Int. j. adv. multidisc. res. stud. 2025; 5(3):1415-1426

Received: 29-04-2025
Accepted: 09-06-2025

International Journal of Advanced Multidisciplinary Research and Studies

ISSN: 2583-049X

Examining the Effects of Drought on Food Security: A Case Study of Chongwe District

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Abstract
Drought is a critical environmental issue with far-reaching effects on food security, especially in regions reliant on rain-fed agriculture. This study investigates the impacts of drought on food security in Chongwe District, Zambia. The key objectives were to examine how drought affects household food security, assess its socio-economic and cultural impacts, explore coping mechanisms, and evaluate the effectiveness of government mitigation measures. Using a mixed-methods approach, data was collected through surveys, interviews, and secondary sources to provide a holistic understanding of the issue. The findings revealed that droughts have significantly reduced maize yields, exacerbated food shortages, and increased reliance on external food aid. Socially, drought has disrupted traditional practices and intensified gender inequalities, as women bear the brunt of resource management. Economically, households have suffered income losses and resorted to selling productive assets. Coping strategies, including crop diversification and reduced meal frequency, were found to be insufficient in mitigating food insecurity. While government initiatives, such as irrigation schemes and cash transfer programs, have shown promise, their effectiveness is hindered by delayed implementation, inadequate funding, and limited coverage. The study concludes that addressing food insecurity in Chongwe requires integrated approaches, including expanding irrigation infrastructure, enhancing social safety nets, and promoting sustainable agricultural practices. Recommendations emphasize the need for timely delivery of resources, increased support for drought-resilient crops, and improved policy coordination to mitigate the adverse effects of drought.

Keywords: Drought, Food Security, Chongwe District, Agriculture, Mitigation Measures

1. Introduction

1.1 Background

Drought is a natural disaster that occurs when there is a prolonged period of abnormally low rainfall, leading to a shortage of water for various human activities, including agriculture. Droughts can have severe consequences on food security, particularly in regions where agriculture is the main source of livelihood. Food security is defined as a situation where all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life (FAO, 2023).

Chongwe District, located in Lusaka Province, Zambia, is one of the areas that has been experiencing frequent droughts in recent years. According to the Zambia Meteorological Department (2021), the district has recorded a significant decrease in rainfall over the past decade, with some years experiencing less than 50% of the normal rainfall. This has led to a decline in agricultural productivity, particularly in the production of staple crops such as maize, which is the main food source for most households in the district.

Drought is characterized by prolonged periods of inadequate rainfall, leading to insufficient water availability for crops and livestock. In Chongwe District, like many other parts of Zambia, agriculture is predominantly rain-fed, making it particularly susceptible to drought conditions. According to the Food and Agriculture Organization (FAO, 2022), drought has become more frequent and intense in Southern Africa due to climate change, exacerbating food insecurity in vulnerable communities.

The impact of drought on agriculture in Chongwe is multifaceted. Reduced rainfall leads to lower crop yields, particularly for staple crops like maize, which is a critical component of food security in the district. As reported by the Zambia Meteorological Department (2023), recent droughts in Chongwe have resulted in significant declines in maize production, contributing to food shortages and increased dependency on food aid. Additionally, the scarcity of water resources during drought periods affects livestock, leading to reduced meat and dairy production, further straining food availability. The effects of drought on food security in Chongwe District are multifaceted. Reduced agricultural productivity leads to a decrease in food availability, which can result in food shortages and price hikes. This, in turn, affects the ability of households to access and afford food, particularly those with low incomes. Additionally, drought can lead to a loss of livestock, which is an important source of income and food for many households in the district.

Several studies have been conducted to examine the effects of drought on food security in different parts of the world. A study by Shiferaw *et al*. (2019) in Ethiopia found that drought had a significant negative impact on crop production and household food security. The study recommended the adoption of drought-resistant crop varieties and the implementation of irrigation systems to mitigate the effects of drought. A study by the Indaba Agricultural Policy Research Institute (IAPRI, 2022) highlights that drought-induced crop failures have led to a decrease in household food stocks in Chongwe, forcing families to adopt negative coping strategies such as reducing meal sizes and selling off productive assets. These coping mechanisms further undermine long-term food security and exacerbate poverty in the district. Moreover, the reliance on rain-fed agriculture, combined with limited access to irrigation and other water-saving technologies, makes Chongwe particularly vulnerable to the impacts of drought.

The effects of climate change on drought patterns in Chongwe have significant implications for food security. As agricultural productivity declines due to reduced water availability, households are forced to rely on alternative livelihoods, such as charcoal production or migration to urban areas, which may not be sustainable in the long term. Furthermore, climate change-induced droughts can exacerbate existing inequalities in food access, as wealthier households may be better able to adapt to changing conditions, while poorer households become increasingly vulnerable (Oxfam, 2022).

Another study by Mishra and Pede (2021) in India found that drought had a significant impact on household food security, particularly among small and marginal farmers. The study recommended the provision of crop insurance and the implementation of soil and water conservation measures to help farmers cope with the effects of drought.

In Zambia, a study by Mulenga *et al*. (2017) found that drought had a significant impact on maize production and household food security in the Southern Province. The study recommended the promotion of drought-tolerant crop varieties and the implementation of conservation agriculture practices to help farmers adapt to the effects of drought. Despite these studies, there is limited research on the effects of drought on food security in Chongwe District specifically. This study aims to fill this gap by examining the effects of drought on food security in the district, with a focus on the impact on crop production, household food security, and coping strategies adopted by households.

1.2 Objectives of Study

The general objective of this study is to examine the effects of drought on food security in the Chongwe district. Specific objectives include analyzing the effects of drought on household food security in Chongwe District, assessing the impact of drought on the social, economic, and cultural dynamics of households in Chongwe District, investigating the coping strategies adopted by smallholder farmers in Chongwe District in response to drought conditions and to evaluate the effectiveness of government mitigation measures implemented to combat drought and improve food security in Chongwe District.

1.3 Theoretical Framework

This study will adopt the Vulnerability Theory which was developed by scholars such as Robert Chambers and Amartya Sen. Chambers emphasized the importance of understanding vulnerability in the context of poverty and environmental hazards, while Sen's work on entitlements and capabilities highlighted how socioeconomic factors influence individuals' ability to cope with crises. Chambers (1989) introduced the concept of ‘vulnerability’ as it relates to poverty, arguing that vulnerability is shaped by various factors, including exposure to risks, lack of resources, and social networks. His work laid the foundation for understanding how environmental changes, such as droughts, disproportionately affect marginalized communities. On the other hand, Amartya Sen's capability approach further complements the Vulnerability Theory by examining how individuals' capabilities and entitlements impact their ability to respond to adverse conditions. Sen (1981) argued that food security is not merely about food availability but also about access and the ability to obtain food, which is particularly relevant in the context of drought-affected regions like Chongwe District.

