

**ASSESSMENT OF FACTORS CONTRIBUTING TO FOOD INSECURITY TO
SMALLHOLDER FARMERS IN MBULU DISTRICT, MANYARA REGION**

BY

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**A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE
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ABSTRACT

This study on factors contributing to food insecurity to small holder farmers was carried out in Mbulu district, Manyara region from September to December 2010. The purpose was to analyze the food situation; identifying limiting factors for optimal food production and to identify various coping strategies employed by smallholder farmers in a situation of food insecurity in the study area. Data for this study was obtained by cross-sectional design whereby random sampling was used to select respondents from the study area. A combination of qualitative and quantitative methods was used to collect data for this study. Primary data was collected from farmers, extension agents and local leaders by using a questionnaire and checklist respectively. A sample of 120 respondents was randomly selected. Quantitative data were analyzed by using Statistical Package for Social Sciences (SPSS) computer program, while qualitative data were analyzed using content analysis. Descriptive statistics such as frequencies and percentages were used. From the study, about 81.7 percent of the households were food insecure. Smallholder farmers in the study area are suffering from food shortage mainly because of low productivity of the sector and low access to food due dependency on farming as the major source of food and income. Agricultural productivity was low as it depends on seasonal rainfall which is inadequate, low hectares under cultivation and food loses due to pests and diseases. Other factors are limited use of modern technology, poor soils and inadequate extension services. Since agriculture play a major role in the reduction of food insecurity, a strategy on strengthening farming and non-farming activities linkages is likely to yield better results in terms of increasing self food production and income generation. On top of that there is need for the government to motivate extension service providers as well as farmers to be insisted to utilize the services effectively and efficiently.

DECLARATION

I, WILMINA DAGNO, do hereby declare to the senate of Sokoine Universty of Agriculture that this dissertation is my own original work and has never been submitted nor concurrently being submitted for a degree award in other Institute.

.....

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.....

Date

The above declaration is confirmed

.....

Prof. Mvena, Z.S.K
(Supervisor)

.....

Date

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DEDICATION

This thesis is dedicated to my beloved husband, Mr Joseph Laurence Geheri who always supported me; and to my parents Mr & Mrs Gabriel Dagno Amsi who laid the foundation for my education; my dearest sons; Josephat, Jackson, Japheth and Justine for their patience.

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LIST OF ACRONYMS

DALDO	District Agricultural and Livestock Development Officer
FAO	Food and Agriculture Organization
IFAD	International Fund for Agricultural Development
	Programme
IFPRI	International Food Policy Research Institute
MAFSC	Ministry of Agriculture, Food Security and
	Cooperatives
MDGs	Millennium Development Goals
NGOs	Non Governmental Organizations
PANTIL	Programme for Agriculture and Natural resource
	Transformation for Improved Livelihood
REPOA	Research on Poverty Alleviation
SNAL	Sokoine National Agriculture Library
SPSS	Statistical Package for Social Sciences
SSA	Sub-Saharan Africa
SUA	Sokoine University of Agriculture
TFNC	Tanzania Food and Nutrition Centre
URT	United Republic of Tanzania
UNDP	United Nations Development Program
USAID	United States Agency for International Development
VEOs	Village Executive Officers

CHAPTER ONE

1.0 INTRODUCTION

1.1 Overview

This study is on factors contributing to food insecurity among smallholder farmers in Mbulu district. The purpose of the study is to analyze the food situation, identifying limiting factors for optimal food production and to identify various coping strategies employed by smallholder farmers in situation of food insecurity.

1.2 Background information

Food is among the most basic and universal requirements for human survival. It does not matter how rich or poor we are, whether young or old, male or female, each one of us equally needs and is divinely entitled to food security and a decent, dignified and self-reliant human existence (Tansey and Rajotte, 2009). According to Baldwin (2006), food security and insecurity are terms used to describe whether or not people have access to sufficient quantity and quality food. The Ministry of Agriculture Food security and Cooperatives (MAFSC, 2006), advocates that food security involves availability, accessibility, stability and peoples' ability to utilize food. According to the Food and Agriculture Organization (FAO, 1996), food security is about people, hunger at a global scale reminds us on the unfinished task of achieving sustainable food security for every one everywhere.

According to FAO (2006), food security is achieved when all people at all times have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs, food preferences for health and active life. The World Food Summit of 1996 addressed the fundamental rights of every one to be free from hunger (FAO, 1998). In addition FAO (1999) insisted that it is important to act in solidarity to ensure that freedom

from hunger becomes a reality. Every effort must be taken to address both symptoms and causes of hunger among people who are suffering from hunger.

Maharjan (2006) reported that, despite a growing world abundance of food, famines and other food-related crises continue to occur. Disparities in food security within countries are common even if the country has sufficient food in aggregate during the normal times. Worldwide the latest estimates indicate that, 840 million people were undernourished in 1998-2000. This includes 11 million in industrialized countries, 30 million in countries in transition and 799 million for developing countries (FAO, 2002). FAO (2008) reported that the number of undernourished people in developing countries has increased by over 800 million.

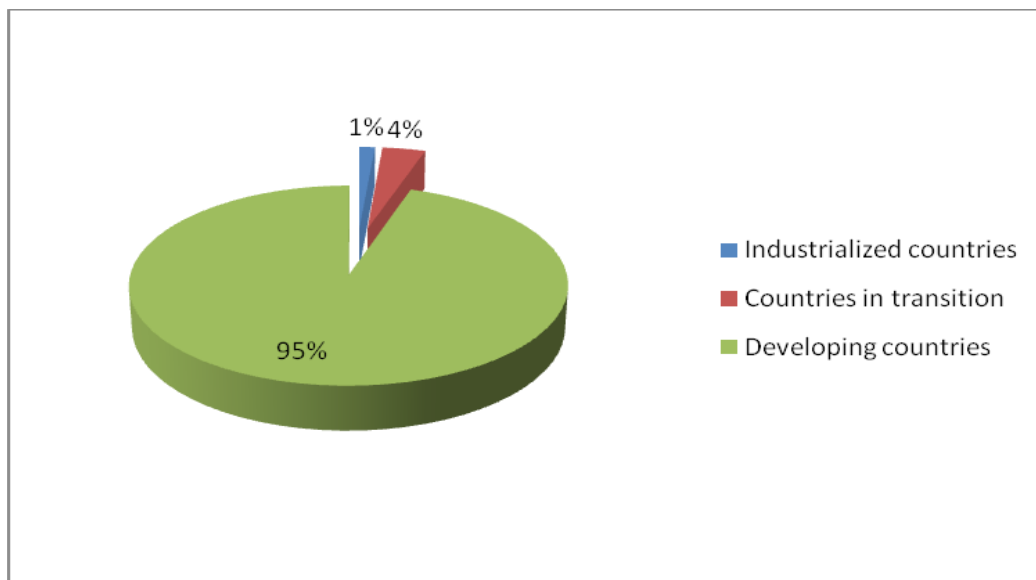


Figure 1: Situation of food insecurity in the world

Source: FAO 2002

The agriculture sector plays an important role in the Tanzanian economy. Food security relies fundamentally on the growth of the agricultural sector, which can guarantee a plentiful, permanent and harmonious supply of food. Improving the performance of

smallholder farmers in poor rural and peri-urban communities offers one of the best and most sustainable avenues for reducing hunger by improving quality and quantity of locally available food. Shetto and Owenya (2007) explained that most rural households depend on crop and livestock production, Present yield have to double if demand for food by the rapidly growing population is to be met.

Agriculture plays a central role in strategies to reduce hunger because about 80%of Tanzanians are smallholder farmers; farming is therefore at the heart of their livelihoods (FAO, 2003). Performance of the agricultural sector falls short of the growth needed to ensure adequate supplies to meet food and nutritional requirements on a sustainable basis. Tanzania is not a famine prone country, and has the potential to produce its own food requirements. However, over the years, food production in the country has sometimes failed to meet demand. The country has been importing food to the tune of 4% to 10% and receiving food aid to meet production shortfalls (Amani, 2005).

According to Rapid Vulnerability Survey carried out by the Food Security Information Team in 2008, Manyara is among the food insecure regions in Tanzania (URT, 2009). Mbulu district received 4 944.4 tons of cereals during distribution of food aid with large portion being allocated to smallholder farmers between may 2009 and March 2010 as per district report. McKinney (2006) reported that, in Manyara food insecurity affects between 20 and 30% of households. In Mbulu district, majority of the population is directly dependent on agriculture and livestock for their livelihood, agriculture is therefore the mainstay of the economy. The main types of farming activities are crop production and livestock husbandry. Mixed farming is the dominant type of farming system and includes both crop production and animal husbandry.

In 2000 world leaders committed themselves to the millennium development goals (MDGs), that aimed at reducing by half, the proportion of people suffering from hunger and poverty between 1990 and 2015 as priority number one (FAO, 2003; MAFSC, 2006).

Devereux and Maxwell (2001) explained that poverty and hunger are seen as the most urgent and intractable problems facing people particularly the poor in rural areas. This shows that solution to one among these two problems will lead to relief of the other.

1.3 Problem statement and justification

Despite the fact that the situation of food security is improving in the developed countries, the overall food insecurity is increasing in Asia and Sub-Saharan Africa (SSA) (FAO, 2002). Food insecurity continues to be a major problem in Tanzania including Mbulu district. URT (2005) reported that smallholder farmers depend on agriculture for their livelihood. Agricultural production has remained low especially among smallholder farmers who constitute the majority of agricultural producers in Tanzania; hence they are vulnerable to food insecurity due to the fact that they depend on subsistence farming as their primary source of food as well as income.

This research is therefore aiming to generate empirical information on factors that contributes to the food insecurity on which planners and policy makers will work on. On the other hand, the study will assist researcher gain skills on addressing food insecurity problems in the household of smallholder farmers and present them in a way they are understandable and recommending the way forward. The research is therefore in line with the implementation of MDGs number one which aimed at reducing by half proportion of population suffering from hunger by the year 2015.

1.4 OBJECTIVES OF THE STUDY

1.4.1 Overall Objective

The overall objective of the research is to assess factors contributing to food insecurity among smallholder farmers in Mbulu district.

