CAUSES OF FOOD INSECURITY AND COPING STRATEGIES IN TANZANIA:

A CASE OF SMALLHOLDER FARMERS IN CHAMWINO DISTRICT

BY

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ABSTRACT

Household food insecurity in Tanzania is widespread even when the country experiences bumper harvest. Food insecurity is widespread and chronic that there is always a certain degree of household food deficit at a given part in a year. Despite the government's efforts to improve agricultural production, food insecurity has persisted. Thus, this study was conducted to assess causes of food insecurity and coping strategies of smallholder farmers in Chamwino district, Dodoma region. Specific objectives were to: identify and examine the causes of food insecurity in households of smallholder farmers; identify and examine various coping strategies employed by smallholder farmers during food insecurity; and suggest possible ways that would be used to reduce food insecurity in households of smallholder farmers. Data were collected from 146 respondents including 120 household heads and two extension agents from four villages in Chamwino district and 24 key informants using questionnaires, researcher's diary and checklist. Quantitative data were analysed by using Statistical Package for Social Science (SPSS) computer software and qualitative data were summarised and analysed manually. Causes of food insecurity include inappropriate use of the available food, poor storage methods and facilities, small farm size, low income and use of poor technology. The major types of food insecurity coping strategies were skipping meals and selling labour. In conclusion despite the food insecurity coping strategies, a serious food insecurity problem still persisted. The coping strategies were not sufficient to minimize food insecurity problem in the study area. Therefore, the government, NGOs and other stakeholders should: create awareness to farmers on proper use of available food, advise farmers on good storage methods, put more emphasis on smallholder farmers' agricultural production, planning and implementing the diversified income generating activities and appropriate technology use. All stakeholders need to play an important role to ensure the availability of food in a sustainable manner and people have access to it.

DECLARATION

I, BENTA NYAMANYI MATUNGA, do hereby declare to the Senate of Sokoine University of Agriculture that this dissertation is my own original work and has not been submitted for a higher degree in any other University.

_____   _____

Benta Nyamanyi Matunga   **Date**

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The above declaration is confirmed,

_____   _____

Prof. R.M. Wambura   **Date**

 (Supervisor)

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DEDICATION

To my parents Mr. and Mrs Matunga for laying down the foundation for my education, the work is also dedicated to my late uncles Joshua Oselu Odago and Richard Awiti Odago who passed away while I was undertaking this study. May Almighty Father rest their soul in eternal piece, Amen.

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LIST OF ABBREVIATIONS AND SYMBOLS

AAEU   Adjusted Adult Equivalent Unit

AE   Adult Equivalent

AIDS   Acquired Immunodeficiency Syndrome

AWLAE   African Women Leaders in Agriculture and Environment

DALDO   District Agriculture and Livestock Development Officer

DEC   Dietary Energy Consumed

DFID   Department for International Development of Uk

DSI   Development Studies Institute

e.g   Exampli glatia (For example)

f   Frequency

FAO   Food and Agriculture Organisation

FEWS NET   Famine Early Warning Systems Network

FHH   Female Headed household

FS   Food Secure

Ha   Hectares

HBS   Household Budget Survey

HH   Household

HIV   Human Immunodeficiency Virus

Kcal   Kilocalories

Kg   Kilogramme

MDGs   Millennium Development Goals

MHH   Male Headed Household

NBS   National Bureau of Statistics

NFS   Non-Food Secure

SACCOS	Savings and Credit Co-operative Society Ltd
SADC	South African Development Cooperation
SNAL	Sokoine National Agricultural Library
Sq km	Square Kilometre
SSA	Sub–Saharan Africa
TAS	Tanzanian Shillings
TAWLAE	Tanzania Women Leaders in Agriculture and Environment
TFNC	Tanzania Food and Nutrition Centre
UN	United Nations
UNAIDS	United Nations Programme on HIV/AIDS
UNICEF	United Nations Children's Fund
URT	United Republic of Tanzania
WB	World Bank
WFS	World Food Summit

CHAPTER ONE

1.0 INTRODUCTION

1.1 Overview

This is a study on the causes of food insecurity and coping strategies in Tanzania. The government of Tanzania accords high priority to improving the food security and nutritional standards of the people. Evidence suggests that food insecurity is widespread and chronic in the sense that there is always a certain degree of food deficit in poor households at a given part in a year. The purpose of this study was therefore to assess the causes of food insecurity and coping strategies of smallholder farmers in Chamwino district, Dodoma region and to draw implications on possible ways that would be used to reduce food insecurity in households of smallholder farmers.

1.2 Background information

Food security became prominent in the 1970s and has been a topic of considerable attention and mostly concerned with food supply in the form of grain stocks applied at regional or district levels (Kavishe and Mushi, 1993). In 1980s, the focus shifted to question beyond supply. It also included accessibility of food at the household level (Maxwell and Frankenberger, 1992). The emphasis of food chain was also given as a component of food security analysis to encompass production, marketing and consumption (WB, 1990). Interests in food security were particularly stimulated by the world food security crisis in 1972-74 and the Africa famine 1984-85. Food security although initially analysed at international and national levels, has also been examined at the household and individual levels. The household is the basic economic unit, which determines the level of consumption by the individual (FAO, 2001). Food security is dependent upon three factors namely: availability, stability and accessibility of food supplies (FAO, 2003).

As such, food security and insecurity are terms used to describe whether or not people have access to sufficient quality and quantity of food. According to Baldwin (2006) they are affected by factors such as poverty, health, food production, political stability, infrastructure, access to markets, and natural hazards. Improved food security is important for global reduction of hunger and poverty, and for economic development. One aim of the Millennium Development Goals is to reduce by half the proportion of people suffering from hunger by 2015. However, currently 820 million people are affected by hunger in developing countries and numbers are not falling quickly enough to achieve the goal, particularly in Africa and Southern Asia (Baldwin, 2006).

According to FAO (2003), in 1999 to 2001 an estimated 798 million people were undernourished in developing world as a whole. Statistics show that the number of undernourished people in the developing world is no longer decreasing. During the first half of the 1990s, the number of chronically hungry people decreased by 37 million. In 1995 to 1997 however, the number has increased by over 18 million. This means that the World Food Summit (WFS) goal of reducing the number of undernourished people by half the year 2015 can now be reached only if annual reductions can be accelerated to 26 million per year. The anticipated decline is more than 12 times the actual pace of reduction per year which at the moment stands at 2.1 million per year to date (FAO, 2003).

Moreover, FAO (2001) observed that many families in Africa especially those living in rural areas continue to face problems in obtaining stable access to food, at the regional level the numbers of undernourished people continues to increase in Sub-Saharan Africa. In Tanzania, as one of the developing countries, the household has a dual role, as it is both a production and consumption unit thus ensures food security to its members. Indicators of food insecurity include number of meals taken per day, dietary energy consumed per adult

equivalent per day and 270kgs (three bags of grain) per adult equivalent per year. FAO (1992) classify Tanzania as "low income and food deficit" country, with an annual per capita income of U.S $210 equivalent, poverty is widespread especially in the rural areas (Deaton, 1998). The situation is worse in Tanzania, 27% of the 32 million people are food insecure (Keenja, 2001). Although the situation has covered the whole country, it is terrible in Dodoma region, as it produces less than 90% of the food requirements (Makundi, 1996).

Dodoma region (where data for this study were collected, as will be explained in other parts of this study) is one of the 21 administrative regions in Tanzania as shown in Appendix 1. It has an area of 41 310sq km and administratively it is divided in six districts of Chamwino, Bahi, Kondoa, Mpwapwa, Kongwa and Dodoma Urban. The region has 486 villages which is grouped into 145 wards with a population of 1 692 025 (with a growth rate of 2.3%) out of which 1 484 763 (87.75%) live in rural areas (URT, 2002). Chamwino district is about 50 km from Dodoma town. Statistically, more than 80% of the population in Chamwino district are smallholder farmers (DALDO, 2004). It boarders Kiteto district to the East, Iringa Rural district to the South, Dodoma Urban district to the West and Kondoa district to the North. Suitable land area for agriculture in Chamwino district is 572 115 hectares but 13.9 % or 79 380 hectares are cultivated land. Demographically, the total population of Chamwino district is 273 579 (2004 projections) of which 131 019 (48%) are males and 142 562 (52%) are females. Administratively, the district comprises four divisions, 28 wards and 72 villages. According to growth rate, the population of females continues to be bigger than males. The dominant tribes in Chamwino district are Gogo, Maasai, Nguu and Nyambwa. Fig. 1: shows the map of Chamwino district and location of the study villages.

