of the farmers believed the information was helpful. 10.3% of respondents said they were unsure whether the material was useful, while 4.6% of respondents said they thought it was generally useful. On the other hand, none disputed the use of the information.	(Belay et al., 2022)
An investigation of the expertise, views, and strategies of smallholder farmers towards climate change adaptation in Mwala constituency, Kenya.	Farmers welcomed the changes and established cooperative organizations and farmers' associations to share information.	(Ochieng., 2015).

Table 2.2: literature review, attitudes towards climate change adaptation and mitigation measures.

2.4 PRACTICES TOWARD CLIMATE CHANGE ADAPTATION AND MITIGATION MEASURES.

STUDY PARTICIPANTS	KEY FINDINGS	REFERENCES
<p>An example of the methods Ghanaian smallholder farmers have used to deal with the effects of climate change</p>	<p>Smallholder farmers adopt various adaptation ways to lessen the impact of variations in the climate, such as altering their diversified cropping, diversified agriculture, and the use of environmentally friendly land and soil management practises, such as mulching, residual crop residue retention, and no tillage. Additionally, they use drought-tolerant crop varieties and intensify their irrigation efforts.</p> <p>Among these tactics, approximately 87% of women and 85% of men who were farmers indicated using crops that can withstand drought.</p> <p>According to the findings, 84% of men and 82% of women said they have adjusted their planting schedule to mitigate the effects of changing climate.</p> <p>Smallholder farmers are gradually moving away from farming and into non-farm jobs. 32% of men and 44% of women in the survey said they were moving to non-farm employment that involved sustainability, to adapt to the effects of climate change.</p> <p>The outcomes also showed that there were gender-specific obstacles to climatic change adaptation, also coping strategies.</p>	<p>(Antwi-Agyei and Nyantakyi-Frimpong., 2021)</p>
<p>Factors and practices influencing farmers' changes in climate adjustment in</p>	<p>Regarding crop management adaption tactics, the research found most commonly employed techniques were the use of fertilizers (12.5%), adoption of diversification of crops (5.6%) and improved seeds (10.7%). Additionally, the study indicated that</p>	<p>(Ahmed and Fatema.,2023)</p>

Bangladesh	<p>agricultural infrastructure, such as tractors and shallow pump machines, was utilized by a significant proportion of farmers (12.8%).</p> <p>Gender, experience with farming, family farm work, and the agricultural sector that had been destroyed were all factors that affected the adaptation..</p>	
The changing patterns of climate change adaption among Sub-Saharan African small-scale farmers,	<p>Farmers are adapting to the changing climate by diversifying their crops, varying the date of planting, plant tree crops, and employing mixed cropping as a reaction to shifting precipitation patterns. and find alternate sources of income.</p> <p>Farmers use water conservation methods including irrigation, wastewater reusing, and water harvesting.</p> <p>In response to short, intense rainy seasons, West African farmers produce grow hilly terrain, short-season crops, and conserve soil.</p>	(Abegunde, Sibanda and Obi.,2019)
Smallholder farmers' understanding of the changing climate and adaptation: results from southern Ethiopia	<p>According to the study, the most widely used CSA practises among farmers were biological measures, crop rotation, better cultivars, agricultural forestry techniques, improved breeding and incorporation of residue.</p> <p>Education, the number of family members, sex, the value of the ownership of land, past agricultural encounters, exposure to meteorological data, instruction obtained, societal affiliation, ownership of animals, agricultural profits, and agricultural service providers all influenced practices.</p>	(Belay., 2022)

<p>Environmental shifts in perceptions and approach decisions among smallholder farmers in Ethiopia,</p>	<p>The majority of sampled families (91.47%) carried out adaptation actions taken to lessen the impact of the changing climate.</p> <p>Diversifying crops (51.47%), increased crop range and quantity of input usage (62.65%), modifying the planting time (45.59%), conserving the environment and water (49.12%), and switching crop types (50.59%) identified the main adaptation measures used by small-scale cultivators in the study region.</p> <p>It was shown that gender, the number of families, agricultural ecology climate knowledge, agricultural failure history, and formal agricultural extension services all had a substantial influence on more than two farmers' adaption approaches at the same time.</p>	<p>(Addis and Abirdew.,2021)</p>
<p>Investigation of subsistence farmers' perceptions of environmental shift and adaptive responses, South Africa</p>	<p>The most favoured technique was the application of artificial fertiliser (72%), followed by the planting of improved seeds (72%).</p> <p>Farmers' techniques of environmental change adaption include changes in planting dates, the use of herbs and pesticides, mixed cropping, mulching, precipitation gathering, irrigation, and tree planting.</p> <p>Farmers stated they preferred growing better seeds and applying fertiliser to increase output when there is not much precipitation.</p> <p>The findings noted that farmers' adoption of shifting timing of sowing as an adaptive method was significantly dependent on their age as well as level of expertise.</p>	<p>(Olabanji., 2021)</p>

<p>The study was focused on examining how smallholder farmers perceive and adapt to mechanisms for actions and assistance related to climate change, South Africa.</p>	<p>Male (35%) responded better than female farmers (21%), using crop diversification and variety.</p> <p>Comparatively to male farmers (39%), about 41% of smallholder female farmers used the method of shifting the dates of planting, which required delaying the regular planting season. Additionally, mixed cropping was preferred by male farmers (15%) over female farmers (only 10%).</p> <p>According to the study, different genders adopted different techniques in reaction to the present environment. The study found that male farmers utilised different crops and diversity (35%) and multi-cropping (15%) more efficiently than female farmers, 41% of female farmers adjusted to changing planting times. The study also revealed that climate change awareness, access to extension services, source of income, and education were among the factors that influenced farmers' adaptation strategies.</p>	<p>(Ubisi.,2015)</p>
<p>The factors impacting smallholder farmers' adaptability to changing weather and unpredictability in Zimbabwe's Chiredzi District</p>	<p>Among the adaptive tactics included dry planting, planting short-season cultivars, moisture-preserving practices, organising prayers and religious celebrations, and diversifying crops.</p> <p>Dry planting (26.8% of all adaption approaches) and conservation agriculture (17.5%) were the two most popular. Short-season plant types planting (12.4%), religious celebrations and prayers (5.2%), crop diversification (3.1%), and nothing (35.1%)</p> <p>The data demonstrate that draught power, capital accessibility, extension training, and</p>	<p>(Muzamhindo.,2015)</p>