1.4.2 Specific Objectives

The specific objectives of the proposed study are:

- i. To analyze the food situation in the study area.
- ii. To identify limiting factors for optimal food production in the area.
- iii. To identify various coping strategies employed by smallholder farmers in situation of food insecurity.

1.5 Research Questions

- i. How is the situation of food security in Mbulu district?
- ii. What are the limiting factors for the factors for the optimal production in the study area?
- iii. What coping strategies do smallholder farmers employ during food insecurity in the study area?

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Overview

This chapter reviewed literature from the findings of other studies in order to provide theoretical framework which guided development of the study. It covers sections such as; Food insecurity; determinants of household food insecurity; factors contributing food insecurity and Coping strategies and household food insecurity.

2.2 Food insecurity

According to World Food Summit of 1996, food insecurity exists when people do not have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active healthy life. Amount of grains and number of meals consumed by family members. It has been reported by URT (1999) that food insecurity is indicated by the population who are unable to get 270kgs of grains per adult per year. According to UNDP (1998), one of the indicators of household food insecurity is the percentage of households with adults eating less than three meals (one meal or none), and percentage of children aged 6 to 59 months eating less than five meals per day. The recommended meals are three meals for an adult, and five meals for children.

Devereux and Maxwell (2001) food security is of people centered poverty-free society based on full and equal access to food and nutrition for all. The emphasis is on both food supply and food self sufficiency and access to food. Improvement food security among the Tanzanian population will depend on the production performance of food crops, livestock and horticultural crops. Food security at the household depends on continued ability to maintain livelihood that allows production and procurement of food needs in an appropriate manner (Tansey and Rajotte, 2009).

2.3 Determinants of household food insecurity.

Three pillars underpinning food security involves food availability, food accessibility, and food utilization (Adekoya, 2009). Food security is availability and accessibility at all times of adequate food-stuffs to sustain a steady expansion of food consumption and to offset fluctuation in production and price (Devereux and Maxwell, 2001). Family is food secure if it has sufficient, safe and nutritious food throughout the year so that all members can meet their nutrients need with the food they like/prefer for active and healthy life (FAO, 2004). MAFSC 2006 explained that, food security consist of three distinct but interrelated aspects such as; food availability, accessibility, stability and utilization.

2.4 Factors contributing food insecurity

The common ways of acquiring food to smallholder farmers is mainly own farm production (subsistence production) and purchase from markets. The major concern is therefore on factors which limit optimal food production and purchasing power of smallholder farmers.

2.4.1 Unreliable/ inadequate rains during crops growing season

According to McKinney (2006) the contribution of the rainfall to transitory shocks in food insecurity in Tanzania is significant. Drought conditions have lead to crop failure consistently within the north central districts of Tanzania over the last 10years and currently Tanzania is experiencing failed rains in many parts of the country. The majority of the country and most of the high potential areas rely on unimodal rainfall regimes; this increases the susceptibility of Tanzania to inadequate or failure in rainfall during the growing season. Drought is the most experienced shock by about 45% of households in Tanzania.

Kinabo *et al* (1998) advocates that, unreliable rainfall is the most limiting factor of crop production in the tropics. This is due to the frequent occurrence of consecutive rainless days during growing season hence crop failure due to drought. Mwaniki (2006) noted that, ninety five percent of the food in Sub-Saharan Africa is grown under rain fed agriculture; food production is therefore vulnerable to adverse weather conditions. However most smallholder farmers in Tanzania depend on rain fed agriculture, unreliable/inadequate rainfall automatically result to low yields hence the country experience periodic food shortages.

2.4.2 Poor soil management

The life of the plant depends on the life of the soil. Soil is very important resource for plants because it holds roots that provide support for plants and stores nutrients. Plants require a soil with good physical structure that has adequate water-retaining and drainage properties. Moreover fertile soil promotes the chemical reactions needed to recycle the needed materials for the plants' use. However poor soil fertility management practices leads to expansion into less-favorable lands hence low crops' yields (FAO, 2008).

According to Baldwin (2006) weathered and inherent low soil fertility leads to poor production. Soil fertility degradation constitutes one of the most important constraints to sustainable food crop production. Small-scale crop production in many parts of Tanzania is constrained by many problems among which soil fertility degradation is a major problem.

2.4.3 Low level of labour force

The major source of labour in many rural households is family members. Labour shortage is a constraint to the increasing food crop production. Matunga (2008) revealed that,

labour shortage for farming activities by households is attributed by selling labour for farming activities in other people's farms and other off-farm activities. Selling labour during farming season contribute labour shortage hence household food insecurity.

According to MAFSC (2006), migration of young people and men for wage work lead to decrease in food crop production. Baldwin (2006) added that, poor health (diseases like chronic malaria, typhoid etc.) has contributed to loss of labour for household agricultural production.

2.4.4 Scarcity of arable land

Land is an important resource for smallholder farmers as their livelihood depend on agriculture. The bulk of the cultivated land is occupied by smallholder farmers who own between 0.5 to 5.0 hectares. The availability of land for agriculture is not uniform in Tanzania due to variation in population pressure. However land scarcity is mainly caused by overpopulation and people not willing to move to new areas where land is not a problem (Navuri, 2011). Scarcity of arable land lead to food insecurity because the number of household members is increasing and yield obtained from the small plots does satisfy the demand of food for the family members (MAFSC, 2006). FAO (2008) added that, the poorest, landless households are the ones facing acute food insecurity.

2.4.5 Limited use of improved modern technologies

Modern farming technologies that will improve farming are mechanization, the improvement of crop varieties, and the development of agrochemicals to fertilize soil and control weeds and pests (Altieri, 1995). Although agriculture is seen as the backbone of the Tanzania economy, agriculture growth is modest due low use of technologies. About 70% of the crop area is cultivated by hand hoe while 20% is cultivated by ox plough and

10% by tractor. Input use is also low, only 27% of the farmers buy fertilizers and 19% buy pesticides (Kinabo *et al*, 1998).

Large number of smallholder farmers do not or under use modern technologies like application of fertilizers, modern seed varieties, pesticides and insecticides due to lack of knowledge and /or low income (IFAD, 2010). Programme for Agriculture and Natural resource Transformation for Improved Livelihood (PANTIL, 2007) reported that, the utilization of modern technologies is very low in Tanzania. Large part of agriculture sector still uses poor technologies partly due to less access to credit.

2.4.6 Pre and post harvest food losses

The issue of food losses is of high importance in the efforts to combat hunger, raise income and improve food security in the world's poorest countries. Food losses occur as a result of inefficiencies in food production and processing operations that diminish supplies (Rooney, 2011).

Given that many small farmers in developing countries live on the margins of food insecurity, a reduction in food losses could have an immediate and significant impact on their livelihood. Food losses are among factors affecting food availability due to high pre and post harvest losses due to pest, diseases and adverse climatic conditions. Pre harvest losses account for over 30% of all crop losses in the country. It is estimated that post harvest losses range from 30-40% for cereal grain and legumes, up to 45% for roots and tubers and 40-80% for fresh vegetables and fruits. Moreover inappropriate food management at house hold level diminishes food stock available for consumption (IFAD, 2010).

2.4.7 Agricultural extension

Extension agents are key actors in transferring improved technologies generated by scientists to farmers. However, many technologies generated and transmitted in this way are too expensive for hundreds millions of small scale farmers who cannot afford to invest in the packages of the required inputs such as improved seeds, fertilizers and pesticides (Reij and Bayer, 2002).

Agricultural extension officers play key role in improving crop production as educators and communicators (Swanson, 1984). The extension program in food production is focusing on commercialization of agricultural activities, modernized farming practices and improved post harvest handling. It also emphasizes on technology transfer from research agencies to extension agencies and finally to the farmers. Under crop production, the focused activities are field preparation, selection of planting materials, weed and pest controls, and fertilizer application. It is imperative that the impacts of extension programs would be able to increase farm income and productivity, boost food production, enhance food safety assurance, and enable surplus food produce be exported to other countries.

Activities such as visits and training of target groups are based on crop calendar and stages in implementing projects. Periodic formal and informal feedback from the target groups is necessary. Farm record keeping is encouraged to all farmers as a tool of backtracking past farming activities for remedial actions especially to analyze what shortfalls or malpractices in using farm inputs and executing farm operations (Fikri, 2009).

According to Rogers (1983) extension has long been grounded in the diffusion model of agricultural development, which means technologies passes from scientists via extension officers to farmers. Lupatu, (1995) reported that, the falling of agricultural production is

blamed on several factors, but the most critical being ineffectiveness of agricultural extension system. Inefficiency of extension services resulted to poor transfer of improved and modern technologies to smallholder farmers.

2.4.8 Low income of smallholder farmers

According to Mjonono (2008) the relationship between poverty and food insecurity is a complex one. There are strong, direct relationships between food insecurity, hunger and poverty. Eradicating food insecurity and poverty requires an understanding of the ways in which these two injustices interconnect. Hunger and malnourishment prevent poor people from escaping poverty, diminishing their ability to learn, work, and care for themselves and their family members.

Poverty and hunger are intractable problems as millions of people become poorer the severity of food insecurity intensifies (Devereux and Maxwell, 2001). Food access addresses the demand for the food which is influenced by economic factors. Food insecurity in developing countries is caused by inability of people to gain access to food due to poverty. Over seventy percent of the food insecure population in Africa lives in the rural areas. Smallholder farmers, the producers of over 90 percent of the food supply, make up the majority of this population (Mwaniki, 2006).

During food shortage, purchasing is an alternative means of obtaining food for households' consumption. Low income and weak access to financial services are among factors which affect purchasing power of smallholder farmers (Baldwin, 2006). Mwaniki (2006) reported that, while the rest of the world has made significant progress towards poverty alleviation, Africa, in particular sub-Saharan Africa continues to lag behind.

However 63% of Tanzanian population depends on agriculture and agricultural related activities for their livelihood. In areas where farmers produce surplus food, they sell their surplus and sometimes they over sell their produce due to competing needs for cash including meeting costs for health services, education expenses, clothing and other basic household assets. Inadequate employment opportunities and lack of other income generating activities lead to low purchasing power and hence affect access to food (Baldwin, 2006; FAO, 2005; MAFSC, 2006).

