

**FACTORS INFLUENCING THE FOOD SECURITY OF SMALLHOLDER
FARMERS IN YAMBIO COUNTY, SOUTH SUDAN**

By

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Declaration

I declare that this work has not been previously submitted and approved for the award of a degree by this or any other University. To the best of my knowledge and belief, the dissertation contains no material previously published or written by another person except where due reference is made in the dissertation itself.

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ABSTRACT

The global population is projected to reach 9.7 billion people by 2050. This will require a 60% increase in global food production. Additionally, over 815 million people are chronically undernourished especially in parts of sub-Saharan Africa (SSA) and South Asia, where 22.8% and 14.7% of the overall populations are undernourished, respectively. Globally, food is the most basic of all human needs. Food security is therefore an important measure of well-being of a household or community and thus food availability, food access, food utilization and stability is paramount. This study sought to investigate the factors influencing food security of smallholder farmers in Yambio, South Sudan. The specific objectives were to evaluate the relationship between access to extension services and food security, to assess the relationship between the size of cultivated land and food security and to analyze the relationship between access to credit and food security. The study was anchored on the food security model and the theory of access. The study used a descriptive survey design and targeted a population of 700 farmers in Bazungua Payam. Simple random sampling technique was used to select a sample size of 255 farmers. Primary data was collected using a questionnaire and the data was analyzed using both descriptive and inferential statistics with the aid of the Statistical Package for Social Sciences. The study found that extension services through the acquisition of agricultural knowledge and capacity strengthening of farmers had a positive correlation with food security. Further, land ownership and food availability were positively correlated, however, land size and food security were negatively correlated. Equally, formal credit sources had a weak negative correlation with food security, while access to informal credit sources and food security were negatively correlated. It was concluded that in order to achieve food security, there should be easy access to extension services like training farmers on good agronomic practices and crop management techniques. That increasing the number of farmers who own land will result in a corresponding increase in food production and therefore an improvement in food security. The study further concluded that there was limited access to credit sources to boost farming activities such as purchase of farm inputs and machinery. The study recommends that in order to achieve sustainable food security in Yambia County and the country at large, the government of South Sudan needs to increase budgetary allocation to the agricultural sector which will in turn be invested in the provision of agricultural extension services to the farmers. Banks and microfinance institutions in Yambio County in collaboration with the government of South Sudan need to come up with tailored programs that will enable farmers to access credit at favorable terms to enable them to sustainably invest and expand agricultural production and consequently realize food security.

DEDICATION

I dedicate this study to my family members, friends and the Catholic Diocese of Tombura-Yambio for their motivation and inspiration to enable me to continue with this course. They remained patient at a time when I was most needed and I am appreciative of the efforts they have made to see this plan through to the finish.



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TABLE OF CONTENTS

DECLARATION	ii
ABSTRACT	iii
DEDICATION	iv
TABLE OF CONTENTS	vi
LIST OF TABLES	ix
LIST OF FIGURES	x
DEFINITION OF TERMS	xii
CHAPTER ONE	1
INTRODUCTION	1
1.1 Introduction and Background Information	1
1.1.1 Food Security.....	4
1.1.2 Access to Extension Services	4
1.1.3 Size of Cultivated Land	5
1.1.4 Access to Credit.....	6
1.1.5 Yambio County Overview.....	7
1.2 Problem Statement.....	7
1.3 General Objectives.....	8
1.4 Specific Objectives	8
1.5 Research Questions.....	8
1.6 Significance of the study.....	8
1.7 Scope of the Study	9
1.8 Expected Limitations to the Study.....	9
CHAPTER TWO	10
LITERATURE REVIEW	10
2.1 Introduction.....	10
2.2 Theoretical Review	10
2.2.1 Availability, Accessibility, Utilization, and Stability of Food framework	10
2.2.2 Theory of Access	15
2.3 Empirical Review	20
2.3.1 Access to extension services and food security	20
2.3.2 Size of cultivated Land and food security.....	22
2.3.3 Access to Credit and Food Security.....	24

2.4 Summary of Research Gaps.....	26
2.5 Conceptual Framework.....	27
2.7 Chapter Summary	29
CHAPTER THREE.....	30
RESEARCH METHODOLOGY	30
3.1 Introduction.....	30
3.2 Research Philosophy.....	30
3.3 Research Design	30
3.4 Population and Sampling	31
3.4.1 Population Frame.....	31
3.5 Sampling Design.....	31
3.6 Sample Size	32
3.7 Data Collection Method.....	33
3.8 Data Collection Procedure.....	33
3.9 Research Quality.....	33
3.9.1 Validity	33
3.9.2 Reliability	34
3.10 Data Analysis.....	34
3.11 Ethical Considerations	35
3.12 Chapter Summary	35
CHAPTER FOUR	36
DATA ANALYSIS AND PRESENTATION.....	36
4.1 Introduction.....	36
4.1.1 Response Rate.....	36
4.2 Background Information.....	37
4.2.1 Gender of Respondents.....	37
4.2.2 Age of Respondents	37
4.2.3 Gender of Household Head.....	38
4.2.4 Number of Family Members.....	39
4.2.5 Years Spent in School.....	39
4.2.6 Forms of Employment Besides Farming	40
4.3 Access to Extension Services	41
4.3.1 Farmer Knowledge, Skills and Capacity	41
4.4 Size of Cultivable Land	43

4.4.1 Land Ownership and Size	43
4.5 Access to Credit.....	44
4.5.1 Presence of Bank Services, Microfinance Services and Other Loan Sources	44
4.6 Food Security.....	45
4.6.1 Food Consumption in the Previous Year.....	45
4.6.2 Main Source of Food	46
4.6.3 Number of Meals Per Day	47
4.6.4 Quality of Meals	48
4.6.5 Variety and Diversity of Meals.....	49
4.7 Inferential Statistics	50
4.7.1 Access to Extension Services and Food Availability	50
4.7.2 Size of Cultivated Land and Food Security	51
4.7.3 Access to Credit and Food Security.....	52
4.8 Regression Coefficients	53
4.9 Chapter Summary	54
CHAPTER FIVE	55
SUMMARY, DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS	55
5.1 Introduction.....	55
5.2 Summary.....	55
5.3 Discussion of Key Findings.....	56
5.3.1 Access to Extension Services and Food Security	56
5.3.2 Size of Cultivated Land and Food Security	58
5.3.3 Access to Credit and Food Security.....	59
5.4 Conclusions.....	61
5.5 Recommendations.....	62
5.6 Limitations of the Study	64
5.7 Recommendations for Further Studies	65
REFERENCES	666
APPENDICES	844
APPENDIX I: QUESTIONNAIRE	844
APPENDIX II: LETTER OF INTRODUCTION.....	89
APPENDIX III: STRATHMORE UNIVERSITY ETHICAL CLEARANCE.....	900
APPENDIX IV: NACOSTI CERTIFICATE	911

LIST OF TABLES

Table 2. 1: Summary of Research Gaps.....	26
Table 2. 2: Operationalization of Variables	29
Table 4. 1: Response Rate.....	36
Table 4. 2: Respondents' Gender	37
Table 4. 3: Age of Respondents	37
Table 4. 4: Other Forms of Employment Besides Farming	41
Table 4. 5: Access to Extension Services.....	42
Table 4. 6: Size of Land Cultivated	43
Table 4. 7: Access to Credit.....	44
Table 4. 8: Relationship between access to extension services and food availability	51
Table 4. 9: Relationship between Size of Land Cultivated and Food Availabilty.....	52
Table 4. 10: Relationship between Access to Credit and Food Security	53
Table 4. 11: Regression Coefficients	54



LIST OF FIGURES

Figure 2. 1: Availability, Accessibility, Utilization and Stability Food Security Model.....	13
Figure 2. 2: Conceptual Framework.....	28
Figure 4. 1: Gender of Household Head	38
Figure 4. 2: Number of Family Members	39
Figure 4. 3: Years in School.....	40
Figure 4. 4: Food Consumption in Previous Year.....	46
Figure 4. 5: Main Source of Food	47
Figure 4. 6: Number of Meals per Day	48
Figure 4. 7: Quality of Meals	49
Figure 4. 8: Variety and Diversity of Meals	50



LIST OF ABBREVIATION

AAH: Action Africa Help

A3 Seeds: Seed Project funded by the Embassy of Netherlands in South Sudan

CDTY: Catholic Diocese of Tombura-Yambio

DV: Dependent Variable

FAO: Food and Agriculture Organization

FHHs: Female-Headed Households

FSNAS: Food Security and Nutrition Analysis System

Ha: Hectare

IV: Independent Variable

MHHs: Male-Headed Household

NACOSTI: National Commission for Science, Technology and Innovation

NGO: Non-Governmental Organization

SBS: Strathmore Business School

SSA: Sub-Saharan Africa

UNMISS: United Nations Mission in South Sudan

WFP: World Food Programme



DEFINITION OF TERMS

Access to credit refers to a smallholder farmer's ability to obtain funds to purchase farming inputs and make long-term investments in their farms.

Extension services provide smallholder farmers with an understanding of agronomic practices that can enhance their livelihoods, food security, and productivity.

Food security is the state of consistently having access to an adequate amount of reasonably priced, nutritious food.

The size of cultivated land refers to the total area sown by a smallholder farmer.

Smallholder: These are farmers who produce relatively small food volumes on small plots of land compared to large or commercial-scale farmers.



CHAPTER ONE

INTRODUCTION

1.1 Introduction and Background Information

Food security is a universally important aspect of household and personal well-being (Bahiru, Senapathy, & Bojago, 2023). Socio-economic conditions play a key role in the households' food security (Panzai, et al., 2021). Globally, food is the most basic of all human needs. (Gerald, 2021). The food shortage has remained persistent in Sub-Saharan Africa, where the proliferation of undernourishment is nearly 30%. (Jozsef Popp, 2019). Globally, food is the most basic of all human needs (Dzanku, 2019). Food security is dependent on access and consumption patterns, food utilization and nutrition, and overall stability of the system as much as food production and availability (Netra Chhetri, 2014).

Since gaining independence in 2011, the oil-reliant East African country has contended with civil wars, economic stagnation, the fallout from COVID-19, and a string of devastating floods and droughts (The World Bank, 2023). The World's youngest Country has faced food security crises throughout its years of independence, a complex balance between conflict and climate change has left South Sudan consistently ranking among the world's hungriest Countries with numbers as 7.2 million people in food crises, 2.4 million people at risk of famine if they don't receive aid, 1.4 million Children suffering from acute malnutrition and 483,000 malnourished pregnant or lactating women (Concern Worldwide, 2022). South Sudan's food security has been deeply and permanently disrupted by the impacts of war since 2013, yet it is the economic and market impact of conflict, rather than the violence itself, that have become the most prominent drivers of food insecurity (FAO/WFP, 2020). South Sudan faces one of the world's most dire food insecurity situations. A September 2019 analysis by the FAO found that 6.35 million people (more than half of the country's population) faced crisis-level food insecurity or worse, with 10,000 of these facing catastrophe; South Sudan faces conflict-induced instability that affects the ability to grow, buy, and sell food, ensuring a cycle of food insecurity (FAO, 2019). While global attention is focused on Ukraine, a hidden hunger emergency is engulfing South Sudan with about 8.3 million there including refugees facing extreme hunger, food becomes scarce and provisions are depleted, particularly at risk are tens of thousands of South Sudanese who are already severely hungry following successive and continuous shocks and could starve

without food assistance (United Nations, 2022). Conflict and climate-driven shocks in South Sudan have significantly damaged agricultural production, which is South Sudan's primary economic sector and source of livelihood; 95 percent of South Sudanese rely on farming, herding, or fishing. Any disruption to this sector causes ripple effects and has the potential to harm South Sudan's overall economy (USAID, 2022). South Sudan is facing unprecedented levels of acute food and nutrition insecurity in the wake of a five-year civil war that ended in 2008. This situation has been exacerbated by extreme weather events, periodic outbreaks of subnational violence, and the global impacts driven by the Russian invasion of Ukraine compounded by the ongoing civil war in Sudan which had caused an inflow of more than 100,000 returnees/refugees into South Sudan (The World Bank , 2023).

Food insecurity in South Sudan has been a persistent and severe issue for years, exacerbated by a combination of factors including conflict, displacement, economic instability, and environmental challenges (FAO, 2023). Yambio County, like many other counties in South Sudan, faces challenges related to food security occasioned by various factors including conflict, displacement, and economic instability. These factors have disrupted agricultural activities, limited access to markets, and hindered humanitarian assistance (World Food Program, 2021). Given the importance of food security, it is necessary to identify appropriate measures that complement each other to capture all the important facets of food security. Implementation of the appropriate measures against food insecurity can only be effective based on empirical studies informing decision-making on interventions. Carrying out the current study may therefore be instrumental in addressing the factors influencing food security in Yambio County in South Sudan.

According to UNICEF (2023), hunger and malnutrition are on the rise across the flood, drought, and conflict-affected areas of South Sudan, with some communities likely to face starvation if humanitarian assistance is not sustained and climate adaptation measures are not scaled up. On its part, World Food Program (2023) noted that despite significant deployment of humanitarian assistance between February and March 2023, an estimated 6.83 million people (55% of the population) faced high acute food insecurity of which 2.37 million people faced emergency conditions. An estimated 55,000 people were classified in Catastrophe in Fangak, Canal Pigi and Uror counties in Jonglei State; Pibor County in Greater Pibor, Tambura County in Western

Equatoria State; and Leer and Mayendit counties in Unity State. Given the high levels of acute food insecurity in the country, an immediate scale-up of multi-sectoral humanitarian assistance was needed to save lives and prevent the total collapse of livelihoods in the affected counties.

Land provides the essential space for growing crops and raising livestock, which are the primary sources of food for human consumption. Agriculture on land produces a wide variety of crops such as grains, vegetables, fruits, and pulses, as well as animal products like meat, milk, and eggs, all of which are essential for meeting nutritional dietary needs (Lestari, Gunarto, & Yuliawan., 2023). Given the importance of land for agriculture, sustainable land cultivation practices and equitable access to land are essential for ensuring food security (Giller, 2020). On the other hand, extension services serve a critical role in supporting agricultural development, more especially in rural areas where smallholder farmers often lack access to information resources, and technologies (Bekele, 2021). Therefore, extension services help in empowering farmers, promoting sustainable agriculture, and fostering rural development by providing technical assistance, knowledge transfer, and policy support tailored to the specific needs and contexts of smallholder farmers (World Vision Kenya, 2022). Similarly, access to credit allows farmers to purchase essential inputs such as seeds, fertilizers, pesticides, and irrigation equipment. These inputs are necessary for improving crop yields, enhancing productivity, maintaining farm fertility leading to food security (Carranza & Niles., 2019). This study focused on the three factors of access to credit, extension services and size of cultivated land as key factors influencing food security.

Farming needs to be profitable, which includes farmers being connected to domestic supply chains and market signals, local value-adding, and post-harvest storage. This will create jobs and increase income earning capacity, which is the key to households' food security (Bjornlund & Rooyen, 2022). It is also noted that family size and distance to the market are important factors negatively influencing household food security (Amare & Simane, 2017). Development interventions that aim to encourage older households to share their experience to younger households, diversify income of the households, improving productivity of land and livestock, improving the supply and access of chemical fertilizer, incentives to use soil and water conservation activities are found to improve the food security status of the households (Muche & Tadele, 2015). These measurements are not only related to food intake and food security;

since they are also related to health measures taken, child care, natural conditions and diseases and thus they should not be used as solitary (specific) methods in food security measurement (Keskin & Demirbas, 2022). Households relying on single source of income alone are expected to have a higher probability of food insecurity than those that have diversified into some other enterprises. This is plausible because such households are more resilient in times of food crisis than those having a single source of income alone (Aziz, Iqbal, & Butt, 2016). Food security status of households is measured by the calorie intake method. Based on the calorie's intake method, the food security line is defined by selecting a "basket" of food items usually consumed by the households (Fikire & Belay, 2022).

1.1.1 Food Security

Serious concerns about food insecurity are being shown worldwide due to the increasing number of people which is more than 900 million undernourished people. Among these 900 million undernourished people, 800 million are living in developing countries of Asia and Africa, that is, 552 and 226.4 million, respectively (Akbar, Niaz, & Amjad, 2020). Rural areas today particularly face food insecurity for a variety of reasons, including rapid population growth, low agricultural productivity, lack of sustainable food security policies, macroeconomic instability, and rapid fluctuations in the prices of agricultural products (Mengistu & Kassie, 2022). Food security exists when everyone always has physical, social, and economic access to sufficient, safe, and nutritious food that meets their dietary needs and dietary preferences for an active and healthy life (Fikire & Belay, 2022). Today, the world faces a potential food security crisis due to a growing population and a lack of secure supply of safe, nutritious, and sustainable high-quality food with lower inputs and other environmental changes and diminishing resources in the light of global climate change (Ayele, 2020).