	<p>the number of participants fit to operate all have a favourable and considerable impact on farmer choices towards climatic adaptation. unpredictability. Farm income and the age of the head of the family both have a negative and significant influence over agriculturalists' choice to adjust.</p>	
<p>Smallholder farmers' views on changing climate concerns and adaptation efforts in northwest Ethiopia</p>	<p>Farmers' most common adaptation method (84% of households) was to modify crop planting dates.</p> <p>Terracing was a widely adopted farming technique, with approximately 82% of households using it.</p> <p>Some methods included growing trees (75% of families), using better agricultural seeds (67% of households), and using crop kinds that can withstand drought (51% of households).</p>	<p>(Likinaw., 2022)</p>
<p>Environmental change mitigation knowledge, attitudes, and practises among small-holder farmers in, Kenya</p>	<p>Agroforestry, farm forestry, growing diverse varieties of crops, and staggered planting times were some of the strategies the farmers used to combat climate variability.</p> <p>Age, formal education level, and level of climate change knowledge were the main motivators for farmers to invest in adaptation practices.</p>	<p>(Ochieng.,2015).</p>

Table2.3: literature review, practices toward climate change adaptation and mitigation measures.

CHAPTER 3: METHODOLOGY

3.1 INTRODUCTION

The research subject, instruments, also methods utilised to evaluate the KAP (knowledge, attitudes, and practices) of smallholder farmers in Manhenga are described in this chapter. The sample size, sampling procedures, and study design are all described. The next section of the chapter goes over the study methods, research validity, research reliability, research ethics, and lastly data analytics techniques.

3.2 DESCRIPTION OF THE STUDY AREA

The research was done in Manhenga, Bindura District, Mashonaland Central, Zimbabwe. Longitude: 31° 18' 45" East Latitude: 17° 23' 14" South. A hilly area, a rounded elevation that rises above the terrain below it with local relief of under 300 metres. A humid subtropical climate with influences from the monsoon.

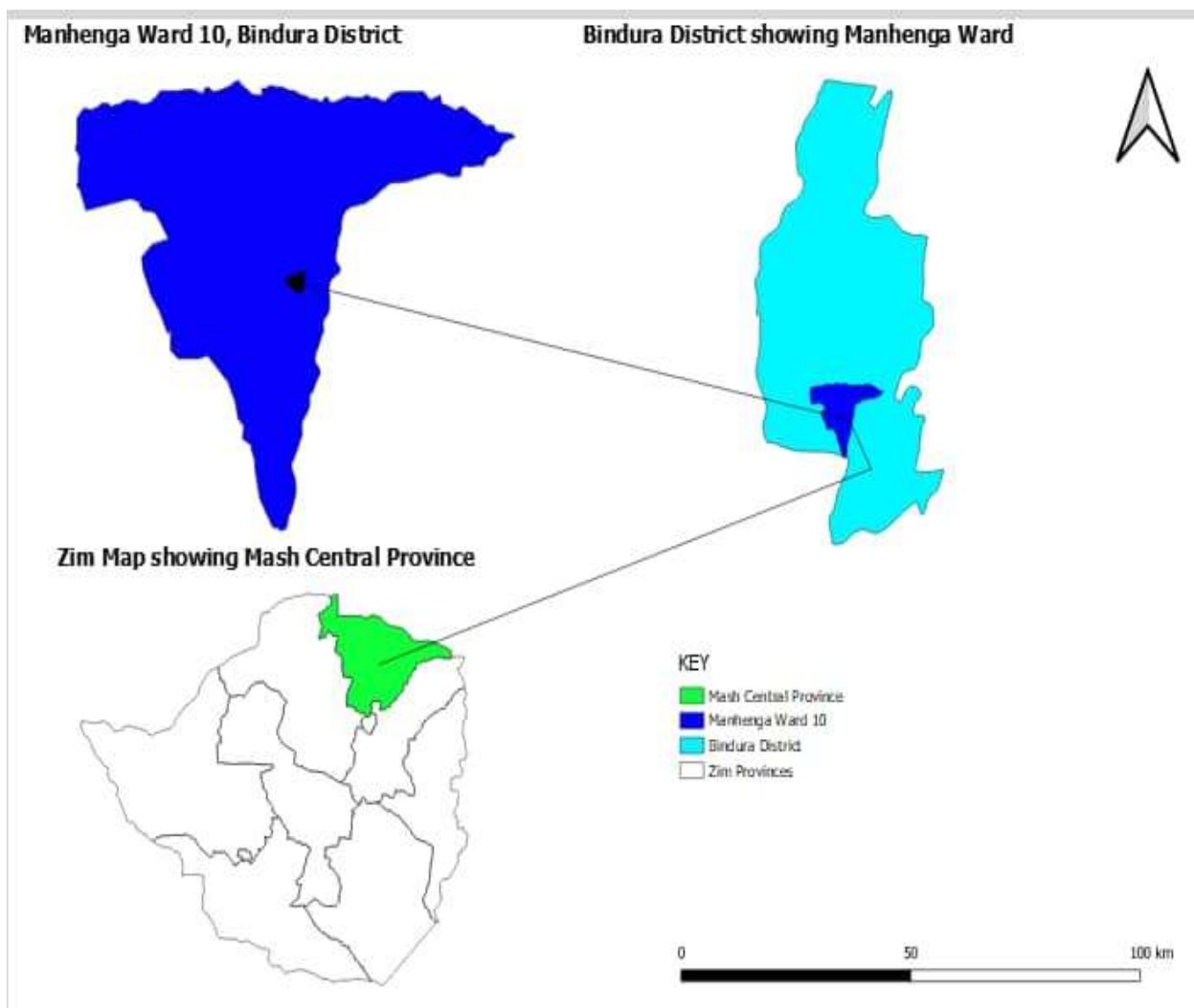


Figure 3.1: Study area map

3.3 STUDY DESIGN

A cross-sectional study was utilised to get information from a sizable population because it is very affordable, can capture many factors at once, and enables the gathering and analysis of a sizable number of findings and results to develop new ideas or hypotheses (Hlahla, 2023). The data gathered through surveys was analysed using both qualitative and quantitative approaches because the study is descriptive. The choice of 43 respondents was made using practical and straightforward random sampling techniques. The KAP survey questionnaire was used to obtain information about the participant's knowledge, attitudes, and practices regarding adaptation and mitigation strategies for climate change.