According to DALDO (2004), Chamwino district is composed of two zones (zone I and II). Features of zone I include undulating plains and hilly areas. The area experiences low rainfall, unreliable and unevenly distributed, of about 400mm per annum. Soil distribution includes reddish–brown loamy sands, grey clays in depressions and dark greyish brown loams in hills to east. Basing on agronomy factors, the zone grows crops such as sorghum, millet, groundnuts, bambaranuts and cassava. Due to such factors, zone I has low population. On the other hand, zone II is most densely populated, low rainfall, unreliable and unevenly distributed. Rainfall is between 500mm–650mm per year. Soil includes reddish brown or dark loamy sands. Such agronomic factors lead to cultivation of sorghum, millet, cassava sweet potatoes, groundnuts, bambaranuts, sunflower, simsim, grapevines, pigeon peas, vegetables and maize. Most of the cultivation is done in the north of the district where rainfall is slightly high.
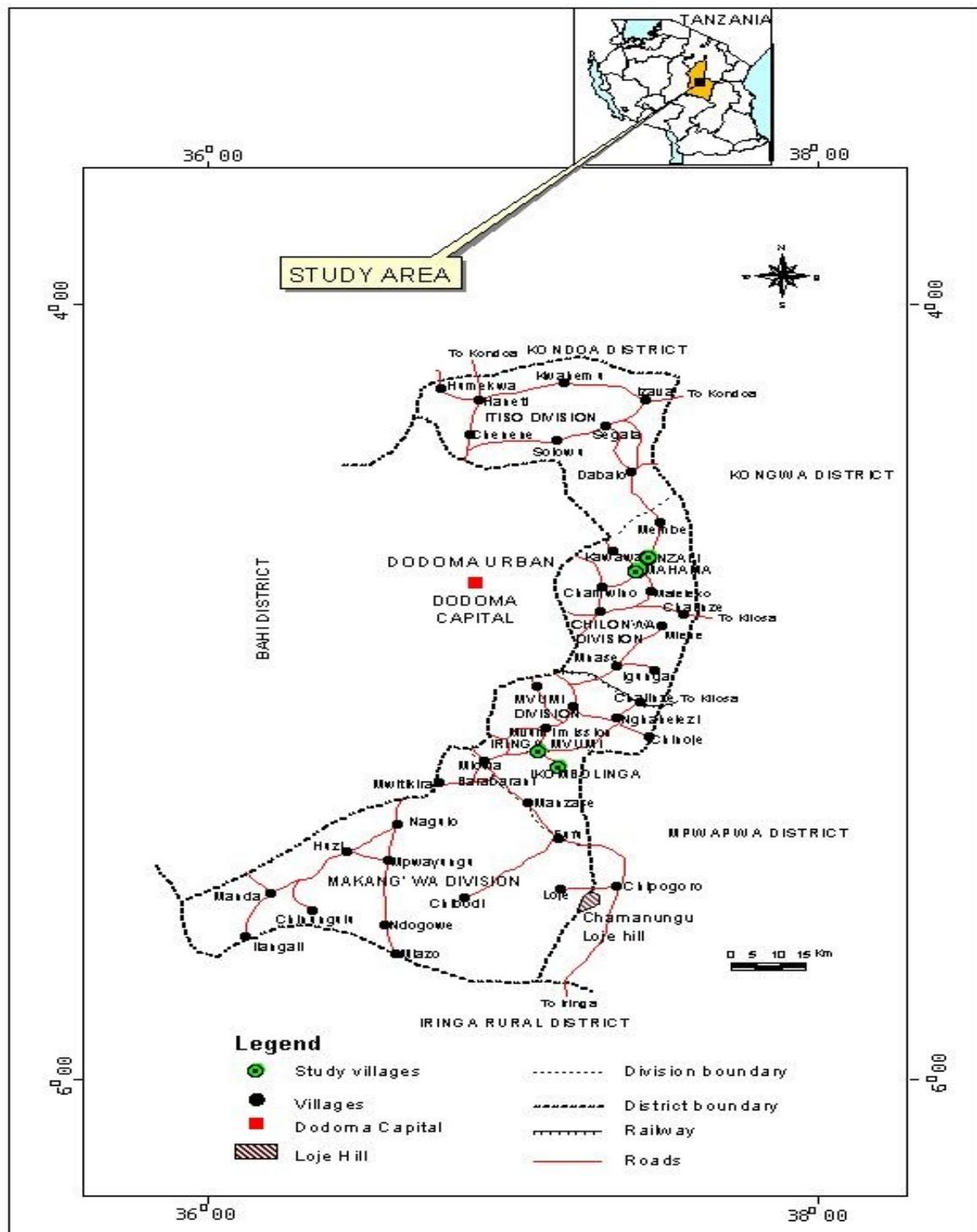
Figure 1: Map of Chamwino district showing the study villages

Source: Department of land and natural resources in Chamwino district (2006)

Several human activities are carried in the district. For instance, major farming systems include shifting cultivation, zero cultivation, water harvesting (irrigation), and livestock keeping (headsman) as well as zero grazing.

1.3 Problem statement

Household food insecurity in Tanzania is a serious problem and is widespread even when the country experiences bumper harvest. Despite people's involvement in small scale farming activities and efforts aiming at improving food security situation, there is still persistence of food insecurity within the households of smallholder farmers in Chamwino district. However, little has been done on identification and assessment of the causes of food insecurity situation in household of smallholder farmers and coping strategies employed during food insecurity situation in the district. The fundamental causes of food insecurity and coping mechanisms used by household of smallholder farmers during food shortage situation is not clearly understood by planners and policy makers. The purpose of this study was therefore to assess causes of food insecurity and coping strategies of smallholder farmers in selected rural communities in Chamwino district, Dodoma region.

1.4 Research objectives

1.4.1 General objective

To assess the causes of food insecurity and coping strategies of smallholder framers in Chamwino district, Dodoma region.

1.4.2 Specific objectives

(i)   To identify and examine the causes of food insecurity in households of smallholder farmers

(ii)   To identify and examine various coping strategies employed by smallholder farmers in situation of food insecurity.

(iii) To suggest possible ways that would be used to reduce food insecurity in household of smallholder farmers.

1.5 Research questions

(i)   What do people in the study area understand on food insecurity?

(ii)   What are people's opinions on the causes of food insecurity?

(iii)   What are people's opinions on factors contributing to causes of food insecurity?

(iv)   What is the trend of food insecurity in the study area?

(v)   What are the coping strategies employed by the smallholder farmers during food insecurity situation?

(vi)   What are people's opinions on coping strategies employed by the smallholder farmers during food insecurity?

1.6 Operational definition of terms

The terms that will be used frequently in the text are defined here to provide a common basis for conveying meaning. These include: food security; food insecurity; coping strategies; and the key variables used in the study.

1.6.1 Food security

Food security is achieved "when all people at all times have physical and economic access to sufficient, safe and nutritious food for a healthy and active life" (WFS, 2002). The components of food security are: availability of food or the amount of food that actually exists (local production and other sources); people's physical, economic and social access to food, and the stability of this access over time; the quality or nutritional adequacy of that food; and people's ability to utilize this food, including the patterns of control over who eats what and the physical ability to absorb nutrients. Generally, food security exists when all people at all time have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life (WB, 1990). In this study food security is taken as the daily recommended intake of diets per adult equivalent for health life.

1.6.2 Food insecurity

Food insecurity is lack of access to enough food (Maxwell, 1990). A household is said to be food insecure when it fails to meet its dietary food intake in terms of quantity and quality (Lorri and Kavishe, 1990). URT (1992) noted that food insecurity exists when there is inadequate food for the people who need it. This situation can arise either due to inadequate food production and problem in distributing this food to the people who need it or because the people can not afford to buy the food that is available. Food insecurity exists whenever the availability of nutritionally adequate and safe foods or the ability to acquire acceptable ways is limited or uncertain (UN, 2006). It arises due to lack of enough food or inadequate diet for part or all the year or faces the possibility of inadequate diet in the future. Therefore, in this study a household is said to be food insecure when it fails to meet its dietary food intake in terms of quantity and quality.

1.6.3 Coping strategies

The strategies that communities adopt when faced with food insecurity before receiving/seeking external assistance are known as coping strategies (Kavishe and Mushi, 1993). These strategies will vary by region, community, social class, ethnic groups, household; gender, age, season, severity and duration of potentially destructive condition. Coping strategies in this study means the Strategies that communities adopt when faced with food insecurity in their area.

