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An Examination of the Effectiveness of Government Institution in Promoting Climate Change to Enhance Agricultural Productivity

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Abstract

This study examines the effectiveness of government institutions, specifically the Zambian Ministry of Agriculture, in promoting climate change adaptation to improve agricultural productivity in Chipata District, Zambia. The study responds to climate-related challenges such as erratic rainfall, drought, and pest infestations, which have significantly impacted crop yields. The research objectives were to determine factors affecting productivity among smallholder farmers, evaluate the Ministry's climate adaptation programs, and provide recommendations to mitigate climate impacts on agriculture.

A mixed-methods research design was utilized, incorporating both qualitative and quantitative approaches. The sample included 100 participants, comprising smallholder farmers, Ministry officials, and other stakeholders. Data were collected through interviews and questionnaires, allowing for a comprehensive assessment of both stakeholder perspectives and the quantitative impacts of climate adaptation interventions. The data analysis was conducted through thematic analysis for qualitative data and statistical analysis for quantitative data.

The findings indicated that several factors affected agricultural productivity, 28.85% over a quarter of the respondents identified erratic rainfall as their most significant challenge, leading to decreased crop yields and unpredictability in farming cycles. Close to 27% of respondents indicated that their limited access to crucial agricultural inputs like seeds and fertilizers significantly hindered their productivity. Around 19% of respondents mentioned that increasing incidences of pests and livestock diseases further decreased productivity and profitability. Although government interventions exist, there were significant gaps in policy implementation and support mechanisms for smallholder farmers, highlighting an area where the Ministry's efforts could be intensified. Findings further revealed that many smallholder farmers were unable to fully benefit from climate adaptation measures due to insufficient training and resource support.

The study recommends enhancing financial resources dedicated to agricultural adaptation, expanding awareness and capacity-building programs, and strengthening technical assistance to bridge the collaboration gaps between government institutions and local communities. These steps are expected to improve the Ministry's effectiveness in promoting sustainable, climate-resilient agriculture, ultimately increasing productivity among smallholder farmers in Zambia.

Keywords: Climate Change Adaptation, Agricultural Productivity, Zambia, Ministry of Agriculture, Smallholder Farmers, Climate Resilience, Extension Services, Financial Support

1. Introduction

1.1 Background

Zambia's economy is heavily reliant on agriculture, employing over 70% of the population and contributing significantly to GDP. However, this sector is under severe threat from climate change, with erratic rainfall, increased temperatures, and frequent droughts adversely affecting productivity. In Chipata District, which lies in Zambia's Eastern Province, smallholder farmers face disproportionate challenges due to their reliance on rain-fed agriculture and limited access to resources.

The Government of Zambia has implemented numerous policies and programs to address these challenges, including the National Climate Change Response Strategy and the Climate-Smart Agriculture initiatives under the Ministry of Agriculture.

1.2 Problem Statement

Agriculture remains the backbone of Zambia's economy, yet the sector's resilience is increasingly undermined by climate change. In Chipata District, where agriculture is predominantly rain-fed, farmers struggle with prolonged droughts, erratic rainfall, and increased pest infestations. These challenges have led to declining crop yields, rising food insecurity, and economic instability. For instance, maize production in the district dropped by 50% during the drought of 2016-2017, exacerbating poverty levels among smallholder farmers.

While the Ministry of Agriculture has introduced programs like FISP and CSA to combat these issues, their effectiveness remains limited. Issues such as delayed input distribution, insufficient farmer training, and weak stakeholder collaboration hinder the success of these initiatives. The Ministry's inability to effectively implement climate adaptation strategies highlights systemic barriers that require urgent attention.

This study seeks to address these gaps by evaluating the Ministry's current efforts, identifying the key factors affecting agricultural productivity, and proposing strategies to enhance climate resilience. By doing so, the research aims to contribute to sustainable agricultural development in Chipata District and beyond.

1.3 Study Objectives

The overall objective of this study is to examine the effectiveness of the ministry of Agriculture in promoting climate change in agriculture productivity in Chipata district.

1.3.1 Specific Objective of the study

1. To determine the factors affecting agriculture productivity among small holder farmers in Chipata.
2. To ascertain the effectiveness of programs implemented by the ministry of Agriculture to mitigate climate change effects in order hence agriculture productivity
3. To identify challenges faced by the ministry of Agriculture in promoting climate change for effective agriculture productivity.