1.1.2 Access to Extension Services

The process of enhancing food productivity and security starts with building the capacity of the farmers. Thus, building the capacity of the farmers to boost sustainable food production cannot be overemphasized given the ever-increasing population and harsh climatic conditions; Farmers' knowledge, skills, capacity and competencies need to be enhanced (Nason &

Nyakiba, 2018). Agricultural training ensures farmers acquire the necessary skills for effective farm management, including accurate record-keeping (Mujibi, et al. 2018). Capacity building is desperately needed to improve crop management technologies, particularly for rainfed systems' nitrogen efficiency (Vidigal, et al. 2020). Agricultural extension encompasses all the activities that offer farmers and other actors the necessary information and services to enhance their production and livelihood. This includes the effective dissemination and adoption of technologies and practices at a large scale by the users, resulting in the anticipated development impact (Toroitich, 2021). In addition to helping to maintain and rebuild vital infrastructure, such as the country's main supply channels, Blue Helmets from Thailand are teaching the local populace in South Sudan, particularly the displaced, how to cultivate their food (UNMISS, 2021).

1.1.3 Size of Cultivated Land

The average operational farm size was already small in the 1970s, ranging from 1 ha in Indonesia and Japan to 3 ha or 4 ha in the Philippines and Thailand. It has declined in subsequent periods in all these countries except in Japan and the People's Republic of China because of rapid population growth in rural areas; the optimum farm size in low-wage economies is bound to be small because of the limited availability of family labor and the costly substitution of capital for labor (Yamauchi, 2021). While the variance of agricultural incomes declines with increasing farm size, the variance of local food production increases with farm size. These results suggest that farmers benefit from larger farms, earning higher and more stable incomes while consumers suffer from lower and more volatile food supply (Noack & Larsen, 2019). The inverse relationship between farm size and productivity, known as the inverse farm size-productivity relationship (IR), has been observed in various regions, including Sub-Saharan Africa. This means that as farm size increases, productivity tends to decrease. This is often due to peasant farmers who apply more of their family labor to their small farms than larger farms, especially when they are unable to adjust their farm size.

1.1.4 Access to Credit

Credit access can be broken down into two main categories: formal credit sources and informal credit sources. While formal credit sources are given by banks or co-operatives that are supervised by the central bank as they are constituted by law, informal credit sources are normally given by money lenders, friends or relative where there is no legal regulator to manage the credit activities (Salima, et al. 2023). Access to credit was understood as a vital means of facilitating the marketization and commercialization of agriculture more generally, but there was considerable uncertainty around whether agricultural credit itself could be delivered on market terms, and how this might be achieved (Bernards, 2022). Access to credit may not directly impact productivity, it may indirectly impact productivity through the positive effects on smallholder farmers' adoption of agricultural technologies; It may also impact productivity, indirectly, through hired skilled labor, improved health care, and increased capital for farm investments (Missiame et al., 2021). Access to formal credit is critical to farmers for purchasing inputs such as seeds, fertilizers, plant protection materials or animal feed; In the absence of personal savings, borrowing from informal sources (such as moneylenders, relatives and friends) may involve unduly high interest rates and unfavorable conditions, which may make many agricultural operations uneconomical (FAO, 2022). Constraints women generally face when accessing markets are related to access to capital, including land ownership, access to credit and financial services (partly due to little or lack of funding) the main hurdle to access to agricultural credit is the provision of a guarantee (solidarity deposit, harvest collateral, personal guarantee: land ownership title, equipment, etc.) (WFP, 2018).

A strong public-private partnership strategy is needed, emphasizing niche markets, certification programs, and incentives for diversification and production systems (Lulanga, et al., 2022). Flexible microcredit can alleviate liquidity constraints for farmers, leading to increased productivity and financial benefits related to investments, pump operation, and maintenance (Bjornlund & Rooyen, 2022). Financial investments in rural areas include aid agencies and government investments in socioeconomic and infrastructural development, microcredit programs, remittances, loans, and investments from urban individuals (Sakketa, 2023). Trade in South Sudan is hindered by inadequate banking services for credit and foreign

exchange transactions. Banks do not provide sufficient access to foreign currency (IFPRI, 2015).

1.1.5 Yambio County Overview

Yambio County is one of the ten counties that comprise Western Equatoria State, which in turn is one of the ten states that comprise the Republic of South Sudan. Ibbra County is located to the east of Yambio County and the west of Nzara County. To the south, it shares its borders with the Democratic Republic of the Congo (DRC) and to the north with Wulu County-Lakes State. Yambio has an estimated population of around 168,858 people. Yambio County is further divided into six Payams namely; Yambio, Bazungua, Ri-Rangu, Bangasu, Gangura, and Nadiangere. This research will focus on Bazungua Payam which has a population of 7,000. The population of the county is a mix of many tribes prominent being, the Azande people.

1.2 Problem Statement

According to African Development Bank (2016), agriculture in South Sudan remains a subsistence activity by smallholder farmers using simple implements, the average farm size is small and in the range of 0.4-1.7 hectares and many small farmers still find it difficult to obtain credit despite the importance of the sector. Farmers complain that they do not get any information from the extension workers or irrigation technicians regarding the timing and amount of irrigation water application for different crops (Qureshi et al., 2018). However, farmers in South Sudan face varied challenges due to incessant conflict and political instability which disrupts farming activities, displaces populations, and destroys infrastructure. This has made it impossible for smallholder farmers to grow enough food (World Food Program, 2021).

There is no study in the researcher's knowledge that has been conducted in South Sudan to assess the relationship between extension services, access to credit and size of cultivated land on food security and this creates an empirical gap. However, in other jurisdiction, various studies have been conducted on factors influencing food security. For instance, in India, Matto (2017) focused on seed treatment skills, technical advice for seed storage and visits of agricultural officers on food security using a mixed research design. In Zimbabwe, Makuvaro (2017) focused on crop production research and land use on food security using a cross-

sectional research design. In Nigeria, Ofana et al. (2016) studied rainfall, exchange rate and food export on agricultural output based on secondary data and qualitative research design was used. In Somalia, Mohammed (2018) focused on the influence of weather, seed varieties, crop pests transport infrastructure on crop production. These studies present both conceptual, geographical and methodological gaps since they were conducted outside South Sudan, they used different methodologies and did not focus on the key variables of the current study namely extension services, size of land cultivated and access to credit. There is a need to fill the identified research gaps. The current study was conducted to examine the factors influencing food security in Yambio County, Western Equatoria State in South Sudan.

1.3 General Objectives

This study aimed to examine the critical factors that influence food security of smallholder farmers in South Sudan.

1.4 Specific Objectives

This study was guided by these research objectives:

- i. To evaluate the relationship between access to extension services and food security.
- ii. To assess the relationship between the size of cultivated land and food security.
- iii. To analyze the relationship between access to credit and food security.

1.5 Research Questions

1. What relationship exists between access to extension services and food security?
2. What relationships exist between the size of cultivated land and food security?
3. What relationship exists between access to credit and food security?

1.6 Significance of the study

The study would be of significance to several stakeholders; to the policy and decision-makers, it would provide recommendations and strategies which once utilized in policy establishment or even in formulation of manuals would lead to an improved food

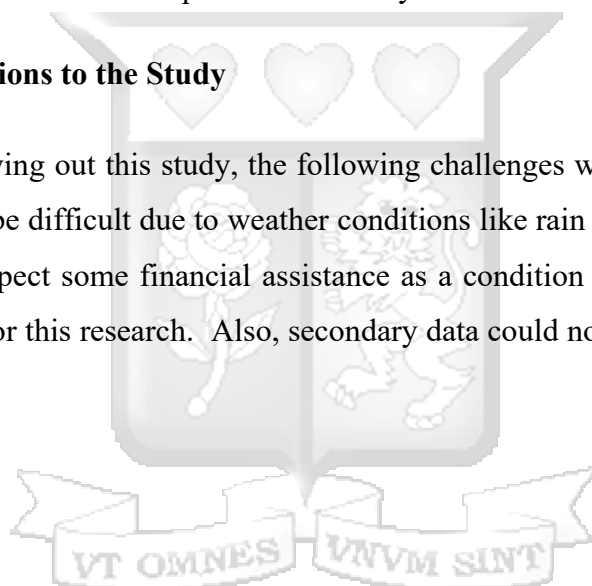
security. This study would also be of significance to extension workers as it will increase their understanding of the issues that they can focus on during their extension service provision. The recommendations from this study would be of very high significance to the farmers and farmer groups in Yambio County as they would use them to improve their productivity towards improving their food security.

1.7 Scope of the Study

This study was only carried out among the farmers of Yambio County, Bazungua Payam. It involved smallholder farmers. This study went in for such farmers as working with them would enable proper measurement of the aspects of this study as it focused on smallholder farmers.

1.8 Expected Limitations to the Study

In the process of carrying out this study, the following challenges were expected; accessibility to some places could be difficult due to weather conditions like rain and also bad roads. Some respondents could expect some financial assistance as a condition or reward for giving out information needed for this research. Also, secondary data could not be readily available for this study.



CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

The chapter includes a literature overview, a conceptual framework, an operationalization of variables, a theoretical and empirical review, and a description of the gaps in the research.

2.2 Theoretical Review

The theoretical review assists in limiting the research's scope and demonstrates an understanding of the theories and concepts pertinent to the study (Sreekumar, 2023). Like a house that cannot be built without a plan, a study's structure and goals are unclear in the absence of a theoretical review (Grant & Osanloo., 2014). Scholars have produced theories to explain several issues such as food security, access to extension services, credit availability and size of cultivated land. The relationship between the three variables was clarified by the theoretical review. The availability, accessibility, utilization, and stability of the food security framework, which focuses on the aspects of food security in any given society, and the theory of Access which is the capacity to gain advantages from things, serve as the foundation for this study.

2.2.1 Availability, Accessibility, Utilization, and Stability of Food framework

The framework was proposed by the 1996 World Food Summit and it provides a comprehensive framework for assessing and understanding food security issues by considering multiple dimensions beyond just the availability of food (Barret et al., 2022). Each component of the framework represents a key aspect of ensuring people have reliable access to nutritious food. Availability describes the physical presence of food within a certain place or region; it looks at elements such as agricultural productivity, food production, imports, exports, and food stocks (Westhoek et al., 2019). Assessing availability entails an examination of whether there is enough and sufficient food to meet the food requirements of the population in terms of amount and variety.

Accessibility considers the capacity of the population and communities to get food. It includes elements such as the affordability of the food, the physical accessibility to the food or proximity closeness to markets, social access and legal and policy frameworks including trade constraints and subsidies (Upton et al., 2022). Accessibility encompasses an analysis of the hindrances or setbacks that prevent certain populations or people from getting food and also identifying strategies to use in order to promote access. Utilization looks at the ability of populations to use the available food and this encompasses factors like nutritional diversity, safety and hygiene in regard to the food available, dietary knowledge, practices involved in food preparation and access to healthcare. Evaluating utilization involves understanding how food is consumed and absorbed by the body, as well as identifying interventions to improve nutritional outcomes (Leroy et al., 2020).

Stability describes the reliability and predictability of food access over time. It includes factors like food price volatility, environmental shocks (such as droughts or floods), political instability and conflict. Evaluating stability involves assessing the resilience of food systems to external shocks and identifying strategies to mitigate the impact of disruptions on food access (Barret et al., 2022). By considering all four components of the Availability, Accessibility, Utilization, and Stability (AAUS) framework, policymakers, researchers, and practitioners can develop comprehensive strategies to improve food security and ensure that all individuals have access to safe, nutritious, and culturally appropriate food.

The AAUS of Food security framework includes seven key tenets discussed here below.

First, the framework is comprehensive in approach. This means that it takes a holistic approach to food security, acknowledging that it is not enough for food to simply be available; it must also be accessible, utilized effectively and stable over time. Secondly, the components of the framework are interconnected, that is it recognizes the interconnectedness of availability, accessibility, utilization, and stability (Westhoek et al., 2019). Changes in one component can have cascading effects on the others, highlighting the need for integrated strategies to address food security.

Thirdly, the framework is multi-dimensional in assessment where it emphasizes the importance of assessing food security along multiple dimensions, including physical, economic, social, and

environmental factors. This comprehensive assessment enables a deeper understanding of the root causes of food insecurity and informs targeted interventions (Konning et al., 2019). The fourth tenet of the framework is equity and social justice since it emphasizes the importance of equity and social justice in achieving food security. It recognizes that inequalities in access to food are often rooted in broader social, economic, and political structures, and seeks to address these inequalities through inclusive policies and interventions (Leroy et al., 2020).

The fifth tenet is resilience and sustainability where it emphasizes the need to build resilience and sustainability into food systems to ensure long-term food security. This includes promoting sustainable agricultural practices, diversifying food sources, and strengthening social safety nets to buffer against shocks and stresses (Upton et al., 2022). The sixth tenet is its participatory approach where it advocates for a participatory approach to addressing food security, involving local communities, stakeholders, and marginalized groups in the design, implementation, and monitoring of interventions. This ensures that solutions are contextually appropriate and responsive to the needs and priorities of those affected by food insecurity. Lastly, the framework is evidence-based in decision making as it emphasizes the importance of evidence-based decision making in addressing food security challenges. This involves collecting and analyzing data on food availability, access, utilization, and stability to inform policy and programmatic interventions and monitor progress over time. By embracing these key tenets, the AAUS framework provides a comprehensive framework for understanding and addressing food security challenges at local, national, and global levels (Barret et al., 2022).

At the World Food Summit in 2016, FAO formally endorsed the concept that; food security exists when all people, at all times, have physical and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life (Hans Van Meijl, 2020). In actuality, these varied dimensions rose to prominence at different points in history as a direct result of broader occurrences and academic discoveries that prompted a growing comprehension of unique facets of food security and their significance for the development of policy (Clapp et al., 2022).



Figure 2. 1: Availability, Accessibility, utilization, and stability of food framework.

The FAO defines this model as having four main components: availability (i.e., having enough food on hand); access (i.e. having enough resources to get food); utilization (i.e., having clean water and a nutritious diet); and stability (i.e the temporal dimension of the other three dimensions ‘at all times’) (Meijl et al., 2020). According to FSNAU, the four primary characteristics of food nutrition, and livelihood security in Somalia are access, availability, utilization, and stability. A system for analyzing food security has been developed by the FSNAU, which combines conceptual and analytical parts of its work comprehensively (FAO, 2022).

The AAUS framework provides several strengths including having a holistic perspective: By considering availability, accessibility, utilization, and stability, the AAUS model provides a comprehensive understanding of food security. This holistic perspective allows policymakers to address the multiple dimensions of food insecurity effectively. The concept identifies the underlying causes of food insecurity, going beyond mere food availability. By examining accessibility barriers, utilization patterns, and stability issues, it sheds light on systemic inequalities, poverty, conflict, and environmental factors contributing to food insecurity.

The framework provides customized interventions by understanding the specific challenges within each component allows for tailored interventions. For instance, improving infrastructure for accessibility, promoting nutritional education for better utilization, or implementing policies

to stabilize food prices can address specific weaknesses identified through the framework. Further, the framework provides a structured framework for evaluating food security interventions and monitoring progress over time. By tracking changes in availability, accessibility, utilization, and stability indicators, policymakers can assess the effectiveness of their strategies and make adjustments as needed. Resilience and adaptability is another strength that involves encouraging the building of resilience into food systems. This resilience helps communities withstand shocks such as natural disasters or economic crises, ensuring continued access to food even in challenging circumstances. Lastly, the framework is applicable globally since its core principles can be adapted to different geographic regions, cultural contexts, and socio-economic settings. Its flexibility makes it a valuable tool for policymakers and practitioners worldwide, allowing for context-specific approaches to addressing food insecurity.

While the AAUS framework offers many strengths, it also has some weaknesses including its complexity due to its holistic approach and consideration of multiple dimensions which can make it complex to implement and evaluate. This complexity may pose challenges for policymakers and practitioners in understanding and effectively addressing all components of food security simultaneously. Secondly, comprehensive assessment of availability, accessibility, utilization, and stability requires robust data across multiple sectors, including agriculture, economics, nutrition, and social sciences. However, data availability and quality may be limited, particularly in low-resource settings, which can hinder the framework's applicability and accuracy. Lastly, successful implementation of the AAUS model relies on active engagement and collaboration among various stakeholders, including government agencies, NGOs, community organizations, and private sector actors. However, inadequate stakeholder engagement may undermine the model's effectiveness and sustainability.

In this study, food security was analyzed in the aspects of food availability, accessibility, utilization, and stability among the farmers and people of Yambio County.