Low income of smallholder farmers affects accessibility of food from the market. United States Agency for International Development reported that, despite an improved global cereal supply resulting from increased cereal production in 2008 and an associated decline in international prices, food prices remain high in most developing countries. Increased food prices continue to negatively affect food access for significant numbers of low-income populations African nations (USAID, 2009).

2.4.9 Weak access to financial services

According to URT (2005) access to credit is among factors that improve agricultural productivity of smallholder farmers since its availability will enable farmers to adopt modern and improved farming technologies that will increase food availability. In addition, credit will provide smallholder farmers opportunity to engage in non-farming activities that will enhance food accessibility. However, rural smallholder farmers in Tanzania have inadequate reliable sources of credit (formal and informal) that farmer could depend upon. Demand for credit exists because farmers do not have access to all inputs required for farming activities. FAO (2008) reported that, a large percent of rural smallholders who are poor suffer from insufficient access to loans and credit.

2.5 Coping strategies and household food insecurity

Devereux and Maxwell (2001) explained coping strategies as all strategies selected by individuals and households in poor socio-economic position to overcome the problem of food shortage. According to Beraki (2009) coping strategies are behavioural responses whereby households actively try to protect their livelihoods, adopting several actions and mechanisms when faced with shocks and stresses that affect their livelihood, one of which is food security. Coping strategies are employed to mitigate the effects of not having enough food to meet the household's needs; some are positive means of overcoming food shortages, for example off-farm employment and savings.

However, for many poor people, coping strategies are negative, for examples; severe reduction in food consumption or skipping whole meals; eating foods that are less preferred and less expensive; selling productive assets, reducing expenditures on basic services such as health and education; reducing the number of consumers by sending certain members of the family to live and/or work elsewhere and abnormal migration (Adekoya, 2009). Matunga (2008) reported selling labour power as the commonest coping strategy on food insecurity though is not an effective way since it constraint production by labour shortage in the individual household's farms.

Zalilah *et al.* (2008) revealed that, coping strategies related to dietary change, food-seeking behaviors, household structure and rationing are commonly adopted by households experiencing food insufficiency. Furthermore, rural low-income households used food-related coping mechanisms (cook whatever food is available at home and borrow money to buy food) during periods of food insecurity. However use of less expensive food, decreased frequency and quantity of food intake and consumption of less

preferred foods are prevalent coping mechanisms among rural low-income. However the scoping strategies may vary within and between household settings.

CHAPTER THREE

3.0 METHODOLOGY

3.1 Overview

This chapter describes the methodology which generated data for the study which were used in and outlines the statistical procedures which were used in analyzing the data. The chapter in brief covers the description of the study area, study design, sampling methods, data collection procedures and tools data processing and analysis.

3.2 Description of study area

The study was conducted in Mbulu district, one of the five districts of Manyara region located in the northwestern part of Tanzania. It lies between 2⁰00 and 4⁰00 Latitude south of Equator and 30⁰ and 34⁰ Longitude east of Greenwich. The study was conducted in six wards of Mbulu district; including Bargish, Gehandu, Masieda, Gunyoda, Murray and Kainam. The district map (Figure: 2) show the study routes during data collection.

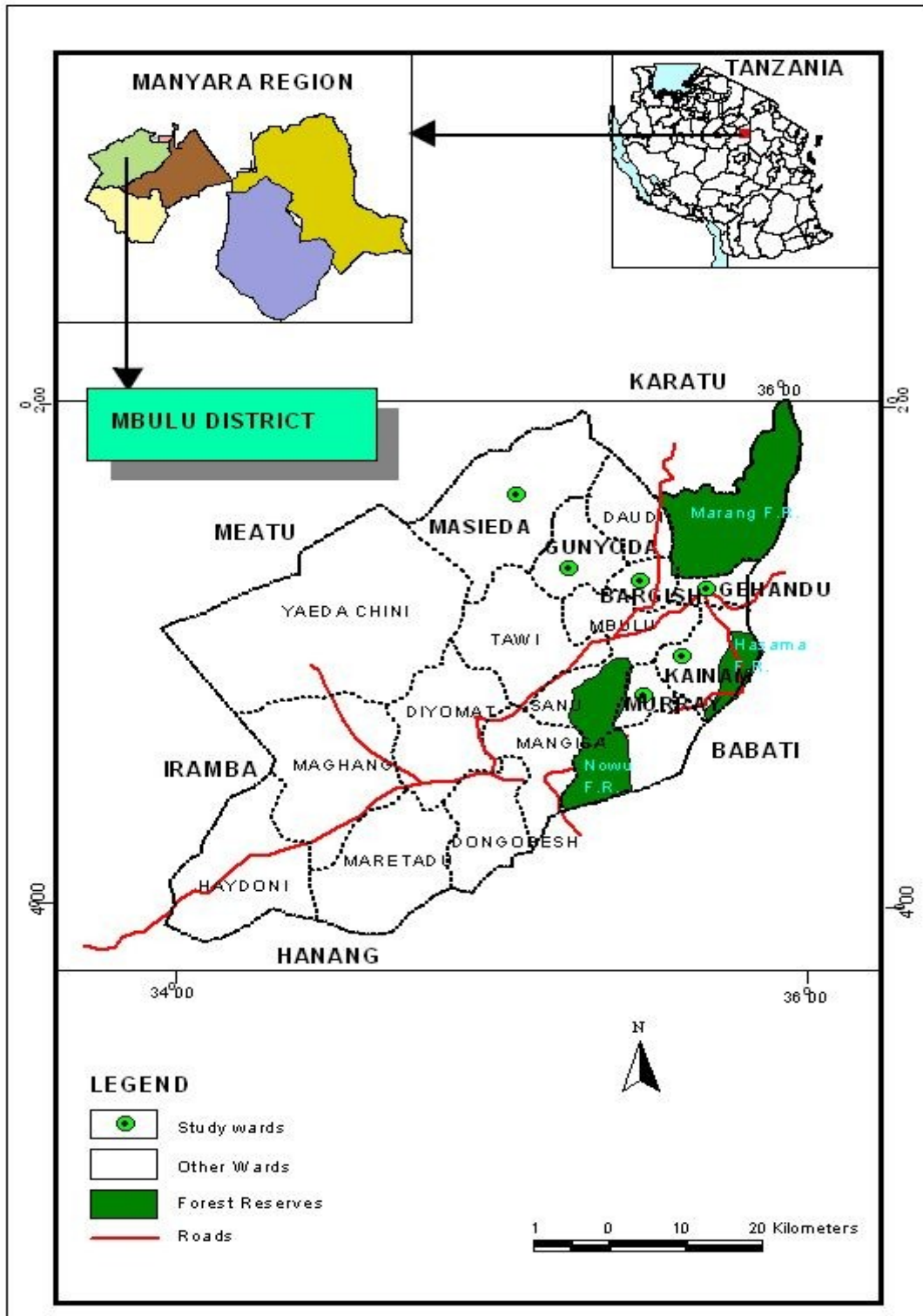


Figure 2: Map of Mbulu District showing study area

3.3 Research design

This study employed cross sectional survey approach whereby data was collected at one point in time from sample selected to represent some large population. This has been chosen due to its flexibility and being economical (Kothari, 2004).

3.4 Sampling

3.4.1 Sampling frame

The population of this study consisted smallholder farmers in Mbulu district. Sampling frame was prepared from purposively selected six wards, including Bargish, Gehandu, Masieda, Gunyoda, Murray and Kainam. List of smallholders were obtained from the VEOs. A multi-stage sampling technique was employed to select the respondents. First stage was selection of nine villages from six wards with smallholder farmers. Finally simple random sampling was done to obtain respondents from the selected villages. Other stakeholders were interviewed including DALDO, extension agents, village leaders and councilors.

3.4.2 Sample size

Given the size of the study population from nine villages and constraints of time and finances a sample of 120 respondents were picked from a sampling frame using a table of random numbers.

3.5 Data collection methods

Two types of data were collected; primary and secondary data.

3.5.1 Primary data collection

Primary data were collected from respondents by the researcher with assistance from three enumerators. All enumerators were trained before data collection on sampling procedures and techniques asking questions from respondents.

3.5.2 Secondary data

Secondary data which was important to enrich the research were gathered from different sources. Secondary data involved reviewing of literature most of which was obtained from books, websites and district report. However, Ministry of Agriculture, Food Security and Cooperatives (MAFSC), Sokoine National Agriculture Library (SNAL) has contributed much as the secondary sources of data.

3.5.3 Qualitative and quantitative data

3.5.3.1. Qualitative data

This involved key informant interviews including DALDO, extension agents and local leaders.

3.5.3.2. Quantitative data

This involved data gathering from smallholder farmers in the study area by using survey instruments (interview schedule) with both open and close ended questions.

3.6 Data Processing and Analysis

3.6.1 Data processing

Data from respondent interview schedule were coded for computer analysis.

Data from extension agent's interview schedule, checklist for key informants and researcher diary were summarized manually with great care to ensure accuracy that reflects original meaning.

3.6.2 Data analysis

Data collected from smallholder farmers were analyzed by using Statistical Package for Social Sciences (SPSS) computer programme version 12.0. Before analysis, data were verified, compiled, coded and summarized. Descriptive statistics such as frequencies and percentages were used to obtain variability among variables.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Overview

This chapter presents the major results and discussion arising from the data analysis related to food insecurity among smallholder farmers in Mbulu district. The major sections include; respondents' personal characteristics, household socio-demographic attributes, household situational characteristics, Strategies to cope with food shortage, extension agents' personal characteristics and opinions on food insecurity as well stakeholders' opinions on food insecurity.

4.2 Respondents' Personal characteristics

The respondents' personal characteristics such as age, sex, marital status and level of education are used to assess the status of smallholder farmers and how they relate with food insecurity in the study area. These characteristics have social and economic implications to the accessibility and availability of food within the household.