2. Literature Review

2.1 Effects of drought on household food security

In South Asia, drought conditions exacerbate existing vulnerabilities due to high population density and dependence on rain-fed agriculture. In India, Kumar and Jain (2019) demonstrated that droughts led to a significant reduction in food grain availability, forcing households to shift from cereals to less expensive food items like tubers and legumes. The reduction in protein and micronutrient intake was especially pronounced, affecting children’s growth and development (Kumar & Jain, 2019). A similar pattern was observed in Pakistan, where drought-affected households reported skipping meals more frequently, especially in rural areas (Ali *et al*., 2018). Additionally, Ali, Khan, and Farooq (2018) found that in drought-affected rural Pakistan, households reduced meal frequency and food variety. A decrease in fresh produce availability led to a higher reliance on processed foods. In China, Yang and Li (2021) observed that Chinese households affected by drought often relied on food purchases rather than self-sustenance, with families substituting higher-priced food groups with more affordable options.

In Latin America, studies on drought impacts have highlighted the socio-economic dimensions of food consumption changes. Research by Fernandez and Bianchi (2021) in Brazil found that droughts led to increased food prices, disproportionately affecting low-income households who spent up to 60% of their income on food. Households coped by substituting high-cost items like meat and dairy with cheaper alternatives, leading to a less varied and less nutritious diet (Fernandez & Bianchi, 2021). In Mexico, droughts were linked to increased migration as households sought alternative income sources due to declining crop yields and reduced food access (Gonzalez & Mendez, 2019).

In Zambia, a country heavily reliant on rain-fed agriculture, drought has been linked to food insecurity and nutritional deficiencies (Mufandaedza *et al*., 2019). The literature indicates that drought is a primary driver of food insecurity in Zambia. According to Zulu *et al*. (2018), drought affects crop yields, leading to lower food availability and higher food prices. This study explored household food security across drought-affected regions in Zambia, concluding that households in these regions consumed fewer meals per day, with lower diversity in their diet compared to non-affected regions.

In a study conducted by Mulenga *et al*. (2020), the researchers focused on the impact of drought on dietary intake among rural households. The findings revealed a reduction in protein and vegetable consumption, as households shifted to more affordable staple foods. This shift in dietary patterns, as highlighted by the study, increased vulnerability to malnutrition, especially among children and pregnant women. Mulenga *et al*. (2020) emphasized that drought not only reduces food availability but also diminishes the quality of diet in affected households.

Chansa (2017) explored the socioeconomic factors that influence food consumption in drought-affected areas. The study found that households with lower income levels were more vulnerable to food insecurity, as they lacked the resources to purchase food during periods of scarcity. Additionally, Chansa (2017) highlighted that households often coped with drought-induced food shortages by reducing meal sizes and frequency, which further compromised nutritional intake.

Mweemba *et al*. (2019) investigated the correlation between drought and food prices in Zambia, with a specific focus on maize, a staple food in the country. The study noted that drought-induced reductions in maize production led to increased prices, which had a direct impact on household food consumption. Households reduced their maize consumption or switched to cheaper, less nutritious food items as a coping mechanism. Mweemba *et al*. (2019) underscored the need for policy interventions to stabilize food prices during drought periods.

Ngoma and Nkonde (2021) examined the adaptation strategies employed by Zambian households to mitigate the effects of drought on food security. Their research identified several coping mechanisms, including food rationing, dependence on food aid, and income diversification. These strategies, however, were found to be inadequate in sustaining long-term food security, as they often involved sacrificing dietary quality. Ngoma and Nkonde (2021) recommended the implementation of government-supported drought-resistant crop programs to help stabilize household food consumption patterns.

In a gender-focused study, Phiri and Mumba (2018) assessed how drought affects men's and women's roles in food procurement and consumption within households. The study highlighted that women bore a greater burden of managing food resources during drought periods, often skipping meals to ensure children had enough to eat. This gendered impact of drought, as noted by Phiri and Mumba (2018), exacerbated nutritional deficiencies among women in rural areas.

Long-term studies, such as those conducted by Lungu (2022), emphasize the persistent effects of drought on food security, even after the immediate drought period has passed. Lungu's research found that recurrent droughts have led to chronic food insecurity in certain districts of Zambia, affecting household food consumption and nutritional outcomes over time. This study called for integrated drought preparedness and resilience programs to prevent cyclical food insecurity.

2.2 Impact of drought on the social, economic, and cultural dynamics of households

Drought is a pervasive climate phenomenon that disrupts ecosystems, livelihoods, and societies across the globe. Its impact transcends environmental consequences, significantly affecting the social, economic, and cultural fabric of households.

In Asia, drought profoundly affects social cohesion and community structures. For instance, studies in India by Mishra and Singh (2010) highlight how drought exacerbates inequality within rural communities. Marginalized groups, particularly women and lower castes, bear a disproportionate burden due to their limited access to water resources and coping mechanisms. Using mixed-methods approaches, including household surveys and ethnographic interviews, these studies reveal how social bonds weaken as competition for scarce resources intensifies.

In South Africa, Archer *et al*. (2020) examined the economic impact of the 2015–2016 drought on smallholder farmers in Limpopo Province. Using a combination of GIS-based drought assessments and household surveys, they found that smallholder farmers experienced a 70% reduction in crop yields. The study highlighted that the lack of access to credit and insurance further aggravated economic vulnerabilities, with many households falling into chronic poverty.

Drought in Africa disrupts deeply rooted cultural practices, particularly those linked to agriculture, water, and traditional ceremonies.

In Tanzania, a study by Kijazi and Reason (2012) explored how drought influenced the cultural rituals of the Chagga people, who depend heavily on Mount Kilimanjaro's water resources. The researchers used ethnographic methods to document how the decline in water availability disrupted traditional irrigation practices and ceremonies associated with the agricultural cycle. The study emphasized that cultural adaptations to drought, such as prayers for rain, reflected the resilience and spiritual ingenuity of the community.

In Mali, Doumbia *et al*. (2017) investigated how drought affected the cultural significance of baobab trees, which are central to local myths and ceremonies. Using qualitative interviews with elders and community leaders, the study found that the decline in baobab populations due to water stress undermined cultural continuity, as younger generations were less exposed to these traditions.

In Botswana, Mberego and Smit (2013) examined the cultural impact of drought on the Basarwa (San) people. Using participatory ethnographic methods, they found that water scarcity disrupted traditional hunting and gathering practices, which are central to the Basarwa's cultural identity. The study highlighted the interplay between environmental degradation and cultural loss, emphasizing the need for policies that protect indigenous livelihoods.