2.2.2 Theory of Access

Jesse Ribot and Nancy Lee Peluso proposed this theory of access in the year 2003. The theory differentiates between one's right to access resources and one's ability to benefit from these. Ribot and Peluso (2003) argue that people may hold the right to access a certain resource, but may not necessarily have the ability to use the resource in a productive way to benefit from it due to a lack of structural and relational mechanisms such as capital, technology, labour, knowledge, authority, market mechanisms, social relations, and identity. McKay and Colque (2016) point out that having the ability to benefit from resources involves access mechanisms that go beyond legal rules or titles and that lacking such mechanisms results in exclusion. So, for example, a farmer may have the right to use the land but lack access to labour or capital to hire labour.

Ribot and Peluso (2003) analyse access along the two variables of “bundle of rights” and “bundle of powers”. While the former embraces all types of formal and informal rules or norms, the latter denotes the structural and relational mechanisms of access that influence whoever gains, maintains, and controls benefits from resources. Thus, according to the theory, bundles of powers mediate or operate in parallel to rights-based access mechanisms to shape how resource users gain control and maintain benefits. This broad definition of access helps us differentiate in this study the importance of property rights and to acknowledge the role of structural and relational access mechanisms that enable households to gain, maintain, and control access to productive resources.

For smallholder farmers, access to land is the most important resource for agricultural production, followed by water for irrigation. Irrigation water helps agricultural crop growth and reduces the effects of inadequate rainfall. Gaining access to productive resources can enable smallholder farmers to adopt sustainable land management approaches such as water-saving strategies and nutrient management, which are needed to achieve sustainable livelihoods by increasing productivity and adapting to and mitigating climate change (Liniger et al., 2011). A livelihood is a means of securing the necessities of life and one necessity or outcome is the achievement of food security. Limited access to productive resources makes smallholder farmers vulnerable to food insecurity and results in unsustainable livelihoods. Since property

and natural resource analysts often use the term "access" without providing a clear definition, this theory created a concept of access and looked at a wide range of variables that distinguish access apart from property.

The theory explains the webs of power as control and maintenance, where control refers to the ability to govern or regulate access to resources like determining who has the authority to decide who benefits from and uses specific resources, in the context of natural resources. Control often lies with powerful actors, such as governments, corporations, or elites. These controlling entities can shape access through formal rules (e.g., property rights, permits) and informal mechanisms (e.g., influence, coercion); for instance, the capitalist class, which owns and controls the means of production, exercises control over resource access. Maintenance pertains to sustaining ongoing access to resources. It involves the efforts made by individuals or groups to ensure that their access remains intact. Those who lack direct control may still maintain access through various strategies like labor where the working class maintains access through their labor; by contributing to resource utilization (e.g., farming, fishing, mining), they secure their benefits. Maintenance is essential for sustaining livelihoods and preventing exclusion from resource use. In summary, control focuses on authority and decision-making, while maintenance emphasizes the ongoing efforts to uphold access (Ribot & Peluso, 2003).

The theory of access, particularly in the context of food security, revolves around the idea that individuals or households must have adequate physical, economic, and social access to food in order to ensure their nutritional well-being (Counterman, 2020). Here are the key tenets of the theory of access: Physical access: This refers to the ability of individuals or households to physically reach food sources. It encompasses factors such as geographical proximity to markets, availability of transportation infrastructure, and the presence of storage facilities. Physical access is crucial, especially in rural or remote areas where food sources may be limited (Ribot & Peluso, 2003).

Economic Access: Economic access focuses on the ability of individuals or households to afford an adequate and nutritious diet. It considers factors such as income levels, food prices, employment opportunities, and access to financial resources such as credit or savings.

Economic access is essential because even if food is available, it may be out of reach for those who cannot afford it (Ribot & Peluso, 2003). Social Access: Social access refers to the social networks, institutions, and support systems that influence an individual's or household's ability to obtain food. This includes social safety nets, community assistance programs, access to education and information about nutrition, as well as cultural and social norms related to food consumption and distribution (Counterman, 2020). Social access is crucial for vulnerable populations, such as marginalized groups or those facing social exclusion.

Utilization refers to the ability of individuals or households to utilize the food they have access to in a manner that ensures adequate nutrition and health outcomes (Ribot & Peluso, 2003). This involves factors such as food preparation and storage practices, knowledge about nutrition and dietary diversity, as well as access to clean water and sanitation facilities (Pangaribowo et al., 2017). Overall, the theory of access emphasizes the multidimensional nature of food security and underscores the importance of addressing not only the availability of food but also the various barriers that individuals or households may face in accessing and utilizing it effectively.

The theory of access offers several strengths in understanding and addressing food security and related issues as discussed here below:

The theory of access provides a comprehensive framework for analyzing food security by considering multiple dimensions, including physical, economic, and social access, as well as utilization. This holistic approach allows for a deeper understanding of the complex factors that influence individuals' and households' ability to obtain and utilize food (Leroy et al., 2020). Secondly, the theory has a multisectoral perspective since it emphasizes on the interplay between various sectors such as agriculture, economics, health, and social welfare, the theory of access encourages multisectoral approaches to addressing food security challenges. This helps in developing more effective policies and interventions that target the root causes of food insecurity (Upton et al., 2022).

The theory is applicable across contexts since it is adaptable to diverse geographical, socioeconomic, and cultural contexts. It can be applied in both rural and urban settings and is relevant to both developed and developing countries. This flexibility makes it a valuable tool

for policymakers, researchers, and practitioners working in different regions and settings. Further, the theory focuses on equity and social justice (Burchi & De Muro, 2020). By highlighting the importance of social access and considering factors such as income inequality, social exclusion, and discrimination, the theory of access underscores the importance of addressing issues of equity and social justice in food security interventions. It emphasizes the need to prioritize the most vulnerable and marginalized populations in efforts to improve food access and nutrition outcomes (Burchi & De Muro, 2020).

The theory focuses on empowerment and participation as it emphasizes on the role of individuals and communities in shaping their own food security outcomes. By focusing on enhancing access to resources, information, and decision-making opportunities, it promotes empowerment and participation at the grassroots level. This can lead to more sustainable and contextually appropriate solutions to food insecurity (Leroy et al., 2020). In overall, the theory of access provides a robust framework for understanding and addressing food security challenges, offering insights into the complex interplay of factors that influence individuals' and households' ability to access and utilize food in a sustainable and equitable manner.

While the theory of access provides valuable insights into food security, it also has some weaknesses and limitations. To begin with, it limits itself on structural factors as it tends to focus on individual and household-level factors that affect food security, such as income, geography, and social networks (Burchi & De Muro, 2020). However, it may not adequately address underlying structural factors such as political economy, governance, and market dynamics, which can significantly influence food access and availability. Ignoring these structural factors may limit the effectiveness of interventions in addressing systemic barriers to food security.

Similarly, the theory employs simplistic assumptions about access as it often assumes a linear relationship between access and food security, where improving access leads to improved outcomes. However, access to food is influenced by complex interactions between various social, economic, and environmental factors (Upton et al., 2022). The theory may oversimplify these dynamics, leading to interventions that fail to address the underlying complexities of food insecurity. The theory does not adequately consider environmental sustainability. While it

emphasizes physical access to food, it does not adequately consider the environmental sustainability of food production and distribution systems (Simelane and Worth, 2020). Unsustainable agricultural practices, environmental degradation, and climate change can undermine long-term food security by compromising the availability and quality of food resources (Upton et al., 2022).

Theory of Access is highly relevant to the issue of food security, as it directly impacts people's ability to obtain nutritious food in a timely and dignified manner. Access to food is essential for acquiring fresh and healthy food (Simelane & Worth, 2020). The theory of access emphasizes the importance of ensuring that these food sources are physically accessible to all community members, regardless of their location or mobility limitations. This includes considerations such as the availability of transport infrastructure for food transportation to desired places. Social accessibility plays a crucial role in ensuring that food distribution systems are equitable and inclusive. This involves addressing barriers related to affordability, and availability of food (Burchi & De Muro, 2020). In overall, the theory of access provides a comprehensive framework for understanding and addressing the various barriers.

According to a study conducted in the North-West Mount Kenya region using the theory of Access to food security among Smallholder family farmers, households who rely on the production of crops and livestock for their sustenance need access to productive resources like land and water. Small-scale farmers have many challenges, particularly in Kenya: limited access to financial resources; high transaction costs due to inadequate infrastructure; and uncertain land and water tenure. Access to land and water is becoming more and more difficult for many impoverished households in rural developing nations (Mutea et al., 2020). In another study carried out in Chiapas, Mexico using the Ribot and Peluso theory of access to study the effects of on-farm diversification strategies on smallholder coffee farmer food security and income sufficiency, it was realized that households' access to assets and choice of activities is mediated by a variety of factors, and entangled in power dynamics often outside the reach of individual households for example, land ownership does not necessarily imply the access to resources that enable the owner to make use of the land. The access to these resources could be limited by absence of credits or other factors. Moreover, access is not static but a process, and access patterns can change over time and hence diversification could be an important

agroecological strategy for strengthening livelihoods and improving the food security and sovereignty of coffee farmers (Anderzéna, et al., 2020).

In another research done to unraveling the effect of gender dimensions and wood fuel usage on household food security: evidence from Ghana, while looking at the right to a resource and the ability to use the resource to one's benefit as proposed by Ribot and Peluso, it was concluded that, there exist substantial differences between MHHs' and FHHs' food security status as men tend to possess greater rights to land while women have either limited or no access to land (Adjei et al., 2022).

The present study employed the theory of access to investigate the relationship between food security and the availability of large-scale agricultural areas, credit and extension services in Yambio County, South Sudan.

2.3 Empirical Review

This chapter discusses various previous studies conducted about factors affecting food security.

2.3.1 Access to extension services and food security

The agricultural skills and knowledge of farming communities is essential for food production and determines food security; gaps in such skills and knowledge hinder rural agricultural producers from embracing new technology and utilizing them to boost productivity (Dick, et al., 2011). Agricultural skills such as applying fungicides and herbicides, calculating intra- and inter-row spacing, and estimating fertilizer application quantities are projected to improve family food security. (Mbongeni Maziya, 2017). In a study conducted to establish the relationship between improved skill development and food security, it was found that while food security can be attained through improved skill development, there are other innovative ways to obtain food quickly and affordably. For example, emerging technologies such as kitchen garden technology and gutter vegetable production, in combination with skills in weather pattern prediction and agricultural produce value addition, not only improve productivity but also enhance food accessibility and consumption (Njura et al., 2020). A further long-term, indirect relation

that many participants endorse is the notion that information, knowledge, and skills may be applied to fix food loss and waste. (Bekele, 2021).

It was concluded from a study of Selected Farmers in Nkomazi, South Africa, on the difficulties with post-harvest practices that specific skills are needed to manage the post-harvest equipment that is now accessible (Sisipo et al., 2021). It was discovered during a training by World Vision International on efficient farming methods that extension services raises households' food security and income levels as one farmer in Kenya, Beatrice, was found to have improved her food security and income. She had gained knowledge of basic farming techniques, such as crop rotation and manure application, for her plot of land, as well as irrigation, kitchen gardening, and raising hens. For her children, she now has an abundance of food and milk. There are also loads to sell to her neighbors and earn money (World Vision Kenya, 2022). Food security becomes a big worry in an enormous portion of the developing world since food losses have a direct and negative influence on the incomes of farmers and consumers. Financial management and technological constraints in harvesting, storing, and processing methods have been blamed for food losses and waste in low-income countries (Ogundele, 2022). Household food security was found to be associated with skills and confidence in general financial management among the 1,433 participants who were interviewed as part of the investigation into the relationship between literacy and food insecurity. Food insecurity was more likely to take place in households with infants who didn't have these attributes (Begley et al., 2019). Food security in the household is known to be associated with abilities and competence in general financial management. Families without such characteristics are more likely to experience food insecurity. Food insecurity is a problem of financial literacy rather than poverty or low income (Arshad, 2021).

The conclusions of a study carried out in South Sudan to find out farmers' viewpoints, approaches, and recommendations for improving agricultural productivity showed that understanding the causes of poor crop yields and farming practices should be used to address farming output (Qureshi et al., 2018). The government of South Sudan undertakes to mobilize effective partnerships to train and empower local people with modern

agricultural farming techniques and practices, this would not only address the challenge of dependence on NGOs but would in the long run create sustainable avenues for food security (Oryem & Sendawula, 2022). By learning "climate-smart" farming methods, individuals can support their families and earn a small income. (WFP, 2021).

2.3.2 Size of cultivated Land and food security

In spite of the fact that farmed land is the foundation for agricultural production and is crucial for maintaining social order and food security, one-third of all agricultural land is currently categorized as highly or moderately degraded (Tan et al., 2020). Numerous economic effects, including employment, poverty, inequality, food security, efficiency, and growth, may be correlated with farm size (Steven & Taylor, 2020). Improving farming productivity and farming systems is essential to sustaining food security welfare in both rural and urban areas because equitable land allocation accelerates economic progress and helps to attain goals of eradicating poverty and sustaining food security at the local and regional levels (Nazeer et al., 2016). Even in rainfed conditions, smallholder farmers can increase their yields three or four times with existing technologies, but their limited land area prevents them from growing as much, and the per capita income from agriculture is inadequate to lift people above the US\$ 1.9 per World Bank-defined poverty line. (Gassner, et al., 2019).

Smallholders in Sub-Saharan Africa (SSA) in particular are renowned for operating on small land areas; globally, about 80% of farms have less than 2 hectares, and in SSA, this is the norm despite some signs that medium-sized farming is starting to emerge. When goals are set, like "lifting X million households out of poverty" or "guaranteeing food security of Y million households," it is often forgotten to recognize the larger contribution that these farms make to ensuring food security, especially for the urban population (Gassner et al., 2019). Farm size is typically correlated with economic development; however, a complete and integrated picture of the effects of farm size and their causes is still lacking. Other aspects of agriculture, such as productivity, efficiency, and rural income, may also be directly tied to farm size (Chenchen et al., 2029). Households in SSA dry regions with less arable land per capita

grow less food and are more likely to face food insecurity as a consequence of climate uncertainty. However, as more land is converted to agricultural or cereal production, the population's dietary status improves; the more land cultivated, the more agricultural surplus that is available to ensure the population's food security, meaning that land for agriculture is subject to increasing returns (Koffia et al., 2020). Land set aside for agricultural use is observed to stimulate crop output in SSA countries; an increase in agricultural land was found to lead to a growth in production and the results of previous research also showed that agricultural output is increased by land utilized for crop cultivation (Asfew et al., 2023).

It has been discovered that there is a U-shaped relationship between productivity and farm size and that the relationship turns positive beyond 4 or 5 hectares (Jayne et al., 2022). There is an inverse relationship between plot size and yield; in other words, larger plots tend to produce smaller quantities of crops, even when controlling for the specific field size. In South Sudan, it is estimated that a household needs to cultivate at least two feddans (0.85 hectares) of land to be able to have enough food for themselves and have a small amount to sell at the market. However, the current average size of a farm is just under 0.8 hectares, which means that most farm households are unable to produce enough food to be food secure. Farmers usually cultivate between one and three feddans of land (0.4 to 1.2 hectares), and farm size has not increased significantly over time. Additionally, livestock is not being fully utilized for economic purposes (World Bank, 2019). 83% of agricultural households are resource-poor smallholder farmers who cultivate 0.4-0.5 hectares on average. However, basic food crop yields are low, often below 0.4 t/ha (Yuga & Wani, 2022). The production of cereal in the country is primarily from sorghum and maize. However, due to small farms, low productivity, and limited market incentives, there is a lack of marketable surplus (IFPRI, 2015).

The size of farms ultimately affects food security in South Sudan because it dictates how much land farming families can clear, cultivate, and weed with tools like the East African hoe, or jembe, or the flat-bladed, long-handled hoe called the *maloda*, the

regional short-handled, bent hoe called the *toriah*, or the common cutlass. This was found in a special report on the trip to assess crop and food security in South Sudan (FAO/WFP, 2019).

2.3.3 Access to Credit and Food Security

One of the most important ways to empower households to take charge of their food is to give them access to credit. Credit can help households become more self-sufficient by allowing them to participate in activities that yield higher income. Additionally, because agriculture is a variable industry in rural areas, it is crucial to offer credit to households that rely on it (Lestari et al., 2023). The amount of loans and advances that the banking industry extends to farmers, rural households, agricultural cooperatives, and other agricultural-related businesses is measured by credit to agriculture. This is because there is a discrepancy between the time farmers spend growing crops or raising livestock and the time, they earn from selling the products (FAO, 2022). To increase the amount of assets they have available for investments in profitable ventures as well as "buffer capital" for unforeseen emergencies, people and businesses need to have access to a wide range of financial services; young people, women entrepreneurs, and smallholder farmers should prioritize having this access (FAO, IFAD, WFP, 2019). In low-income nations, agriculture frequently serves as the primary source of income, and smallholder farmers who depend on it are recognized to be seriously threatened by climate change. Financial resources may enable smallholder farmers to undertake adaptation techniques and diversify their sources of income and investments, which may affect household income and food security (Carranza & Niles., 2019).