1.6.4 Key variables

The definitions of various key variables (background, independent and dependent variables) as used in the study are given in Appendix 2. The following Chapter reviews the empirical literature in areas of food security, food insecurity and coping strategies as well as the model for the analysis of the study data.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Overview

This Chapter reviewed literature from the findings of other studies in order to provide a theoretical framework which guided the development of the study model, on which the analysis of data for the present study was based. It focuses on: (a) food security; (b) food insecurity; and (c) coping strategies.

2.2 Food security

Thomson and Metz (1997) elucidate that, food security at national level is a satisfying balance between food demand and food supply at reasonable prices. This intends to indicate a situation where there have been no major upheavals in food markets in the recent past, where adequate food is available and where most of the population has access to that food. Moreover, at national level, changes in food security can be identified over time by rising prices. This will affect the poor, as they spend a higher proportion of their income on food. Thus, the imbalance between food demand and food supply does not mean that all households in the nation are food secure. It means that if they suffer from food insecurity, it is because they lack entitlement to food. In addition, a country may be food secure at national level but have a considerable number of food insecure households. This will generally be identified in regional or socio-economic terms.

Benson (1986) portrayed a food secure household as having assurance of sets of entitlement from food production, cash income, reserves of food or assets and/or assistance from government programmes such that in times of need they will be able to maintain sufficient nutrients intake for their physical well-being. According to Maxwell

and Frankenberger (1992) household food security is the ability of all members of the household to acquire sufficient amount of food continuously over time for an active and health life, which refer to: (a) sufficient food, which is defined as calories needed to active healthy life; (b) access to food defined by entitlement to produce, purchase or exchange food or receive it as gift; (c) security explained by balance between vulnerability, risk and insurance; and (d) time where food insecurity can be chronic, transitory or cyclical. Therefore, household food security is an integral and highly complex multi-sectoral issue, composed of intersectional macro and micro relationships, which requires an interdisciplinary approach and involvement of different actors (Liwenga, 1995).

Ishengoma (1998) makes clear that household food security is concerned with the microeconomics of a household. In particular, it describes the use of food in the household, access to it by various members of the house, survival strategies, and the role of gender. Ishengoma further points out that, decision concerning the use of resources output and cash income are important critical variables in the overall household food security. National development in a developing country like Tanzania depends largely on its human capital. The quality and level of productivity of the population determines the pace of development. Quality of productivity of human capital is in turn determined by food security. The population must eat adequate and nutritionally balanced diets to survive and be able to carry out individual activities in community and national development activities. It is an important role of the government to ensure that food is available in a sustainable way and that people (especially the vulnerable) have access to it. Basing on such criteria, food is the basic essential human right and therefore each citizen is entitled to adequate and nutritionally balanced food or diet. Improved food security (and therefore improved nutritional status) leads to higher agricultural productivity and wages in the

labour market. This is necessary for increased total volume of goods and services or gross national product (GNP).

Food security is therefore an important development issue and has been streamlined in the development agenda of Tanzania (URT, 2003a). Science and technology can help improve food security through increasing food production (using new crop types, etc.); improvements in cost and quality of food storage, processing, packaging and marketing; labour saving technologies; and better communications. Apart from that, appropriate technological governance is also necessary, including examining who technologies are developed for and the impacts of their use. Improving access to and understanding of current technology and privately financed research is also important (DFID, 2002). Improved crop varieties developed using traditional plant breeding methods and occasionally biotechnologies can achieve higher yields, increased nutritional content, more tolerance to drought and pests, and/or more efficient use of water and soil nutrients. Such improvements may become more important as depletion of soil nutrients and water resources in existing farmland, expansion into previously unfarmed lands in risk-prone environments and the impacts of climate change mean that the poor are increasingly farming in marginal ecological zones (DFID, 2002).

In order to increase food production, availability of water is a key issue. Water and food security are closely related. FAO (2003) reports that with such fact, agriculture is the biggest user of water, accounting for about 69% of all withdrawals worldwide and over 80% in developing countries. Reliable access to adequate water increases agricultural yields, providing more food and higher incomes in the rural areas that are home to three-quarters of the world's hungry people. Water as a key ingredient to food security, lack of it can be major cause of famine and under nourishment, particularly in food-insecure rural

areas where people depend on local agricultural production for both food and income. Many households rely on domestic water supplies for a wide variety of small-scale industrial and agricultural activities, including brewing, building, tending goats and cattle, and cultivating home gardens and orchards. These activities tend to be particularly important for the poorest and most vulnerable members of the community, including many female-headed households. Water is likely to be a major constraint to achievement of food security in many developing countries in the future. Kassambala (2004) noted that, in Sub–Saharan Africa (SSA) where population growth is expected to continue to be high, available per capita water resources are quite low. The low available water resources have direct effect on the agricultural production, hence lowering food availability.

According to FAO (2003), irrigation increases yields of crops by 100% to 400% along with higher yields; irrigation increases income and reduces hunger and poverty. Where irrigation is widely available, under nourishment and poverty are less prevalent. Farmers benefit directly from irrigation. Through increased production and more stable incomes, the higher value of irrigated land increases. Even landless and labourers and small farmers who lack   the resources to employ irrigation themselves often benefit through higher wages, lower food prices and more varied diet. Every job created in irrigated agriculture yields another job in agricultural services and the processing industry. When agriculture is less labour-intensive, it may employ affordable small–scale techniques. The impact can be great if combined with access to credit, marketing and agricultural extension services.

FAO (2003) further noted that more than 70% of poor people in developing countries live in rural areas and depend on agriculture for both food and income. Unfortunately, many developing countries have neglected the rural sector, giving priority instead to urban areas and the drive for industrialisation. What little attention agriculture has received has

focused, more often than not, on cash crops for export rather than staple crops for local consumption. In recent years, the developed world has also paid less attention to helping developing countries to increase agricultural production. Between 1980 and 1990, the share of development assistance directed to agriculture dropped from 20 to 14 percent. In many cases, the most effective way to strengthen food security and improve the lives of the poor is by helping the agricultural sector. Increased agricultural production can raise the incomes of farmers and agricultural inputs, services and consumer goods. This, in turn, increases employment opportunities in rural areas and helps slow down migration to urban centres (FAO, 2001).

Higher agricultural production can improve food security by decreasing food prices for consumers, increasing rural incomes and contributing to economic development. Baldwin (2006) reported that in developing countries one percent rise in per capita agricultural output led to nearly two percent rise in incomes of the poorest people. However, increased agricultural production is vital, but not sufficient, for poverty reduction and economic development. No developing country has successfully reduced poverty through agriculture alone (institutional and industrial development are often needed), but almost none have achieved it without first increasing agricultural productivity.

It has been noted (URT, 1999) that actual indicator of food security is dietary energy consumption (DEC). According to Collier *et al.* (1986), expression of variables per adult equivalent is important. Using the method that is common in Tanzania, children, women and old people need less nutrients than adults, men, and old people, respectively. It is good to convert household size into adult equivalent units. All household members are identified by age and sex, and two approaches are combined to obtain AAEU. Values of various variables for whole households are then divided by AAEU of respective households to get per adult equivalent values. The two steps procedures are done by

combining nutritional requirements approach and Deaton approach. Calorie requirements by age and sex in East Africa have been noted by Collier *et al* (1986) as given in Table 1. In the first step each household member is assigned an appropriate adult equivalent unit, and all the weights for all the household members are summed up to get household sizes in adult equivalent units (AEU). This step is done to adjust for household composition owing to the fact that children, women and old people need less nutrients than adults, men and young people, respectively. In the second step the AEUs is multiplied by the average cost factor for a household with the corresponding number of adults to get the AAEU of each household. This second step is important to take into account economies of scale as given in Table 2 (Collier *et al*., 1986) since larger households need fewer resources per person due to sharing some facilities. Dietary energy consumed in each household is divided by its own AAEUs to get corresponding dietary energy consumed per adult equivalent (DEC/AE).