1.4 Theoretical Framework

This study adopts the Sustainable Livelihoods Approach (SLA) and the Institutional Analysis and Development (IAD) Framework to evaluate the effectiveness of government institutions in promoting climate change adaptation for agricultural productivity in Chipata District. These frameworks provide a structured lens for analysing the interplay between institutional capacity, resource allocation, and farmer livelihoods in a changing climate context.

The SLA, developed by the UK's Department for International Development (DFID), examines the relationships between livelihood assets, external influences, and institutional interventions. In the context of this study, SLA emphasizes the interconnectedness of resources such as natural, physical, financial, human, and social capital in shaping farmers' ability to adapt to climate change.

Livelihood Assets: Farmers' access to essential resources, including land, water, financial credit, and technical knowledge, is critical for climate adaptation. Limited access to these assets constrains their ability to implement resilience-building practices like crop diversification and water conservation.

Vulnerability Context: Factors such as erratic rainfall, drought, and market volatility amplify farmers' vulnerability to climate impacts. These external shocks often undermine agricultural productivity, necessitating robust institutional support.

Institutions and Policies: Government institutions, especially the Ministry of Agriculture, play a vital role in providing extension services, financial support, and climate-resilient technologies. The SLA highlights the importance of effective policies in enabling farmers to leverage their assets for sustainable livelihoods.

1.5 Significance of The Study

The study on examining the effectiveness of the Ministry of Agriculture in promoting climate change in agriculture productivity in Zambia's Eastern Province is significant for several reasons. Firstly, agriculture is the backbone of the Zambian economy, with over 60% of the population relying on it for their livelihoods (Mwiinga *et al*., 2021). Secondly, climate change is a pressing issue that is affecting the agricultural sector in Zambia, with changes in rainfall patterns and temperatures having a significant impact on crop yields and livestock production (Mwale *et al*., 2021). Therefore, understanding the effectiveness of government institutions in promoting climate change adaptation in agriculture is critical for ensuring sustainable agricultural production and food security in Zambia.

The study will contribute to existing literature on climate change adaptation in agriculture in Zambia, which has mainly focused on the impacts of climate change on crop yields and livestock production (Mubanga *et al*., 2020) [17]. It will provide insights into the role of government institutions in promoting climate change adaptation and mitigation measures in the agricultural sector. This will be important for policy-makers and other stakeholders in designing and implementing effective climate change policies and programs that promote sustainable agriculture in Zambia.

2. Literature Review

2.1 Overview

This chapter coins the work of other scholars in the related field, it unfolds the knowledge by other writers in various context and further indicates the empirical discovery of other researchers across the world.

2.2 Factors Affecting Agricultural Productivity Among Smallholder Farmers

Agricultural productivity in Chipata District, as in many parts of Sub-Saharan Africa, is heavily influenced by climatic, socio-economic, and institutional factors. Studies highlight that erratic rainfall, prolonged droughts, and extreme weather events are critical climate-related stressors reducing crop yields and livestock productivity (Mwale & Phiri, 2017; Ngoma *et al*., 2021) [20, 24].

Pests and diseases exacerbated by warming temperatures are another major challenge. According to Bebber *et al*. (2013) [3], rising temperatures expand pest habitats, increasing crop vulnerability. For instance, maize Zambia's staple crop has suffered significant yield losses due to pest infestations, particularly during drought seasons.

Socio-economic barriers also play a significant role. Smallholder farmers in Chipata face limited access to modern farming technologies, affordable credit, and agricultural inputs. A study by Phiri *et al*. (2020) found that

resource constraints prevent farmers from adopting climate-resilient practices like conservation farming or using improved seed varieties. Moreover, land tenure insecurity and poor market access reduce incentives for investment in sustainable agricultural practices (Nshimbi & Simatele, 2018) [25].

Institutional factors, such as weak extension services, also hinder agricultural productivity. Muyangana *et al*. (2020) [19] noted that the Ministry of Agriculture's limited staffing capacity leaves many farmers without access to technical advice, further constraining their ability to adapt to climate impacts.

2.3 Effectiveness of Programs Implemented by the Ministry of Agriculture

Several initiatives have been implemented by Zambia's Ministry of Agriculture to enhance climate adaptation, including the Farmer Input Support Program (FISP), Climate-Smart Agriculture (CSA), and Conservation Agriculture (CA). While these programs aim to mitigate climate change impacts and boost productivity, their effectiveness has been mixed.