If farmers have access to agricultural finance services like financing, they may be persuaded to invest in farm inputs to achieve sustainable production and preserve food security. Agricultural loans, on the other hand, generally improve a farmer's performance by enabling the use of superior farm inputs and increasing efficiency in technology by 3.8% (Ullah et al., 2020). When it comes to covering unforeseen food expenses, having access to credit is useful. It has been acknowledged that credit is a crucial instrument

that could improve food security by empowering households to engage in more productive income-generating activities. This is because, without access to these financial services, households are unable to reach their full potential economically (Salima et al., 2023). In a study carried out by Cheteni et al. (2020), it was indicated that household income, gender, and credit availability all had an impact on dietary diversification and food security in the studied area. The findings demonstrated that income had a significant impact on addressing food insecurity in the study area. Evidence indicated that household food insecurity was a major problem in the locations studied. Smallholders could benefit more from market-oriented, high-value irrigated farming if credit availability or other financing options were improved. However, actual interest rates on agricultural loans can reach 30%, which makes it extremely difficult for smallholders to get credit (Balana, et al., 2020).

Sub-Saharan African rural communities often have farms that are too small to support a household's needs for food security or a livable wage. Rural households are frequently "unwilling" farmers because they lack the finances or the incentives to finance agriculture due to their substantial reliance on income from sources outside of the farm and lack of motivation to increase production (Giller., 2020). The Food and Agriculture Organization of the United Nations (UNFAO) discovered in a baseline report on resilience for better targeting and action in South Sudan that although credit access is crucial for enhancing household productivity, well-being, and knowledge and provides a means of getting out of poverty, some respondents stated that their primary motivations for applying for credit were to purchase food (33 percent), gain access to healthcare (29 percent), and pay for tuition (9 percent). The households are likely to grow further poorer and lose their creditworthiness in their social circles because most credit is used for these fundamental needs (FAO, 2021).

2.4 Summary of Research Gaps

Table 2. 1 Summary of Research Gap

Author	Title	Findings	Research Gaps	How the gaps were Addressed
Anderzena et al., 2020	Effects of on-farm diversification strategies on smallholder coffee farmer food security and income sufficiency in Chiapas, Mexico	Land ownership does not necessarily imply access to resources that enable the owner to make use of the land. The access to these resources could be limited by the absence of credits or other factors, thus the need for diversification.	Data collection was through surveys to a random selection of householders comprising beekeepers and farmers	This research used questionnaire and probability sampling with simple random sampling and also purposive nonprobability sampling
Salima, Manja, Chiwaula & Chirwa, 2023	The impact of Malawian household food security on credit availability	Having access to credit is essential to achieving food security for the family, especially during years of shocks like droughts or floods	This study used descriptive statistics for its data analysis and secondary data from a National Statistical Office in Malawi	This research used a binary logistic regression model and primary data for the research.
Mutea, Rist, & Jacobi, 2020	Applying the Theory of Access to Food Security among Smallholder Family Farmers around North-West Mount Kenya	Small-scale farmers have many challenges, particularly in Kenya: limited access to financial resources; high transaction costs due to inadequate infrastructure; and uncertain land and water tenure	The research used semi-structured household surveys for data collection and the Spearman Correction Coefficient for data analysis.	This research used a binary logistic regression model and primary data for the research
Muange & Ngigi, 2022	The effects of mixed farming in Kenyan rural areas with varying levels of aridity on food insecurity and dietary quality	Mixed farming lowered the perception of food insecurity at the mild, moderate, and severe levels	The research was carried out in Kenya	This study was carried out in South Sudan
Adjei-Mantey, Kwakwa, & Adusah-Poku, 2022)	Unravelling the effect of gender dimensions and wood fuel usage on household food security: evidence from Ghana	There exist substantial differences between MHHs' and FHHs' food security status as men tend to possess greater rights to land while women have either limited or no access to land.	Thisstud used secondary data and stratified random sampling technique.	This research used probability sampling with simple random sampling and also purposive nonprobability sampling.

Source: Researcher, (2024)

2.5 Conceptual Framework

Conceptual framework is an estimated model derived from the literature review that shows the study's variables as well as the relationships between the independent, dependent, and intervening (moderating) factors. (Kothati, 2014). The interplay between household-level food security factors and how they impact food security was studied. As seen below, the conceptual framework uses block (A) as the independent Variable (IV) and block (B) as the dependent variable (DV).

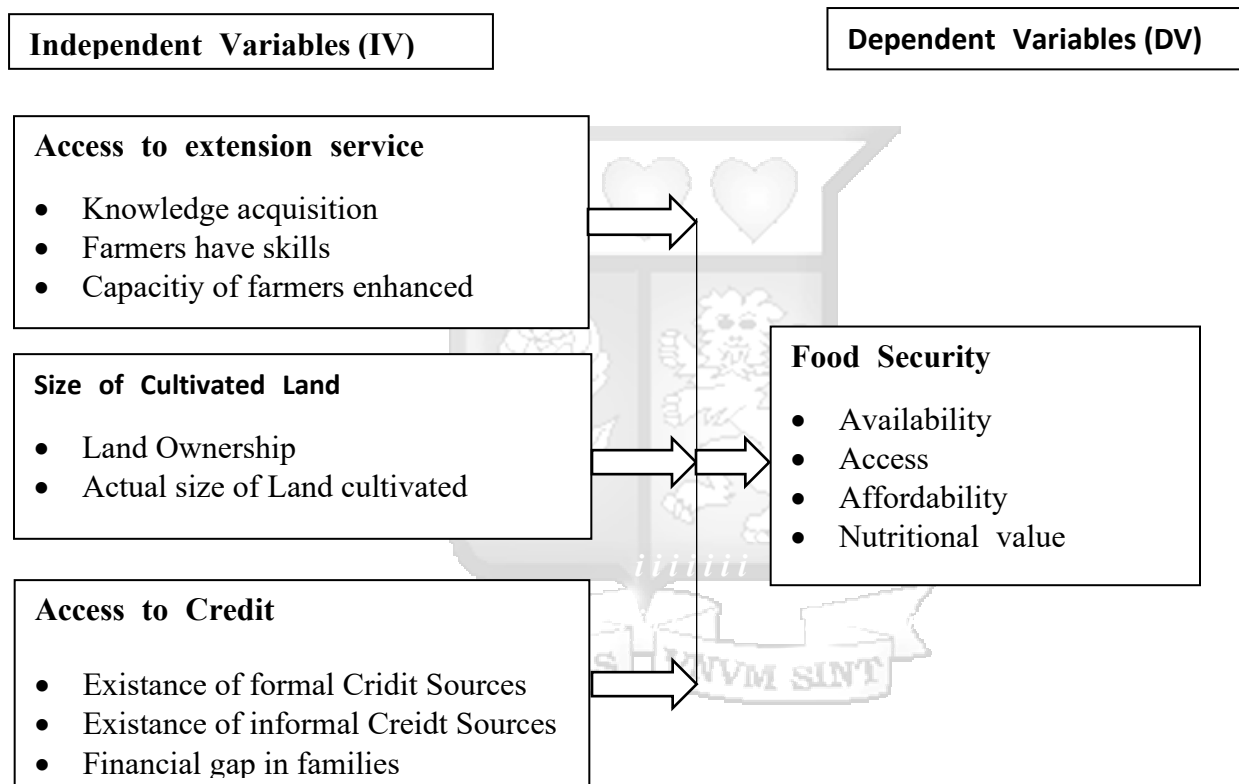


Figure 2. 2: Conceptual Framework

Source: Researcher (2024)

2.6 Operationalization of Variables

The several variables under study were measured as specified below:

Table 2.2: Operationalization of variables

Specific Objectives	Independent Variables	Sub-Variable	Measurement	Data Collection instrument
To establish the relationship between access to extension services and food security in Yambio County, South Sudan.	Access to Extension services	<ul style="list-style-type: none"> • Knowledge acquisition • Farmers have skills • Capacity of farmers enhanced 	Quantitative (Binary)	Semi-structured questionnaire with structured and unstructured questions.
To establish the relationship between the size of cultivated land and food security in Yambio County, South Sudan.	Size of land cultivated.	<ul style="list-style-type: none"> • Land Ownership • Actual size of Land cultivated 	Quantitative (Binary)	Semi-structured questionnaire with structured and unstructured questions.
To establish the relationship between access to credit and food security in Yambio County, South Sudan.	Access to Credit	<ul style="list-style-type: none"> • Existence of formal Credit Sources • Existence of informal Credit Sources • Financial gap in families 	Quantitative (Binary)	semi-structured questionnaire with structured and unstructured questions.

Source: Researcher (2024)

2.7 Chapter Summary

This chapter covered the theoretical underpinnings of the study as well as the empirical investigations conducted by earlier scholars on the variables influencing food security. Following a summary of the study gaps from the empirical studies, a conceptual framework outlining the relationships between the variables was developed. The description of the variables and their measures was condensed in the operationalization table.



CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents the approach used to answer the research problem. It covers several topics: research philosophy, research design, population and sampling, sampling design, data collection methods, research quality, reliability, data analysis, ethical considerations, and chapter summary.

3.2 Research Philosophy

Research philosophy is a collection of ideas that guides the design and execution of scientific investigations (Kovalainen & Eriksson, 2015). The researcher adhered to the post-positivism research philosophy which calls for quantitative deductions of empirical knowledge. The researcher's job was to objectively analyze and interpret data to determine the relationship between the variables under study—that is, the factors influencing food security and food security itself.

3.3 Research Design

Research design explains the method the researcher used for data collection and analysis to answer the research questions and resolve the problem presented (Sekaran & Bougie, 2016). Quantitative research involves the collection and analysis of numerical data to understand phenomena, relationships, or patterns in a structured and objective manner.

Here's a breakdown of the key components and steps involved. Since the study gathered quantifiable data, this study used a quantitative research design. Quantitative research relied on numerical data, which was analyzed objectively using statistical method. This enhanced the reproducibility of the study, as other researchers can replicate the study's methods and analysis to verify the findings.

Quantitative research used was well-suited for testing causal relationships between variables. Through statistical control techniques, the researchers established cause-and-effect relationships between the variables, providing valuable insights into the mechanisms underlying phenomena of the study. Describing the current state of the phenomenon being studied using primary data, the study was able to demonstrate the link between the dependent and independent variables.

3.4 Population and Sampling

3.4.1 Population Frame

A population is a group of institutions, subjects or individuals with common observable characteristics about which inferences are made (Walliman, 2017). The criteria of determining the population is to select individuals who are better placed to share experiences and facts about the topic being studied. Therefore, the population for this study comprised Bazungua Payam with a population of 700. This is one of the 6 Payams (Yambio town, Gangura, Nadiangere, Bangasu, Lirangu, and Bazungua Payam) under Yambio County located in the East along Maridi Juba road and it is 7 Kilometers away from Yambio Central Town (CDTY, 2023). The researcher selected Bazungua Payam because it is the epicenter of incessant conflicts that have led to food insecurity and malnutrition. Armed groups have always used the Bazungua Payam as their hiding place while destabilizing the community of the Payam making people to frequently be displaced from their homes and live in fear of going to their farms. Recently a gang leader Mr. Anisa with his team have been terrorizing the communities of Bazungua Payam (Samuel, 2024). A Medicines San Frontier (MSF) driver was also killed with his wife on Bazungua road and no property was taken (Sudan Tribune , 2016). Buzungua is a place frequently affected by insecurity (MSF, 2018). This is backed by UNICEF (2022) which associated high levels of malnutrition among children seeking healthcare services at Bazungua outpatient centers to the challenge of food insecurity.

3.5 Sampling Design

Sampling is a process that involves selecting a portion of the target population to participate in the study (Sharma, 2017). The selected portion is considered capable of providing information

on behalf of the entire population being targeted. A researcher uses a particular sampling technique to come up with a sample size big enough to be representative of the target population (Cooper & Schindler, 2014). Two kinds of sampling methods exist namely probability and non-probability sampling. Probability sampling involves a random selection procedure where the selection ensures that all elements in the population are provided an equal selection opportunity. On the other hand, non-probability sampling is subjective since the population elements do not have equal selection opportunity (Crossman, 2019).

In this study, the researcher used simple random sampling in selecting respondents for the study. This means that all the 700 farmers at Bazungua Payam had an equal chance of being selected to participate in the research.

3.6 Sample Size

A sample is an element chosen to represent the population of the study (Bless & Smith, 2016). It is basically a small portion of the population that represents the entire population (Saunders et al., 2015). Sample sizes can be accurately determined using a formula and upon specifying the level of confidence and margin of error the investigation will tolerate (Kothari, 2014). Generally, for most social sciences, a significance level of 0.1 is adopted. According to Yamane (1967), the following formula can be used to calculate a simple random sample when the target population is less than 10,000.

$$n = \frac{N}{1+N(e^2)}$$

Where: n = the desired sample size

N = The target population of the Study

e = the level of statistical significance set (that was 0.05, implying a 95% confidence level)

$$\frac{700}{n = 1 + 250 (0.05)^2} = 255$$

Consequently, the sample comprised 255 respondents who were picked from Bazungua Payam and randomly selected from the area of study.

3.7 Data Collection Method

Data collection method describe the instruments that are used in collecting data such as questionnaire, interviewing, case studies, checklists, and observation. In this research, questionnaires were used in collecting data. A questionnaire is a method of data collection whereby the study respondents are asked to respond to a similar set of questions in specific order. The researcher chose to use questionnaires because they are time saving since the researcher does not need to interact with each participant so as to collect the data. Sekaran and Bougie (2016) observed that questionnaires are ideal in gathering quantitative data from a sample within a fairly short period time and since the study was quantitative in nature, questionnaire became suitable. In addition, questionnaires allow time for the participants to think through the answers and are also easy to administer and score.

3.8 Data Collection Procedure

Following the university's approval of the research proposal and authorization to begin data collection, the researcher requested permission from the Strathmore University Ethics Review Board and appropriate authorities in the western Equatoria State of South Sudan. As the respondent farmers were selected through probability sampling with a simple random sampling, respondents were homogenous as all were farmers. In cases where there was a possibility of encountering a language barrier, the research assistants offered assistance with matters about the clarity of the questions on the questionnaires. To avoid the non-availability of respondents with busy and fixed schedules, phone calls and in-person visits were used to organize interviews.

3.9 Research Quality

Questionnaire construction, question design, and pilot testing were done as an important measures of the quality and how reliable the research is internally.

3.9.1 Validity

The extent to which an assessment captures the intended result is known as the validity of research instruments. Validity regulates whether the respondents observe questions in

the research instruments the way the researcher projected. (Kothati, 2014). The researcher established research instruments and sought expert assistance from specialists, mostly supervisor controlling how the study was conducted for improvement of the research instruments, to determine content validity.

3.9.2 Reliability

To find out if the research instrument was reliable, a pilot study was conducted. Seven sample respondents who were not part of the final sample size of the study participated in the pilot study. This procedure demonstrated whether the questionnaire was a trustworthy tool for gauging the study's goals or not.

3.10 Data Analysis

The collected data was cleaned to remove any irrelevant data, errors and unanswered questionnaires (Green & Salkind, 2016). The data was then coded and entered into the Statistical Package for Social Sciences (SPSS) version 26 for data analysis. In this procedure, the output in form of tables and figure were computed and interpreted. Both descriptive and inferential data analysis approaches were adopted. Descriptive analysis produced findings in the form of frequencies, and percentages that were easy to understand (Green & Salkind, 2016). Additionally, inferential statistics were also used whose findings allowed inferences to be made. The statistical model that was used was regression analysis or linear regression. The correlation analysis through regression enabled the researcher to determine the relationship between the independent and dependent variables in this study. Specifically, binary logistic regression in determining the relationships as illustrated below.

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + e$$

Where:

Y= the expected state of smallholder food security.

X=Independent variables, which were:

X1 – Access to extension services, X2 – Size of cultivated Land

X3 – Access to Credit, e - error term

β_0 = this is the value of Y at the time the independent variables X1-X3 are equal to zero and β_1 to β_3 coefficient which were estimated. The study adopted a limit of 0.05 statistical significant level, with the research question having a negative relationship when the value of its statistics is equal to or less than the significant level. The individual questionnaire items were investigated by use of descriptive statistics like frequencies and percentages. For the Likert scale questions, average scores and standard deviations were recorded, enabling a tabular presentation of the respondents' responses.

3.11 Ethical Considerations

To meet the ethical standards, the researcher sought permission from the National Commission for Science, Technology and Innovation (NACOSTI), and ethical approval from Strathmore University Business School (SBS). By requesting permission to be selected as respondents, the researcher was mindful of the ethical concerns of informed consent, privacy of the information provided, respondent anonymity, and voluntary involvement in the study. By ensuring that the information was used in a way that prevented anyone other than the researcher from knowing where it came from, anonymity and secrecy was guaranteed. Before the respondents were involved in the study, they were informed of their right not to participate or to withdraw from the study at any moment. Furthermore, the researcher asked for the consent of the respondents to involve them in the study. Furthermore, a statement outlining the study's goals and ensuring the study's anonymity, confidentiality, and voluntary nature was appended to the questionnaire.