Table 1: Calorie requirements by age and sex

Age group	Sex	
	Male	**Female**
0-2	0.40	0.40
3-4	0.48	0.48
5-6	0.56	0.56
7-8	0.64	0.64
9-10	0.76	0.76
11-12	0.80	0.88
13-14	1.00	1.00
15-18	1.2	1.00
19-59	1.00	0.88
60+	0.88	0.72

Source: Collier *et al*. (1986)

Table 2: Household economies of scale

Household size (number of adults)	Marginal cost	Average cost
1	1.000	1.000
2	0.892	0.946
3	0.798	0.897
4	0.713	0.851
5	0.632	0.807
6		0.778
7	0.632	0.757
8	0.632	0.741
9	0.632	0.729
10+	0.632	0.719

Source: Collier *et al*. (1986)

According to Seshamani (1981), dietary energy consumed (DEC), is calculated based on only grains consumed because grains are the main staple foodstuffs in most areas. Moreover, it is a popular measure of dietary energy consumed, based on the fact that in Tanzania cereals supply 80% while other foods supply 20% of dietary energy. By using only grains, DEC obtained has to be inflated by multiplying it by 100/80 to cater for energy from other foods. Tables for Proximate Composition of Foods Commonly Eaten in East Africa (Appendix 3) (West *et al.*, 1988) are used for the calculation. The Tables (Appendix 3) show that sorghum contains 335 kcal per 0.1 kg. For example, if the only grains eaten in a household are 0.6 kg of sorghum per adult equivalent per day, the following formula is used to calculate DEC: 335 kcal = 0.1 kg, DEC = Kilograms of all grains eaten, which is 0.6 kg in this example. Therefore, DEC will be [(335kcal x 0.6 kg)/0.1 kg] x 100/80, which is 2 513 kcal per AE/day.

In Tanzania, the Household Budget Survey (HBS) Report (NBS, 2002) reported that 19% of the Tanzanian population is below the food poverty line of TAS 5295 per adult equivalent for 28 days in 2000 prices, and below the caloric energy consumption of 2200 kcal per adult equivalent per day, which is the official minimum recommended dietary intake in Tanzania. Food production in Tanzania has been increasing at about 3.5% (Keenja, 2001). However, since the food production growth rate is not much different from the population growth rate of 2.9% per year, while about 80% of the population is engaged in agriculture (which is the most important way of improving food security in Tanzania) there is a need to increase the growth rate of food production. This will be possible if the major causes of food insecurity are well known and worked on.

2.3 Food insecurity

It has been shown that food insecurity is wide spread in the sense that there is always certain degree of food deficits in poor households during part of the year but it is not acute

in the sense that no emergence action is required apart from disaster situations such as localised floods and droughts (UN, 2006). Three forms of food insecurity can be distinguished as: transitory food insecurity, which occur when population suffers a temporary decline in consumption; and chronic food insecurity which occurs when households lack the resources to acquire enough food for a health and active life but the households are not directly threatened by starvation; and emergency food insecurity is a situation of acute and unpredictable food shortage which arise as a result of natural calamities (Temu *et al.*, 1997).

According to WB (2001), time is a very important factor in determining the nature of food insecurity problems. It is important to draw a distinction between chronic and transitory food insecurity. When individuals or groups of people suffer from food insecurity all the time, they can be grouped as sufferers of chronic food insecurity. Chronic food insecurity is a persistently food shortage due to inability to meet the needs of household members, either through production, low income to buy food or poor food transport. It is associated with lack of access to sufficient fertile land, capital, unemployment and political instability. Chronically food insecure households constitute the most important risk group that policies for poverty alleviation and food security improvement should be targeted at, and most developing countries like Tanzania fall under this group.

 Transitory food insecurity is a temporary decline in households' access to enough and needed food due to factors such as instability in food production and/or income caused by crop failures, loss of employment, import problems, lack of exchange, and lack of suitable foodstuffs from markets. It arises due to seasonality in production. Normally, just before harvests many subsistence farmers have little or no food stocks and depend on purchased food. Often, transitory food insecurity results into famine, hitting hardest chronically food

insecure households. Emergence food insecurity is a situation of acute and unpredicted food shortage, which arises suddenly as a result of factors such as war, hurricanes, earthquakes, floods, and other natural calamities that cause an abrupt breakdown of food production processes due to loss of production assets, including land, farming tools and time. Food in store is destroyed and physical, economic and social food access is abruptly cut down (WB, 2001).

Transitory food insecurity can be further divided into temporary food insecurity and cyclic or seasonal food insecurity. Temporary food insecurity occurs when sudden and unpredictable shocks, such as drought or pests attack, affect household's entitlements. For the urban households, sudden unemployment may also be a cause of transitory food insecurity. Seasonal food insecurity occurs when there is a regular pattern of inadequate access to food. This is often linked to agricultural seasons particularly when it is difficult for household to borrow even outflows of food overtime (WB, 2001).

According to Baldwin (2006), food insecurity applies to a wide range of phenomena, from famine to periodic hunger to uncertain food supply. Hunger can be experienced temporarily by people who are not food insecure, as well as those who are food secure. Hunger is often used to refer in general terms to millennium development goal (MDG1) and food insecurity. Baldwin (2006) further noted that about 10% of world hunger is acute, when lack of food is short term, and is often caused when shocks such as drought or war affect vulnerable populations. Chronic hunger is a constant or recurrent lack of food and results in underweight and stunted children, and high infant mortality. 'Hidden hunger' is a lack of essential micronutrients in diets. In 2000, Millennium Development Goals (MDGs) first target is to eradicate poverty and hunger, including "to reduce by half the proportion of people who suffer from hunger" between 1990 and 2015. However, by

2003 the proportion of world population that was undernourished had only decreased from 20% to 17% (823 to 820 million people) (FAO, 2006).

Mwaniki (2006) noted that over seventy percent of the food insecure population in Africa lives in the rural areas as indicated in Fig. 2. Ironically, smallholder farmers, the producers of over 90 percent of the continent's food supply, make up 50% of this population. The rest of the food insecure population consists of the landless poor in rural areas (30%) and the urban poor. Over 70% of the poor live in rural areas, where also the largest proportion of the food insecure live. It is therefore evident that we cannot significantly sustain and ably reduce food insecurity without transforming the living conditions in these areas. The key lies in increasing the agricultural profitability of smallholder farmers and creating rural off-farm employment opportunities.
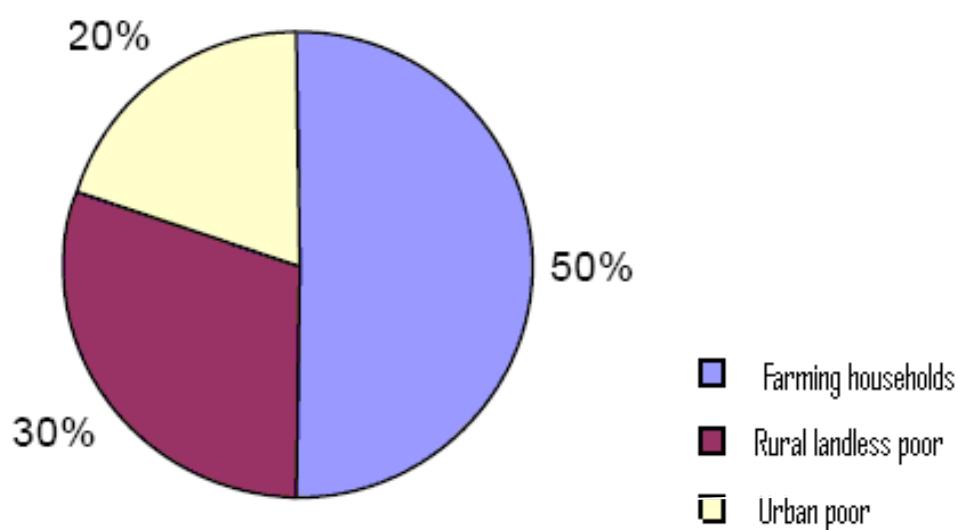
Figure 2: Proportion of the food insecure population in Africa
Source: Mwaniki (2006)

It is predicted that many regions will not reach their MDG targets, particularly SSA where a third of the population is food insecure and there is an actual increase (through population growth) in the number of hungry people. According to the WFS (2002),

globalisation of agriculture has resulted to rising in food insecurity. Trade liberalisation and globalisation are resulting in declining food production that is a threat to food security, particularly in the countries of the south. The same process are wiping out small family farms and replacing them with inefficient and unhealthy industrialised food systems under corporate control. Trade liberalisation and globalisation of agriculture are supposed to increase production of food, increase efficiency of food production, improve economic situation of farmers and improve pattern of food consumption.

However, the opposite is observed in many developing countries (Tomlins, 2003). Tomlins further noted that, the United States and other industrialised countries of the North are trying to change the meaning of food security from fundamental human right to participation in global markets, which excludes the large number of poor without adequate purchasing power. Food growing land is being diverted to non-food crops such as flowers or other luxury commodities. Removal of agricultural input subsidies had led to decrease among food production especially in the rural areas where most of small-scale farming is done. This poses a threat to the national and local food security (WFS, 2002).