African households employ various coping strategies to mitigate the impacts of drought, though their effectiveness varies significantly.

In Ethiopia, Deressa *et al*. (2009) examined the effectiveness of livelihood diversification strategies, such as non-farm employment and petty trading, in improving drought resilience. The study used regression analysis to demonstrate that households with diversified income sources experienced 30% fewer income losses during drought years compared to those reliant solely on agriculture.

A study by Mulenga *et al*. (2015) examined the impact of drought on household dynamics in Southern Province, an area heavily reliant on rain-fed agriculture. Using a mixed-methods approach combining household surveys and focus group discussions, the researchers found that drought exacerbated gender inequalities within households. Women assumed greater burdens in securing water and food, as men often migrated to urban centers in search of employment. This shift strained traditional gender roles and increased the workload on women, particularly in female-headed households.

Similar findings were documented by Mwape *et al*. (2019) in Eastern Province, where prolonged droughts led to the dissolution of extended family networks as households struggled to meet basic needs. The study used qualitative interviews to reveal how resource scarcity reduced collective caregiving practices, weakening traditional social safety nets.

Drought-induced migration is another significant social consequence. Chanda *et al*. (2018) conducted a longitudinal study in Gwembe Valley to track migration patterns during drought periods. The study employed GIS mapping and household surveys to document how rural families relocated to urban areas, disrupting traditional social structures. While migration provided temporary relief through remittances, it also fragmented communities and increased urban poverty.

2.3 Effectiveness of government mitigation measures implemented to combat drought and improve food security

In Asia, government responses to drought focus on water management, agricultural resilience, and social safety nets. In India, the Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS) includes provisions for drought mitigation through water conservation projects. Venkatasubramanian *et al*. (2015) conducted a mixed-methods evaluation of the program, using household surveys and case studies in drought-prone districts of Rajasthan. The study found that MGNREGS improved water availability for agriculture by constructing check dams and reservoirs. However, inconsistent implementation and corruption in fund allocation reduced its overall effectiveness.

In China, large-scale irrigation projects have been a cornerstone of drought mitigation. Yang *et al*. (2018) evaluated the South-North Water Transfer Project using hydrological modeling and economic cost-benefit analysis. The study highlighted how the project alleviated water shortages in northern China, boosting agricultural productivity. However, it also raised concerns about ecological damage and the displacement of communities.

In Vietnam, the government's promotion of drought-resistant rice varieties has shown mixed success. A study by Hoang *et al*. (2020) used field trials and farmer surveys to assess the adoption of these varieties in the Mekong Delta. While yields improved by 15–20% during drought years, limited access to seeds and high input costs constrained widespread adoption.

In the Americas, government interventions focus on policies for water allocation, agricultural subsidies, and social safety nets. California's Sustainable Groundwater Management Act (SGMA) aims to regulate groundwater use during droughts. Scanlon *et al*. (2017) evaluated the policy using satellite imagery and groundwater data. The study found that SGMA reduced groundwater overextraction, but the high costs of compliance disproportionately affected smallholder farmers.

In Mexico, government programs prioritize equitable water distribution during droughts. A study by Conde *et al*. (2016) analyzed the National Water Reserves Program, which allocates water for environmental preservation and agricultural use. The program, evaluated through econometric modeling, successfully improved water availability for smallholder farmers but faced challenges in enforcement and monitoring.

The U.S. Supplemental Nutrition Assistance Program (SNAP) has been instrumental in supporting food-insecure households during drought periods. Gundersen *et al*. (2018) conducted an impact assessment of SNAP using household income and food security data. The study found that the program reduced food insecurity by 30% among low-income households, demonstrating the critical role of social safety nets in drought resilience.

In Kenya, the Hunger Safety Net Programme (HSNP) provides cash transfers to drought-affected households in arid and semi-arid regions. Ndetei *et al*. (2018) used impact evaluation methods to assess HSNP's effectiveness. The study found that cash transfers reduced food insecurity by 25%, enabling households to maintain dietary diversity during drought periods. However, the program's limited coverage left many vulnerable households without support.

In Malawi, the government's Food for Work program has been implemented to improve food security during droughts. A study by Kambewa *et al*. (2015) analyzed the program using focus groups and beneficiary surveys. The findings showed that the program provided immediate relief to food-insecure households while contributing to long-term resilience through infrastructure projects, such as roads and water systems. However, delays in food distribution and insufficient wages limited its overall impact.

Zambia's vulnerability to drought has been exacerbated by its reliance on rain-fed agriculture, which employs a significant portion of the population and contributes substantially to the national economy. Recurrent droughts have strained household food security and livelihoods, prompting government interventions to mitigate their impacts.

The introduction of drought-tolerant maize varieties under the Farmer Input Support Program (FISP) is one of Zambia's flagship initiatives. Mofya-Mukuka *et al*. (2016) evaluated FISP's effectiveness using program data and household surveys. The study found that farmers using drought-tolerant seeds achieved 25–30% higher yields during drought years. However, delays in input distribution and insufficient targeting of vulnerable households limited the program's overall impact.

Crop diversification has also been promoted as a resilience-building strategy. Musonda *et al*. (2019) conducted field trials and interviews in Eastern Province to examine the adoption of sorghum and millet as alternatives to maize. The study found that these crops performed better under drought conditions and contributed to improved household food security. However, limited market access for non-maize crops discouraged widespread adoption.

Agricultural extension services are vital for disseminating knowledge about drought-resilient practices. Kalaba *et al*. (2017) evaluated the effectiveness of extension programs in Southern Province using qualitative interviews and focus group discussions. The study found that farmers who received extension support were more likely to adopt conservation agriculture practices, such as minimum tillage and mulching, which improved soil moisture retention. However, inadequate staffing and logistical challenges constrained the reach of these services.

2.4 Coping strategies adopted by smallholder farmers

The coping strategies adopted by smallholder farmers in response to drought are critical for understanding how agricultural communities can sustain their livelihoods in the face of increasing climate variability. In the United States, smallholder farmers are primarily concentrated in niche markets or organic production. A study by Fisher *et al*. (2019) examined coping strategies among smallholder farmers in California during drought periods. Using a mixed-methods approach, including surveys and interviews, Fisher *et al*. found that farmers coped by adopting water-saving technologies, shifting to drought-resistant crop varieties, and diversifying their crops. Some farmers also reduced their farm sizes to manage water more efficiently. The study concluded that smallholder farmers prioritize adaptability and innovation in coping with drought, emphasizing technology and crop diversification as key strategies.