Table 1: Respondents' personal characteristics (n=120)

Age categories	Frequency	Percentage
19 – 31	4	3.3
32 – 59	85	70.8
Above 59	31	25.9
Total	120	100.0
Sex		
Male	109	90.8
Female	11	9.2
Total	120	100.0
Marital status		
Married	107	89.2
Never ever married	1	.8
Separated	5	4.2
Widowed	7	5.8
Total	120	100.0
Educational level		
Primary education	89	74.2
Non-formal education	31	25.8
Total	120	100.0

4.1.1 Age distribution among smallholder farmers

From the results (Table 1), 70.8% of the respondents fall under the age group of between 32 -58; 3.3% fall under the age group of between 19-31 and 25.9% fall above 59 .This gives an insight that, surveyed area comprises energetic people who work for their food production. The age group of 32-58 is said to be economically active, hence improve the situation of food shortage. This study contradicts with Singh *et al.* (2003) that, age affects experience, wealth and decision making all of which affects how one works and hence influences individual productivity. This is due to the fact that, although majority of respondents are under active group who are believed to be experienced, still agricultural productivity is low.

4.1.3 Sex of the respondents

The results in Table 1 show that, 90.8% and 9.2% of respondents were male and female respectively. This means that most women did not participate during interviews due to household heavy work load although they play the key role in maintaining household food security. Other women were not ready to be interviewed claiming that; they can not disclose the household information on behalf of their husbands. It was assumed that, the sex of the household head being male or female could influence food security within the household. The study is therefore in agreement with the study conducted by Fabiyi *et al.* (2007) that rural women farmers play a vital role in food production and food security. They account for 70% of agricultural workers, 80% of food producers, and 100% of those who process basic foodstuffs. Women take part actively in farming activities and in processing farm products, in addition to their domestic and reproductive responsibilities.

4.1.3 Marital status of smallholder farmers

It is believed that married couples are likely to be more productive than single parent families due to labour supply in farming activities and access to productive resources in agriculture (Matunga, 2008). The research findings show that, among the food secure households (18.3%) and non food secure (81.7%) majority of respondents (89.2%) are married. This shows that marital status is not an important factor on household food security.

4.1.4 Education level of smallholder farmers

From the Table 1, 74.2% of respondents attended primary education while 25.8% didn't go for formal education. This implies that among the interviewed smallholder farmers, no one has either attended secondary neither tertiary education; meaning that majority of them had low level of education. Education status of the farmer is an important factor in

adoption of improved agricultural practices and high yielding varieties (Singh *et al*, 2003). Cyphers *et al*. (1993) added that education is expected to be positively and significantly associated with adoption of sustainable technologies.

According to International Food Policy Research Institute (IFPRI, 2004), education is vital in struggle to ensure food security. Mass education can make difference in agriculture output as it plays a great role in adoption of technologies; farmer must be able to read and write the documents and use them to improve agricultural production. Those who can neither read nor write; those who are without basic numeracy can not be relied upon to modernize agriculture to achieve the quantity and quality needed in maintaining food security at both household and national level.

The research findings contradict with IFPRI report; although results from the Table 1 shows 74.2% of respondents who have attended primary education, still farmers face problems in improving agricultural production. During the study, one private extension service provider reported that most of technologies introduced are labeled in English language which is difficult to be understood or be easily translated by smallholder farmers with their primary and non-formal education.

4.2 Household Socio-Demographic attributes

Household socio-demographic attributes such as family size, family labour force and family dependents is an important factor in households of smallholder farmers.

Table 2: Distribution of Household socio-demographic attributes (n=120)

Variable characteristics	Frequency	Percentage
Family size		
below 4	8	6.6
5 – 7	37	30.8
8 – 9	42	35.0
Above 9	33	27.5
Total	120	100.0
Family labour force		
1	9	7.5
2	80	66.7
3	25	20.8
4	3	2.5
5	3	2.5
Total	120	100
Family dependents		
Below 3	26	21.7
4-5	23	19.2
6-7	48	40.0
8-9	13	10.8
Above 9	10	8.3
Total	120	100.0

The situation of food security may be affected by household socio-demographic attributes such as family size, family labour force and family dependants. From the findings 6.6% have family members below 5 individuals, 65.8% have family members between 5 and 9 and 27.5% have family members above 10 people per household.

Family size, labour force and dependants

Family size is the number of household members usually residing in household and share household expenses ('common' kitchen), including children of the head, and other dependants (REPOA, 2000). Family size is more pertinent to this study because the welfare of a household is also drawn from a larger network of relationships. The result from the Table 2 shows that, 87.5% have labour force between two to three people

working all the time. This means that in most cases only couples provide labour force for farming activities with little support from children during holidays. Again 78.3% of households have family dependents between four to nine individuals, meaning that, most families has large number of dependants with few contributing labour force.

TFNC (2005) reported that, food security is determined by what that particular household is able to produce. In turn food crop production is determined by agricultural productive resources available to that particular household such as the amount and division of labour. Large family in the rural house holds results in declining farm size which in turn results in low level of per capita production. Most smallholder farmers rely on the agricultural sector which is characterized by low labour productivity, declining farm and subsistence farming (Beyene, 2008). Zalilah *et al.* (2008) added that, larger household size and higher number of children and school-going children contributes to food insecurity in that, more children mean higher child expenditures which include general and education expenses.

4.3 Household situational characteristics

The household situational characteristics examined were in two categories. The first category included productive assets such as land and livestock; under this category, issues considered were farm size; land acquisition; land ownership and control. Food crop production, as well as livestock ownership were are also examined. The second category was off-farm activities that could support farming activities.

4.3.1 Land size, acquisition, ownership and control

Land is among the most important factor and means of agricultural production. Land distribution (both quantity and quality) is a major factor to maintain household food

security since more than 80% of smallholder farmers depend on it for their own crop production to feed their families (Sibuga, 2008).

Table 3: Household farmland distribution (n=120)

Variables	Frequency	Percentage
Land size (ha)		
Below 3	73	60.8
3 – 4	33	27.5
5 – 5	10	8.3
6 – 7	1	.8
Above 7	3	2.5
Total	120	100.0
Land acquisition		
By inheritance	90	75.0
Bought	4	3.3
village offers	21	17.5
clear natural forest	5	4.2
Total	120	100.0
Land ownership and control		
Father	104	86.7
Mother	11	9.2
Both father and mother	2	1.7
all family members	3	2.5
Total	120	100.0

4.3.1.1 Land size

Empirical study shows that land is an important resource to smallholder farmers whose lives depend on farming. Those farmers with large farm plots are most likely be food secure compared to those with small farm holdings. Results in the Table 3 shows that, 60.8% of the respondents have the land less than or equal to 2.0 ha, while 39.2% have farm size above 3.0 and hectors. This means there is shortage of arable land in the study area, hence contributed to low crop production because amount and quality of land determine quality and quantity of food crop production. The current study is compared to that of URT (2005) that, the dominant group

in Tanzanian agriculture is small-holder subsistence farmers who utilize about 85% of the land cultivating not more than 2.0 ha.

4.3.1.2 Land acquisition

From the study, majority of smallholder farmers (75.0 %) acquired land by inheritance, 17.5% from village offer, 4.2% from clearing natural forest and 3.3% of the respondents bought the land for cultivation. This indicates that, large number of smallholder farmers is prone to shortage of arable land since they acquire land by inheritance. This is due to the fact that, the family size is expanding, and depend on available piece of land which limit expansion of agricultural activities. Land acquired by clearing natural forest leads to environmental degradation resulting to existence of drought that lowers agricultural production hence food insecurity. This study is compared with that conducted by Matunga (2008) in Dodoma where by large percent of smallholder farmers acquired land by inheritance which does not allow expansion of agricultural activities as family size is also expanding.

4.3.1.3 Land ownership and control

The results from the Table 3 shows that in most of the households of smallholder farmers (86.7%), land is owned and controlled by men; 9.2%, 2.5% and 1.7% of the land is controlled and owned by women, all family members and by both parents respectively. These results imply that, women can control and own the farmland if they are widowed or separated. The results from this study are comparable to those of REPOA (2000), that resources generated from agricultural activities are mainly dominated and controlled by men as heads of most households despite equal participation of all family members in farming activities.

Sibuga (2008) added that, in Tanzania over 80 % of the women constitutes the main part of the agricultural labour force. Moreover IFPRI (2004) added that, in most cases women play a very important role in improving household food security as they are key role players in provision of labour in farming activities though they neither own nor control land. Moreover IFPRI insisted that ,the role of women must be clearly defined to make sure that, they can own and control the land as it is done in Senegal; their constitution provide rural women the property rights exactly like men. The result from the research indicate that women has no property right to own and control productive resources because the distribution of land were left upon to traditional authorities which is dominated by patriarchy system which deny women to have any land.

4.3.2 Types of crops grown

The types of crops grown in the study area include maize, sorghum, millet, beans pigeon peas and lablab. Diversification of crop types is important in both supplying individual dietary needs and reducing reliance on single crop types which are more or less susceptible to environmental changes, therefore protecting the food security of the household.

Table 4: Types of crops grown in Mbulu district (n=120)

Crop	Number of farmers growing	Percentage
Maize	120	100.0
Cow peas	6	5.0
Sorghum	17	14.2
Millet	11	9.2
Beans	56	46.7
Pigeon peas	68	56.7
lablab	2	1.7

The results from Table 4 reveal that, all interviewed farmers grow maize, 56.7% respondents grow pigeon peas, and 46.7% grow beans. Sorghum, millet and lablab are grown in small quantities i.e. 14.2%, 9.2 and 1.7 respectively. Maize is predominantly grown by farmers in the study area; implying that it is the major cereal crop. Sorghum and millet are considered as less preferable cereals though they withstand drought compared to maize. Recently farmers have adopted pigeon peas as both food and cash crop which is intercropped with maize and beans; particularly in Daudi and Endergikoti divisions. Lablab is the cash crop which is recommended to be grown in Masieda and Gunyoda wards (semi-arid areas), where there is scarcity of rainfall. The problem with this crop is that, it is sold at high prices as a result farmers do sell all harvested quantity without reserving seeds hence no seeds for next season (DALDO, 2010).