3.12 Chapter Summary

This Chapter covered the methodology that was used to address the research problem, it also explained the research philosophy, research design, context of the study, target population, sample, and sampling procedures. In addition, the chapter described the methodology and instruments for gathering data and assessing how valid and reliable they were, as well as the data collection techniques and analysis procedures that was used in the project. Finally, this Chapter has concluded with the ethical considerations.

CHAPTER FOUR

DATA ANALYSIS AND PRESENTATION

4.1 Introduction

In chapter four, data analysis is conducted, the research findings are presented and interpreted. The presentation focuses on the study participants' background information and analysis outcomes based on the research objectives. The study employed both descriptive and inferential statistics in form of regression in data analysis. The purpose of the study was to examine the critical factors that influence food security at the household level in South Sudan. The specific objectives were to explore the relationship between access to extension services and food security, study the relationship between the size of cultivated land and food security and find out the relationship between access to credit and food security in Yambio County, South Sudan.

4.11 Response Rate

The study had a sample size of 255 respondents, implying that 255 questionnaires were administered out of which 234 were duly filled and returned resulting in a response rate of 93%. According to Oladipo et al. (2015), a response rate of 80% and above is excellent for data analysis and reporting. The response rate is illustrated in Table 4.1.

Table 4. 1: Response Rate

Questionnaires	Frequency	Percent
Dully filled	234	93
Partially filled	21	7
Total	255	100

4.2 Background Information

4.2.1 Gender of Respondents

Analysis results on gender distribution of respondents are illustrated in Table 4.2.

Table 4. 2: Respondents' Gender

Gender	Frequency	Percent
Male	137	58.5
Female	97	41.5
Total	234	100

The findings presented in Table 4.2 show that 137(58.5%) of the respondents were male, while 97(41.5%) were female. This implies that although male respondents were more than female, men and women were involved in farming activities and hence there was gender parity among the study respondents.

4.2.2 Age of Respondents

The researcher inquired into the age of the respondents and the results are presented in Table 4.3.

Table 4. 3: Age of Respondents

Age	Frequency	Percent
20-25	24	10.3
26-30	28	12
31-35	36	15.4
36-40	55	23.5
41-45	38	16.2
46-50	29	12.4
51-55	9	3.8
56-60	9	3.8
Over 61 years	6	2.6
	234	100

The study findings regarding the age of respondents indicate that 24 (10.3%) of the respondents were between 20-25 years, 28(12%) were aged between 26-30 years, 36 (15.4%) were between 31-35 years, 55(23.5%) were 36-40 years, while 38(16.2%) were between 41-45 years. Further, 29 (12.4%) were 46-50 years, 9 (3.8%) were 51-55 years of age, another 9 (3.8%) were between 56-60, while 6(2.6%) respondents were over 61 years of age. The results demonstrate that both the young and the old engaged in farming activities and therefore respondents were spread across all the ages.

4.2.3 Gender of Household Head

This section sought to establish the gender of the head of the family and the findings are presented in Figure 4.1.

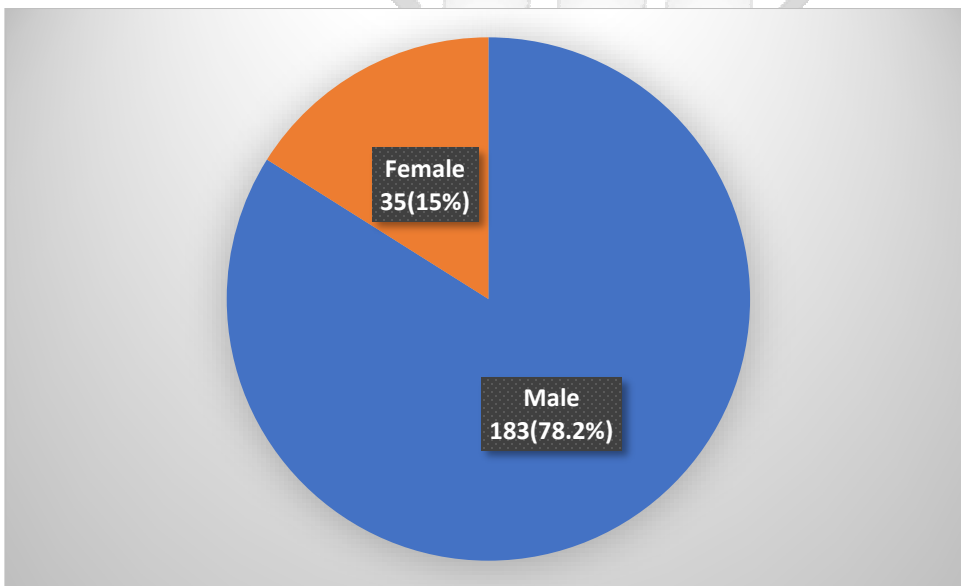


Figure 4. 1: Gender of Household Head

The findings illustrated in Figure 4.1 indicate that 183 (78.2%) male respondents headed their household, while 35(15%) female respondents headed their households. This means that decisions in regard to farming practices to adopt were mostly made by the men.

4.2.4 Number of Family Members

The researcher sought to establish the number of household members that respondents had and the findings are presented in Figure 4.2.

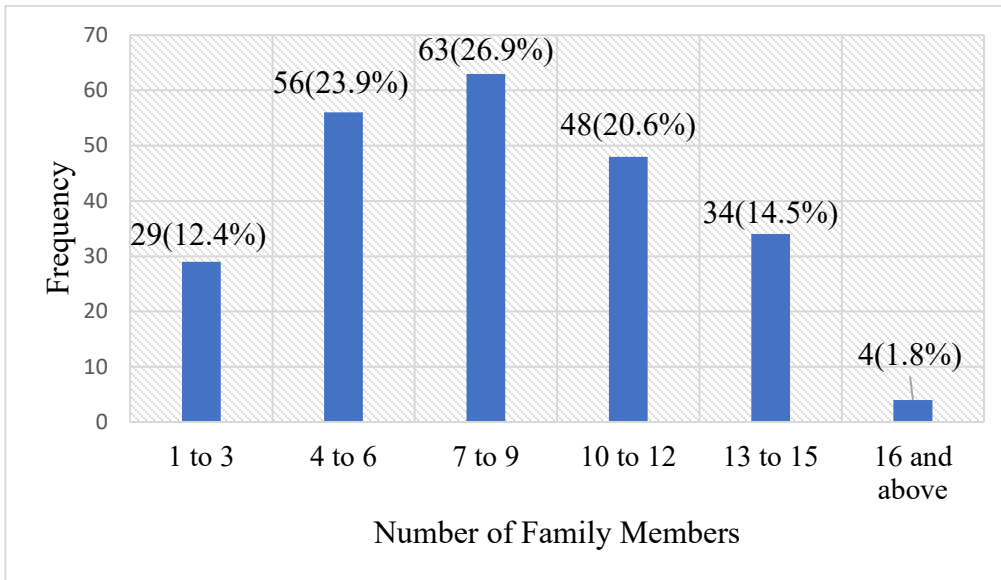


Figure 4. 2: Number of Family Members

The findings Figure 4.2 show that 63 (26.9%) of the respondents had 7-9 household members, 56 (23.9%) had 4-6 household members, 48 (20.6%) 10-12 members, 34 (14.5%) 13-15 members, while 29 (12.4%) had 1-3 members and 4 (1.8%) had 16 and above household members. This implies that respondents had huge family sizes that calls for sustained food security from their agricultural activities, hence the need to employ modern farming approaches to increase food production.

4.2.5 Years Spent in School

The researcher asked respondents to indicate the number of years they had spent in schools and the results are depicted in Figure 4.3.

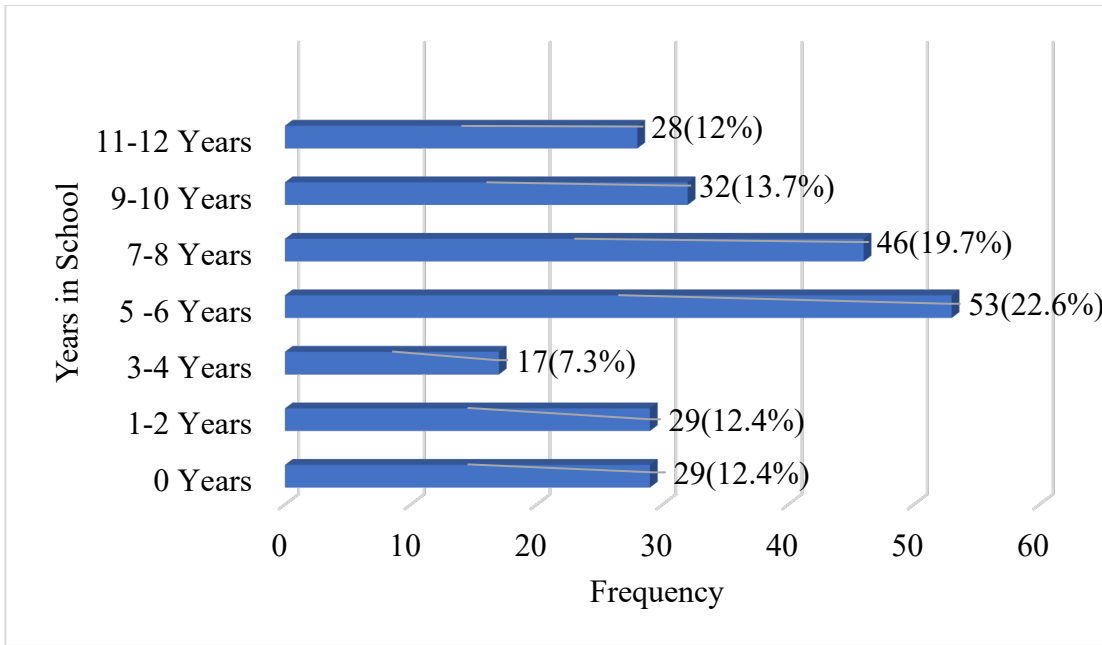


Figure 4. 3: Years in School

The findings illustrated in Figure 4.3 show that 53 (22.6%) of the respondents had spent 5-6 years in school, 46 (19.7%) 7-8 years, 32 (13.7%) 9-10 years, 28 (12%) 11-12 years, 29 (12.4%) 1-2 years, while 17 (7.3%) had spent 3-4 years in school and 29 (12.4%) had not been to school. The findings imply that the sample of respondents comprised the educated and the uneducated with the majority having been to school and therefore could implement modern farming practices to guarantee food security.

4.2.6 Forms of Employment Besides Farming

The researcher inquired other forms of employment that respondents engaged in besides farming activities and Table 4.4 presents the results.

Table 4. 4: Other Forms of Employment Besides Farming

Other form of employment beside farming	Frequency	Percent
No	93	39.7
Yes	137	58.5
Brewing alcohol	13	5.6
Driver	5	2.1
Business	36	15.4
Civil servant	7	3
Fisherman	8	3.4
Teacher	10	4.3
Medical officer	8	3.5
Carpenter	5	2.1
Policeman	4	1.7
Building houses	2	0.9
Cleaner	2	0.9
Bodaboda rider	4	1.7
Hunting	2	0.9
Mechanic	1	0.4
Midwife	1	0.4
Security guard	9	3.9

Besides farming, the findings show that 137 (58.5%) of the respondents engaged a variety of income earning activities where, 36 (15.4%) indicated engaged in running business, 13 (5.6%) brewing alcohol, 10 (4.3%) were teachers, 9 (3.9%) were security guards, 8 (3.4%) engaged in fishing activities, another 8 (3.4%) were medical officers, 7 (3%) were civil servants, 5 (2.1%) were carpenters, another 5 (2.1%) were drivers, while 4 (1.7%) were policemen. Others were mechanics, hunters, bodaboda riders, and cleaners. The findings demonstrate that the earnings from farming were not enough to meet food demand and therefore most respondents engaged in various income earning activities to supplement what they earned from farming in a bid to become food secure.

4.3 Access to Extension Services

4.3.1 Farmer Knowledge, Skills and Capacity

The researcher sought to determine the influence of extension services on food security in terms of knowledge acquisition, skills farmers had, and enhancement of farmer capacity. Analysis findings are illustrated in Table 4.5.

Table 4. 5: Access to Extension Services

		Yes	No
knowledge acquisition	Trained by extension worker	60(25.6%)	174(74.4%)
	Have good agronomic practices	103(44%)	131(56%)
Farmer skills	Finding information to support production easily anytime	32(13.7%)	202(86.3%)
	Record keeping of farm activities	86(36.8%)	148(63.2%)
	Calculating loss or profit in the farm	152(65%)	82(35%)
	Solving the problems on the farm	72(30.8%)	162(69.2%)
Capacity of farmers enhanced	Operating any farming machinery	32(13.7%)	202(86.3%)
	Aware of what to do during climate change to mitigate it	43(18.4%)	191(81.6%)
	Using ICT gadgets to increase productivity	44(18.8%)	190(81.2%)
	Knowing crop management techniques like crop rotation	148(63.2%)	84(35.9%)

Regarding knowledge acquisition, 60 (25.6%) of the respondents indicated they were trained by extension workers, while a majority at 174 (74.4%) were not. In regard to whether the respondents had good agronomic practices, 103 (44%) indicated they had, while a majority at 131(56%) indicated they did not. Further, on whether farmers could easily and at any time find information to support production, 32(13.7%) indicated they could, while a majority of the respondents at 202(86.3%) could not. These findings imply that a majority of the farmers were not trained on best agricultural practices and could not access agricultural information and therefore could not implement the best agricultural practices and hence their agricultural production was not to optimum levels to guarantee food security.

In regard to farmer skills, 148 (63.2%) stated that they know how to keep records of their farm activities, while 86 (36.8%) indicated they did not know. Also, 152 (65%) indicated they know how to calculate loss and profit on their farm, while 82 (35%) did not know. On whether the farmers could solve most of the problems they face on their farm, 72 (30.8) indicated they can, while 162 (69.2%) indicated they cannot. On whether the farmers can operate farm machinery, 32 (13.7%) stated they can, while a majority at 202 (86.3%) indicated they cannot. The findings demonstrate that most of the farmers had the skills to keep records and knew how to calculate profits and losses. However, most of the respondents did not have knowledge to solve problems

they encounter on their farms and cannot also operate farm machinery, a fact that can hamper effective production and undermine food security.

4.4 Size of Cultivable Land

4.4.1 Land Ownership and Size

This section also sought to determine the influence of the size of land cultivated on food security, the findings of which are presented below:

Table 4. 6: Size of Land Cultivated

		Yes			No
Land ownership	Available land for farming practices	177(75.6%)			57(24.4%)
	Land ownership status	Owned land	169(72.2%)	Hired land	65(27.8%)
Size of land for farming		0-3 acres	4-6 acres	7-10 acres	11-13 acres
	Frequency	62	88	72	12
	Percent	26.5	37.6	30.8	5.1
Size of land cultivated yearly		1-2 fedans	2-3 fedans	4-5 fedans	6-7 fedans
	Frequency	57	130	39	8
	Percent	24.4	55.6	16.7	3.4

In regard to whether farmers had land available for their farming practices, 177 (75.6%) of the respondents indicated they did, while 57 (24.4%) did not. Also, on land ownership status, 169 (72.2%) stated they owned their land, while 65 (27.8%) stated they hired the land. This demonstrates that a majority of respondents owned their land, hence they needed not to incur extra costs to hire land or face food insecurity for lack of land to cultivate. On the size of land, the farmers had for farming, 62 (26.5%) indicated their land was between 0-3 fedans, 88 (37.6%) had 4-6 fedans, 72 (30.8%) had 7-10 fedans, and 12(5.1% had 11-13 fedans. This implies that the farmers had various sizes of land for carrying out their farming activities and this ensured food security for their households. Regarding the number of fedans of land the farmers cultivated yearly, 57 (24.4%) stated they cultivated 1-2 fedans, 130 (55.6%) cultivated 2-3 fedans, 39 (16.7%) cultivated 4-5 fedans, while 8(3.4%) cultivated 6-7 fedans of land

yearly. This implies that the size of land was big enough to guaranteed sufficient food for food security.

4.5 Access to Credit

4.5.1 Presence of Bank Services, Microfinance Services and Other Loan Sources

Here, the researcher sought to determine the influence of access to credit interms of banks being closer to farmers, banks giving agricultural credit and microfinance service availability on food security. Analysis results are depicted in Table 4.7.