Research conducted by Indigenous scholars examined how Indigenous smallholder farmers in Canada cope with climate change-induced droughts affecting their traditional food systems. Using participatory research methods involving community engagement and interviews, findings revealed that traditional ecological knowledge was integral to developing adaptive strategies such as crop rotation and sustainable land management practices. The study emphasized the necessity of incorporating Indigenous knowledge into broader climate adaptation frameworks.

Research conducted in Brazil by Lexon (2016) focused on how smallholder farmers cope with recurrent droughts affecting their livelihoods. Using ethnographic methods combined with quantitative surveys, the study found that common coping mechanisms included selling livestock, diversifying income sources through alternative crops, and seeking off-farm employment. The findings underscored the need for supportive policies that facilitate access to credit and resources for smallholder farmers to enhance their adaptive capacity during drought periods.

Furthermore, a study conducted in Isiolo County, Kenya, by Owambo (2020) examined the coping strategies of smallholder farmers through qualitative narratives. Researchers conducted 83 interviews across 20 households to explore the perceived impacts of drought and various coping strategies. The findings revealed that farmers experienced decreased agricultural productivity and livestock hunger, leading to reliance on aid and livelihood diversification. The study categorized coping strategies into four groups: Livelihood diversification, longer-term strategies, short-term activities, and erosive strategies. The authors emphasized the importance of understanding individual farmer experiences to inform context-specific policy recommendations.

A case study investigated the drought coping mechanisms among small-scale farmers in the Motheo District of Free State Province. Data were collected from 200 farmers using semi-structured questionnaires analyzed through SPSS. Findings indicated that many farmers were unprepared for drought due to a lack of awareness and resources. Common coping strategies included changing cropping systems and seeking alternative water sources. The study concluded that increased awareness and preparedness are vital for reducing vulnerability to drought.

This study analyzed how agroecological regions in Swaziland influenced smallholder farmers' choice of drought-coping strategies. Researchers used chi-square tests and probit analysis to assess strategy selection across different regions. Results showed that farmers in more drought-susceptible areas were more likely to adopt adaptive measures such as purchasing water and changing livestock types. The study highlighted the importance of socioeconomic factors in determining effective coping strategies.

A study published in Environmental Science & Policy (2023) assessed the social vulnerability and coping strategies of smallholder farmers in two districts of Zambia. Utilizing household data from 194 households, the study employed a social vulnerability index (SVI) to evaluate vulnerability levels and coping mechanisms. The findings revealed that the most common coping strategies included planting drought-tolerant crops (85.4%), varying planting times (71.3%), and diversifying crops. The study concluded that enhancing access to climate information and resources could improve farmers' adaptive capacity against climate change impacts.

Also, a report by Musika (2018) assessed key climate change coping strategies employed by smallholder farmers in Zambia. The study focused on techniques used to mitigate climatic hazards and how farmers access necessary information for adaptation. Findings indicated that many farmers utilized traditional knowledge alongside modern practices such as crop rotation and agroforestry to enhance resilience. However, limited access to resources hindered the broader adoption of these strategies, emphasizing the need for improved information dissemination and resource allocation.

2.5 Establishment of research gaps

Drought represents a significant environmental stressor affecting food security in Zambia, particularly in vulnerable agricultural districts like Chongwe. Although existing research highlights the general consequences of drought, such as decreased crop yields and heightened food prices, there are critical gaps in understanding its localized effects. Key points include:

Research shows that drought leads to reduced agricultural outputs and increased vulnerability among households (Mubiana & Chileshe, 2020). Most studies take a broad approach, often overlooking specific regional nuances in places like Chongwe. Studies like Mwale and Phiri (2018) focus on larger regions but miss the unique socio-economic dynamics at the district level. Targeted research is essential to uncover how local conditions influence drought resilience and food security.

There is a lack of focused studies on how drought affects household consumption, income, and coping strategies. Research by Tembo and Ngulube (2019) provides a broad perspective but fails to delve into specific household responses such as food rationing and income diversification.

Many studies overlook how socio-economic factors and gender influence food insecurity during droughts. Understanding the experiences of vulnerable groups, including women, children, and the elderly, can inform more effective and inclusive policy measures.

The concept of resilience needs further exploration, particularly about Chongwe's specific climatic and socio-economic conditions. Research by Mulenga and Phiri (2020) examines broad adaptive strategies but does not address the unique resilience challenges faced by this district. Research often prioritizes food availability and access, neglecting the nutritional quality and diversity of diets during droughts. Investigating how drought affects dietary choices in Chongwe is crucial for assessing potential health implications, especially among vulnerable populations.

As such, a focused study on the interactions between drought and food security in Chongwe is needed to address these gaps. Such research can yield targeted insights that inform effective policies and interventions tailored to the local context.

3. Methodology

3.1 Research Methods

The basic research design employed in this study is a case study design as it will provide a comprehensive understanding of how drought affects food security in Chongwe District. The quantitative component will allow for statistical analysis of food security indicators among smallholder farmers, while the qualitative component will provide deeper insights into the experiences and coping strategies of the participants.

3.2 Target population

Population is the universe of units from which the sample is to be selected. According to Babbie (1992), a study population is the aggregation of elements from which the sample elements are selected. The target population consists of smallholder farmers who rely on agriculture for their livelihoods, along with local agricultural extension officers and community leaders.

3.3 Sampling design and Sample size

Sample size refers to the number of items to be selected from the universe to constitute the sample, and this answers how many sampling units should be surveyed and interviewed, (Kothari 1990). However, our sample size for this study will be 50; which includes 30 smallholder farmers, 10 Agriculture extension officers, and 10 community leaders from Chongwe District. With a total sample size of 50 participants, stratified random sampling will ensure that each subgroup is adequately represented, allowing for a more nuanced analysis of how different stakeholders perceive and respond to drought-related challenges.

A stratified random sampling technique will be employed to ensure representation across different groups within the population. The sample will be divided into three strata based on participant categories:

Smallholder Farmers: 30 participants who actively engage in farming activities in Chongwe District.

Agriculture Extension Officers: 10 professionals who provide technical support and advice to farmers.

Community Leaders: 10 individuals who have a significant influence on local agricultural practices and community resilience. For this study, the researcher will employ two sampling techniques:

3.4 Data collection methods

The main instruments for data collection are the interview guide and a structured questionnaire with both closed and open-ended questions. They will both be administered to the respondents at their areas of operation.