3.4 DATA SOURCES

During the research, the student utilised primary as well as secondary sources. Primary data is information that investigators have obtained from original sources through studies, polls, or interviews. The respondents and the BRDC were Manhenga's main sources of data. Information from primary sources has already been gathered and made available for researchers to utilise in their own research, such as in the literature review, in the form of secondary data, such as E-Journals. The data was gathered using semi-structured questionnaires.

3.5 SAMPLING METHOD AND SAMPLE SIZE

The research employed a multiple phases sample design to make the sampling process more realistic because of the vast population in the Manhenga community. A population was divided into smaller and smaller groups, and samples of people were taken from the smallest of these groups in a process known as multistage sampling.

The Manhenga community was first divided into strata by the researcher. The Manhenga community is divided into 13 wards. Secondly, the researcher employed convenience sampling to choose Ward 10. There are six villages in ward 10, Wayerera, Madzvanya, Chingwaru, Gunyere, Mhizha, and Nyanhewe. The selection of Mhizha village was made due to its proximity. The goal of convenience sampling is to collect data from people (the sample) who are easy for the researcher to reach. (Lee and Landers, 2022). The process is fairly quick and economical.

Finally, to choose 43 respondents, the researcher employed a straightforward random sampling approach. It's also important to note that using a simple random sample strategy, where every single village member was chosen at random and solely by chance, it was a

trustworthy way to get information. Due to the equal likelihood that each person would be picked and included in the sample, there is an opportunity to get information from all smallholder farmers in the selected village.

3.6 RESEARCH TOOLS

Questionnaires were employed by the researcher as a study instrument. A questionnaire is a research tool for gathering the responses of participants for a poll. It is made up of a series of questions or different kinds of questions, (HR and Aithal, 2022). Open-ended, closed-ended, or a hybrid of the two with 29 questions are frequently found in survey forms. Questionnaires were manually distributed by the author of the study to the target people in the chosen village. The researcher patiently awaited the respondents' responses to the survey. Four sections made up the questionnaire: 5 questions make up Section A's sociodemographic characteristics, while 6 questions make up Section B's knowledge. 7 questions make up Section C, which examines attitudes. Section D asks 10 questions about smallholder farmers' practices for mitigating climate change, and Section E with one question about smallholder farmers' media preferences.

3.7 RELIABILITY AND VALIDITY OF RESEARCH INSTRUMENTS

The researcher examined the results' consistency with other measures of the same concept and known theories over time, among different observers, and across various test sections to determine their reliability and validity. To increase validity, families were chosen at random.

3.8 ETHICAL CONSIDERATIONS

When it comes to employing people or animals in research, the study abides by the fundamental standards outlined in the Declaration of Helsinki. The researcher was given permission to conduct the research with the help of the supervisor and the FAES Chairperson. Additionally, the researcher was given permission by the Bindura Rural District Council in Manhenga to carry out the research. Following a thorough description of the study's objectives and procedures, every individual provided informed permission. When acquiring data, researchers always made an effort to ensure privacy when gathering data.

According to their race, colour, ethnicity, or socioeconomic status, the researcher did not arbitrarily and unfairly exclude some study participants. Participants agreed to take part in the research, and the researcher ensured that no one was coerced or forced but rather gave their consent to supply the information needed.

The study's participants were also informed by the researcher that they might leave the study at any time without having to offer a reason or deal with any repercussions. In order to maintain anonymity on the data collection platform, the researcher made sure that the responses they received did not include their names and addresses.

3.9 STATISTICAL ANALYSIS

Data analysis was conducted using Microsoft Excel 2019 and SPSS version 20 software. A score of 1 was assigned for each selected answer, while a score of 0 was given for each unselected answer. The scores were combined to obtain the total KAP score, which was used to evaluate the level of knowledge, attitude, and practice of the participants towards smallholder farmers and their adaptability to changes in the environment along with mitigation measures. Responses were categorized as 'Good' if the average score was above 70%, 'Fair' if it was between 51-69%, and 'Poor' if it was less than 50%. Tables and graphical representations were used to illustrate the data, and statistical analysis was performed at an acceptable level of significance of 5% and a confidence range of 95%.

CHAPTER 4: RESULTS

4.1 INTRODUCTION

This section is mostly concerned with the data presentations and the analysis of the research project's outcomes. Tables were used to present the data.

4.2 SECTION A: DEMOGRAPHY

Demographic variable	Category	n =43	%=100
Age	18 to 25 years	16	37.2
	26 to 33 years	13	30.2
	34 to 41 years	5	11.6
	42 to 49 years	5	11.6
	50 to 57 years	2	4.7
	58+	2	4.7
Sex	Male	18	41.9
	Female	25	58.1
Employment	Unemployed	26	60.5
	Employed	17	39.5
Number of years in Mhizha village	-1 year	12	27.9
	1 to 5 years	11	25.6
	5 to 10 years	7	16.3
	10 + years	13	30.2
Education level	Primary	8	18.6
	Secondary	30	69.8
	Tertiary	5	11.6

table 4.1: demography variables

This table shows the distribution of a sample population (n=43) based on several demographic variables. The age is divided into six categories. Largest age group in the sample is 18-25 years (16 individuals or 37.2% of the sample), followed by 26-33 years (13 individuals or 30.2% of the sample).

Secondly, 18 individuals (41.9% of the sample) identified as male, and 25 individuals (58.1% of the sample) identified as female.

Thirdly, employment status, with 26 individuals (60.5% of the sample) being unemployed and 17 individuals (39.5% of the sample) being employed.

The number of years the individuals have lived in Mhizha village. The largest group in the sample is those who have lived in the village for over 10 years (13 individuals or 30.2% of the sample).

Education level, with 8 individuals (18.6% of the sample) having a primary education, 30 individuals (69.8% of the sample) having a secondary education, and 5 individuals (11.6% of the sample) having a tertiary education.