Table 4. 7: Access to Credit

		Existence of formal credit sources	
		Yes	No
Whether there are banks closer to farmers			
	Frequency	214	20
	Percent	91.5	8.5
Whether banks give agricultural credit	Frequency	18	216
	Percent	7.7	92.3
Availability of microfinance service in the area	Frequency	23	211
	Percent	9.8	90.2
		Existence of informal credit sources	
		Yes	No
Presence of money lenders for agricultural investment	Frequency	19	215
	Percent	8.1	91.9
Loans from friends for farming needs	Frequency	54	180
	Percent	23.1	76.9
Loans from relatives for farming needs	Frequency	111	123
	Percent	47.4	52.6
		Financial gap in farming	
		Yes	No
Need funds to improve production	Frequency	210	24
	Percent	89.7	10.3
Lacking funds to increase production	Frequency	207	27
	Percent	88.5	11.5

Regarding the question of whether there were banks closer to farmers, 214 (91.5%) indicated there were banks closer to them and only 20 (8.5%) stated there were no banks closer to them.

On whether the banks give agricultural credit, 18 (7.7%) stated that banks give agricultural credit, while 216 (92.3%) indicated they did not. This means that a majority of the farmers cannot afford to farm inputs to guarantee food security. On whether microfinance service was available for farmers, 211 (90.2%) indicated there was not microfinance service available for farmers, while 23(9.8%) stated there was. This implies that a majority of farmers could not access microfinance service to finance their agricultural activities, a fact that is a threat to food security.

Regarding the question on whether there were some money lenders who could give farmers money for their agricultural investment, 215(91.1%) of the farmers stated there were no lenders and only 19(8.1%) stated there were. This implies that a majority of the farmers lack money lending sources for their agricultural investment. On whether farmers had their friends give them money as a loan for their farming needs, 180 (76.9%) of the farmers stated there was no such, while 54 (23.1%) indicated they had their friends lend them money as a loan. With regard to whether farmers had their relatives give them money as a loan for their farming needs, 111 (47.4%) of the farmers stated they had their relatives lend them money, while 123(52.6%) stated they had no such.

On whether farmers would need funds to improve their production, 210 (89.7%) indicated yes, they need funds, while only 24 (10.3%) of the farmers did not require such funds. Further, 207 (88.5%) of the farmers indicated they had been lacking funding to increase their production and only 27 (11.5%) farmers indicated they had not been lacking funding to increase their production. The findings demonstrate that a majority of the respondents lacked funds to improve their production and hence their agricultural production was not up to their potential.

4.6 Food Security

4.6.1 Food Consumption in the Previous Year

The respondents were required to indicate how they could define their food consumption the previous year, findings which are illustrated in Figure 4.4.

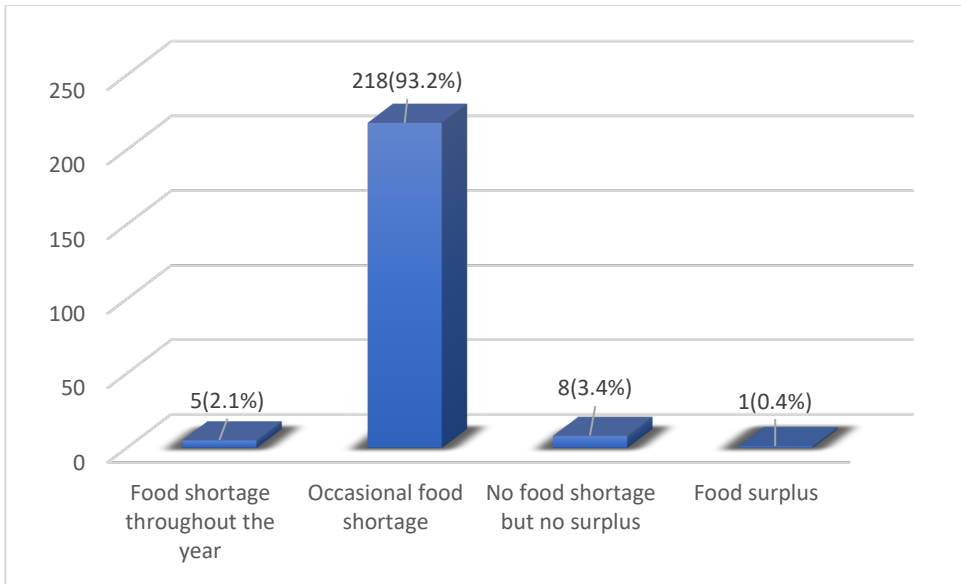


Figure 4.4: Food Consumption in Previous Year

From the findings, 218 (93.2%) of the respondents indicate that there was occasional food shortage in the previous year, 8 (3.4%) indicated that there was no food shortage but no surplus, 5 (2.1%) indicated that there was food shortage throughout the year, while 1 (0.4%) indicated that there was food surplus. The findings may imply that food security was not guaranteed since a majority of the respondents stated that there was occasional food shortage in the previous year.

4.6.2 Main Source of Food

Respondents were required to indicate their main source of food, findings of which are presented in Figure 4.5.

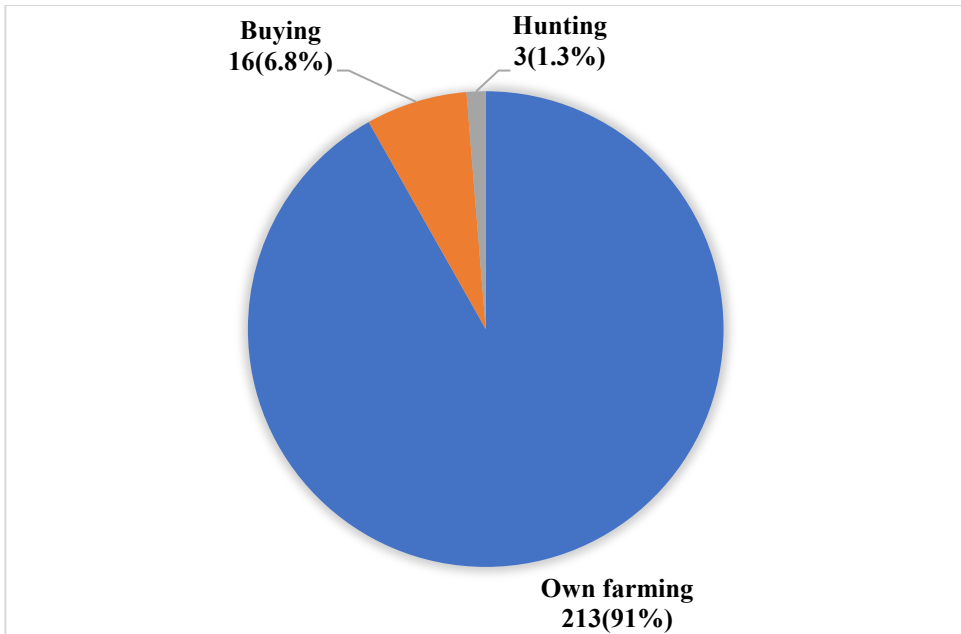


Figure 4. 4: Main Source of Food

From the findings, 213 (91%) of the respondents indicated that their main source of food was from their own farm produce including maize, cassava, and potatoes, 16 (6.8%) indicated that their main source of food was through buying, while 3 (1.3%) indicated that hunting was their main source of food. The findings demonstrate that the main source of food was from farming activities.

4.6.3 Number of Meals Per Day

The respondents were asked to indicate the number of meals they had per day compared to the previous year, findings of which are presented in Figure 4.6.

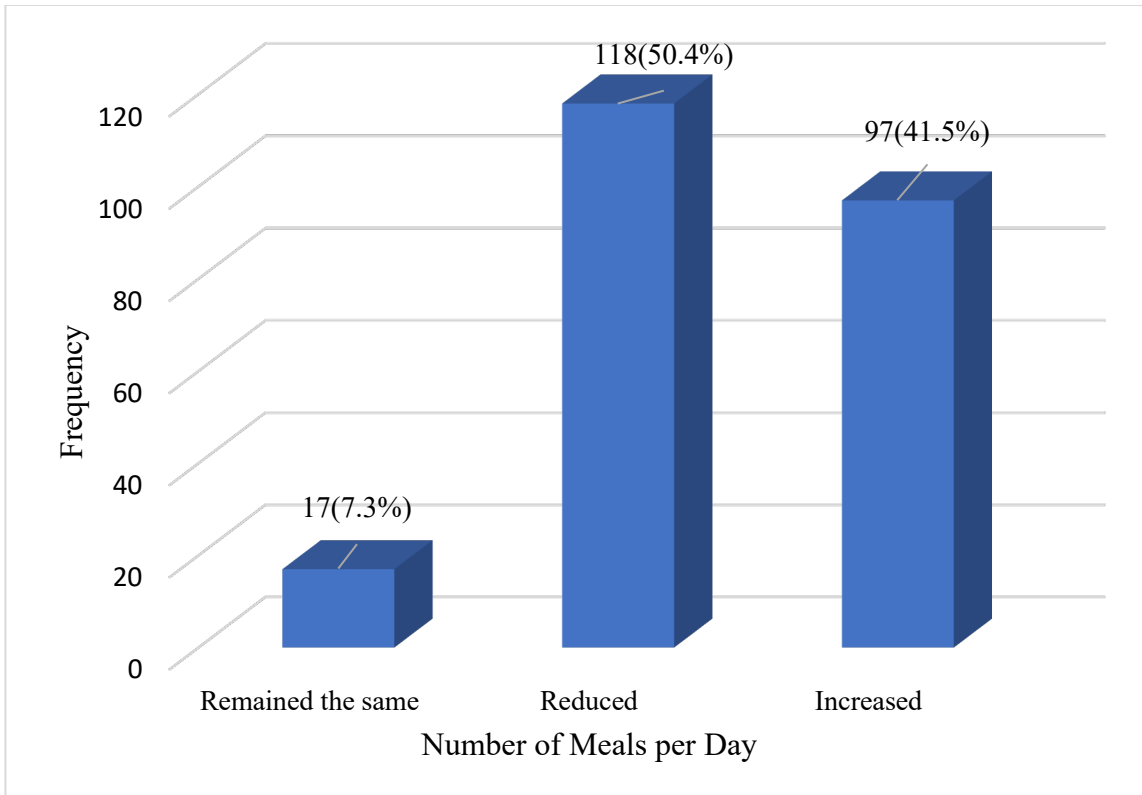


Figure 4. 5: Number of Meals per Day

According to 118 (50.4%) of the respondents, the number of meals reduced in the current year compared to the previous years, 97 (41.5%) indicated that the number of meals increased, and 17 (7.3%) respondents indicated it remained the same. The findings imply that compared to the previous year, the number of meals per day reduced, meaning that food security was under threat.

4.6.4 Quality of Meals

The respondents were also required to indicate the quality of meals they had compared to the previous year, findings of which are presented in Figure 4.7.

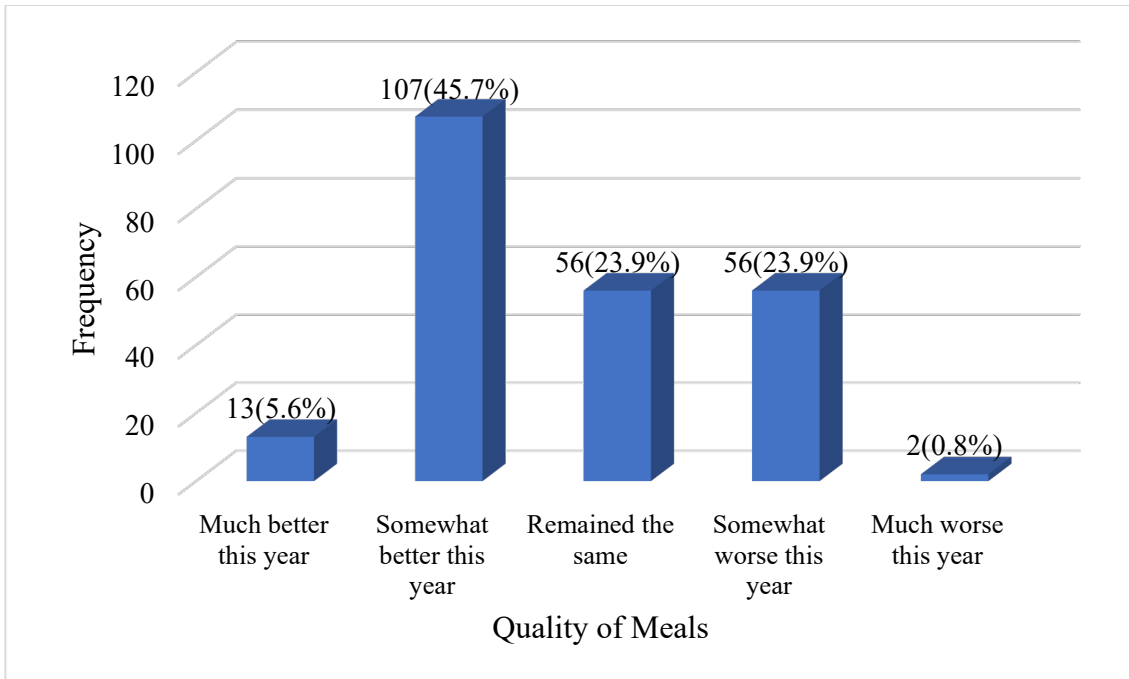


Figure 4. 6: Quality of Meals

According to 107 (45.7%) of the respondents, the quality of meals was somewhat better that year compared to the previous years, 56 (23.9%) indicated that the quality of meals remained the same, another 56(23.9%) indicated it was somewhat worse, while 13 (5.6%) indicated it was much better this year and 2 (0.8%) stated it was much worse that year.

4.6.5 Variety and Diversity of Meals

This section required the respondents to indicate the variety and diversity of meals they had compared to the previous year, results of which are presented in Figure 4.8.

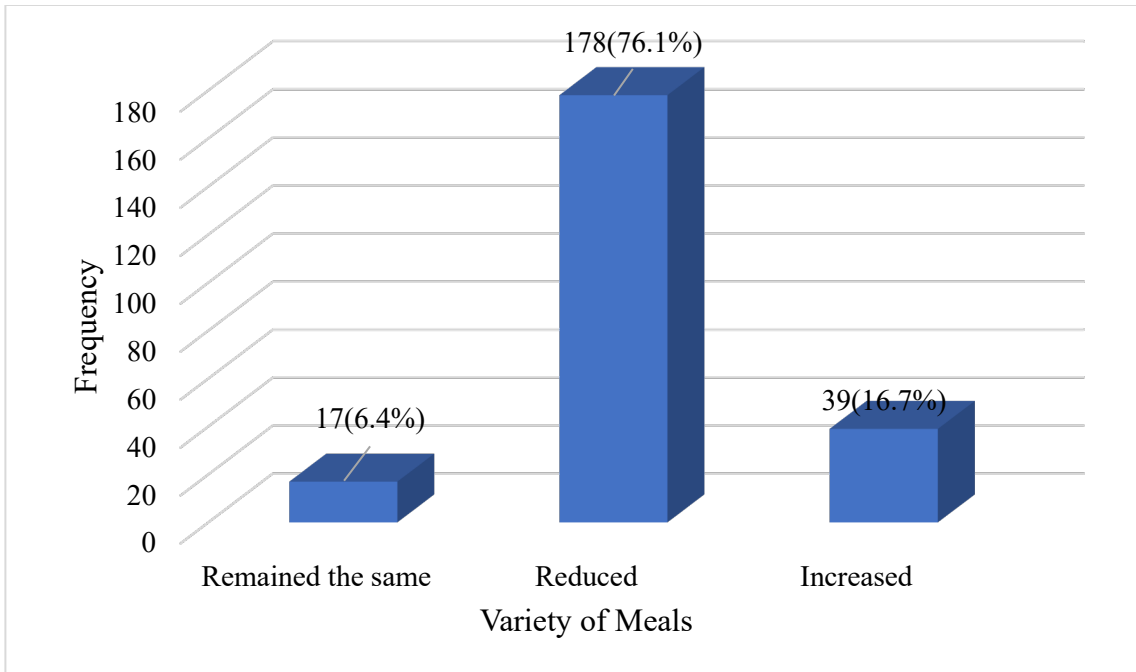


Figure 4. 7: Variety and Diversity of Meals

According to 178 (76.1%) of the respondents, the variety and diversity of meals reduced that year compared to the previous years, 39 (16.7%) indicated that the variety of meals increased, while 17(6.4%) indicated it remained the same this year. The findings demonstrate that the variety of meals reduced this year, implying that food security was under threat.

4.7 Inferential Statistics

4.7.1 Access to Extension Services and Food Availability

The first objective was to explore the relationship between access to extension services and food security which was measured by food availability. A bivariate correlation was used to examine the strength and direction of the relationship and Table 4.8 depicts the results.