3.5 Data Analysis

3.5.1 Qualitative analysis

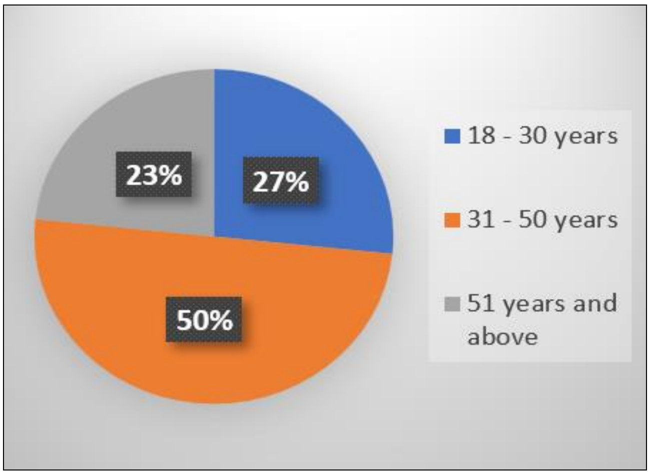
The researcher will use thematic analysis as it looks at patterns of meaning in a data set. Thematic analysis takes bodies of data and groups them according to similarities in other words, themes. These themes help us make sense of the content and derive meaning from it.

3.5.2 Quantitative analysis

Quantitative data will be presented using simple descriptive statistic methods including tables, bar graphs, percentages and pie charts. Cross tabulations will be used to find out the relationship between different variables. The researcher will further use STATA Application and Microsoft Excel to enter and tabulate the data.

4. Findings and Results

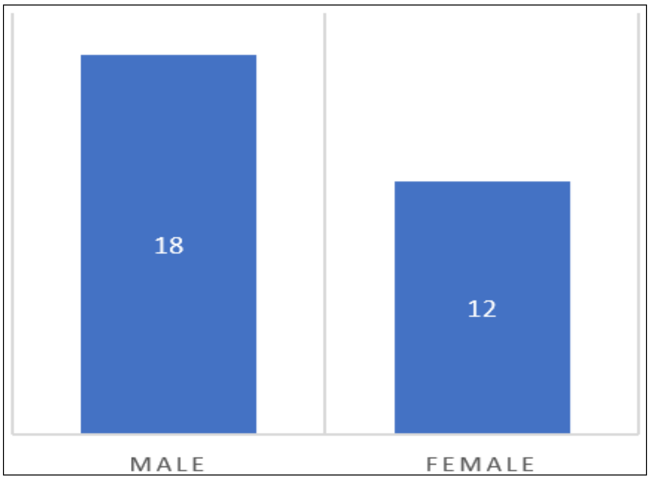
4.1 Findings from smallholder farmers



Source: Primary Data, 2024

Fig 1: Age Distribution

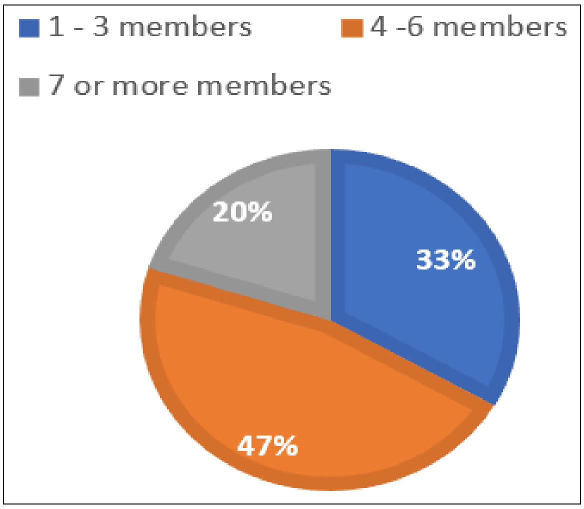
According to our findings on the age distribution of the research participants, 50% of the respondents were in the 31- 50 years old bracket, then 27% of the respondents were in the 18 -30-year-olds bracket and 235 of the respondents were 51 years old and above.



Source: Primary Data, 2024

Fig 2: Gender Distribution

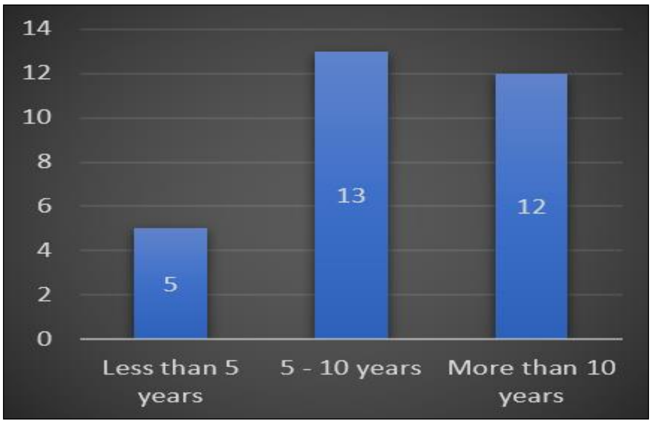
According to our finding on the gender distribution, 18 research partcipants were Male and the 12 research participants were Female.



Source: Primary Data, 2024

Fig 3: Household Size

According to our findings on the household size, 47% of the research participants came from a 4 – 6member household, then 33% of the research participants came from a 1 – 3-member household and 20% of the respondents came from a 7 or more-member households.



Source: Primary Data, 2024

Fig 4: Years in Farming

The researcher was trying to understand the number of years the research participants have been engaging in farming. According to findings, 13 research participants have been in farming between 5 to 10 years, then 12 research participants have been in farming for more than 10 years and 5 of the research participants have been in farming for less than five years.

4.1.2 Effects of Drought on Household Food Security

Table 1: Effects of Drought on Food Security

Question	Categories	Frequency	Percentage (%)
Frequency of Drought	Once every year	20	66.7
	Once every 2-3 years	10	33.3
Impact on Food Production	No impact	2	6.7
	Reduced Significantly	22	73.3
	Reduced slightly	6	20.0
	Increased	0	0.0
Reliance on food aid	Yes	18	60.0
	No	12	40.0

Source: Primary Data, 2024

Drought occurred annually for 66.7% of respondents, with 73.3% reporting significant reductions in food production. Over half (60%) relied on external food aid during drought periods. This reliance underscores the vulnerability of these households to food insecurity, especially during recurring droughts.