The FISP provides subsidized inputs like seeds and fertilizers to smallholder farmers. Studies such as Manda and Nsingo (2019) [16] acknowledge FISP's potential to improve crop yields and food security. However, delays in distribution, corruption, and logistical inefficiencies significantly reduce its impact. Farmers often receive inputs too late in the planting season, undermining their productivity.

CSA promotes sustainable practices like agroforestry, crop rotation, and drought-resistant seeds. Research by Mwiinga *et al*. (2021) found that CSA improves soil health and enhances resilience to droughts, but adoption rates remain low due to inadequate technical support and limited awareness among farmers.

Similarly, CA, which encourages minimum soil disturbance and crop diversification, has shown promise in improving yields and conserving soil moisture (Simwanda & Mwiinga, 2020) [27]. However, insufficient funding and a lack of trained extension officers hinder its widespread implementation.

Despite the potential of these programs, weak policy enforcement and fragmented stakeholder coordination remain major barriers to achieving their intended goals (Chisanga *et al*., 2019) [8].

2.4 Challenges Faced by the Ministry of Agriculture

The Ministry of Agriculture faces numerous challenges in promoting climate-smart agriculture in Chipata District. One significant issue is inadequate funding. Mubanga *et al.* (2018) highlight that financial constraints limit the Ministry's ability to scale up successful programs, hire and train extension officers, and provide timely inputs to farmers.

Weak policy enforcement is another critical barrier. Although Zambia has established climate adaptation policies, their implementation at local levels is inconsistent. Poor coordination between government departments and other stakeholders exacerbates these challenges (Muyangana *et al*., 2020).

Farmer resistance to change also poses a challenge. Many smallholder farmers are reluctant to adopt new technologies or practices due to cultural preferences, risk aversion, and a lack of understanding of climate-smart agriculture's benefits (Gbegbelegbe *et al*., 2018) [15].

2.5 Establishment of Research Gaps

One potential research gap in this context could be the lack of comprehensive studies focusing specifically on the effectiveness of adaptation strategies implemented by farmers in Chipata to cope with climate change impacts. While there is existing research highlighting the challenges posed by climate change on agriculture in the region, there may be limited information available on the specific actions taken by farmers to adapt to these challenges and their success rates.

Addressing this research gap could involve conducting surveys or interviews with local farmers to gather insights into the adaptation strategies they employ, such as changes in cropping practices, water management techniques, or adoption of resilient crop varieties. Additionally, assessing the effectiveness of these strategies in mitigating the adverse effects of climate change on agricultural productivity could provide valuable insights for policymakers and agricultural extension services in designing more targeted and effective interventions.

Furthermore, examining the socio-economic factors influencing farmers' decision-making processes regarding adaptation measures could contribute to a better understanding of the barriers and facilitators to successful adaptation in the region. This holistic approach to studying adaptation strategies could help bridge the research gap and provide actionable recommendations for enhancing climate resilience in Chipata's agriculture sector.

3. Research Methodology

3.1 Overview

This chapter outlined the methodology that was used in conducting the study, including the design, target population and sample size. The Chapter also outlined the data collection procedures, the data collection tools and methods of data analysis. The aim of research design was to ensure that the evidence gathered permits the researcher to answer the research questions clearly (De Vaus, 2001) [11].

3.2 Research Design

The study adopted a descriptive research design, aimed at obtaining both qualitative and quantitative data on the effectiveness of climate change adaptation programs. A case study approach was utilized, focusing on the Ministry of Agriculture in Chipata District. The descriptive nature of the research allowed for a detailed examination of the existing practices and challenges faced by government institutions in promoting climate-smart agriculture.

3.3 Data Collection

Data collection methods included both primary and secondary sources. Primary data were collected through structured questionnaires and semi-structured interviews:

Questionnaires: A structured questionnaire was administered to smallholder farmers. The questionnaire captured demographic information, farmers' awareness of climate change, their experiences with government interventions, and the challenges they faced in implementing climate-smart agriculture practices.

Interviews: Semi-structured interviews were conducted with key informants from the Ministry of Agriculture and other stakeholders. The interviews aimed to explore the

effectiveness of government programs, policy implementation, and the institutional barriers that affected climate change adaptation efforts.
Secondary data were gathered through a review of existing reports, policy documents, and previous studies on climate change adaptation in agriculture within Zambia.