Table 4. 8: Relationship between access to extension services and food availability

Access to extension services	Correlations	Food availability
Knowledge acquisition	Pearson Correlation	0.022
	Sig. (2-tailed)	0.735
	N	234
Farmers have skills	Pearson Correlation	-0.002
	Sig. (2-tailed)	0.981
	N	232
Capacity of farmers enhanced	Pearson Correlation	0.012
	Sig. (2-tailed)	0.862
	N	234

The findings indicate that knowledge acquisition had a statistically insignificant positive correlation with food availability ($p=0.735$, $r=0.022$). Similarly, capacity of farmers had a statistically insignificant positive correlation with food availability ($p=0.862$, $r=0.012$). This implies that an increase in knowledge acquisition in terms of training farmers, good agronomic practices and having information that support production results to increased availability of food and hence increased food security. This finding is similar to those of Nason and Nyakiba (2018) who found that empowering farmers through extension services is the first step in increasing food security and productivity. On the other hand, farmers' skills and food availability had a statistically insignificant negatively correlation ($p=0.981$, $r=-0.002$). The findings demonstrate that a decrease in the number of farmers who have skills like record keeping, calculation of loss and profit as well as operation of machinery undermines food availability and hence poses a threat to food security in the region. This implies that in order to increase food production, farmers must be equipped with record keeping skills, loss and profit calculation skills and use of farm machinery. The findings are consistent with Nason and Nyakiba (2018) who asserted that developing farmers' capacity through extension services helps in promoting food sustainability by providing technical assistance, knowledge transfer and increasing food security and productivity. That farmers' knowledge, skills, capacity and competencies boost sustainable food production.

4.7.2 Size of Cultivated Land and Food Security

The second objective was to study the relationship between size of cultivated land and food security, which is measured by food availability. Table 4.9 shows the result findings.

Table 4. 9: Relationship between Size of Land Cultivated and Food Availability

Size of cultivated land	Correlations	Food availability
Land ownership	Pearson Correlation	0.028
	Sig. (2-tailed)	0.675
	N	234
Land size	Pearson Correlation	-0.074
	Sig. (2-tailed)	0.261
	N	234

Analysis results indicate that land ownership and food availability had a statistically weak positive correlation ($p=0.675$, $r=0.028$). This demonstrates that as the number of farmers who owned land increased, there was a corresponding increase in food production and therefore an improvement in food availability in Yambio County. However, land size and availability of food had a weak negative correlation ($p=0.261$, $r=-0.074$). This means that as farm size increases, food productivity tends to decrease, a fact that may be associated with peasant farmers who apply more of their family labor to their small farms than larger farms. Family labour cannot be able to till large farms resulting to decreased food production and therefore a decline in food security. Similar findings were established by Noack and Larsen (2019) which showed that as farms grow in size, the variability of local food production increases, while the variability of agricultural revenues decreases. Equally, Jayne et al. (2022), noted that there exist an inverse relationship between plot size and yield; in other words, larger plots tend to produce smaller quantities of crops, even when controlling for the specific field size.

4.7.3 Access to Credit and Food Security

The third objective was to establish the relationship between access to credit by farmers and food security, measured by availability of food. Table 4.10 shows the study findings.

Table 4. 10: Relationship between Access to Credit and Food Security

Access to credit	Correlations	Food availability
Formal credit sources	Pearson Correlation	-0.109
	Sig. (2-tailed)	0.098
	N	234
Informal credit sources	Pearson Correlation	-0.079
	Sig. (2-tailed)	0.229
	N	234
Financial gap	Pearson Correlation	-0.089
	Sig. (2-tailed)	0.174
	N	234

The findings show that formal credit sources had a weak negative correlation with availability of food ($p=0.098$, $r=-0.109$). Access to informal credit sources and food availability had a weak negative correlation ($p=0.229$, $r=-0.079$). Similarly, financial gap and food availability had an insignificant negative correlation ($p=0.174$, $r=-0.089$). The study findings imply that there was limited access to credit sources to boost farming activities such as purchase of farm inputs, machinery and other services such as labour. This resulted in decreased food production output and therefore threatening food security. Access to credit allows farmers to purchase essential inputs such as seeds, fertilizers, pesticides, and irrigation equipment. These inputs are necessary for improving crop yields, enhancing productivity, maintaining farm fertility leading to food security (Carranza & Niles., 2019).

4.8 Regression Coefficients

The researcher used a regression analysis to find out the link between food availability and the three independent variables, that is, access to extension services, size of cultivated land and access to credit. The findings are presented in Table 4.11.

Table 4. 11: Regression Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.824	0.295		9.582	0.00
	Access to extension services	0.011	0.04	0.018	0.274	0.784
	Size of cultivated land	-0.029	0.047	-0.04	-0.608	0.544
	Access to credit	-0.528	0.206	-0.197	-2.559	0.011

Dependent Variable: Food Availability

The study findings shows that the predictor variables access to credit ($t=-2.559$, $p= 0.011$) had statistical significance with food security, while access to extension services ($t=0.274$, $p=0.784$), size of cultivated land ($t=-0.608$, $p=0.544$) were not statistically significant with food security. The standardized coefficients, Beta suggested that access to credit had a moderate negative impact ($B= - 0.528$). Access to extension services ($B= 0.011$) had a positive impact on food security. Size of cultivated land ($B= - 0.029$) had weak negative impact on food security. The findings demonstrate that taking all other independent variables at zero, a unit increase in credit inaccessibility resulted to a decrease in food security by 0.528 units and a unit increase in access to extension services contributed to an increase of 0.011 in food security. Similarly, an increase in size of cultivated land by one unit led to corresponding decrease of 0.029 units in food security.

4.9 Chapter Summary

Chapter four has provided the analysis results and interpreted them consistent with the objectives of the study. The first section analyzed the background information, second section presented findings on access to extension services, section three presented findings on size of cultivated land, section four on access to credit and section five on food security.

CHAPTER FIVE

SUMMARY, DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

Guided by the Theory of Access by Ribot and Peluso (2003) and understanding “access” as spanning the *property rights* to benefit from resources on the one hand to the *ability* to benefit on the other, the researcher explored how bundles of rights and powers relate to access to extension services, access to land for farming and access to credit for farmers. The current study focused on examining the critical factors that influence food security of smallholder farmers in Yambio county, South Sudan. The specific objectives were to evaluate the relationship between access to extension services and food security, assess the relationship between the size of cultivated land and food security and to analyse the relationship between access to credit and food security in Yambio County, South Sudan. In chapter five, the study conducts a discussion of the findings consistent with research objectives.

5.2 Summary

The main objective of this study was to examine the critical factors that influence food security of smallholder farmers in South Sudan. The focus was on access to extension services, size of cultivated land and access to credit services. The target population was 700 smallholder farmers and the sample size was 255 respondents, while the response rate was 93%.

Correlation analysis findings indicated that extension services had a statistically insignificant positive correlation with food availability, hence food security ($p=0.735$, $r= 0.022$). Similarly, capacity of farmers had a statistically insignificant positive correlation with food availability ($p=0.862$, $r=0.012$). On the other hand, farmers’ skills and food availability had a statistically insignificant negatively correlation ($p=0.981$, $r=-0.002$). Also, land ownership and food security had a statistically weak positive correlation ($p=0.675$, $r=0.028$), However, land size and food security had a weak negative correlation ($p=0.261$, $r=-0.074$). Formal credit sources had a weak negative correlation with food security ($p=0.098$, $r= -0.109$). Access to informal credit sources and food security had a weak negative correlation ($p=0.229$, $r=-0.079$).

5.3 Discussion of Key Findings

5.3.1 Access to Extension Services and Food Security

The first objective sought to explore the relationship between access to extension services and food security which was measured by availability of food. Findings showed that extension services through acquisition of agricultural knowledge and capacity of farmers had a positive correlation with food availability. This implies that an increase in agricultural extension services in terms of training farmers, good agronomic practices and having information that support production results to increased production and hence increases food security. On the other hand, farmers' skills and food security were negatively correlated, meaning that increase in farmer skills increased food security and a decrease in the number of farmers who have agricultural skills poses a threat to food security in the region. Therefore, in order to increase food production, farmers must be provided with agricultural extension services which equip them with modern farming skills and practices. This is consistent with the theory of access which states that individuals or households must have adequate access to extension services to empower farmers by providing technical assistance, knowledge transfer tailored to the specific needs and contexts of smallholder farmers.

The findings are consistent with Nason and Nyakiba (2018) who asserted that developing farmers' capacity through extension services is the first step in increasing food security and productivity. That, given the severe climate and ever-increasing population, farmers' knowledge, skills, capacity and competencies must be improved to boost sustainable food production. Extension services like agricultural training ensures farmers acquire the necessary skills for effective farm management, including accurate record-keeping (Mujibi et al., 2018). On their part, Vidigal et al. (2020) stated that capacity building among farmers is critical in improving crop management technologies, particularly for rain fed systems' nitrogen efficiency. Agricultural extension encompasses all the activities that offer farmers and other actors the necessary information and services to enhance their production and livelihood. This includes the effective dissemination and adoption of technologies and practices at a large scale by the users, resulting in the anticipated development impact (Toroitich, 2021).

Agricultural skills such as applying fungicides and herbicides, calculating intra- and inter-row spacing, and estimating fertilizer application quantities are projected to improve family food security (Mbongeni Maziya, 2017). A similar study by Njura et al. (2020) on the relationship between agricultural skill development and food security, it was found that food security was positively correlated with farmer skill development. On his part, Bekele (2021) noted that agricultural information, knowledge, and skills are very critical in fixing food loss and waste. Therefore, mobilizing extension services empowers farmers with modern agricultural farming techniques and practices and this will not only address the challenge of dependence on NGOs but will in the long run create sustainable avenues for food security (Oryem & Sendawula, 2022).

However contrary to the findings, Bekele (2021) found that extension services do not necessarily lead to enhanced food security as there can be situations when agricultural extension services do not effectively increase food security. In areas or situations where there is inadequate access to agricultural extension services because of factors like remote locations, poor infrastructure, or socio-economic inequalities, the contribution of these services may be hampered (Chilunjika & Gumede, 2021). Further, if the extension services availed are of poor quality, outdated, or not tailored to the specific farmer needs and contexts of local farmers, their effectiveness in enhancing agricultural practices and production become limited (Danso et al., 2021). This means that agricultural information that is not relevant or actionable to the needs of farmers cannot contribute to meaningful improvement in food security.

In areas prone to environmental challenges like floods, droughts, floods, and soil degradation, agricultural extension services can encounter significant barriers in promoting sustainable agricultural practices and resilience (Mupambwa et al., 2023). This means that failure to address existing environmental issues, access to extension services cannot make substantial contribution to enhanced food security. Furthermore, even with access to agricultural extension services, farmers may be constrained in realizing food security when there are challenges in accessing markets or lacking sufficient storage and transportation infrastructure (Ndebele & Zenda, 2023). This means that extension services alone cannot address wider issues associated with market access and development of infrastructure.

5.3.2 Size of Cultivated Land and Food Security

The second objective was to study the relationship between size of cultivated land and food security. Analysis results indicate that land ownership and food availability were positively correlated. This demonstrates that as the number of farmers who owned land increased, there was a corresponding increase in food production and therefore an improvement in food security. However, land size and food security were negatively correlated, meaning that as farm size increases, food productivity tends to decrease, a fact that may be associated with peasant farmers who apply more of their family labor to their small farms than larger farms. Family labour cannot be able to till large farms resulting to decreased food production and therefore a decline in food security. The findings resonate well with the theory of access which promotes accessibility to land for agriculture, which if well cultivated and supported with modern agronomic practices will ensure food availability and hence links well with the Availability, Accessibility, Utilization, and Stability (AAUS) of Food security framework which acknowledges that it is not enough for food to simply be available but must also be accessible, utilized effectively, and stable over time.

According to Noack and Larsen (2019), as farms grow in size, the variability of local food production increases, while the variability of agricultural revenues decreases. This means that consumers may have to deal with a less reliable and inconsistent food supply, while farmers benefit from larger farms and receive more stable, higher wages. The authors further noted that the inverse relationship between farm size and productivity, known as the inverse farm size-productivity relationship (IR), has been observed in various regions, including Sub-Saharan Africa. This means that as farm size increases, productivity tends to decrease. This is often due to peasant farmers who apply more of their family labor to their small farms than larger farms, especially when they are unable to adjust their farm size. In support, Jayne et al. (2022) noted that there exist an inverse relationship between plot size and yield; in other words, larger plots tend to produce smaller quantities of crops, even when controlling for the specific field size.

On their part, Fikire & Belay (2022) differed with the findings of this study since their study found that increasing the size of cultivated land can for sure lead to increased productivity and hence food security. The researchers found that tilling more land enables production of a greater quantities and crop varieties which leads to enhanced overall food productivity. This is particularly so when the newly tilled land is suitable for high-yielding crops or the land is employed to diversify agricultural production. Also, increasing the size of cultivated land promotes food security through increased availability of food crops. This is particularly so in areas with limited food availability either because of inadequate agricultural production or insufficient access to food markets.

Furthermore, cultivating previously untilled or underused marginal lands can increase agricultural production into places that were not previously contributing to food production. Although these lands may need extra inputs and management practices, they can lead to overall food productivity. It is however noteworthy that increasing the size of cultivated land cannot come without challenges and potential constraints. It can lead to issues such as land degradation, deforestation, loss of biodiversity, and conflicts over land use. Additionally, simply expanding cultivated land without addressing underlying issues such as access to markets, agricultural inputs, infrastructure, and technology may not lead to sustainable increases in food production. Therefore, while expanding cultivated land can be part of a strategy to increase food production, it should be accompanied by comprehensive planning and sustainable land management practices.

5.3.3 Access to Credit and Food Security

The third objective was to establish the relationship between access to credit by farmers and food security. The finding show that formal credit sources had a weak negative correlation with food availability. Access to informal credit sources and financial gap were negatively correlated with food availability. The study findings imply that there was limited access to credit sources to boost farming activities such as purchase of farm inputs, machinery and other services such as labour. This resulted in decreased food production output and therefore threatening food security. Based on the theory of access, credit accessibility allows farmers to purchase essential

inputs such as seeds, fertilizers, pesticides, and irrigation equipment. These inputs are necessary for improving crop yields, enhancing productivity leading to food security.

According to Bernard (2022), it is widely acknowledged that having access to credit is essential to helping marketize and commercialize agriculture more broadly. Credit availability may not directly impact productivity but it can indirectly contribute by enabling smallholder farmers to adopt agricultural technologies. It can also indirectly affect productivity by facilitating the hiring of skilled labor, providing better healthcare, and allowing for more investments in the farm (Missiame, Nyikal, & Irungu, 2021). For farmers to buy inputs like seeds, fertilizers, plant protection products, or animal feed, formal credit access is essential; Without personal resources, borrowing from unofficial sources (moneylenders, friends, and family) may come with unreasonably high interest rates and unfavorable terms, which might render many agricultural ventures unprofitable (FAO, 2022). Many farmers face difficulties in obtaining credit for agricultural purposes due to the requirement of providing a guarantee such as a solidarity deposit, harvest collateral, or personal guarantees such as land ownership title or equipment. Women, in particular, face more challenges in accessing markets due to their limited financial resources. A lack or poor access to credit means that farmers cannot be able to buy agricultural inputs like seeds, fertilizers, plant protection products, or animal feeds. They will also not be able to hire skilled labor, providing better healthcare, and allow for more investments in the farm. Ultimately, farm productivity will be undermined leading to either low or no productivity hence food insecurity.

If farmers have access to credit, they may be persuaded to invest in farm inputs to achieve sustainable production and preserve food security. Agricultural loans, generally improve a farmer's performance by enabling the use of superior farm inputs and increasing efficiency in technology (Ullah et al., 2020). According Salima et al. (2022), it is widely acknowledged that credit is a crucial instrument that can improve food security by empowering households to engage in more productive agricultural activities. This is because, without access to these financial services, farmers are unable to reach their full potential. This implies that smallholder farmers can benefit more if credit availability or other financing options were improved.

However, findings by Carranza and Niles (2019) disagreed with the findings of this study by stating that access to credit alone may not necessarily enable increased food production. The authors noted that a number of factors may influence the effectiveness of credit in contributing to agricultural productivity. The cost of credit, lack of collateral, poor credit history, interest rates, and terms of repayment may undermine the ability of farmers to effectively access and use credit. High-interest rates or loan terms that are not favorable can hinder farmers from borrowing or cause financial stress. Similarly, farmers require financial know how and management skills to make sound decisions in regard to borrowing, investment, and repayment. This implies that in the absence of financial literacy and awareness, the impact of credit on agricultural productivity can be limited and cannot contribute to food security (Quarshie et al., 2021). Further, government policies and regulations associated with credit, input subsidies, and agricultural support programs may influence access to credit by farmers and their ability to effectively utilize it for enhanced food production and security (Asfew et al., 2023).