4.1.3 Impact of Drought on Social, Economic, and Cultural Dynamics

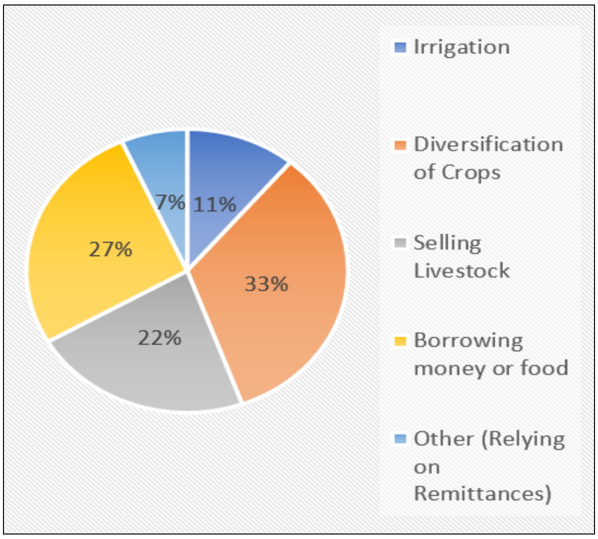
Table 2: Impact of Drought on Income and Migration\

Question	Categories	Frequency	Percentage (%)
Impact on Income	No impact	3	10.0
	Reduced significantly	20	66.7
	Reduced Slightly	7	23.3
	Increased	0	0.0
Migration due to drought	Yes	10	33.3
	No	20	66.7

Source: Primary Data, 2024

Two-thirds (66.7%) of respondents reported a significant reduction in household income due to drought, reflecting its economic impact. While 33.3% experienced migration within their families as a coping strategy, the majority (66.7%) remained in their communities despite adverse conditions, possibly due to limited resources or strong community ties.

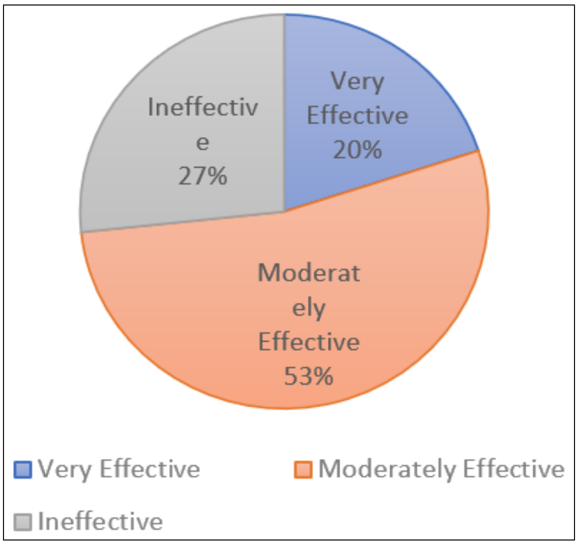
4.1.4 Coping Strategies



Source: Primary Data, 2024

Fig 7: Coping Strategies Adopted by Farmers

According to our findings, half of the respondents (50%) diversified their crops to reduce reliance on a single yield, while 40% borrowed money or food to cope. Only 16.7% used irrigation, likely due to limited access to water infrastructure.

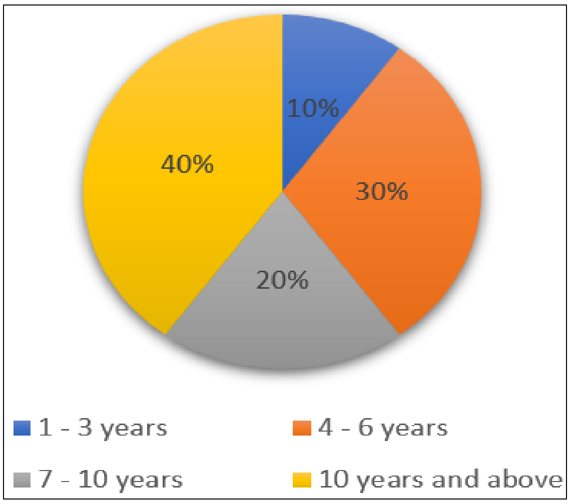


Source: Primary Data, 2024

Fig 8: Effectiveness of Coping Strategies

According to our findings, most respondents (53.3%) found the above strategies moderately effective, though 26.7% rated them as ineffective, indicating room for improvement in support systems.

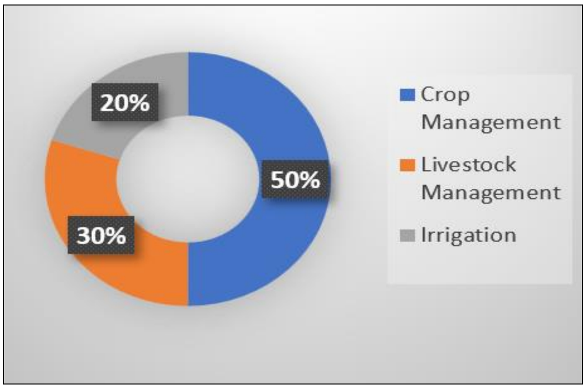
4.2 Findings from Agriculture Extension Officers



Source: Primary Data, 2024

Fig 9: Years Worked as Extension Officer

After engaging agriculture extension officers on their years of experience, our findings indicate that 40% of the respondents have more than 10 years' work experience, 30% have 4 to 6 years of work experience, 20% have 7 to 10 years of experience, and 10% have 1 to 3 years of work experience.

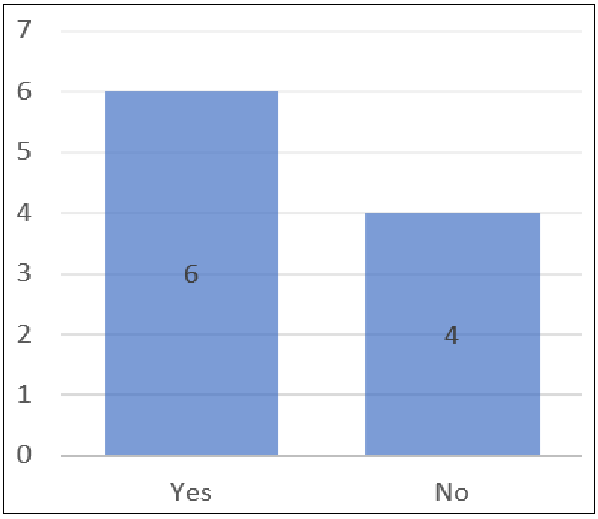


Source: Primary Data, 2024

Fig 10: Area of Expertise

Most respondents (40%) had worked as extension officers for over 10 years, reflecting significant experience in the field. The primary **area of** expertise was cropping management (50%), critical in addressing the drought-induced challenges in the food sector. Most extension officers supported between 20–50 farmers (50%), suggesting a manageable but impactful workload.