3.4 Data Analysis
Data analysis involved both qualitative and quantitative approaches. Quantitative data obtained from the questionnaires were entered into SPSS for statistical analysis. Descriptive statistics, such as frequencies and percentages, were used to summarize the responses of smallholder farmers regarding their knowledge of climate change and the impact of government programs on their farming practices.
Qualitative data from the interviews were analyzed using thematic analysis. The transcribed interviews were coded and categorized into themes related to the effectiveness of government interventions, barriers to adoption of climate-smart practices, and institutional challenges. The findings from both the qualitative and quantitative data were integrated to provide a comprehensive analysis of the research objectives.

3.5 Ethical Considerations
Participants were briefed on the study's objectives and provided informed consent. Anonymity and confidentiality were maintained throughout the research process. Ethical clearance was obtained from the Information and Communications University.

4. Presentation of Research Findings
4.1 Overview
This chapter presents the results derived from both quantitative surveys and qualitative interviews conducted in Chipata District. The data collected addresses the study's three main objectives: Identifying significant factors affecting agricultural productivity among smallholder farmers, evaluating the effectiveness of the Ministry of Agriculture's climate change programs, and identifying challenges faced by the Ministry.

4.2 Demographic Characteristics of Respondents

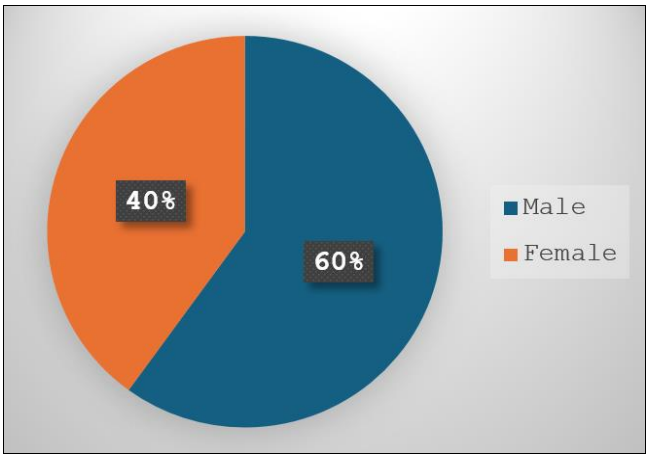


Fig 4.1.1: Percentage Distribution of Respondents Gender

Figure 4.1.1 shows the percent distribution of the respondents by gender. The results show that 60% of the respondents were male and 40% were female. Despite the differences in the statistics on the gender involvement of the respondents, the study involved a balanced view on perceptions of both male and female thus having an understanding of the issue from both perspectives. However, one other important attribute is that the research reveals that there are generally fewer females in the field of agriculture productivity and climate change adaptations.

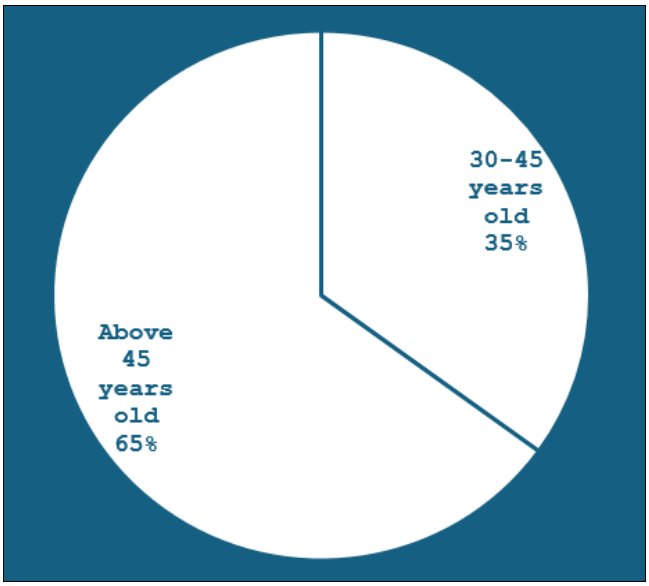


Fig 4.1.2: Percentage Distribution of Respondents Age

Figure 4.1.1 shows the percent distribution of the respondents by age-group, 22% of the respondents were in the age group 30 -45. The second highest percent was 30% who were in the age group 45 and above. This verifies that the study was conducted among the fair age group to give out data that can be verified and validated.