4.3 SECTION B: KNOWLEDGE OF CLIMATE CHANGE ADAPTATION AND MITIGATION MEASURES.

Knowledge Variable	Participant response	N=43	%	Score
K1 . Do you know what the word "climate change" means?	Yes	36	83.7	0.837
	No	7	16.3	
K2 . Where are you likely to have encountered the term "climate change"?	Television	8	18.6	0.186
	Radio	11	25.6	0.256
	Newspaper	2	4.7	0.47
	Internet	7	16.3	0.163
	friend	3	7.0	0.70
	Family member	2	4.7	0.47
	School	28	65.1	0.651
K3 . Explain what you understand by climate change	Able to define	32	74.4	0.744
	Unable to define	11	25.6	
K4 . What kinds of incidents do you believe will occur as an outcome of climate change?	Tropical storms	16	37.2	0.372
	Low rainfall	29	67.4	0.674
	Flooding	16	37.2	0.372
	Increase in temperature	35	81.4	0.814
	Increase in rainfall	15	34.9	0.349
	Crops and livestock diseases	22	51.2	0.512
	Insect and pest prevalence	17	39.5	0.395
	Reduced fish levels	12	28.6	0.286
	Earthquake	15	34.9	0.349
Cyclone	25	58.1	0.581	

K5 .In the last five years, what kinds of events have you experienced in Manhenga?	Tropical storms	0	0	
	Low rainfall	24	55.8	0.558
	Flooding	0	0	
	Increase in temperature	32	74.4	0.744
	Increase in rainfall	5	11.6	0.116
	Crops and livestock diseases	28	65.1	0.651
	Insects and pests prevalence	21	48.8	0.488
	Reduced fish levels	2	4.7	0.470
	Earthquake	1	2.3	0.230
Cyclone	0	0		
K6 . Which of the factors listed below do you believe is the primary cause of present-day climate change?	Agriculture	11	25.6	0.256
	Combustion of fuels	28	65.1	0.651
	Electricity generation	10	23.3	0.233
	Industry/Factories	22	51.2	0.512
	Land clearing	13	31.0	0.310
	Transportation	13	30.2	0.302
Veldfires	22	51.2	0.512	
Total score				16.814

table 4.2: knowledge of climate change adaptation and mitigation measures.

Table (5) provides information on the knowledge of climate change among a sample population (n=43).

The total score for knowledge of smallholder farmers was 16.814 and it was divided by 33 participant responses to give a 0.510 score. To find the percentage knowledge average score the score is then multiplied by 100% to give 51% which is slightly fair.

(83.7%) participants have heard climate change. School is common Source of knowledge (65.1%), followed by radio (25.6%) and television (18.6%). (74.4%) participants were able to define climate change while 25.6% were unable to define it.

The most commonly selected events were an increase in temperature (81.4%), low rainfall (67.4%), and cyclones (58.1%). The most commonly selected events experienced in the last five years in Manhenga were low rainfall (55.8%), crop and livestock diseases (65.1%), and insect and pest prevalence (48.8%). Combustion of fuels, was the most commonly selected factor (65.1%), followed by industry/factories (51.2%) and veldfires (51.2%).

Overall, the responses show that the sample population has a reasonable level of knowledge about climate change, with most participants having heard of the term and being able to define it. The participants also appear to have a good understanding of the kinds of events that are the result of climate change. However, there is some variation in the responses regarding the factors causing climate change, with no single factor being selected by a large majority of participants.

4.4 SECTION C: ATTITUDE TOWARD CLIMATE CHANGE ADAPTATION AND MITIGATION MEASURES.

Attitude Variable	Participant response	N=43	%	Score
A1 .How eager are you to discover the issue of climate change?	Interested	28	65.1	0.651
	Somehow interested	9	20.9	0.209
	Not interested	0	0	
	I don't know	6	14.0	
A2. How significant do you believe the difficulties posed by climate change are affecting the agriculture sector? industry on a ranking of 1 to 5, with 5 considered the most essential?	1	4	9.3	
	2	4	9.3	
	3	12	27.9	
	4	10	23.3	
	5	14	32.6	0.326
A3.Are you comfortable planting new varieties or seeking information and training?	Yes	40	93.0	0.930
	no	3	7.0	
A4. Whom do you believe should be in charge of dealing with climate change problems?	All stakeholders	15	34.9	0.349
	Government	14	32.6	
	Cooperatives	1	2.3	
	Agriculture firms	1	2.3	
	Regional	12	27.9	

	organizations			
	Everyone	16	37.2	0.372
	The future generations	1	2.3	
	Community groups	4	9.3	
	Volunteer organizations	2	4.7	
	Private sector	1	2.3	
A5. Is the country's Ministry of Agriculture undertaking everything possible to help smallholder farmers cope with climate change concerns?	Yes	28	65.1	0.651
	No	14	32.6	
A6. How well aware are you of the ministry's stance on the issue of climate change?	Great deal	9	20.9	0.209
	Fair amount	14	32.6	0.326
	Not much	6	14.0	
	Hardly anything	7	16.3	
	I do not know	7	16.3	
A7. Do you believe that suitable knowledge on climate change is currently being shared with smallholder farmers?	Yes	23	53.5	0.535
	No	6	14.0	
	I do not know	14	32.6	
Total score				4.478

table 4.3: attitude toward climate change adaptation and mitigation measures.

This table provides information on the attitudes of a sample population (n=43). The average score for attitude was 4.478 when all participant responses were added up, the score was divided by 10 correct options resulting in 0.448 and 45% when converted to percentages, which is bad because it is below half.

The participants responded that they were interested (65.1%) or somehow interested (20.9%) in learning more. (32.6%) selected 5, indicating that they believe climate change is a major concern for farmers. (93.0%) were comfortable planting new types, or searching for information and expertise. Most commonly selected response for tackling climate change issues was "everyone" (37.2%), followed by "all stakeholders" (34.9%) and "regional organizations" (27.9%). (65.1%) participants believed the Ministry of Agriculture

undertaking everything possible to assist smallholder farmers in adjusting to changing conditions concerns. but a significant minority responded no (32.6%). Participants responded that they knew a fair amount (32.6%) or a great deal (20.9%) about the Ministry's stance on climate change (53.5%) said yes, while 14.0% responded no, and 32.6% were unsure that suitable knowledge on climate change is currently being shared to smallholder farmers.

Overall, the responses suggest that the sample population is generally interested in learning more about the effects of environmental change including its agricultural impact. The majority also believe that everyone has a responsibility to tackle climate change issues and that adequate information is not necessarily being shared with smallholder farmers at present. However, there is some variation in the responses regarding the Ministry of Agriculture's response to climate change, with a significant minority of participants responding that they do not believe the Ministry is doing all it can to assist smallholder farmers.