Food insecurity is determined by the immediate causes of hunger, underlying determinants of conditions in a community (affecting poverty, food production, and ability to respond to shocks), and the impact of shocks. In the last few decades, agricultural output in SSA has barely kept up with population increases, and Africa now imports 25% of its grain requirements. Inherent differences in agricultural systems prevented the large increases in food production ('green revolution') seen in Asia. These were due to wide introduction in the 1960-70s of high yielding varieties of rice and wheat, expanded fertiliser use, and more irrigation (Baldwin, 2006).

Food insecurity is expected to accelerate in SSA. SSA share of the world's food insecure population is projected to almost quadruple from 11% in 1969/71 to 39% in 2010 (FAO, 1996). According to FAO (1996), about 40% of the total African population, largely children and women face mounting problems of poverty and malnutrition. Malnutrition is due to lack of adequate calories, protein, vitamins and other essential micronutrients. Decreasing levels of mortality combined with persistently high (but gradually or marginally declining) fertility rates, have resulted in large increases of population, which is growing at an annual rate of 2.6% compared to world average of 1.3%. Countries such as Angola, Botswana, Malawi, Namibia, Tanzania and Zimbabwe in Southern Africa and Gambia, Mali and Niger in West Africa, had annual population growth rates exceeding three percent between 1990 and 1995 (FAO, 1996).

Food demand is expected to increase tremendously in the coming decades. It is estimated that SSA will account for 10.6% of the 690 million tones increase in the global demand for cereals and five percent of the 115 million tones increases in the global demand for meat products while 42.8% of the 234 million tones will increase in the global demand for roots and tubers between 1995 and 2020. Large increases in demand will result not only from increase in population but also urbanisation (FAO, 1996).

FAO (1999) observed that it is difficult to identify the number of individuals who are food insecure, given intra household inequalities of differing natures in different regions as well as changes over time. Depending on factors such as agro-ecological characteristics access to land, diversity of income and state of development of the economy, food insecure household can be members of different socio-economic and demographic groups in different areas. Nevertheless, some common characteristics of the food insecure emerge, of which poverty is central. In the 1990s, food production levels in the majority of the

countries in the SADC region either declined or remained stagnant while the population growth rate continued to rise (Nyange, 2001). The above-mentioned phenomena have resulted into food insecurity.

Food insecurity is a global problem. The number of food insecure people, which is high, corroborates this fact. By the end of December 2004, there were 852 million undernourished people, 96.7% of whom were living in developing countries (FAO, 2004). It has been reported by URT (1999) that food insecurity is indicated by the proportion of the population who are unable to get two meals a day and the proportion of household that are unable to get 270kgs of grains per adult per year. According to UNDP (1998), one of the indicator of household food insecurity is the percentage of households with adults eating less than two meals (one meal or no meal), 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.

Some of the major causes of food insecurity in Tanzania, according to Keenja (2001) are: little acreage; low agricultural output per capita and per area of land due to using low level technologies; dependency on rainfall whereby only 16% (156 000 ha) of land that is suitable for irrigation (1 000 000 ha) is irrigated; low income, which weakens the ability to buy food and applying even technologies that are well known, such as uses of fertilisers, pesticides, herbicides and so on; poor availability and high prices of inputs for agricultural and livestock production; and, just to name a few; weak agricultural extension services, which limit farmers' access to new research findings and to getting inputs and technical advice. Furthermore, the underlying causes of food insecurity include: smallholdings, low soil fertility and lack of agricultural inputs, low levels and limited employment, high post-harvest losses; natural disasters such as droughts, floods, locusts and insects (Ishengoma, 1998).

Besides, the above factors, some theorists have explained the causes of food insecurity in terms of theories. Four groups of the theories on food insecurity are famous. One of the theories is Malthusianism, which contends that food insecurity exists due to too many people and too little food production to feed them adequately (Brigham, 2004). This theory began during the time of Thomas Malthus (1766 to 1834) and lingered in the mainstream thinking up to the early 1960s. The above theory is no longer valid. The second theory is based on arguments of Esther Boserup who contends that food insecurity is due to using poor technology to produce food. She elaborates that good technological development can boost food production enough to keep up with population growth for many years (Brigham, 2004). Her arguments won worldwide cognisance, and were substantiated by the Green Revolution that occurred in South-Eastern Asia between 1965 and 1969 due to intense use of improved seeds; irrigation, and better crop husbandry practises, and made India to change from an importer of food to a net exporter of food. The third theory is that which was put forward by Professor Amartya Kumar Sen who theorised the *entitlement approach* by which it is contended that "People do not usually starve because of an insufficient supply of food at the local, national or international level, but because they have insufficient resources, including money ('entitlements') to acquire it" (Sen, 1981). This contention gave rise to hot debates, most people opposing him. For example, Brigham (2004) argues that the entitlement theory makes a grave error to ignore long-term decline in food availability, which may cause famine. Another counter-argument pertinent to the entitlement approach is given by Alexandratos (1997) who contends that the entitlement approach relegates the need to increase food production to a subsidiary role. The counter-arguments against entitlement approach gave rise to the fourth theory, whereby it is contended that food security attainment is contingent upon four determinants, viz.: availability, institutional elements, market forces and possessions.

UNICEF/URT (1990) estimated that one third of the world's people do not reach their physical and intellectual potential due to micronutrient deficiencies caused by food insecurity. According to Baldwin (2006), many other issues also affect food security. Access and rights to land, education, gender and social exclusion all have big impacts. Poor governance and corruption can affect hunger levels by disempowering vulnerable groups (such as women and minority ethnic groups), and seriously undermine any policies in place. According to Baldwin (2006), the underlying determinants of community conditions on food insecurity include: infrastructure and local markets; trade and international markets; HIV/AIDS; investment power and finance power; health, water, and sanitation; and environmental sustainability.

The food crisis that threatened more than 14 million people in Southern Africa in 2002–2003 brought into sharp focus the interactions between HIV/AIDS and food security. It is demonstrated that hunger cannot be combated effectively in regions ravaged by AIDS unless interventions address the particular needs of AIDS–affected households (FAO, 2003). HIV/AIDS causes and exacerbates food insecurity in many ways. Most of its victims are young adults who fall ill and die during what should be their peak productive years. They leave behind population overbalanced with the elderly and young, many orphans. The impact on farm production and food security is often devastating (FAO, 2003). It is estimated that, by 2020, the epidemic will have claimed one-fifth or more of the agricultural labour force in most southern African countries. In several affected countries, 60 to 70 percent of farms have suffered labour losses as a result of HIV/AIDS. Lacking the labour, resources and know-how to grow staple crops and commercial crops, many households have shifted to cultivating survival foods. Others have abandoned their fields.

A relatively recent contributor to food deficiency in African continent is the HIV/AIDS pandemic. In its incidences in the economically active and working population, both in the rural and urban areas, it has had the effect of weakening, debilitating and killing off a large segment of the food producing population. As its infection rate continues to rise and spread like wild fire in several regions of Africa, it poses grave dangers to food security in the continent and calls for more effective policies and programmes to tackle the pandemic (Tibaijuka, 2003).

According to URT (2005) lower labour availability decreases production and productivity, farm animals are sold to raise money for medicines, and income declines preventing food purchases. Moreover, food insecurity leads to too much of human sufferings. It results in substantial productivity losses in both short and long term due to reduced work performance, lower cognitive ability and school performance. It reduces income earnings and increases access as well as resource misallocation and loss of productive assets. High level of morbidity due to part of insufficient food intake can reduce work time directly or indirectly through the need to take care of sick family members. Poor nutrition in early childhood can have long term consequences affecting child's later progress during school enrolment, absenteeism, dropouts and poor class performance (Tibaijuka, 2003).

2.4 Coping strategies

Food purchase has been reported as an important means of acquiring food for the household during shortage period (Mhinte, 2001). Rural households therefore design different ways to raise income for purchasing food. Labour selling is the most common income strategy in many African countries. In Malawi, the period of high labour requirement coincides with that of food shortage (Mhinte, 2001). Moreover, about 70% of food shortage households in Kondoa district in Tanzania had to buy food to cater for

deficit while the rest had to work as casual labourers in other people's fields and get payment in form of cash or food (Liwenga, 1995). Therefore, attaining enough food through purchases becomes impossible for the majority of farmers in the rural areas. Furthermore, apart from labour selling other income strategies adopted by rural people have been identified. The strategies include sale of livestock, sale of cash crops, sale of local brew, employment seeking, small business, oxen lease, sale of domestic assets and lease of farm machines and equipment (Ashimogo, 1995, Liwenga, 1995, Makundi, 1996, Ishengoma, 1998).