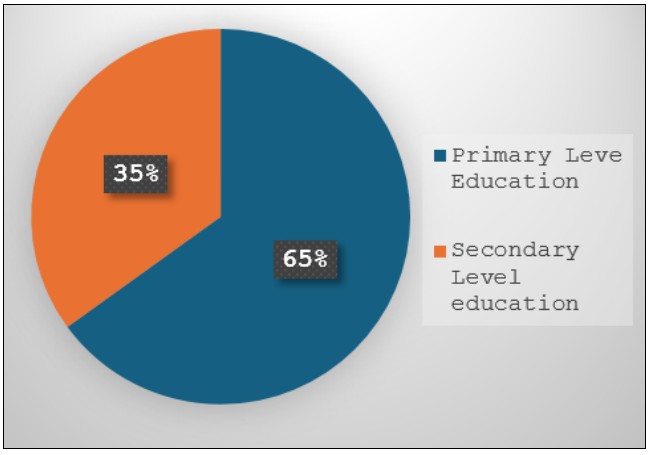


Fig 4.1.3: Percentage Distribution of Respondent Educational attainment

Figure 4.1.3 shows the percent distribution of the respondents by level of education. The highest percentage was those in secondary education represented by 65%. The respondents who indicated having primary education were represented by 35%. This shows that the study involved the respondents with a fair education status.

4.2 Factors Affecting Agricultural Productivity

The key factors influencing productivity included environmental, economic, institutional and social cultural factors.

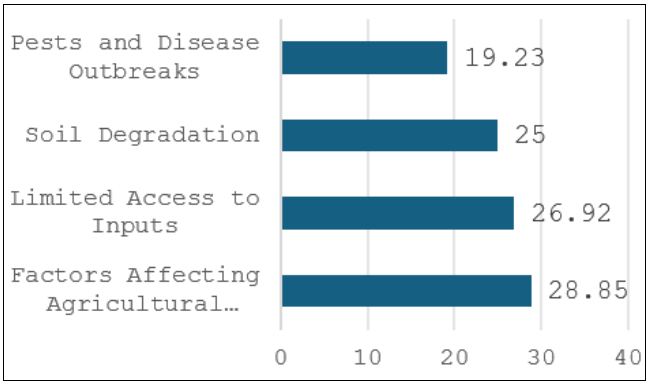
4.2.1 Environmental factors affecting agriculture

Erratic Rainfall (28.85%): Just over a quarter of the respondents identified erratic rainfall as their most significant challenge, leading to decreased crop yields and unpredictability in farming cycles.

Limited Access to Inputs (26.92%): Close to 27% of respondents indicated that their limited access to crucial agricultural inputs like seeds and fertilizers significantly hindered their productivity.

Soil Degradation (25.00%): Soil degradation, caused by overuse and lack of proper soil conservation techniques, was reported by a quarter of the farmers.

Pests and Disease Outbreaks (19.23%): Around 19% of respondents mentioned that increasing incidences of pests and livestock diseases further decreased productivity and profitability.

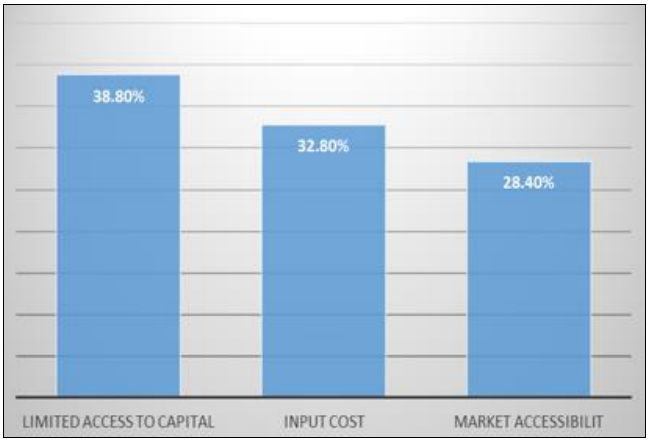


4.2.2 Economical factors affecting agricultural productivity

Limited Access to Capital: 38.8% of respondents Smallholder farmers lacks access to credit facilities, affecting their ability to invest in modern inputs and technologies

Input Costs: High costs for seeds, around 32.8% smallholder farmers indicated that high cost of fertilizers, and pesticides pose barriers to adoption, particularly for resource-constrained farmers.

Market Accessibility: 28.4% respondent stated that remote location limits market reach, affecting pricing, demand, and income stability for smallholder farmers.