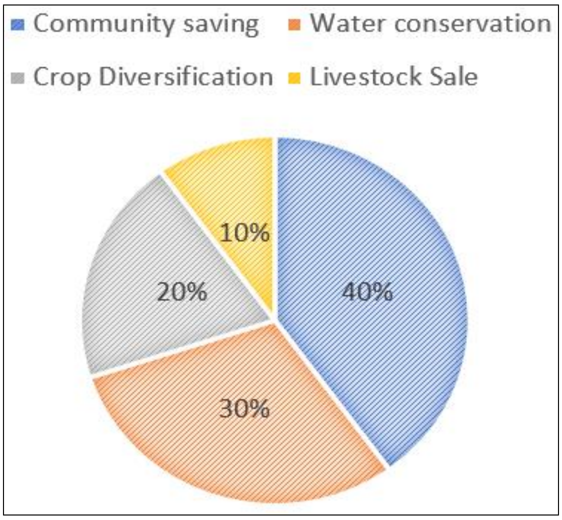
Impact of Drought on Social, Economic, and Cultural Dynamics



Source: Primary Data, 2024

Fig 11: Migration and Socioeconomic Effects

Our findings indicate that a majority (60%) of extension officers noted migration within the district as a direct consequence of drought, often as households sought alternative income sources. Respondents also reported disruptions in community cohesion and cultural practices, such as reduced participation in communal ceremonies.

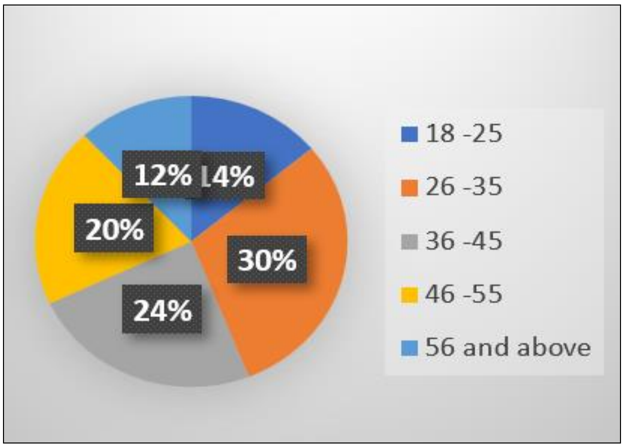


Source: Primary Data, 2024

Fig 12: Community-Level Coping Strategies

According to our findings, community savings (40%) emerged as the most common strategy to combat drought, followed by water conservation (30%). While crop diversification (20%) and livestock sale (10%) were also used, these strategies were less impactful without systemic support.

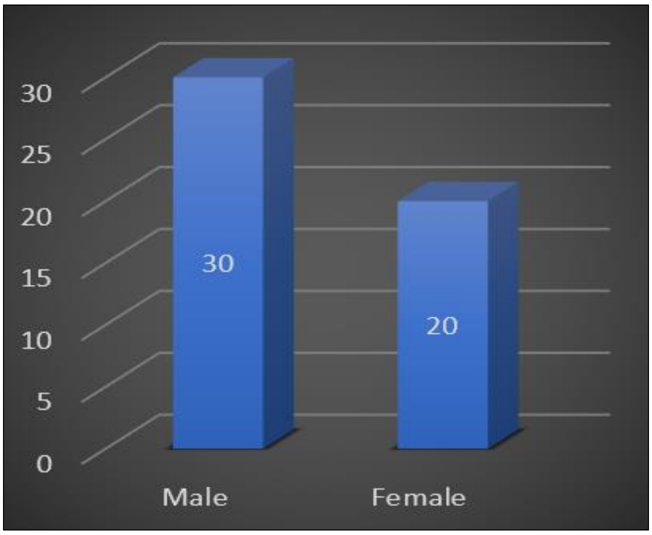
4.1.1 Demographic Characteristics of Respondents



Source: Field data, 2024

Fig 13: Age group

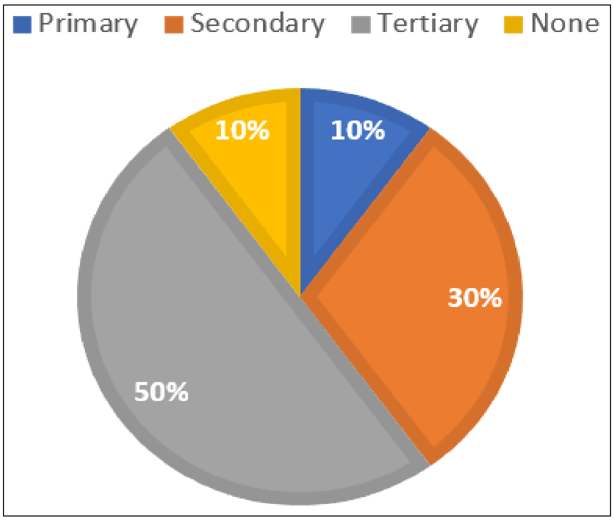
According to our findings on the age group of the respondents, the majority of our respondents were between the age of 26 and 35 represented by 30%. And the least of our respondents were between the agree bracket of 56 and above represented by 12%.



Source: Field data, 2024

Fig 14: Gender Distribution

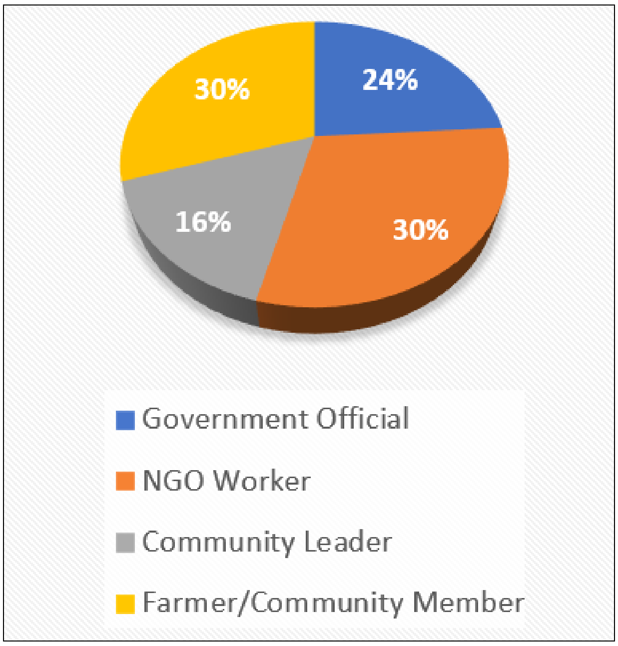
According to our findings on the gender distribution, our research participants comprised of 30 men and 20 women. This shows a marginal representation from both genders.



Source: Field data, 2024

Fig 15: Educational Level

According to our findings on the educational level of our participants. Our data show that 50% of the respondents attained tertiary education, then 30% of the respondents attained secondary education, then 10% of the respondents attained primary education and another 10% of the respondents haven't attained any education at all.