The availability of many alternative foods gives consumer wide choice while the availability of only one food type limits consumer choice (Ishengoma, 1998). However, even under good purchasing power a household may not consume a certain kind of food due to some social, religious or cultural inclinations (Ishengoma, 1998). Previously people used to consume many alternative foods but through domestication and specialization only few species have remained for human consumption. This kind of specialisation has caused what is referred to as "Food Erosion" i.e the removal or disappearance of some food species from the world of consumption (Mosha, 1990, Ishengoma, 1998). Ishengoma furthermore, reported that the foods that have remained important items are referred to as the staple foods. The staple food differs from one area to another depending on ecological, social economic and cultural preferences of the people residing in that particular area.

The erosion of food determines to some extent the degree of access to food at household level. Many families now rely on too few food types (such as maize and rice) with other food type eaten only during periods of food deficit and which are actually considered as inferior types of food (FAO, 1996). Consumption of the less popular foods to cope with seasonal food deficit was found in Malawi (Mhinte, 2001). Similar strategy of switching

to less popular foods was reported by Njiro (1997) in Kenya and Ogbu (1993) in Nigeria, cited by Mhinte (2001). In Tanzania consumption of foods which are not main staple like cassava, sweet potatoes and wild fruits were also reported by Kavishe and Mushi (1993), as means of coping strategies with food insecurity.

Household adopt a variety of allay to food insecurity coping strategies. Mutangara *et al.* (1999) found that households cut back the number of meals when faced with food shortages. Mutangara further noted that in Zambia and Uganda, rural households engage in small income generating activities such as selling firewood, brewing millet beer, selling livestock, building fences, handicrafts, tailoring and petty trade to supplement their income. In Malawi, households cope by doing causal labour. In Zambia some households were reported to have migrated to urban areas in search for employment to remit income to their rural areas, while some work in neighbours' fields as casual labourers to earn income.

It has been reported (Wagao, 1991; Ishengoma, 1998; Mgondo *et al.,* 1996) that in Tanzania, residents in rural areas have diversified strategies to lessen the adverse effects of the crisis. Household members cope with food shortages by reducing the frequency of and changing the content of meals consumed daily, undertaking more income earning activities and buying or borrowing from either relatives or friends. Many households also have reported selling important productive and non-productive assets such as furniture and radios to meet food requirements in times of food scarcity. Households also use the alternatives of employment and distress migration; wage labour constitutes one of the most important coping strategies available to chronically food insecure households, out migration in search of employment (Ishengoma, 1998). Furthermore, Mgondo *et al.* (1996) observed that poor households have difficulties in meeting their food requirements

from own production. To bridge the gap especially in the pre harvest period, they rely on off –farm enterprises.

Ishengoma (1998) noted that in Shinyanga strategies taken by households include the following: (a) adjustments to meals and food substation–a downward adjustment in the number of meals eaten per day and the quantity prepared per meal was the most commonly adopted coping strategy utilised by most households; (b) sale of assets–many households have reported to selling important productive and non–productive assets to meet food requirements in times of scarcity; (c) borrowing from relatives/friends; (d) alternative employment and distress migration–wage labour, constitutes one of the most important coping strategies available to chronically food insecure households while out migration in search of employment is a much less common phenomenon; and (e) wild foods–most wild foods (wild green vegetables and fruits) are not collected and consumed as a coping strategy, but continue to constitute important contributions to the diet like vitamins and other micronutrients and roughage.

Other coping strategies mentioned include food aid and redistribution of children where many poor households send their children to be cared for by relatives and friends over period of time when households are experiencing difficulties in meeting livelihood needs. Tibaijuka (1997) for example, noted that in Kagera region, Tanzania households sold banana (their staple food) in desperation to raise money to meet medical cost.

According to Famine Early Warning Systems Network (FEWS NET, 2004), the findings in Dodoma and Singida Regions in central Tanzania suggested that food security in these areas was worsening. In June/July 2003 it is estimated that, from November, 2004 approximately 200 000 people in this area would run short of food before the next harvest,

it was clear that many more households had already run out of food stocks, and their alternative means of obtaining food were increasingly constrained. Furthermore, it was common for households in Dodoma and Singida, especially the poorer ones, to run out of their own food stocks before the beginning of the next harvest (April/May). When the harvest nears and stocks run out, they turn to the market, selling livestock (for better-off households) or labour (for poorer households) to earn the cash necessary to buy food.

However, in 2004 stocks had run out early, and market options were limited. In particular, the terms of trade between livestock and cereals had deteriorated. For example, in 2003 in Chonde village (Dodoma Rural District) one could, with the sale of one cow, purchase around forty tins (720 kg) of maize, or the equivalent of around seven months of food for a household of six people. However, in 2004 for the same cow, one could only buy around seven tins of maize (126 kg), which would cover just over a month of food for the same household. In addition, rural wages dropped sharply and labour opportunities were constrained. More people than normal were seeking labour opportunities, both within and outside their villages, but jobs were hard to come by since fewer people had the means to hire help. Due to a lack of their own food reserves, more households than normal sought extra paid work and therefore spent less time than normal cultivating their own fields. Therefore, the overall area of cultivated land in Dodoma and Singida Regions were lowered than normal (FEWS NET, 2004).

2.5 Model for the analysis of the study data

The literature for the present Chapter has been reviewed from a wider perspective of food security. The reflections drawn in this review provides the basis for assessing causes of food insecurity and coping strategies in Tanzania. In the context of the present study the purpose of which was to assess the causes of food insecurity and coping strategies of

smallholder farmers in Chamwino district, the model shown in Fig. 3: was developed. This model provides a framework for analysing a large volume of data and is oriented towards establishing findings which fulfil the objectives of the study. It allows drawing implications on possible ways that would be used to reduce food insecurity in households of smallholder farmers.

The model suggests that the dependent variable food insecurity is influenced by background variables such as age, sex, household size, marital status and education level and independent variables under causes of food insecurity–factors linked to agricultural production, accessibility to food, socio–economic factors; and socio–cultural factors. The model indicates that food insecurity situations need coping strategies (Fig.3) and the definition of key variables (background, independent and dependent variables) used are given in Appendix 2. The research methodology is now presented.

Background
Variables

Independent
variables

Dependent
variables

Causes of Food Insecurity

Agricultural production

-Size of the land
-Technology
-Rainfall
-Source of labour

Accessibility to food

-Sources of food supply
-Resources accessed

Socio-economic factors

-Income

Socio-cultural

-Uses of food
-Methods of food storage

Age
Sex
Household
size
Marital
status
Education

Food
Insecurity
(DEC/AE)

Coping strategies

- Selling labour
- Number of meals taken
- Livestock sales
- Borrowing food
- Sales of productive assets
- Migration

Figure 3: Model for the analysis of the study data: causes of food insecurity and coping   strategies of smallholder farmers in Chamwino district

Key: ⟶ Relationship for primary analysis

▪ ▪ ▪▶ Relationship for secondary analysis

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1 Overview

This study sought to assess the causes of food insecurity and coping strategies of smallholder farmers in selected villages in Tanzania. This Chapter discusses the methodology adopted under seven parts: (a) study area; (b) study design; (c) sampling procedures; (d) sample size; (e) data collection instruments; (f) data collection procedures; and (g) data processing and analysis.

3.2 Study area

The study was conducted on smallholder farmers in Chamwino district, Dodoma region. It covered two wards namely: Iringa Mvumi at Iringa Mvumi and Ikomboringa villages; and Chilonwa at Mahama and Nzali villages (see Figure 1). Chamwino district was chosen for the study following the consideration of its unique characteristics of being among the list of food insecure districts in Tanzania even when there is bumper harvest in the country.

3.3 Research design

Cross sectional research design was used in this study in which a one–stage survey was conducted. According to Bailey (1998) and Babbie (1990), this design allows data to be collected at a single point in time and can be used for a descriptive study as well as for determination of relationship between variables. This design was considered to be favourable because of time limit and resources available for data collection (Casley and Kumar, 1988).