4.3 Effectiveness of Government Programs

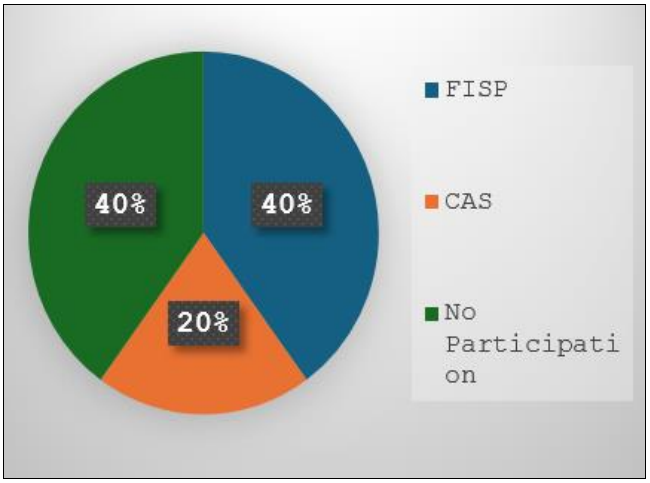
4.3.1 Percentage Distribution of respondent's, Implementation of CSA and farmer support programs to enhance agriculture productivity.

Participation Rates:

FISP (40%): 40% of the farmers reported participating in FISP, showcasing its broader reach among farming communities.

CSA (20%): CSA had a significantly lower participation rate, with only 20% of farmers engaging with this program.

No Participation (40%): A significant portion of the respondents (40%) did not participate in either program, underscoring gaps in outreach or program awareness.

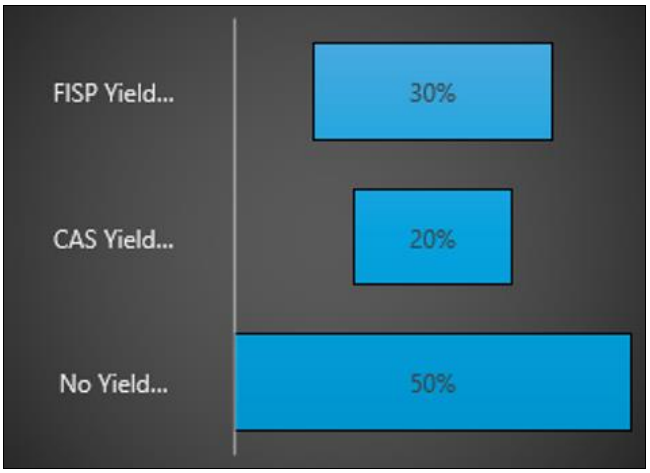


4.3.2 Percentage Distribution of respondent's on yield improvement

FISP Yield Improvement (30%): A third of FISP participants reported noticeable yield improvements, pointing to the benefits of input subsidies, though the majority did not see marked improvements.

CSA Yield Improvement (20%): Similarly, CSA showed some positive results, but only for a smaller group (20%) due to the long-term nature of its practices.

No Yield Improvement (50%): Half of the respondents did not experience yield improvements under either program, signaling the need for better program implementation and monitoring.



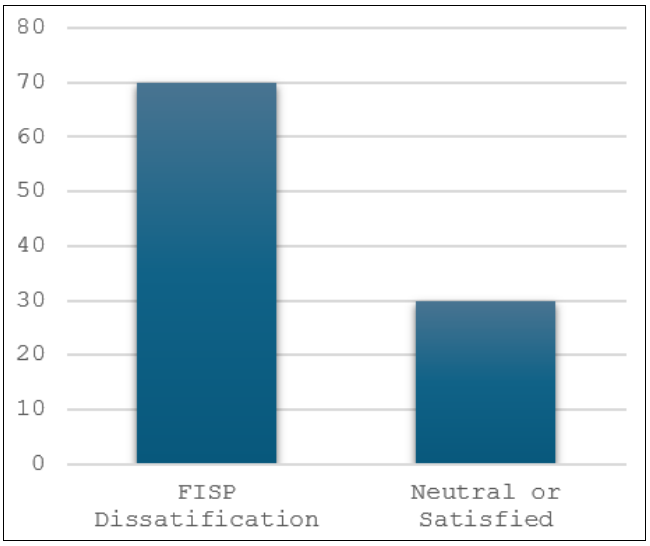
4.3.3 Percentage Distribution of respondent's satisfaction levels for CSA and FISP

FISP Dissatisfaction (70%): A large portion of FISP participants expressed dissatisfaction, with complaints largely centered on delayed input distribution and corruption in the program.