Table 5: Quantity of crops harvested in the year 2010 (n=120)

Type of crop	Quantity of crops harvested in kgs	Frequency	Percentage
maize	Below 101	3	2.5
	101 - 1575	82	68.3
	1576 - 3050	26	21.7
	3051 - 4525	5	4.2
	Above 4525	4	3.3
	Total	120	100.0
Pigeon peas	Below 101	26	21.7
	101 - 467	38	31.7
	468 - 833	3	2.5
	Above 833	1	.8
	Total	68	56.7
Beans	Below 101	29	24.2
	101 - 393	20	16.7
	394 - 687	5	4.2
	Above 687	2	1.7
	Total	56	46.7
Sorghum	Below 101	4	3.3
	101 - 800	9	9.2
	801-1500	4	3.3
	Total	17	14.2
Millet	Below 101	4	3.3
	101 – 467	4	3.3
	468 – 833	2	1.7

	Above 833	1	.8
	Total	11	9.2
Others		8	6.7

The findings from Table 5 reveal that 85% of respondents harvested below 1500kg of maize per year; while 14.2% who were growing sorghum harvested below 1500kg. Those who were growing pigeon peas and beans harvested below 400kg per year. Other crops like millet, cow peas, lablab, root and tubers were produced in small quantity (6.7%). These results from the study area indicate that, to most smallholder farmers' food crops production was low; and majority of farmers depend on the maize as their main staple food.

This study is in agreement with that conducted by Sibuga (2008) that, maize is the main cereal produced in Tanzania, representing 74 percent of total cereal production. The study is also in line with that of McKinney (2006) that, majority of the main food crop maize (around 40% of the total maize production) is planted in the unimodal rain regime thus higher susceptibility to rain failure. Consequently rain failure in the unimodal regime has a major impact on total crop cereal production in Tanzania.

Kinabo *et al.* (1998) added that, productivity of food crops in Tanzania is not encouraging. From 1995/1996 to 2000/01, the productivity of major cereals which are maize and sorghum was below 2000kg per ha. Cereals production has staggered around 75-95% of requirements implying a cereal deficit of between 375 000 and 875 000 tones. During 2009/2010, cereal supply stood at 79% implying a deficit of 1 348 445 tones. Currently in 2010/11, approximately 50% of national food crop production is composed of cereals and 30% is maize, the normally drought prone crop (URT, 2010).

4.3.3 Livestock kept

The ownership of livestock is important for both improving coping mechanisms and improving nutrition in the household. Livestock act as a banking system in that they can be sold or exchanged when there are shocks to the household (McKinney, 2006)

Table 6: Livestock kept in the study area (n=120)

Livestock type	Number of farmers keeping livestock	Percentage
Cattle	70	58.3
Pigs	40	33.3
Goats	36	30.0
Sheep	17	14.2

The livestock kept in the study area include cattle, goats, pigs and sheep. The result from Table 6 shows that 58.3% of respondents keep cattle; 33.3% keep pigs; 30.0% keep goats and 14.2% keep sheep. It has been reported that, farmers do keep livestock for various purposes such as: payment of bride wealth, prestige, source of income and provide food for the family members. Moreover, farmers do keep livestock (draught animals) to ease cultivation of land and provision of manure for improving soil fertility. This means that, livestock keeping play a key role in improving household food security due to provision of manure, source of income and use of draught animals for simplifying cultivation of land.

This study is compared to that conducted by Bryceson (1990) that, the accumulation of cattle is not only a means of bride wealth payment and prestige but also important precaution against crop failure and famine. In the event of food shortage, cattle are readily

bartered and sold. Furthermore study agrees with that conducted by Beraki, (2009) that livestock play a significant role in the production system as a means of food, income and draught power.

4.3.4 Off-farm activities

During the study respondents were asked whether they are performing off-farm activities. The researchers' aim of investigating off-farm activities was to discover other sources of income that could help farmers to buy food. Since production and productivity of the agricultural sector is low, farm households' income is not sufficient even to feed their families; smallholder farmers were expected to participate in off-farm activities mainly to supplement their agricultural income.

Table 7: Non-farming activities (n=120)

Non-farm activity	Frequency	Percentage
Small shop	7	5.8
Tailoring	2	1.7
Carpentry	5	4.2
Masonry	2	1.7
Watchman	6	5.0
making local brew	5	4.2
Total	27	22.6

From the findings, only 22.6% smallholder farmers were performing off- farm activities apart from farming. The activities mentioned were small shops, tailoring, carpentry, Masonry, watchman and making local brew. The findings imply that a large number of smallholder farmers depend mainly on farming as their major source of livelihood. The findings are comparable to those of Broca (2002) that, majority of the hungry and poor in developing countries still live in rural areas and depend solely on agriculture for their

livelihoods. For the poor, the rural off-farm sector offers a relatively easy escape route from poverty and hunger.

According to Beyene (2008), non-farm activities have a great potential to provide employment and additional incomes during the slack season to rural households. The finding show that, 75% of rural farmers engage in off-farm activities which offers a relatively easy escape route from poverty and hunger; given rising population pressure on agricultural land which results in a decline in land holding per individual. Mjonono (2008) reported that food secure households are described as having access to income through various sources such as remittances, off-farm employment and other income-generating activities.

4.4.1 Food situation in the study area

From the research findings, 81.7% of the respondents were food insecure while 18.3% had enough food for the family members until next harvesting season. Majority of smallholder farmers in the study area harvested little maize which is the main staple food as shown in Table 5. The study also show that 85% of the respondents harvested below 1500kg of maize which is not enough family consumption with average of seven individuals. Individuals will consume approximately around 200kg of grains per year.

According to URT (1999) food insecurity is indicated by the population who are unable to get 270kgs of grains per adult per year. This indicates that large number of household did not harvest enough food from their farms; hence food insecure since the average family size of 7 individuals per household cannot be fed by amount harvested by majority of smallholder farmers.

Respondents were also asked to mention number of meals consumed by family members, which is also an indicator of food insecurity. From the findings, 49.2% of children aged under five years eat less than five meals per day; and 27.5 % adult were reported consuming less than three meals per day. According to UNDP (1998), one of the indicators of household food insecurity is the percentage of households with adults eating less than three meals, and percentage of children aged 6 to 59 months eating less than three meals per day. The recommended meals are three meals for an adult, and five meals for children aged under five years.

4.4.2 Limiting factors for optimal food production

Household heads were asked to give factors that limit optimal food production. The researcher was mainly interested in food production since most rural Tanzanians are peasants and depend on their own food production for their households. Agricultural production in Tanzania and most developing countries has a primary role of producing enough food to feed the family, and therefore providing food security. Tanzania does not produce enough to feed the population. The major constraints for low food production includes; dependence on seasonal rainfall which is in some years inadequate; low productivity per unit area and low hectares under cultivation and loses due to pests and diseases. Other factors are limited use of modern technology, poor soils, (Kinabo *et al.* 2003).

Table 8: Factors limiting food production (n=120)

Factor	Number of farmers mentioning	Percentage
Unreliable rains	109	90.8
Limited use of modern technology	111	92.5
Poor soils	107	89.2
Low and stagnant level of labours	77	64.2

Scarcity of cultivatable land	65	54.2
Poor extension services	64	53.3
Food losses	51	42.5
Food sales	46	38.3

4.4.2.1 Unreliable rains during crops growing season

From Table 8, 90.8% of respondents mentioned unreliable rains as the major factor that limits optimal food production as they depend on rain-fed farming. Most of them reported that, rainfall pattern varies from year to year. Based on farmers' report, the onset of rains delays and some times end before maturity of crops and at other times it prolongs after maturity causing destruction of produce by causing fungal disease. This implies that, effects on food security through unreliable rains is evident as there is increase in extreme weather variability such as droughts coupled with poor distribution of rainfall affecting production of food crops.

The findings from research are in agreement with the study conducted by URT (1993) that, food crop production in Tanzania is highly variable and subjected to periodic droughts. Moreover Baldwin (2006) added that, Tanzanian agriculture is rain-fed and this makes it vulnerable to weather changes especially uneven distribution of rainfall. Furthermore, Kinabo *et al.* (1998) reported that in most regions of Tanzania, an unreliable and erratic rain with unpredictable onset and abrupt stop is common. In such areas, rains falls within a short period and drought set in during the critical periods of crop-grain filling. URT (2010) added that, the country is vulnerable to the impacts of climate change because of its dependency on agriculture and more specifically rain fed.

4.4.2.2 Low soil fertility

As shown in Table 8 above, 89.2% of the respondents reported poor soils as a problem that hinders optimal food crop production. Respondents were asked on what they add in their

farms to fertilize soil. The result show that, 63.3% of the respondents used farmyard manure partially, 5.8% use both fertilizers and farmyard manure and 30.8% add nothing to their farms. The major reason for poor soils as reported by respondents was that; they add farmyard manure partially because the amount available is not enough for the whole farmland. Another reason is that, although government has subsidized price for chemical fertilizers, (voucher) still majority are claiming that they can't afford purchasing because it is expensive. Even those who are able to purchase claimed that, its application requires high man power.

The result from the findings implies that soil fertility depletion is a big challenge to small holder farmers since large number of them have low purchasing power; and have no knowledge on how to make farmyard manure as they depend on collected cow dung only. However, continuous cultivation without strategies to improve soil fertility is linked to irreversible soil degradation hence diminishing per capita food production. This study is supported with that conducted by IFPRI (2004) that, soil depletion is the major problem that hinder optimal food crop production since tremendous quantity of nitrogen and phosphorous has been taken out of the soil through crop grain, crop residue and soil erosion that have not returned.

However, crop residues are taken away to feed cattle and for other uses like making fence and also some use them as firewood; Farmers do take away the crop residues not because of ignorance, but they need those resources. Kinabo *et al.* (1998) added that, there is inadequate use of organic manure due to lack of close integration between crop and livestock and lack of appropriate transport of farmyard manure and unavailability of adequate farmyard manure especially those who don't keep livestock. Poor soil

management due to increased price of fertilizers is among the factors contributing to low crops' yields (FAO, 2008).

4.4.2.3 Limited use of modern technology

The technologies that will improve farming are mechanization, the improvement of crop varieties, and the development of agrochemicals to fertilize crops and control weeds and pests (Altieri, 1995). Results from Table 8 show that 92.5% of the respondents don't use modern technologies. 51.7% used improved seeds but below recommended amount per hectare, 5.8% use chemical fertilizers. 33.3% use plough, 2.5% use power tiller 2.5% use tractor. This means that, most smallholder farmers depend on hand hoe cultivation due expenses of modern cultivation facilities. Other observed problems with application of tractors, power tillers and plough is that, some farmlands are in sloppy areas which limit their use for example Murray, Mahheri, Tsaayo, Tsawa and some areas of Gunyoda villages.