4.5 SECTION D: PRACTICES TOWARD CLIMATE CHANGE ADAPTATION AND MITIGATION MEASURES.

Practice Variable	Participant response	N=43	%	Score
P1. Have you tried to intentionally prohibit any of these actions?	Cutting down trees	31	72.1	0.721
	Waste burning	17	39.5	0.395
	Waste products dumping	8	18.6	0.186
	Use of pesticides	20	46.5	0.465
	Ploughing down slope	19	44.2	0.442
	River bank cultivation	24	55.8	0.558
P2. In overall, which of these practises do you practise on your land?	Irrigation	16	37.2	0.372
	Composting	21	48.8	0.488
	Ridging	14	33.3	0.333
	Contour Marking	7	16.3	0.163
	Aforestation	7	16.3	0.163
	Agro-Forestry	4	9.3	0.930
	Conservation	9	20.9	0.209

	Agriculture			
P3. Do you hold prayers and religious festivals for rain	Yes	30	69.8	
	No	13	30.2	0.302
P4. Do you practice crop diversification?	Yes	29	67.4	0.674
	No	14	32.6	
P5 .Do you practice dry planting?	Yes	20	46.5	
	No	23	53.5	0.535
P6 .Do you practice zero-tillage?	Yes	32	74.4	0.744
	No	11	25.6	
P7. Did you change the planting time?	Yes	31	72.1	0.721
	No	12	27.9	
P8 .Do you practice crop rotation and mixed cropping techniques?	Yes	36	83.7	0.837
	No	7	16.3	
P9. What varieties do you grow?	short-season varieties	34	79.1	0.791
	long season varieties	9	20.9	
P10. Do you get information from extension services?	Yes	22	51.2	0.512
	No	21	48.8	
Total score				11.211

table 4.4: practices toward climate change adaptation and mitigation measures.

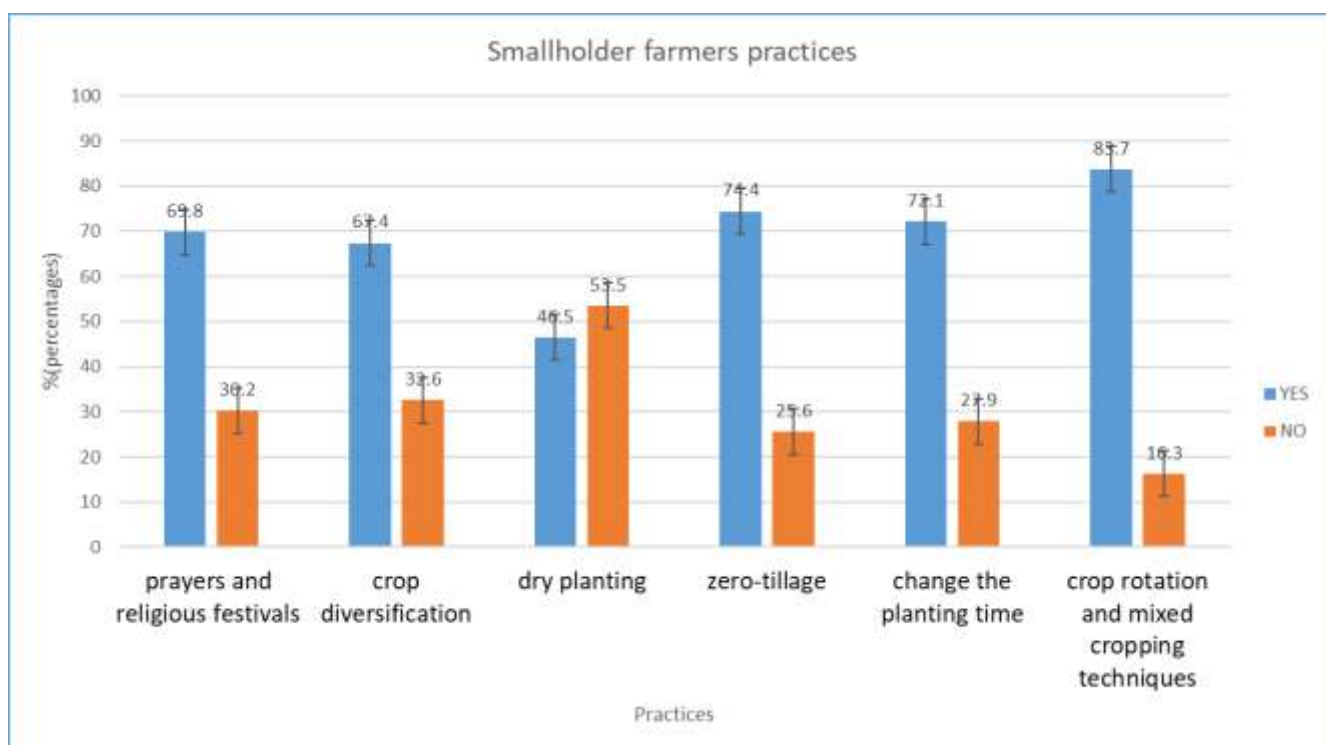


Figure 4.1: smallholder farmers' practices in Manhenga

This table provides information on the agricultural practices of a sample population (n=43) in relation to environmental conservation and adaptation.

The average score for the practices of smallholder farmers was 11.211 and it was divided by 21 participant responses to give a 0.533 score. The score was multiplied by 100% to give 53% which is fair, slightly above half.

The majority of participants responded that they have tried to prevent cutting down of trees (72.1%) and river bank cultivation (55.8%), while smaller percentages have tried to prevent waste burning (39.5%), waste products dumping (18.6%), use of pesticides (46.5%), and ploughing down slope (44.2%).

The most commonly selected practices on farmland were composting (48.8%), followed by conservation agriculture (20.9%), irrigation (37.2%), ridging (33.3%), afforestation (16.3%), agro-forestry (9.3%), and contour marking (16.3%).

The majority of participants (69.8%) hold religious celebrations and prayers for rain. (67.4%) diversify their crops. (46.5%) engage in dry planting. (74.4%) use zero-tillage. (72.1%) altered the planting time. (83.7%) use crop rotation and mixed cropping methods. (20.9%) of participants grow long-season varieties, compared to (79.1%) who grow short-season kinds. (51.2%) of the participants rely on extension services for information.

Overall, the responses suggest that the sample population engages in a variety of agricultural practices that are aimed at environmental conservation and adaptation. The majority of participants have tried to prevent activities with negative environmental impacts, practice crop diversification, and engage in conservation agriculture. However, there is room for improvement as only slightly more than half of the participants get information from extension services, and some practices, such as dry planting, are not widely adopted.