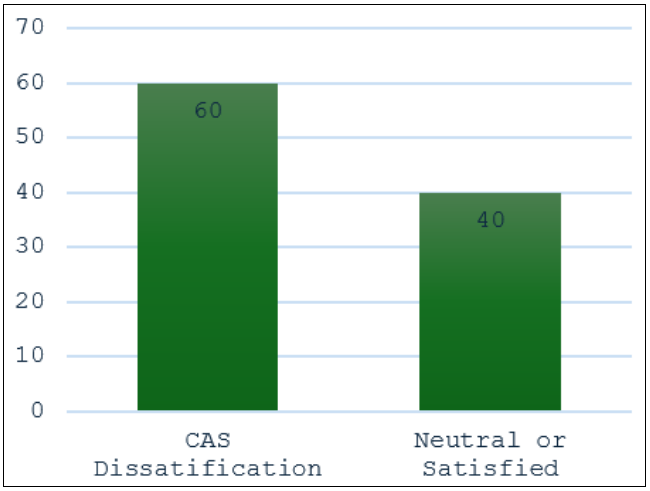
CSA Dissatisfaction (60%): The dissatisfaction rate for CSA was also high, largely due to insufficient technical support and lack of knowledge sharing.

Neutral or Satisfied (30-40%): Around 30-40% of farmers were either neutral or satisfied, but these numbers remain relatively low, indicating room for improvement.

Satisfaction Level FISP



Satisfaction Levels CSA



4.4 Challenges Faced by the Ministry of Agriculture in promoting agricultural Productivity to enhance Climate Change in Chipata District.

Figure 4.4.1 Percentage Distribution of Respondent Economical and Financial Challenges faced by the Ministry of Agriculture.

Inadequate Funding (33.33%): Over a third of the respondents identified inadequate funding as the biggest challenge, highlighting the Ministry's financial constraints in implementing and scaling up climate adaptation programs. Budget constraints hindered investment in climate-resilient technologies, such as drought-resistant seeds or water conservation systems.

High Cost of Inputs: Close to 27% of respondents identified limited access to critical agricultural inputs, such as fertilizers, seeds, and farming equipment, as a significant barrier to productivity improvement. This high cost of climate-resilient inputs, including hybrid seeds and organic fertilizers, makes them challenging for smallholder farmers to afford, and available subsidies are often insufficient to fully alleviate these costs.

Technical Training Gaps (18.75%): Just under a fifth of the respondents mentioned gaps in technical training, both for farmers and ministry staff, indicating the need for more comprehensive education and training initiatives to enhance productivity and climate resilience.

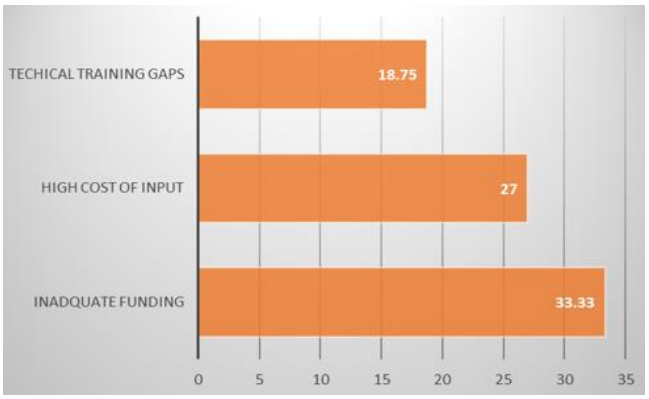
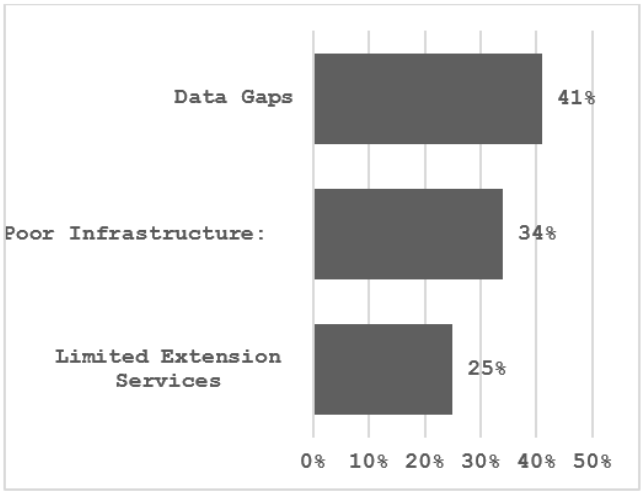