Although 51.7% of farmers planted improved maize seeds, most of them under used recommended amount per unit area as a result they harvested little amount of maize. It has also been revealed that use of chemical manure was very minimal. Although there was subsidy for the inputs like modern seeds and chemical fertilizers, farmers were claiming that, the vouchers brought were not enough for all smallholder farmers; some were claiming that there is delay of these inputs while others were claiming that, they can not afford to buy the package of inputs. For those who are able to purchase, they are interested to purchase seeds only claiming that, chemical fertilizer require large man power during application and others have negative perception that it may lead to soil degradation.

These observations are in agreement with the study conducted by Kinabo *et al.* (1998) that although large numbers of technologies have been released or recommended for use by farmers, very few of the technologies has been adopted; and where adopted, it is rare for farmers to realize the maximum potential of the technology.

Reasons for poor adoption are; technologies are expensive because of low purchasing power of smallholder farmers due to their low income. Other reasons are lack of information dissemination and ineffective extension services. The research findings are further supported by McKinney (2006), that overall use of chemical fertilizer is less than natural fertilizer. He added that majority (68%) of seeds are obtained by reserving seeds from the previous harvest, about 23% acquired seeds by purchase. Use of seed reserves may result in a reduced or severely reduced subsequent harvest and cycling of production problems. Over 80% of households in Dodoma, Iringa, Manyara, Rukwa and Zanzibar/Pemba rely heavily on seeds reserved from the previous harvest for cereal crops.

4.4.2.4 Availability of labour force

Table 8 show that 64.2% of respondents mentioned labour force as the problem that limits optimum food crop production. The results from the Table 5 show that, 88.3%; 8.3% and 3.3% depend on family, both family and hired and hired labours respectively. Again from Table 8, 87.5% have labour force between 2 and 3 individuals; and 78.3% have family dependants between 4 and 9. The study also revealed that a large number of family dependants are students and young children who have little or no contribution to farming activities. This implies that, majority of smallholder farmers depend on family members as source of labour for farming activities. With large number of dependants, labour is therefore observed to be the limiting factor to farming output.

Table 9: Source of labor for farming activities (n=120)

Source of labour	Frequency	Percentage
Family labours	106	88.3
Hired labours	4	3.3
Both family and hired labours	10	8.3
Total	120	100.0

The findings are similar to those of Bryceson (1990) that, the household is the main unit of production. A productive effort centered on household members' labour is linked to the number of family size with the ability and enough time to work in their farms. Nevertheless the results from the study contradict with those of REPOA (2000), that labour availability is crucial in improving agricultural production. For example, households with higher labour or proportion of household members in labour force seem to be less food insecure. This reason for disagreement is that, although most families are larger in size, only few contributes to farming due large number of dependents who are students, young children and old people. Some household heads reported that, young people who didn't get opportunity to continue with secondary and tertiary studies went to work for wages in towns.

4.4.2.5 Scarcity of arable land

Table 8 shows that, 54.2% of the respondents mentioned shortage of cultivatable land as a problem that hinders maximum food crop production. The respondents were asked to mention reasons for shortage of cultivatable land; 87.2% reported that there is no area for expansion. This implies that majority of smallholder farmers acquire land by inheritance which lead to reduction of sizes as family size increases.

Since land is the most important asset base in small-scale agriculture and is a critical factor in crop production; it is evident that, its scarcity will limit optimal food production.

Low productivity of land lead to food insecurity because the number of household members is big and yield obtained from the small plots does satisfy the demand of food for the family members (MAFSC, 2006).

4.4.2.6 Availability of extension services

From Table 8, 53.3% of smallholder farmers mentioned inadequate extension services as major problem. Most of the respondents reported that, extension agents don't visit the farmers; they receive extension agents' information from village leaders during village meetings. This means that, farmers have poor and inadequate access to extension services, hence poor performance in agricultural production. The research findings are compared to those conducted by Beyene (2008) who found that, weak agricultural extension services contribute to low agricultural food crop production.

4.4.2.7 Pre and post harvest food losses

As shown in Table 8, 42.5% of smallholder farmers reported food loss due pests and diseases as a problem that affects food production and 29.2% of farmers applied pesticides while crops were in the field. Table 10 reveals that during food storage 55.8% used ashes; 24.2% used both chemicals and ashes; 15.0% use chemicals; and 5.0% didn't use any control against pests during food storage.

The mentioned agents for food losses were birds, insects, rodents and weevils. The results from the study imply that, although their crops are attacked by pests and diseases few of them used chemicals as scientific control against pest and diseases and some mix chemicals with ashes. The reasons mentioned for not using chemicals were expenses and worry for side effects of chemicals.

Table 10: Control of pests during food storage (n=120)

Control agents pests	Frequency	Percentage
Chemicals	18	15.0
Ashes	67	55.8
both chemicals and ashes	29	24.2
None	6	5.0
Total	120	100.0

This study is therefore in agreement with other researches such as Bryceson (1990) who reported that, food crop loss due to pests and diseases in the field can not be estimated while post harvest losses are reckoned at 20-30 percent. Once food crops are harvested, they are subjected to fungus and insects attack being particularly prone to weevils. Often storage methods have been blamed; storage in rafters of the house or simple containers made of local materials offers little protection from insects and pest attack. Chemical control of pests and plant diseases is not practiced by most farmers. According to IFAD (2010), pre harvest losses account for over 30% of all crop losses in the country. Post harvest losses of food crops have been observed high due to poor storage facilities. Traditional method was observed to be used by majority of farmers to store cereals.

Table 11: Storage practices (n=120)

Storage facilities	Frequency	Percentage
Bags	36	30.0
Local containers	70	58.3
Rafters	8	8.0
Silos	6	3.7
Total	120	100

The respondents further mentioned poor storage facilities as a source of food losses during storage. From the finding 58.3% stored their food crops in bags/sacks; 30% stored in local containers; 8.0% used rafters as storage facilities and 3.7% of respondents used silos as storage facilities for food crops. The results from the study indicate that, food stuffs stored in poor storage facilities are easily attacked by insect pest and rodents. IFAD (2010)

reported that, the estimates for post harvest losses range from 30 and 40 percent for cereal grain and legume respectively. Moreover inappropriate food management at household level diminishes food stock available for consumption. Food storage is the only part of the system or interim phase through which food passes from the farm through processing to consumption. However, TFNC (2005) also reported on post harvest losses of food that occur during improper storage due to pests and poor storage conditions.

4.4.2.8 Access to financial services

Access to credit facilities is poor within the sample. On average 89.2% of the respondents said they had no access to credit. If they did it were predominantly from friends or relatives, some get credit from local lenders, charity/ Non Governmental Organizations (NGOs) or local banks (totaling 10.8 %). Reasons for such poor access were fear of being indebted and lack of information. This means that smallholder farmers who depend on farming as their major source of income have poor access to financial services fearing uncertainties facing agriculture, except those who engage in other income generating activities. The findings from this study are in agreement with the study conducted in Tanzania by McKinney (2006) that, less than 20% of respondents in Lindi, Manyara, Mara, Singida and Tabora had access to credit facilities.

4.5 Strategies to cope with food shortage.

As it has been reported that a large number of smallholder households in some study areas; like Masieda, Gunyoda and Tsawa experienced food shortage for more than five years, and the problem continues to be more serious in these areas. Households therefore employ various strategies to cope with food insecurity problem. During the study, respondents were asked to point out the coping strategies they employ during food shortage. The findings from the study are given in Table 12.

Table 12: Coping strategies during food shortages in the study area (n=120)

Coping strategy	Frequency	Percentage
Selling livestock	29	42.2
Borrowing from the relatives	22	18.3
selling labour	20	16.7
Reducing quantity of meals	19	15.8
Buying	12	10.0
Skipping meals	7	5.8
Others	5	6.5
Total	120	100.0

From the above table, 42.2% of the farmers do sell livestock to buy food for their families during food shortage; 18.3% borrow from the relatives; 16.7% sell labour and 15.8% reduce quantity of food per meal; 10.0% buy food especially those who earn income from other sources and 5.8% do skip meals. Other coping strategies mentioned by respondents were begging from other people, selling banana and horticultural crops.

The results from the study reflect a situation whereby the majority of households still have a number of options left to them in order to deal with the shocks that arise. A large number of smallholder farmers do keep livestock as the precaution against calamities like food shortage. Off-farm activities also play an important role to cope with food shortages as cash earned can be used to buy food. These findings are supported by those conducted by McKinney (2006) that, livestock act as a banking system in that they can be sold or exchanged when there are shocks to the household. Zalilah *et al* (2008) reported borrowing money to buy food and receiving foods from family members, relatives and neighbors are ways to cushion the food insecure households from experiencing food insufficiency.

4.6 Extension agents' personal characteristics and opinions on food insecurity

During the study, extension agents were interviewed in order to find out the root causes of food insecurity to smallholder farmers in the study areas. The aspects concerning the extension agents are presented in two major categories: the first category is extension agents' personal characteristics and the second one is their opinions on food insecurity.

4.6.1 Extension agents' personal characteristics

The extension agents' personal characteristics were examined since they were expected to influence performance of services they provide in the study areas. Sex, age, marital status, level of education and in-service training are among the most important personal characteristics dealt with. The investigation involved three extension agents; one male aged 52 years and two female aged 48 and 27 years respectively. Two of them were married with eight and five children, while the third one is not married. Concerning the education level, the extension agent aged 27 years old has diploma level with two years working experience while the other two have certificate with 22 and 17 years working experience respectively. Among the interviewed extension agents, all are working at wards level and no one has attended in-service training .It is therefore observed that, the two married extension agents have family responsibilities that might affect their performance. It is expected that married people are more likely to stay in one place than unmarried who may have little commitment to serve people. However it has been discovered that the ward in which unmarried extension agent is working, most farmers reported to have adequate access to extension services. This means that long served extension agents without in-service and refresher courses lead to poor and inadequate service provision.