4.6 SECTION E: MEDIA PREFERENCE AND USAGE BY SMALLHOLDER FARMERS

Media Preference and usage Variable	Participant response	N=43	%
M1. Which method of information delivery do you think is most effective for you?	Television	17	39.5
	radio	18	41.9
	newspaper	1	2.3
	Internet	9	21.4
	Community groups	10	23.3
	Workshops	3	7.0
	Posters	3	7.0

	School	14	32.6
	Friends or family	3	7.0
	faith-based organizations	3	7.0
	cell phones	23	53.5

Table 4.5: media preference and usage by smallholder farmers

This table provides information on the media preferences and usage of a sample population (n=43) in relation to accessing information.

The most commonly selected medium was cell phones/smartphones (53.5%), followed by radio (41.9%), television (39.5%), schools (32.6%), and community groups (23.3%). The remaining options, including newspapers, the internet, workshops, posters, friends/family, and faith-based organizations, were selected by smaller percentages of participants.

Overall, the responses suggest that the sample population relies heavily on digital media, specifically cell phones/smartphones, to access information. This is followed by more traditional media such as radio and television. Schools and community groups are also important sources of information for a significant minority of participants. The low percentage of participants who selected newspapers, workshops, posters, friends/family, and faith-based organizations suggests that these media may not be as effective in relaying information to the population surveyed.

CHAPTER 5: DISCUSSION

5.1 KNOWLEDGE OF SMALLHOLDER FARMER'S CLIMATE CHANGE ADAPTATION AND MITIGATION MEASURES

The score for knowledge of smallholder farmers was 0.510. To find the percentage knowledge average score the score is then multiplied by 100% to give 51% which was slightly fair.

A large percentage of participants (83.7%) were familiar with the term "climate change," with schools serving as the main source of knowledge (65.1%), followed by radio (25.6%) and television (18.6%), potentially due to their secondary school education, where they were taught geography basics. These findings were consistent with previous research conducted in South Africa, indicated that 98% of responders were conscious of changes in climate, with crop growers experiencing higher temperatures (87%), shorter rainfall durations (76%), and earlier rainfall cessations (Olabanji et al., 2021). Furthermore, 74.4% of participants were able to define climate change.

The most commonly selected events related to climate change were an increase in temperature (81.4%), low rainfall (67.4%), and cyclones (58.1%), which were consistent with observed changes in climate patterns. Similar findings were reported in other studies, such as (Belay.,2022), where (81.8%) of respondents believed the changing of local environment, and (71.9%) noted warmer temperatures also, 53.15% noted decreased rainfall. Moreover, in the Manhenga, low rainfall (55.8%), crop and livestock diseases (65.1%), and insect and pest prevalence (48.8%) were the most commonly selected events experienced in the last five years. These findings were similar to research conducted in Mwala constituency, Machakos County, Kenya, where farmers were sensitive to fluctuations in temperature and rainfall, with 81% of respondents noticing changes in their immediate surroundings (Ochieng.,2015).

Finally, Combustion of fuels, was the most commonly selected factor (65.1%) contributing to climate change, followed by industry/factories (51.2%) and veld fires (51.2%). These factors were selected by farmers determined by their experiences also observations of modifications to their local environment.

5.2 ATTITUDE TOWARDS SMALLHOLDER FARMER'S CLIMATE CHANGE ADAPTATION AND MITIGATION MEASURES

Average score for attitude was 0.448 and 45% when converted to percentages, which is below half.

The study found that a significant majority of participants were interested in learning more about climate change issues, with (65.1%) indicating that they were very interested and (20.9%) somehow interested. Additionally, (32.6%) of participants considered climate change issues to be very important to the agricultural sector. These findings highlight the need for targeted education and outreach efforts to promote smallholder farmers adopting climate-smart farming practises.

The research also found that large proportion (93.0%) of participants were comfortable with adopting new practices and seeking information as well as climate change adaptation education. It is consistent with research conducted in Zvishavane District, Zimbabwe, where the majority of farmers (81.5%) expressed interest in using new agricultural techniques to deal with climate change (Nciizah., 2021). Similarly, research conducted in East Africa showed that farmers were willing to alter planting decisions and adopt new practices to address climate change, such as introducing new crops or crop varieties (Shikuku., 2017).

There was also a recognition among participants of the need for collective action and shared responsibility in addressing climate change, with "everyone" (37.2%) and "all stakeholders" (34.9%) being the most commonly selected responses for tackling climate change issues.

Regarding the Ministry of Agriculture's response to climate change issues, (65.1%) of participants believed that the ministry of Agriculture undertaking everything to assist smallholder farmers in adjusting to climate change concerns, but a significant minority responded negatively (32.6%). The results suggest that there may be gaps in communication or outreach efforts, as (32.6%) of participants were unsure about suitable knowledge on climate change is being shared to smallholder farmers. These findings are consistent with research conducted in southern Ethiopia, where only (4.6%) of respondents found the information on climate change to be generally useful (Belay et al., 2022).

Finally, the study found that farmers in the Mwala constituency of Machakos County, Kenya, established cooperative organizations and farmers' associations to share information and welcome changes to address climate change (Ochieng, 2015).

5.3 PRACTICES OF SMALLHOLDER FARMERS` CLIMATE CHANGE ADAPTATION AND MITIGATION MEASURES

The score was 0.533 for the practices of smallholder farmers. The score was multiplied by 100% to give 53% which is slightly above half.

The study found that the majority of participants attempted to prevent cutting down trees (72.1%) and river bank cultivation (55.8%), while a smaller percentage attempted to prevent burning waste material (39.5%), disposing of hazardous waste (18.6%), using pesticides (46.5%), and ploughing down slope (44.2%). These responses may reflect the perceived importance of these practices for environmental conservation and the influence of cultural and economic factors on participant behavior.

On farmland, composting (48.8%) was the most commonly selected practice, followed by conservation agriculture (20.9%), irrigation (37.2%), ridging (33.3%), afforestation (16.3%), agro-forestry (9.3%), and contour marking (16.3%). The higher percentage of composting may indicate a growing recognition of its benefits for both the environment and agriculture, as it transforms organic waste into a nutrient-rich soil amendment that can enhance soil quality, water retention, and plant growth. The study's findings align with previous research conducted in Sub-Saharan Africa, which indicates that farmers use various water conservation methods, including irrigation, wastewater reusing, and water harvesting. (Abegunde, Sibanda and Obi.,2019)

According to the study, the majority of participants (69.8%) engage in religious celebrations and prayers for rain, which may indicate the cultural and spiritual significance of water and rain in the community, as well as the traditional practices associated with agriculture. These findings are consistent with previous research conducted in the Chiredzi District of Zimbabwe, where religious celebrations and prayers for rain were reported at a rate of (5.2%) (Muzamhindo.,2015).