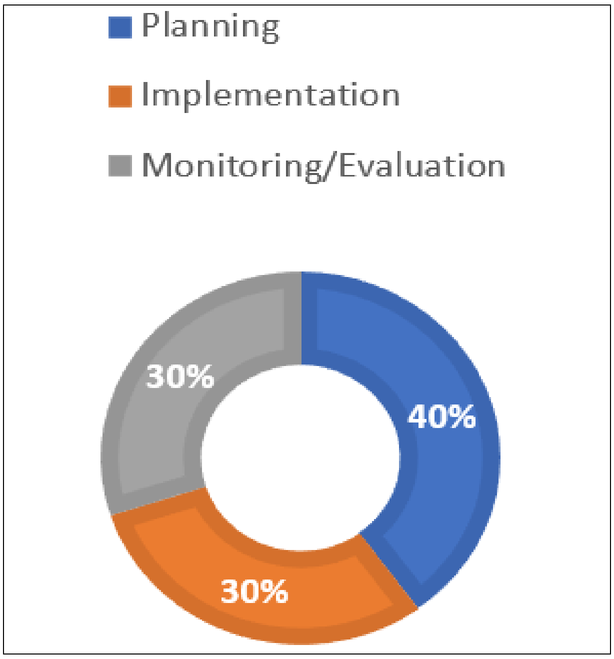


Source: Field data, 2024

Fig 16: Occupation

Based on our findings on the occupation of the research participants, our data shows that 30% of them are NGO workers, and another 30% of the participants are farmers or community members. Then 24% of them are government workers and 16% of the research participants are community leaders.

Involvement in Rural Development Projects



Source: Field data, 2024

According to our findings on the area of involvement of our research participants in rural development projects, 40% of them mentioned that they were involved in planning, then 30% of them mentioned that they are involved in implementation and another 30% of the participants mentioned that they are involved in monitoring and evaluation.

4.2 Presentation of Results Based on Key Challenges in Managing Rural Development Projects

Table 4.2: Key Challenges in Managing Rural Development Projects

Challenge	Frequency (N=50)	Percentage (%)
Financial Constraints	40	80%
Inadequate Infrastructure	35	70%
Limited capacity and training	32	64%
Governance and coordination issues	28	56%
Cultural barriers	25	50%
Logistical challenges	22	44%

Figure 4.2: Key Challenges in Managing Rural Development Projects

Financial constraints (80%) and inadequate infrastructure (70%) were identified as the most significant challenges faced in managing rural development projects, followed by limited capacity and training (64%).

Fig 4.3: Severity of Challenges

Challenge	Not severe	Slightly severe	Moderately severe	Very Severe
Financial Constraints	0%	10%	10%	80%
Inadequate Infrastructure	5%	10%	15%	80%
Limited capacity and training	10%	15%	11%	64%
Governance and coordination issues	12%	20%	12%	56%
Cultural barriers	20%	15%	15%	50%
Logistical challenges	22%	15%	19%	44%

5. Discussion of Findings

The research identified several critical challenges and strategies in managing rural development projects in Zambia. The key challenges include financial constraints, inadequate infrastructure, and limited capacity and training. Strategies employed to address these challenges include capacity building, public-private partnerships (PPPs), and community participation. The effectiveness of these strategies varied, with capacity building and PPPs rated as particularly effective.

1. Financial Constraints and Infrastructure Deficiencies

The finding that financial constraints and inadequate infrastructure are major challenges is consistent with existing literature. Chambers (1997) [11] highlights how financial limitations often hinder the successful implementation of rural development projects, aligning with our findings where 80% of respondents identified financial constraints as a significant issue. Similarly, Moyo (2017) [26] discusses how inadequate infrastructure impedes agricultural and economic development in Southern Africa, which is reflected in the 70% of respondents who cited infrastructure deficiencies as a challenge. For instance, the Rural Electrification Program in Zambia faced significant delays and budget overruns due to financial constraints and inadequate infrastructure (Chitonge, 2019) [12]. This example illustrates the real-world impact of financial and infrastructural challenges on rural development projects.

2. Capacity Building and Training

Limited capacity and training emerged as a notable challenge, with 64% of respondents citing it as a significant issue. This finding supports the literature on the necessity of building local capacities to ensure effective project management and sustainability. The FAO (2020) emphasizes the importance of training and capacity building in overcoming agricultural challenges, which resonates with the research findings that capacity building is a widely used and effective strategy. For instance, the Enhanced Smallholder Livelihoods Project in Zambia, which focused on training local farmers in sustainable agricultural practices, demonstrated how capacity building can significantly improve project outcomes (FAO, 2020). The project's success highlights the importance of targeted training programs.

3. Public-Private Partnerships (PPPs)

Public-private partnerships were found to be an effective strategy, with 60% of respondents employing them. This aligns with the literature suggesting that PPPs are crucial for leveraging additional resources and expertise in rural development (Moyo, 2017) [26]. PPPs facilitate collaboration between government, private sector, and local communities, which enhances project implementation and sustainability. For instance, the Zambia National Commercial Bank's collaboration with the government to finance rural infrastructure projects is a practical example of a successful PPP. This partnership has facilitated the construction of roads and schools in remote areas, demonstrating the effectiveness of such collaborations (Chitonge, 2019) [12].

4. Community Participation

Community participation emerged as a common strategy (56%) but was less effective compared to capacity building and PPPs. This finding is consistent with the literature that acknowledges the importance of community involvement but also notes the challenges in achieving meaningful participation (Chambers, 1997) [11]. Effective community engagement requires addressing local needs and ensuring that communities have a voice in project planning and implementation. For instance, the Community-Based Rural Development Project in Zambia faced challenges with community participation due to inadequate local involvement in decision-making processes. The project's mixed results highlight the need for more inclusive participation strategies to enhance effectiveness (Moyo, 2017) [26].

5.3 Effectiveness of Strategies

The effectiveness of the strategies employed varies. Capacity building programs and public-private partnerships were rated as highly effective, which aligns with the literature emphasizing their role in fostering sustainable development. In contrast, strategies such as the use of local resources and policy reforms were rated less effective, indicating potential areas for improvement. For instance, the Zambia Agricultural Development Support Program demonstrated high effectiveness in using capacity building and PPPs to improve agricultural productivity. However, the program's limited impact from policy reforms suggests a need for more comprehensive policy adjustments (FAO, 2020).

6. Acknowledgment

My sincere gratitude goes to my supervisor, Dr Kelvin Chibomba, for his commitment and
competent guidance throughout the process of conducting this study.

I am also very grateful to Information, and Communications University for empowering me with project planning and management skills and knowledge.

I am also thankful to everyone who participated in the study for their valuable responses which made this study possible.

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