4.6.2 Extension agents' opinions on food insecurity

Extension agents were asked to give their opinions on factors contributing to food insecurity and coping strategies employed during food shortage in the study area and how long the problem has existed. The researcher further made an investigation on people who are mostly affected by food insecurity in the study area.

All the interviewed extension agents reported that households in their areas experienced food shortage for more than five years. Areas like Masieda, Gunyoda and Tsawa were reported being mainly affected. The report from extension agents revealed the major causes of food security as inadequate rains, limited use of modern technology, poor soils, pre and pos-harvest food losses, food sales, poor household food budget and use of cereals for making local brew. Extension agents respondents were further asked to mention the reasons for the existence of the problem since farmers are aware of the causes of the food insecurity. The reported problems were low income of the farmers, reluctance on adoption of recommended technologies, farmers' preferences on some food crops, use of food crops for other uses like selling, making local brews and sharing available amount of food with other relatives and extended families.

The extension agents were also asked to mention the coping strategies employed by smallholder farmers in the study area. They responded that, farmers do employ various coping strategies to cope with the situation that exists; such as selling livestock, selling labour, reducing number and or size of the meal to be eaten per day, borrowing food or cash from the relatives and or merchants and repay back after harvesting. In addition, the extension agents were further asked to explain whether coping strategies employed by households of smallholder farmers during food shortage solve their problems efficiently. They responded that most of these strategies are outdated (i.e. borrowing and begging) and

they may cause health and psychological effect to family members. For example reduction of number and meal size will lead to malnutrition; livestock are sold in very low price during food shortage and selling labour depends on availability of casual labour on that particular period of time.

Challenges faced by extension agents during services provision to smallholder farmers were also examined. The responses were reluctance of farmers on adoption of modern and recommended technology as the major problem. For example smallholder farmers in Masieda and Gunyoda were advised to grow sorghum and lablab due inadequate rains and poor soils (gravel and sandy soils), but most of them are still growing maize which do not withstand drought. Those who adopted newly introduced crop i.e. lablab as cash crop; do sell the entire harvested amount as a result no seed for next planting season.

4.7 Stakeholders opinions on food insecurity

The stakeholders involved in this interview were four local leaders (councilors and village leaders). All interviewed respondents were male with different education level; one is a graduate from the university; and the other three have completed primary education. The respondents were asked whether there is existence of food insecurity in their areas. They mentioned the existence of the problem. On the aspect of trend, it was reported that the problem of food insecurity has existed for along time in some areas like Masieda and Gunyoda wards. The reasons mentioned were inadequate rains, poor soils, farmers' reluctance on adoption of recommended technologies, extended families, selling of food crops for other uses and making local brew.

The stakeholders were further asked to point out months of the year when households of smallholder farmers experience food shortage. They reported that, Masieda and Gunyoda

which receive marginal rains normally have food shortages from November to April; other areas like Bargish and Endagikot face the problem from December to March. Murray and Kainam wards are in better position since they have opportunity to produce two times a year, but their major problem is small plots of farm sizes.

CHAPTER FIVE

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Overview

This chapter gives conclusions and recommendations coming out of the analysis of the data gathered in the study area. The conclusions and recommendations were drawn based on findings in relation to the study objectives. The recommendations show measures that can contribute to improve food security situation in Mbulu district.

5.2 Conclusions

This study on factors contributing to food insecurity concludes that, agriculture is the major source of livelihood to smallholder farmers in Mbulu district. Agriculture sector directly affects the lives of many people since about 80% depend on agriculture. Despite the different measures taken by government such as; agriculture first (*'kilimo kwanza'*) campaign, still the overall performance of this sector is not encouraging. Based on the study findings the following conclusions are drawn:

- a) About 81.7 percent of the households in the study area were food insecure. Smallholder farmers in the study area are suffering from food shortage mainly because of low productivity of the sector and low access to food due dependency on farming as the major source of food and income. Although maize is prone to drought, it is predominantly grown by farmers; sorghum and millet are considered as less preferable cereals though they withstand drought compared to maize. Recently, farmers have adopted pigeon peas as both a food and cash crop which is intercropped with maize and beans; particularly in Daudi and Endagikoti divisions. Lablab is the cash crop which is recommended to be grown in Masieda and

Gunyoda wards (semi-arid areas), where there is scarcity of rainfall but few farmers have adopted it.

- b) It was noted that low food productivity is caused by limited use of modern and improved technologies due to inadequate provision of extension services which is interrelated with low income and weak access to financial services.
- c) The study further revealed that poor household food and inappropriate use of available food such as selling food for income, repayment of loans and poor storage practices lead to food insecurity.
- d) It was found that many smallholder farmers employed negative coping strategies. For examples; severe reduction in food consumption or skipping number of meals; eating foods that are less preferred and inferior; selling productive assets, reducing expenditures on basic services such as health and education and reducing the number of consumers by sending certain members of the family to live and/or work elsewhere. These coping strategies employed by households of smallholder farmers are not sufficient to solve the problem of food security.

5.3 Recommendations

Based on findings of this study, the following are recommended for improving household food insecurity in Mbulu district.

- a) Farmers should pay much attention on increasing food crop output by using appropriate farming technologies, such as fertilizers improved seeds, tractors and ox plough. In addition, government should motivate extension officers to advice

farmers on importance and proper use of modern farming practices; and insisting farmers to grow drought resistant crops such as sorghum, millet, pigeon peas, cassava as well as lablab which is a seasonal cash crop to boost income of smallholder farmers.

- b) Apart from increasing food availability, attention should also be given on increasing food accessibility promoting non-farming activities. A strategy on strengthening farming and non-farming activities linkages is likely to yield better results in terms of employment and income generation. This can be achieved by forming and strengthening appropriate credit scheme for smallholder farmers. The key lies in mutual honest intention from multi-stakeholders to ensure that all is done with the sole purpose of benefiting them.
- c) Reduction of both pre and post harvest losses should be advocated through education on proper produce treatment and handling. This can be achieved by using preventives and curative measures against pest and diseases as well as the use of modern storage facilities such as silos.

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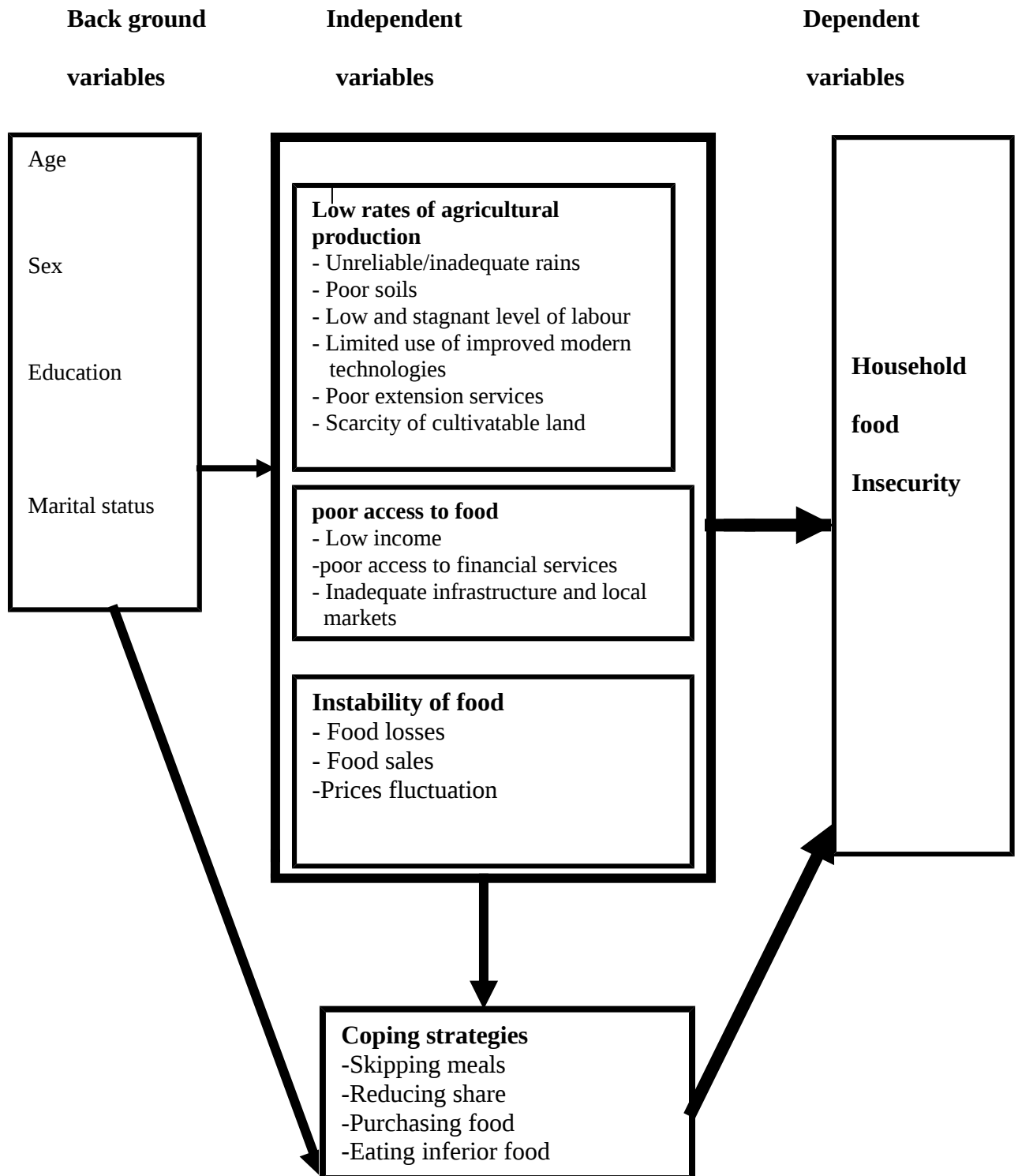
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APPENDICES

Appendix 1: Conceptual Framework

Linkage between Background, Independent and Dependent variables



Appendix 2: Interview schedule for data collection

Personal interviews

SECTION A: GENERAL INFORMATION (Circle or fill in)

- A1. Name of Enumerator
- A2. Name of respondent.....
- A3. Respondent identification.....
- A4. Date of interview
- A5. Division
- A.6 Ward
- A.7 Village

SECTION B. HOUSEHOLD HEAD CHARACTERISTICS. (Fill in or circle.)