3.4 Sampling procedures

Multistage sampling technique was employed in selecting region, district, wards and villages. This technique is convenient for a large sampling unit (Kothari, 2004). In it, purposive sampling methods were used to select two divisions and two wards from Chamwino district. Out of the two selected wards, two villages were selected from each ward. Household heads were selected from the existing list of households from each village. Stratified and purposive sampling techniques were used to select 30 household heads from each of the four selected villages (72 males and 48 females) according to gender and food security status. The sample of households was further categorised into 58 (32 males and 26 females) food secure (FS) households and 62 (40 males and 22 females) non–food secure (NFS) households using dietary energy consumption per adult equivalent per day (DEC/AE) calculation procedures (see Table 1, Table 2 and Appendix 3). All the two extension agents (2 males and 0 females) engaged in agricultural production at ward level serving in the selected villages were involved in the study. A total number of 24 key informants (16 males and 8 females) were selected using snowball technique. Thus, a sample of 146 respondents was involved in the study.

3.5 Sample size

A summary of the distribution of all respondents involved in the study is given in Table 3.

Table 3: Distribution of all respondents (N=146) involved in the study

Type of respondent	Status of food security				Total	
	Food secure		Non–food secure			
	Male	female	Male	female	Male	female
Household heads	32	26	40	22	72	48
Extension agents	-	-	-	-	2	-
Key informants	-	-	-	-	16	8
Sub total	58		62		90	56
Total	-		-		**146**	

3.6 Data collection instruments

a)   Questionnaires:

(i)   Household heads questionnaire: were used to collect primary data from   heads of households in each village, as shown in Appendix 4.

(ii)   Extension agents' questionnaire: were used to collect primary data from extension agents, as shown in Appendix 5.

b)   Checklist: This was used to collect primary data from key informants as supplements of information to support the study, as shown in Appendix 6.

c)   Researchers diary: This was used to collect secondary data from different sources including books, journals and official reports, library, NGOs, relevant offices and other institutions, focused group discussion (FGD). This instrument was also used to record researcher's observations of smallholder farmers' activities.

3.7 Data collection procedures

Fieldwork was conducted during the period of October to December 2006. The permit for data collection was obtained from the Chamwino district commissioner in Dodoma region after getting an introductory letter from the Director of Research and Post-graduate Studies, at Sokoine University of Agriculture (SUA). The study employed combination of multiple methods of data collection, mainly involving qualitative and quantitative information collection techniques and procedures. It took holistic participatory process in identification of causes of food insecurity and coping strategies. In each of the selected villages from Chamwino district, one research team lead by the researcher was formed to collect primary data in Chamwino district. Two research assistants assisted the researcher

over a period of three months to collect primary data. The researcher was responsible for training and guiding the research assistants during data collection.

Prior to initiation of the survey in villages, much care and foresight were taken to legitimise the research in the eyes of the village leaders, farmers as well as government officials at village and district levels. Before primary data collection, a preliminary survey was conducted by the research team to be familiar with the study area as well as to acquire general information on the causes of food insecurity and coping strategies in the study area. Structured questionnaires were used as a tool for interviewing household heads and extension agents. The questionnaires were designed to permit acquisition of both qualitative and quantitative information. Open and close–ended questions were used. In the open–ended questions, respondents were supposed to give their own views while in close–ended questions they were supposed to choose among the given alternatives. The focus was to assess the causes of food insecurity in household of smallholder farmers and coping strategies employed by the household to cope with food insecurity situation. To ensure reliability and validity the first draft of the HHs questionnaire was pre-tested in 10 households in respondents not included in the study sample. Furthermore, necessary changes were made on the basis of the pre–testing results before the final administration which included restructuring and omission of some questions. Of the 120 interview schedules meant for smallholder farmers' household heads, all were properly completed, constituting a return rate of 100 percent. Likewise, all the two interview schedules meant for extension agents were also completed. Interviews were conducted in private household heads environment using Swahili language and each lasted at least 30 minutes.

Focus group discussion and non-participant observation techniques were also employed to collect the information to supplement the study findings. Focus group discussion involved

participation in casual talks with local people on issues focusing on causes of food insecurity and coping strategies in each village of study. Such conversations were held in places where the researcher and participants found appropriate. The participants were asked to give their opinions on the main causes of food insecurity, factors contributing to the causes of food insecurity, effects of food insecurity, how they define food insecure household in their area and coping strategies employed by the households during food insecurity. Furthermore, the participants were asked to give their opinions on how the problem of food insecurity can be eliminated. The information collected was documented immediately after the conversation.

Direct researcher's observations were made to verify some of the information given by the respondents during the household questionnaire survey and community meetings. Experience has shown that most villagers avoid discussing openly in an interview or village meetings (Kajembe and Luoga, 1996). The researcher in this case had to become part of the situation in the study area. Most information was obtained through close observation on what was happening. In such a situation the researcher was keen to check on what was said and what was seen for recording. For example, sell of firewood and charcoal making as off–farm activity respondents did not readily report as being one of their off–farm activities, probably they feared to be accused of being destructive to the environment. However, it was observed that firewood and charcoal have significant financial contribution to a number of households in the area.

In addition, primary data were collected using checklist from 24 key informants through directed discussions. The researcher also collected secondary data through review of documentary information from SUA Library, regional, district, village files and websites using researcher's diary.

3.8 Data processing and analysis

3.8.1 Data processing

Data from completed household heads questionnaire were coded for computer analysis. Data from extension agent's questionnaire, researcher's diary and checklists were summarised manually to single sheets of paper. In summarising the data great care was taken to ensure that it accurately reflected the original meanings of the statements made.

3.8.2 Data analysis

Data from household heads questionnaire were analysed using SPSS computer programme. The method of analysis involved univariate, bivariate and multi-variate analysis. It used techniques of frequency counts, cross tabulation and multiple linear regressions. Multiple linear regression analysis was carried out to determine the effect of various socio–economic factors when combined together on food security status. In this aspect, multiple linear regression models was used, as follows:

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \varepsilon$$

Where:

Y = Dietary Energy Consumed in Household per Adult Equivalent

α = Constant

β_i = Regression Coefficients

X_1 = Sex of respondents (Dummy: 1if male, 0 if otherwise)

X_2 = Marital status of respondent (Dummy: 1if married, 0 if otherwise)

X_3 = Age of household head (years)

X_4 = Education level of household head (years in school)

X_5 = Household size (number of household members)

X_6 = Size of land used for farming (hectares)

X_7 = Income per year ('000 TAS)

X_8 = Use of improved technology (Dummy: 1 if use technology, 0 if otherwise)

ε = Random error

Therefore, inferential analysis was used to find the relationship between some variables and to suggest whether the patterns described in the sample was likely to apply in the population from which the sample was drawn.

Data from other sources were analysed manually. Numerical data were summarised in Tables using descriptive statistics of percentages to facilitate assessment of causes of food insecurity and coping strategies in the study villages. In addition, expression of dependent variable (dietary energy consumed in a household) in per adult equivalent was done using adult equivalent scales following Collier *et al* (1986) (Table 1) and determination of dietary energy consumed was done using tables for proximate composition of foods commonly eaten in Africa (West *et al* 1988) (Table 2).

3.9 Limitation of the study

(i)   More than three quarter of respondents were involved in off–farm activities, mostly as doing casual labour. Since the interview was conducted during working hours (day time), when they were at work, the interviews had to be rescheduled for late hours in the evening, after work time as a result, data collection timeframe had to be prolonged.

(ii)   Other respondents had problems in recalling amount of food stuffs consumed in their households per month. Thus the estimates were taken, making some of the data to be just estimates and not the actual ones.

(iii)   Many respondents had problems in understanding Kiswahili language, this required translation of Kiswahili language to Gogo language by the person who is competent in both languages (Kiswahili and Gogo) in the study area. The translation may sometimes become difficult to express the meaning of questions exactly, hence may lead to unclear answers from the respondents. Results and discussion is a subject of the next Chapter.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Overview

This Chapter presents the major results and discussions arising from the data analysis related to food insecurity and coping strategies of smallholder farmers in Chamwino district. These were discussed under two main sections. The first section dealt with smallholder farmers household heads respondents' characteristics and their opinions related to causes of food insecurity and coping strategies. The second section examines extension agent respondents' characteristics and their opinion on food insecurity and coping strategies. The findings from these sections were examined from the perspective of their implications for improvement of food security in the study area.

4.2 Household heads (HHs) respondents' characteristics and their opinions on causes of food insecurity and coping strategies

4.2.1 Household heads (HHs) characteristics

HHs characteristics covered personal and situational characteristics in farming which were expected to improve food security. This part is therefore organised under two main categories: the first category involves personal characteristics. These were: sex, age, marital status, household size and education level. The second category deals with situational characteristics, such as on–farm activities, off –farm activities and income from on–farm and off–farm activities.