Additionally, the results showed that a significant proportion of smallholder farmers diversify their crops (67.4%), recognizing the importance of crop diversity in improving resilience to climate change and reducing risk. Dry planting (46.5%) was also prevalent among participants, which may reflect the challenges faced by smallholder farmers in Manhenga due to unpredictable or insufficient rainfall. These results align with previous research conducted in the Chiredzi District of Zimbabwe, (Muzamhindo.,2015) where dry planting (26.8% of all adaption approaches) and conservation agriculture (17.5%) were the most popular methods.

Short-season crop planting (12.4%), crop diversification (3.1%), and doing nothing (35.1%) were also reported.

A significant proportion of smallholder farmers (74.4%) use zero-tillage, which may indicate their growing recognition of the benefits of conservation agriculture as well as environmentally sound land management practises. These findings were consistent with research conducted in Northern Ghana, where farmers employ various adaptation techniques, including diversification of crops, multipurpose agriculture, and smart land and soil conservation techniques include mulching, use of crop residues, and no-tillage cultivation, (Antwi-Agyei and Nyantakyi-Frimpong., 2021).

The study also found a significant proportion in farmers (72.1%) altered their crop planting time, which can help optimize crop performance and reduce the risk of crop failure. These results align with research conducted in northwest Ethiopia, (Likinaw., 2022) where farmers' most common adaptation method (84% of households) was modifying their crop planting dates.

The study found that a significant proportion of farmers (83.7%) use crop rotation and mixed cropping methods, which can improve soil health and fertility, lower the likelihood of insects and infections, optimize nutrient uptake, also increase the resilience of agricultural systems to environmental stressors such as drought. These findings are consistent with research conducted in southern Ethiopia, where farmers widely use CSA practises which include rotational cultivation, upgraded cultivars, high-yielding crops, agroforestry techniques, enhanced breeds and residual integration, (Belay., 2022).

In terms of crop varieties, only a small proportion of participants (20.9%) grow long-season varieties, while the majority (79.1%) grow short-season kinds. This may be because short-season varieties require less water and can be harvested earlier in the season, reducing the drought-related agricultural failure or other environmental stressors. These findings align with research conducted in Sub-Saharan Africa, which suggests that small-scale farmers should diversify their crops, and vary the date of planting in coping with changing rainfall trends, (Abegunde, Sibanda and Obi.,2019

The study's results align with previous research conducted on West African farmers who cultivate upland terrain, practice soil conservation, and produce short-duration crops (Abegunde, Sibanda, and Obi.,2019). This indicates that smallholder farmers across different

regions may use similar agricultural practices to cope with climate change along with improvements in their livelihoods.

Moreover, the study found that a significant proportion of participants (51.2%) rely on extension services for information. This highlights the crucial role that agricultural extension agencies in supplying smallholder farmers with access to information, knowledge, and resources that can enhance their agricultural productivity and improve their livelihoods.

CHAPTER 6: CONCLUSION AND RECOMMENDATIONS

6.1 CONCLUSION

Considering the results presented, it appears that smallholder farmers in Manhenga have a reasonable depth of understanding of the changing climate. The majority of participants have heard of the term and are able to define it. Additionally, the participants seem to have a good understanding of the kinds of events such as temperature rises, limited precipitation, and disasters are all consequences of environmental degradation.

However, there was variation in the responses regarding the factors causing climate change, with no single factor being selected by a large majority of participants. Combustion of fuels was the most commonly selected factor, followed by industry/factories and veld fires. This suggests that there may be some confusion or lack of clarity among participants about the specific factors that contribute to climate modification.

Also, the attitudes of the participants towards climate alteration were mixed, with some participants showing a high level of interest and support for climate change issues, while others were less convinced. However, the majority of participants were willing to learn more and take action to lower the impact of climatic change on agricultural techniques.

The practices of smallholder farmers in Manhenga demonstrate a positive trend toward environmental conservation and adaptation. The majority of participants have tried to prevent activities with negative environmental impacts, practice crop diversification, and engage in conservation agriculture. However, there is still room for improvement, as some practices, such as dry planting, are not widely adopted.

Regarding the issue of information accessibility, the findings indicate that smallholder farmers rely heavily on digital media, specifically cell phones, to learn more about climate change. This emphasises the significance of utilising technology to spread information about climate change and ways to adapt to smallholder farmers..

6.2 RECOMMENDATIONS

Considering these results, it is suggested that extension services be expanded in order to offer timely and precise details concerning climate change and adaptation efforts to smallholder farmers. Furthermore, efforts should be made to improve the use of environmentally friendly agriculture practises, like dry planting also agroforestry, through targeted training programs

and incentives. Finally, the use of technology, such as mobile applications and social media, should be explored as a means of reaching and engaging with smallholder farmers more effectively.

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APPENDICES

APPENDIX 1: RESEARCH QUESTIONNAIRE

My name is Jervas Gift Muchabaya registration number (B193394B) from Bindura University of Science Education, Faculty of Agriculture and Environmental Science. I would like to conduct a study survey in Manhenga in Bindura District of Mashonaland Central Province in Zimbabwe for my final year dissertation. The aim of the research is to evaluate smallholder farmers' knowledge, attitudes, and practices regarding adaptation to and mitigation of climate change. Your home was chosen at random. We will handle all of the information we receive from you in strict confidence. Please take a moment to respond to this question. Your responses will provide us with information that we can use to plan environmental initiatives and create more effective climate change regulations.

Remember that this is only a survey and not an exam; we only want to know your thoughts on these issues. There are no "correct" or "incorrect" responses. If you would voluntarily enable me to interview you based on this questionnaire, I would be very grateful. Please feel free to respond; all ethical principles were followed.