On their part, Balana et al. (2020) also found that access to credit may not always lead to increased food production. In some instances, even if farmers have access to credit, they may fail to utilize effectively for agricultural productivity. They may apply the accessed credit for expenses that are non-agricultural or investments that don't directly contribute to enhanced food productivity. This is where proper guidance and financial literacy comes in. Equally, in places that have environmental challenges like water scarcity, soil degradation, or climate change impacts, accessing credit cannot address underlying constraints to agricultural productivity (Dokye et al., 2022). While access to credit serves as a valuable instrument for promoting food production, its contribution is dependent on complementary aspects like supportive policies, infrastructure, and ability of farmers to effectively apply credit.

5.4 Conclusions

Based on the findings of the study, the study makes the following conclusions

The study found that extension services are positively correlated with food security and therefore the study concludes that in order to achieve food security, there should be easy access to extension services like training farmers on good agronomic practices and crop

management techniques, empowering farmers on how to mitigate the effects of climate change and keeping record for every farm activity.

It was also found that land ownership and food security were positively correlated. On this basis, the study concludes that increasing the number of farmers who own land will result in a corresponding increase in food production and improvement in food security. However, land size and food security were found to be negatively correlated. It was therefore concluded that there is an inverse relationship between farm size and productivity as farms grow in size leading to an increase in variability of food production. This means that family labour cannot be able to till large farms, making use of farm machinery suitable.

Similarly, the study results showed that formal credit sources had a weak negative correlation with food security. Equally, access to informal credit sources and food security were negatively correlated. Based on this finding, it was concluded that there was limited access to credit sources to boost farming activities such as purchase of farm inputs, machinery and other services such as labour. It is this situation that causes a decrease in food production output and therefore threatening food security.

5.5 Recommendations

Based on the study findings, the researcher proposes the following recommendations;

The study found that extension services through acquisition of agricultural knowledge and capacity of farmers had a positive correlation with food availability. On the other hand, farmers' skills and food security were positively correlated, meaning that increase in farmer skills increased food security and a decrease in the number of farmers who have agricultural skills poses a threat to food security in the region. On this basis, the study recommends that in order to achieve a sustainable food security in Yambia County and the the Ccountry at large, the government of South Sudan need to increase budgetary allocation to the agricultural sector which will in turn be invested in the provision of agricultural extension services to the farmers in terms of training farmers on good agronomic practices such as crop rotation, intercropping, mixed farming, and integrated pest management. These agronomic practices will not only enhance soil health, biodiversity, and resilience to climate but also agricultural productivity.

Further, the government can implement supportive agricultural policies, regulations, and incentives to incentivize sustainable agricultural practices and ensure equitable access to resources. Similarly, there is need to strengthen agricultural extension services geared at providing farmers with technical knowledge, skills, and information through training on the best practices for maximizing agricultural production. Training programs may also focus on crop management, preservation of soil fertility, water conservation, and management of pest.

Since the study found that there was limited access to formal credit sources to boost farming activities including purchase of farm inputs, machinery and labour, The study recommends that banks and microfinance institutions in Yambio County in collaboration with the government of South Sudan need to come with tailored programs that will enable farmers to access credit at favorable terms to enable them sustainably invest and expand agricultural production and consequently realize food security and thus expanding economic development of the county as well. The South Sudan government can implement policies and regulations that boost financial inclusion for farmers, ensuring that formal financial services are available to rural communities, farmers included. This can mean formulating and enforcing regulatory frameworks that facilitate the operation of financial institutions in rural set ups and encouraging innovation in financial products and services tailored to the farmers' needs. Further, the government can encourage formal banks and microfinance institutions to establish or expand rural banking services infrastructure including branches and mobile banking facilities. This will not only bring banking services closer to farming communities and reduces barriers to accessing financial services but also encourage farmers to engage with formal banking institutions. The government can also establish credit guarantee schemes which can mitigate the risk for formal financial institutions lending to farmers, especially smallholder farmers that may not have collateral or credit history. These schemes may be supported by insurance mechanisms that provide reassurance to banks and incentivizing them to provide credit to farmers.

An inverse relationship was found between farm size and productivity or food security. This means that as farms grow in size, a variability in food production is experienced. This is because land size dictates how much land farming families can cultivate and weed with tools like jembes. On this premise, the researcher recommends that the County government need to invest in farm machinery for farmers with huge tracts of agricultural land

to enable carry out agricultural activities towards ensuring food security for the county. The government can also increase large-scale food production through implementation of strategies that improve productivity, efficiency, and sustainability. Such strategies may include investing in research and development aimed at developing high-yielding crop varieties that are resistant to pests, diseases, and environmental challenges like drought. The government also needs to ensure farmers have good access to quality seeds, fertilizers, and agrochemicals at prices that are affordable. Through the implementation of these strategies in a coordinated way, policymakers, agricultural stakeholders, and development partners can help in supporting farmers to enhance sustainable large-scale food production, and hence contributing not only to food security and economic development, but also in poverty reduction.

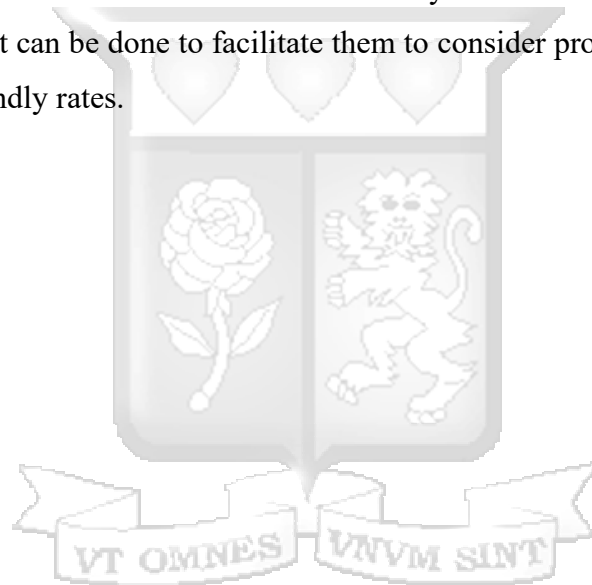
5.6 Limitations of the Study

The study faced some limitations including low literacy levels among some respondents, suspicion which led to some of the smallholder farmers being unwilling to participate in the study irrespective of the reassurance that the research was confidential. Long distance travelling to cover all farmers during the process of data collection due to bad road network in the villages. This had the effect of prolonging the data collection process beyond the estimated duration.

Further, the study faced sampling bias, where most of the participants were smallholder farmers who were available on the ground. This implies that most of the large-scale farmers were under represented in the study and hence the findings of this study are largely attributable to smallholder farmers. There was potential for reporting bias on the part of the researcher in trying to selectively report or emphasize certain results over others due to the desire to produce statistically significant results. However, the researcher ensured objectivity in reporting the findings as they were. The sample size used was small and this limits the generalizability of findings in other communities in South Sudan.

5.7 Recommendations for Further Studies

1. Similar research should be conducted in different counties to determine whether the factors influencing food insecurity are peculiar to Yambio County.
2. The researcher proposes that another research be done within the same County to establish viable off-the-farm income earning activities that can be adopted by the farmers to supplement agricultural activities.
3. Research should be conducted to determine the influence of inputs subsidy so that they can be adopted by the South Sudan government to improve agricultural production and consequently food security.
4. A study needs to be carried out to establish why banks are not providing agricultural credit and what can be done to facilitate them to consider providing agricultural credit to farmers at friendly rates.



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APPENDICES

APPENDIX I: QUESTIONNAIRE

INSTRUCTIONS

Dear respondent,

This questionnaire's purpose is to collect data regarding “**factors influencing the food security of smallholder farmers in Yambio County, South Sudan**” You have been selected as one of the participants, and we sincerely ask that you take part by answering the following questions as honestly as possible. Also, be aware that this information will be handled with the highest confidentiality and used only for research purposes.

Section one: Background information

1. what is your gender?

- i. Male []
- ii. Female []

2. what is your age? -----

3. What is the gender of household head?

- i. Male []
- ii. Female []

4. How many are you in the family? _____

5. For how many years have you been in School _____

6. Besides farming, do you have any other form of employment No [] Yes [].

If yes, what else do you do for income _____

Section two: Access to extension services

The researcher intends to determine the influence of extension services on food security.

a) Knowledge acquisition

Have you ever been trained by an extension

worker? Yes [] No []

Do you know some good agronomic practices

Yes [] No []

If you want some information to support production, can you easily find it anytime? Yes [] No []

b) Farmers have skills

Do you know how to take and keep records of your farm activities Yes [] No []

Do you know how to calculate loss or profit on your farm? Yes [] No []

Can you solve most of the problems you face on your farm? Yes [] No []

Can you operate any farming machinery? Yes [] No []

c) Capacity of farmers enhanced

When there is any climate change like drought or flood, are you aware of what you can do to mitigate it?

Yes [] No []

Can you use any ICT gadget to increase your

productivity? Yes [] No []

Do you know some crop management techniques like Crop

rotation? Yes [] No []

Section three: Size of cultivated land

The researcher intends to examine the influence of the size of cultivated Land on food security

a) Land Ownership

1. Do you have land available for your farming practices?

Yes [] No []

2. What is your land ownership status? Tick the appropriate

A. Owned Land []

B. Hired Land []

b) Size of Land

3. What size of land do you have for farming?

0 – 3 [] 4 – 6 [] 7 – 10 [] 11 – 13 []

4. How many fedans (60 meters x 70 Meters) of land do you cultivate yearly? _____

Section Four: Access to credit

The researcher aims to determine the influence of access to credit on food security.

a) Existence of Formal Credit Sources

Are there banks closer to you? Yes [] No []

Do the banks give agricultural credit? Yes [] No []

Is there a microfinance service in

your area? Yes [] No []

b) Existence of informal credit sources

Are there some money lenders in the area who can give money for your agricultural investment?

Yes [] No []

Do some of your friends give you money as a loan for your farming needs? Yes [] No []

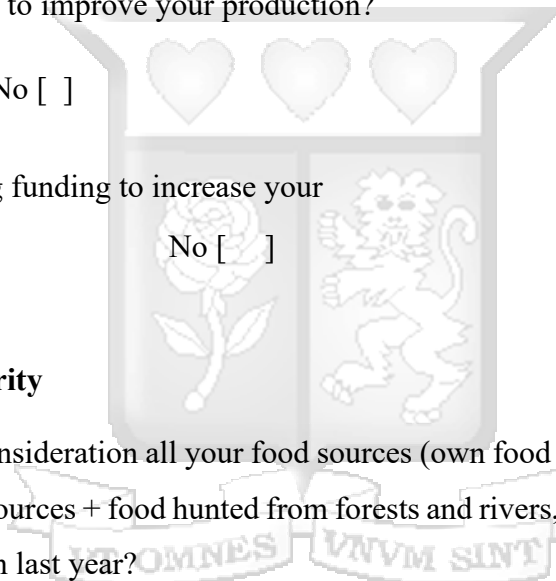
Can some of your relatives give you money as a loan for your farming needs? Yes [] No []

c) The financial gap in farming

Would you need funds to improve your production?

Yes [] No []

Have you been lacking funding to increase your production? Yes [] No []



Section 5: Food Security

Part 1: Taking into consideration all your food sources (own food production + food purchase + help from different sources + food hunted from forests and rivers, etc), how would you define your food consumption last year?

Tick the most appropriate

- A. Food shortage throughout the year []
- B. Occasional food shortage []
- C. No food shortage but no surplus []
- D. Food surplus []

Part 2: Regarding your nutrition intake, food, and nutrition security.

1. What is your main source of food? _____

Compared to last year, the number of meals you had per day, would you say

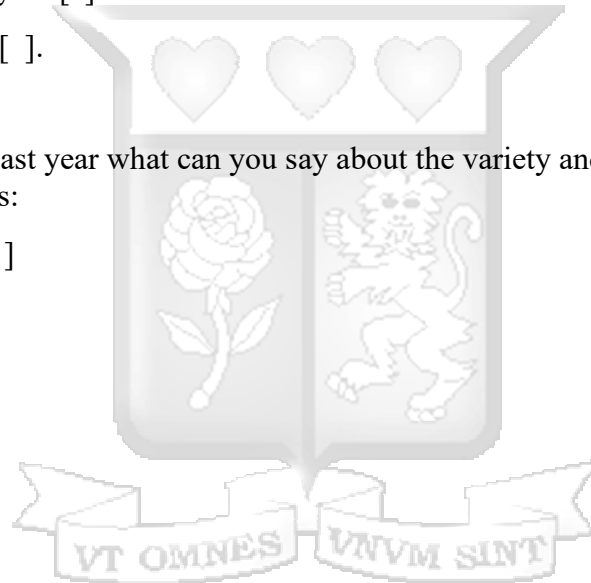
- A. Remained the Same []
- B. Reduced []
- C. Increased []

Part 3: Compared to last year, what is your quality of meals:

- A. Much better this year []
- B. Somewhat better this year [].
- C. Remained the same [].
- D. Somewhat worse this year []
- E. Much worse this year [].

Part 4: Compared to last year what can you say about the variety and diversity of your meals:

- A. Remained the Same []
- B. Reduced []
- C. Increased []



APPENDIX II: LETTER OF INTRODUCTION

Ole Sangale Rd, Madaraka Estate,
P.O. Box 59857 00200, Nairobi, Kenya.
Cell: +254 703 414/6/7, Twitter: @SBSKenya
Email: info@sbs.ac.ke or visit www.sbs.strathmore.edu



18th April 2024

To Whom It May Concern,

RE: FACILITATION OF RESEARCH – BAKIRI NGBAPIA JOHN

This is to introduce Bakiri Ngbapia John who is a Master of Management in Agribusiness Student at Strathmore University Business School, admission number MMA/137770. As part of our MMA Program, John is expected to do applied research and undertake a project. This is in partial fulfilment of the requirements of the MMA course. To this effect, John would like to request appropriate data from your organization.

John is undertaking a research paper on “FACTORS INFLUENCING SMALL HOUSEHOLD FOOD SECURITY IN YAMBIO COUNTY, SOUTH SUDAN.” The information obtained shall be treated confidentially and shall be used for academic purposes only.

Our MMA seeks to establish links with industry, and one of these ways is by directing our research to areas that would be of direct use to industry. We would be glad to share our findings with you after the research, and we trust that you will find them of great interest and of practical value to your organization.

We appreciate your support and shall be willing to provide any further information if required.

Yours sincerely,

A handwritten signature in black ink, appearing to read "Njoki Kiagiri".

Njoki Kiagiri
Manager – Graduate Programs.
Strathmore University Business School.



APPENDIX III: STRATHMORE UNIVERSITY ETHICAL CLEARANCE



17th April 2024

Mr Ngbapia John,
john.bakiri@strathmore.edu

Dear Mr Ngbapia,

RE: Factors Influencing Small Household Food Security in Yambio County, South Sudan

This is to inform you that SU-ISERC has reviewed and **approved** your above **SU-masters** research proposal. Your application reference number is **SU-ISERC2159/24**. The approval period is from **17th April 2024 to 16th April 2025**.

This approval is subject to compliance with the following requirements:

- i. Only approved documents including (informed consents, study instruments, MTA) will be used.
- ii. All changes including (amendments, deviations, and violations) are submitted for review and approval by SU-ISERC.
- iii. Death and life-threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to SU-ISERC within 72 hours of notification.
- iv. Any changes anticipated or otherwise that may increase the risks or affected safety or welfare of study participants and others or affect the integrity of the research must be reported to SU-ISERC within 72 hours.
- v. Clearance for the export of biological specimens must be obtained from relevant institutions.
- vi. Submission of a request for renewal of approval at least 60 days prior to the expiry of the approval period. Attach a comprehensive progress report to support the renewal.
- vii. Submission of an executive summary report within 90 days of completion of the study to SU-ISERC.


Before commencing your study, you will be expected to obtain a research license from National Commission for Science, Technology, and Innovation (NACOSTI) <https://research-portal.nacosti.go.ke/> and obtain other clearances needed.


Yours sincerely,

**Mr Ambrose Rachier,
Chairperson; SU-ISERC**



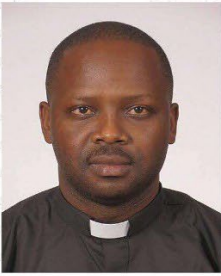
APPENDIX IV: NACOSTI CERTIFICATE


REPUBLIC OF KENYA


**NATIONAL COMMISSION FOR
SCIENCE, TECHNOLOGY & INNOVATION**

Ref No: **949117** Date of Issue: **06/May/2024**

RESEARCH LICENSE




This is to Certify that Rev.. Ngbapia John Bakiri of Strathmore University, has been licensed to conduct research as per the provision of the Science, Technology and Innovation Act, 2013 (Rev.2014) in Nairobi on the topic: FACTORS INFLUENCING SMALL HOUSEHOLD FOOD SECURITY IN YAMBIO COUNTY, SOUTH SUDAN for the period ending : 06/May/2025.

License No: **NACOSTI/P/24/35099**

949117
Applicant Identification Number

Walter Muriuki
Director General
NATIONAL COMMISSION FOR
SCIENCE, TECHNOLOGY &
INNOVATION

Verification QR Code



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