B1. What is the age of household head in years?.....

B2. What is the sex of the household head?

- 1. Male 2. Female

B3. Marital status of the household head

- 1. Married
- 2. Never ever married
- 3. Divorced
- 4. Separated
- 5. Widowed

B4. What is the education level of the household head?

1. Primary education
2. Secondary education
3. College
4. Others (specify)

SECTION C: HOUSEHOLD SOCIO-DEMOGRAPHIC ATTRIBUTES

1C. Please fill in the information of all members of the household in the table below.

Serial number	1	2	3	4	5	6	7	8	9	10
Name (only one)										
Sex: Female/male										
Age in years										
Years of schooling										
Relationship with household head										
Main occupation										

2C. In the table below indicate number of meals eaten by family members according to age categories.

Age category (in years)	Number of meals per day
Below 5	
6 and above	

SECTION D: SITUATIONAL CHARACTERISTICS

1D. Does your house own any farmland?

- 1. Yes
- 2. No

2D. If yes in question 1D above, what is the size of the farmlands?..... ha/acre

3D. How much land is used for farming activities?..... ha/acre

4D. How was the land of your holding acquired?

- 1. By inheritance
- 2. Bought
- 3. Village offers
- 4. Clear natural forest
- 5. Others (specify)

5D. Who owns and control the land? 1. Father 2. Mother 3. Both

- 4. All members of the family
- 5. Others (specify).....

6 D. Circle the land available ownership category bellow.

- 1. Permanent
- 2. Temporary
- 3. Both permanent and temporary

7D. If both permanent and temporary, Indicate portion owned permanently.....

8D. What is the source of labour for the farming activities?

- 1. Family labours
- 2. Hired labours

9D. If family labours, indicate their age and sex in the table below.

Serial number	1	2	3	4	5	6	7	8	9	10
Sex male/female										
Age in years										

10D. In the table below **put a tick (√)** against the facilities used for cultivating the land.

Facility	put a tick (√)
Hand hoe	
Plough	
Tractor	
Power tiller	

11 D. Do you have access to extension service providers? 1. Yes 2.No

12 D. If yes, what services do you get from them?

1. On disease control
2. On fertilizers use
3. On crop production
4. On storage
5. On animal health
6. On drug/vaccination issues
7. Others (specify)

13 D. How do you conserve the soil?

1. Use of farmyard manure
2. Use of fertilizers
3. Both farmyard manure and fertilizers
4. Others (specify).....

5. None

14D. Do you practice contour farming? 1. Yes 2. No

15D If No in question 14D, why?

16D. Did you use improved seeds in 2009? 1.Yes 2.No

17D. If No in question 16D, why?.....

18D. Did you use fertilizer in 2009 in your farm? Yes/No

19D. If No in question 18D above, why?.....

20D. (a) Indicate in the table below the farming inputs and the amount used in the last season. (2009)

Inputs	Amount per ha	Number of hectares cultivated
Fertilizers		
Improved seeds		
Pesticides		

21 D. Do you have access to financial services or loans for farming activities?

1Yes 2.No

22 D. If No in question 21D above, what are the major limiting factors for obtaining credits?

1.....

2.....

3.....

23D. List in order of their importance major types of food crops you grow in your field.

1.

2.

3.

4.

5.

24D. (b) In the table below indicate the yield for the crops harvested in the year 2009

Crops	Quantity harvested in kgs
Maize	
Sorghum	
Millet	
Beans	
Cow peas	
Pigeon peas	
Others (specify)	

25 D. Was the amount harvested enough for your family until the next harvesting season?

1. Yes 2. No

26 D. Do you have any livestock? 1. Yes 2. No

27D. If yes in question 26D above, indicate in the table below the number against each livestock.

Type of livestock	Number
Cattle	
Goats	
Sheep	
Pigs	
Others (specify)	

28D. Did you sell your farm produce the years 2008 and 2009? 1. Yes 2. No

29 D If yes in question 29 D, fill in the tables below

30D (a) Livestock sale

YEAR	2008			2009		
Type of livestock	Number sold	Price/unit	Amount	Number sold	Price/unit	Amount
Cattle						
Goats						
Sheep						
Pigs						
Others (specify)						

30D (b) Crops sale

YEAR	2008			2009		
Type of Crop sold	quantity sold (kgs)	Price/unit	Amount	quantity sold (kgs)	Price/unit	Amount
Maize						
Beans						
Sorghum/millet						
Pigeon peas						
Others (specify)						

31 D Give major purposes for sold crops

- 1.....
- 2.....
- 3.....
- 4.....
- 5.....

32 D. Give major purposes for sold livestock

- 1.....

- 2.....
- 3.....
- 4.....
- 5.....

33 D. Did you engage in other income generating activities apart from farming?

- 1. Yes
- 2. No

34D. If yes in question 15 D above, list in the table other income generating activities you are engaged in showing amount income per year.

S/No.	Activity	Income per year (2009)
1.		
2.		
3.		
4.		
5.		
6.		

35D. Indicate Yes/No against the following causes of food insecurity.

Cause	Yes/No
Unreliable/inadequate rains	
Poor soils	
Low and stagnant level of labour	
Limited use of improved modern technologies	
Poor extension services	
Scarcity of cultivatable land	
Food losses	
Food sales	
Others (specify)	

36D. Indicate in table below the causes and reasons for food insecurity

Cause for food insecurity	Reasons
Unreliable/inadequate rains	1..... 2..... 3.....

Poor soils	1..... 2..... 3.....
Low and stagnant level of labours	1..... 2..... 3.....
Limited use of improved modern technologies	1..... 2..... 3.....
Low household income	1..... 2..... 3.....
Scarcity of cultivatable land	1..... 2..... 3.....
Food losses	1..... 2..... 3.....
Food sales	1..... 2..... 3.....
Others (specify)	1..... 2..... 3.....

37D. What are the coping strategies to overcome the food shortage in your household?

- 1.....
- 2.....
- 3.....
- 4.....
- 5.....

38D. Do pests attack your crops while in the field? 1. Yes 2. No

39D. If Yes in question 24D, how do you control pests?

1. Use of chemicals
2. Natural
3. None

40 D. Where do you keep your farm produce after harvesting (before trashing)

.....

41. After thrashing the grains, indicate the storage structure for each category in the table below.

Storage facility	1	2	3
Grains			
Pulses			

42D. What do you add to your food stuffs during storage?

- 1.....
- 2.....
- 3.....

43D. Do you face any problem during food storage

1. Yes
- 2 No

44D (b). If yes what are they?.....

THANK YOU FOR YOUR COOPERATION.

Extension agents' interview schedule

Confidential

Research topic: factors contributing to food insecurity to smallholder farmers in Mbulu district.

Region..... District Division

Ward Village ID of Respondent.....

Date

Section A: Personal characteristics (Fill in or circle)

1A. Sex: 1. Male 2. Female

2A. What is your age in years.....

3A. Marital status: 1. Married 2. Never ever married

4A. Do you have any children? 1. Yes 2. No

5A. If yes in question 4A above, indicate their number.

6A. In the table below **put a tick (√)** against level of formal education attained and indicate the year of completion

Formal education	put a tick (√)	Year completed
Standard VII/VIII		
Form IV		
Form VI		
Others (specify)		

7A. In the table below, indicate the professional training attained.

Level of training	Final qualification	specialization
Certificate		
Diploma		
Degree		
Others (specify)		

8A. In the table below indicate In-Service training attended.

Organized	Number of times attended	Last time attended
Government		
NGO		
Others (specify)		

9A. How long have you been working in this area?..... years

Section B: Factors contributing to food insecurity to households of smallholder

Farmers

1B. Have households experienced food insecurity in your area?

1. Yes 2. No

2B. If yes in question 1B, who are mostly affected by food insecurity in your area?

.....

3B. Indicate Yes/No against the following causes of food insecurity.

Cause	Yes/No
Unreliable/inadequate rains	
Poor soils	
Low and stagnant level of labour	
Limited use of improved modern Technologies	
Poor extension services	
Scarcity of cultivatable land	

4B. Indicate in table below the causes and reasons for food insecurity

Cause for food insecurity	Reasons
Unreliable/inadequate rains	1..... 2..... 3.....
Poor soils	1..... 2..... 3.....
Low and stagnant level of labour	1..... 2..... 3.....
Limited use of improved modern technologies	1..... 2..... 3.....
Low household income	1..... 2..... 3.....
Scarcity of cultivatable land	1..... 2..... 3.....

Section C: Coping strategies during food shortage

1C. What coping strategies do households of smallholder farmers employ during food shortage?

- 1.....
- 2.....
- 3.....
- 4.....
- 5.....
- 6.....
- 8.....
- 9.....
- 10.....

2C. Do the coping strategies employed by households of smallholder farmers during food shortage solve their problems efficiently?

- 1. Yes 2. No

3C. If No in question 2C above, what advice do you normally give to farmers during food shortage to cope with the situation?

.....

4C. Do you face any challenges during your extension services to smallholder farmers?

- 1. Yes 2. No

5C. If yes in question 4C, how do you address the mentioned challenges to improve the situation

THANK YOU FOR YOUR COOPERATION.

Checklist for key informants

Confidential

Village..... Ward ... Division

District Date Checklist No.....

1. What is your designation?.....
2. Have you experience food shortage in your village?
3. What do you think are the causes of food insecurity in your area?
4. Can you give the reasons for food insecurity in your area?
5. What is the trend of food insecurity in your area? Past present and possible future?
6. What months of the year do households of smallholder farmers do experience The food shortage.
7. What coping strategies do households of smallholder farmer employ during food Shortage?
8. Who owns and control productive resources in households in your village?
9. How is utilization of technology by smallholder farmers in your village?
10. What are your comments on the coping strategies employed by households of smallholder farmers in your village?
11. What suggestions do you advice to overcome household food insecurity among smallholder farmers.

THANK YOU FOR YOUR COOPERATION.