INSTRUCTIONS TO PARTICIPANTS

- *Tick the answer and fill in where ever possible.*
- *Never put your name on any portion of the page.*

SECTION A: SOCIO-DEMOGRAPHIC CHARACTERISTICS

1. Age (years): 18-25 26-33 34-41 42-49 50-57 58+
2. Sex: Male Female
3. Employment: Unemployed Employed
4. How long have you been a resident of this area?
Less than 1 Year 1 – 5 years 5 – 10 years Over 10 years
5. Highest Educational level: Primary Secondary Tertiary

SECTION B: KNOWLEDGE

6. Have you heard of the term climate change? YES NO
7. If yes, where have you heard the term climate change?

TV Radio Newspaper Internet Friend Family member School

8. Explain what you understand by climate change?

9. What types of incidents do you believe climate change is causing?	Tick
Tropical storms	<input type="checkbox"/>
Low rainfall	<input type="checkbox"/>
Flooding	<input type="checkbox"/>
Increase in temperature	<input type="checkbox"/>
Increase in rainfall	<input type="checkbox"/>
Crops and livestock diseases	<input type="checkbox"/>
Insects and pest prevalence	<input type="checkbox"/>
Reduced fish levels	<input type="checkbox"/>
Earthquake	<input type="checkbox"/>
Cyclone	<input type="checkbox"/>

10. In the last five years, what kinds of events have you experienced in Manhenga?	Tick
Tropical storms	<input type="checkbox"/>
Low rainfall	<input type="checkbox"/>
Flooding	<input type="checkbox"/>
Increase in temperature	<input type="checkbox"/>

Increase in rainfall	<input type="checkbox"/>
Crops and livestock diseases	<input type="checkbox"/>
Insects and pest prevalence	<input type="checkbox"/>
Reduced fish levels	<input type="checkbox"/>
Earthquake	<input type="checkbox"/>
Cyclone	<input type="checkbox"/>

11. What factors do you believe are responsible for global climate change?

- ❖ Agriculture
- ❖ Burning fuels, such as coal, oil, and natural gas
- ❖ Electricity generation
- ❖ Industry/Factories
- ❖ Land clearing
- ❖ Transportation
- ❖ Veldfires

SECTION C: ATTITUDES

12. What level of interest do you have in learning more regarding climate change?

- ❖ Very interested
- ❖ Somehow interested
- ❖ Not interested
- ❖ Don't know

13. How significant do you believe climate change issues are to the agriculture industry on a rating system of 1 to 5, with 5 indicating the most essential?

1 2 3 4 5

14. Are you comfortable planting new varieties or seeking information and training?

YES NO

15. Who, in your opinion, ought to be in charge of resolving the difficulties associated with climate change?

All stakeholders The government The cooperative Agricultural NGOs Regional organizations Everyone The future generations

Community groups Volunteer organizations Private sector

16. Is the Ministry of Agriculture making every effort to aid smallholder farmers in coping with the effects of climate change? YES NO

17. If YES, to what extent are you aware of the Ministry's reaction to climate change?
- ❖ A great deal
 - ❖ A fair amount
 - ❖ Not much
 - ❖ Hardly anything
 - ❖ Don't know
18. Do you believe that smallholder farmers are receiving enough information about climate change from the media or other sources? Yes No I don't know

SECTION D: PRACTICES

19. Have any of the following practices been actively avoided by you?
- ❖ Cutting down of trees
 - ❖ Burning of waste material
 - ❖ Disposal of waste/hazardous material
 - ❖ Use of pesticides
 - ❖ Ploughing down slope
 - ❖ River bank cultivation
20. Which of the following activities do you typically carry out on the area of land?
- ❖ Irrigation Composting Ridging Contour marking
 - ❖ Aforestation Agro-forestry Conservation agriculture
21. Do you hold prayers and religious festivals for rain? Yes No
22. Do you practice crop diversification? Yes No
23. Do you practice dry planting? Yes No
24. Do you practice zero-tillage? Yes No
25. Did you change the planting time? Yes No
26. Do you practice crop rotation and mixed cropping techniques? Yes No
27. What varieties do you grow? short-season varieties long season varieties
28. Do you get information from extension services? Yes No

SECTION E: USAGE AND PREFERENCE FOR MEDIA

29. Which do you think communicates information to you the best?
- Television Radio Newspapers Internet Community groups Workshops Posters
 Schools Friends/Family Faith-based organizations Cell Phones

APPENDIX 2: ACADEMIC SUPERVISOR'S PERMISSION

DEPARTMENT OF ENVIRONMENTAL SCIENCE



Bag 1020 **BINDURA, Zimbabwe**
Tel: 263 - 71 - 6505
Cell: 0778371588
Email: vamugure@gmail.com

BINDURA UNIVERSITY OF SCIENCE EDUCATION

04 March 2023

Dear Sir/Madam

REQUEST FOR PERMISSION TO COLLECT DATA FOR AN ACADEMIC RESEARCH PROJECT

PROJECT TITLE: AN ASSESSMENT ON CAP OF SMALLHOLDER FARMERS ON CLIMATE CHANGE ADAPTATION AND MITIGATION MEASURES.

ACADEMIC SUPERVISORS: MR T NYAMUGURE

This letter serves to inform you that **Jevas Gift Muchabaya, Registration Number (B193394B)** is a fourth-year student at Bindura University of Science Education, in the Department of Environmental Science. During his fourth year of study, he is supposed to do a research project in his area of specialisation.

Please assist in any possible way. Data collected will be used for academic purposes only and will not be published without your prior consent.

Thank you for your assistance.

Yours faithfully,


Mr T. Nyamugure
DEPARTMENT OF ENVIRONMENTAL SCIENCE



APPENDIX 3: BRDC PERMISSION

BINDURA RURAL DISTRICT COUNCIL

All communications
To be addressed to
The Chief Executive Officer
P/A Manhenga
BINDURA



Cell: 0778006259

ceo.bindurardc@gmail.com

VISION

A Council with socially and economically empowered communities by 2030.

Ref: XC121/ADM23

Jevas Gift Muchabaya

13 April 2023

RE: APPLICATION FOR PERMISSION TO UNDERTAKE RESEARCH IN BINDURA DISTRICT

This letter will serve as authorization of Jevas Gift Muchabaya to conduct data gathering research for project entitled "An assessment on kap of smallholder farmers on climate change adaptation and mitigation measures". After the completion of your study, the data gathered may be of use to the local authority, may you share the data with this office after.

Should you require any clarification pertaining to the same do not hesitate to contact the undersigned.

Yours faithfully


D. KAPONDORO
CHIEF EXECUTIVE OFFICER
P/A, BINDURA
TEL: 077 800 6259

BINDURA RURAL DISTRICT COUNCIL
REGISTRY
13 APR 2023
P/A, BINDURA
TEL: 077 800 6259

APPENDIX 3: FIELD PICTURE