Fig 4.4.1: Percentage Distribution of Respondent, Technical and Infrastructural Challenges faced by the Ministry of Agriculture

Limited Extension Services (25.00%): A quarter of the respondents pointed out that the lack of sufficient extension services, such as training and technical support for farmers, hindered the effective adoption of new agricultural practices.

Poor Infrastructure: Roughly 34 of respondents highlighted lack of essential infrastructure, such as irrigation systems and storage facilities, which are critical for climate-resilient farming.

Data Gaps: Around 41. % of rural farmers had limited or no access to accurate climate data and early warning systems. The absence of localized and timely data on weather patterns limited farmers' ability to prepare for extreme weather events.



5. Conclusion and Recommendations

The study concludes that climate change significantly affects agricultural productivity in Chipata District, with erratic rainfall, limited access to agricultural inputs, soil degradation, and increased pest infestations identified as key challenges. These issues are exacerbated by institutional shortcomings within the Ministry of Agriculture, including inadequate funding, weak policy enforcement, and limited reach of extension services. As a result, smallholder farmers, who are most vulnerable to climate impacts, are left without the necessary resources and knowledge to adopt sustainable practices and improve their resilience.

The Farmer Input Support Program (FISP) and Climate-Smart Agriculture (CSA) initiatives, while promising, have been only partially effective. The study found that delays in input delivery and logistical inefficiencies undermine the potential benefits of FISP, leaving farmers frustrated and unable to make full use of the program. Meanwhile, the low adoption of CSA practices reflects the inadequate technical support and lack of farmer education, which are necessary to encourage sustainable farming methods.

The Ministry of Agriculture's role in promoting climate resilience is constrained by structural and institutional barriers. Inadequate funding limits the Ministry's ability to expand its programs, while the lack of sufficient extension services hinders the dissemination of knowledge and technical assistance to farmers. Weak governance and policy enforcement further impede the effective implementation of climate adaptation strategies. Overall, the study concludes that while there are frameworks and programs in place, the Ministry of Agriculture needs significant improvements in both capacity and execution to effectively support farmers in coping with the impacts of climate change.

Based on the findings and discussion, the following recommendations are proposed to enhance agricultural productivity and climate resilience in Chipata District. Ministry of Agriculture requires increased funding to scale up its climate adaptation programs and ensure timely distribution of inputs. Allocating more resources can address staffing shortages in extension services, support research and development, and provide farmers with access to advanced technologies. Specifically: Ensure budgetary allocations prioritize critical areas such as training, resource distribution, and infrastructure development. Leverage partnerships with international donors and NGOs to supplement funding for climate-smart agriculture initiatives.

To improve adoption rates of climate-smart agricultural practices, targeted training and capacity-building programs should be prioritized. Training programs should: Focus on practical demonstrations of conservation agriculture, agroforestry, and sustainable water management techniques.

Use locally relevant approaches, such as integrating traditional knowledge with modern methods.

Target vulnerable groups, especially women and youth, who play critical roles in agriculture.

Policy implementation and fragmented coordination hinder the success of government programs. To address these issues: Establish monitoring and evaluation frameworks to ensure consistent policy enforcement at local levels. Improve inter-agency collaboration among departments such as agriculture, environment, and finance to foster cohesive action. Decentralize decision-making processes to empower district and community-level authorities.

Partnerships between government agencies, NGOs, private sector actors, and community leaders are essential for effective climate adaptation. To enhance collaboration: Create platforms for regular dialogue among stakeholders to align goals and coordinate resources.

Engage community leaders and farmers in program design and implementation to ensure interventions address local needs. Encourage private sector involvement in providing climate-resilient technologies and credit facilities. Farmers require access to modern resources and technology to build resilience to climate change. To support this: Develop affordable financing options, such as microloans, to help farmers invest in inputs and equipment. Establish irrigation schemes in vulnerable areas to reduce reliance on rain-fed agriculture.

Improve the availability of climate information services to help farmers make informed decisions about planting and harvesting.

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