4.2.1.1 HHs personal characteristics

The personal characteristics of HHs have important social and economic connotations to the accessibility and availability of food within a household. Household composition

usually influences the decision on production, consumption and even storage of food. Among the more important household heads personal characteristics dealt with in this study are: (a) sex, (b) age, (c) marital status, (d) level of education and (e) household size. Frequency distribution of HHs respondents' personal characteristics is given in Table 4.

Table 4: Frequency distribution of HHs respondents (N=120) personal characteristics by status of food security

| Characteristics | Status of food security | | | |
| | Food secure (n=58) | | Non -food secure (n=62) | |
	Number	Percent	Number	Percent
Sex				
Male	32	55.2	40	64.5
Female	26	44.8	22	35.5
Age				
<30	8	13.8	14	22.6
30 – 40	19	32.8	14	22.6
41 – 50	13	22.4	18	29.0
51 – 60	11	19.0	8	12.9
>60	7	12.0	8	12.9
Marital status				
Married	50	86.2	47	75.8
Widowed	5	8.6	6	9.7
Divorced	3	5.2	5	8.1
Single	0	0.0	2	3.2
Separated	0	0.0	2	3.2
Level of education in years				
0	15	25.9	12	19.4
1 – 4	1	1.7	7	11.3
5 – 8	41	70.7	39	62.8
9 – 12	1	1.7	4	6.5
Household size				
<5	17	29.3	24	38.7
5 – 10	39	67.3	35	56.5
>10	2	3.4	3	4.8

(a) Sex

It was assumed that the sex of HHs being either a female (FHHs) or male (MHHs) could influence food security within a household. From the study findings given in Table 4, among the surveyed groups of food secure (FS) and non-food secure (NFS) households, the findings show that most of the households in FS and NFS households to be male headed (55.2% and 64.5%, respectively). However there were a substantial proportion of households (44.8%) in FS households, which was headed by females.

This shows that to some extent FHHs have much concerned with household food security compared to MHHs. This might be one of the reasons for fewer FHHs being NFS compared to MHH.

(b) Age

Age of the household head could influence decision–making on food production. Furthermore, HHs is responsible for fulfilling household needs and household food sufficiency. Findings from Table 4 show that the difference in age distribution of the HHs between FS and NFS households was not important. In both group of households, proportion of HHs fall under the category of productive age (30 to 50 years). Therefore, regarding this study, age of the HHs had no relationship with food insecurity in the study area.

(c) Marital status

Married couples are likely to be more productive than single persons due to labour supply in farm activities and access to productive resources in agriculture. The results showed that majority of respondents in FS (86.2%) and NFS (75.8%) households were married. This implies that marital status was not an important factor in food security status in the study area.

(d) Education level

Education not only endows one with the power to read and hence be informed, but it also allows one to communicate. The findings presented in Table 4 show that majority of FS households (70.7%) and NFS (62.8%) households had 5 – 8 years in schooling that is the primary school level in Tanzania. Therefore, it is impressive that majority of respondents had some formal education that can enable more people to read leaflets of

newly introduced improved agricultural technologies, inputs and services hence are able to use them to improve food security.

(e) Size of household

The size of household may affect the food security situation within a household. Therefore, HHs were asked to indicate the number of household members, including sex, age and relationship with the head of household. The findings in Table 4 further show that most of the households in FS households (67.3%) and NFS households (56.5%) had household size ranges from 5 – 10. This observation implies that large household sizes were common in both groups. This is due to the fact that "many people in the study area practise polygamous (more than one wife) marriage especially people with many cattle herds which enable them to have more women and children, hence more household members" as reported by one of the key informants. The study further revealed that the average household size was 5.86 and 5.52 for FS and NFS households, respectively. This figure is higher than the one found during population census of 2002, which was 4.5 for Dodoma region and 4.2 for Dodoma Rural which includes Chamwino district (URT, 2003b).

It was observed that large household size with able bodies provide labour for production. Fig. 4: depicts a household size of 22 members from one of the HHs study respondents.

Figure 4: Household size of 22 members from one of the HHs study respondent

Further analysis show that dependence on family labour predominated in both groups of households with, 75.9% and 79.0% in FS and NFS, respectively. However, use of group labour was observed in households of NFS only. This implies that NFS households use traditional methods of sharing labour as an alternative means of increasing manpower due to low ability to hire labour. Chi–square test shows that there was no significant difference (P>0.05) between FS and NFS households with regard to labour source. This implies that smallholder farmers in the study area depend entirely on family labour in agricultural production.

4.2.1.2 HHs situational characteristics

The situational characteristics examined were in three main categories. The first category involved factors related to on–farm activities. These include: land ownership and size of

land under production, food crop production, improved technology use, food storage and livestock ownership. The second category involved off–farm activities engaged in by HHs respondents and the third category deals with income generated from on–farm (crops and livestock) and off–farm activities.

(a) On–farm activities

(i) Land ownership and size of land under production

Land is one of the most important factors and means of agricultural production. Access to land enables production of both food and cash crops for individuals as well as households. The findings revealed that both categories of FS and NFS households own land, 100% and 98.4%, respectively as shown in Table 5. Data in Table 5 indicate that relatively large proportion of respondents (61.3%) in NFS households own less than two hectares compared to FS households (48.3%). Similar trend was also observed for area under farming. About 71.0% of the respondents in NFS households cultivate less than two hectares for crop production compared to 41.4% in FS households.

Table 5: HHs respondents (N=120) land ownership by food security status

Household owning farm land	Food security category				Chi-Square value
	Food secure (n = 58)		Non food secure (n= 62)		
	Number	Percent	Number	Percent	
Size of land owned in Ha.					
<2	28	48.3	38	61.3	3.240 NS
2 – 5	26	44.8	18	29.0	
>5	4	6.9	6	9.7	
Size of land used for farming by respondents					
<2	24	41.4	44	71.0	11.580**
2 – 5	30	51.7	14	22.5	
>5	4	6.9	4	6.5	
Land ownership and control					
Men	36	62.1	27	43.5	0.198NS
Women	5	8.6	9	14.5	
Both	9	15.5	17	27.5	
All members of the family	7	12.1	9	14.5	
In -laws	1	1.7	0	0.0	

NS = Non significant (P >0.05), ** = significant at P <0.01

About 51.7% of the respondents in FS households put between 2–5 hectares under agriculture, while for NFS it is about 22.5%. Results for Chi-square test indicated these differences between groups to be significant (P<0.01). Very few respondents in FS households and NFS households cultivated more than five hectares (Table 5). Size of land under cultivation may aggravate food insecurity by limiting people's production capacity. This is in agreement with the findings by URT (1999) in which it was reported that majority of smallholder farmers in Tanzania usually cultivate between 0.9 to 5 hectares of land for crop production.

Moreover, the respondents were further asked to give the information on land ownership and control. About 62.1% of FS households and 43.5% of NFS households reported that men were the owners and controllers of the land resource. Very few (8.6%) respondents of FS households and 14.5% of NFS households reported women to be the owner and controller of the land (Table 5). FGDs also supported the findings that the owners and controllers of the resources such as land are mostly men. However, in other households in the study area both men and women own land. Nevertheless, it is men who control the transfer of resources including land. This control includes the sale and price of the resources. It was noted that gender awareness in the study area is high but not yet converted into practical terms. One of the key informants in this study was quoted saying: "*People now have awareness on equal gender balance but men still dominate on resources ownership and control. For example, women cannot make the decision on the sale of livestock or any resource such as land while men do*".

Further analysis revealed that the majority of FS households (77.6%) and NFS households (62.9%) acquired land through inheritance. In most cases, land acquired through inheritance is usually small that do not allow for more agricultural expansion.

This is associated with the tendency to divide the larger pieces of land into smaller ones fitting the family distribution demand. Nevertheless, in the study area land was not a constraint in agricultural expansion but low income and lack of capital to expand more land and buy inputs as well as farm implements as reported by some of the participants in FGD. However, there were a significant number of respondents (15.5% and 21.0%) of FS households and NFS households, respectively who reported to acquire land through clearing of natural forest. Clearing natural forest has a negative impact on environment. Since it is associated with environment degradation, leading to existence of drought that lowers agricultural production, hence increased food insecurity in the study area. Therefore, agricultural land should be allocated to people and there should be a by–law for environmental conservation by planting trees in the study area. Other means of land acquisition include buying land, village offer, reverting fallow and obtaining land from friends and relatives.

(ii) Food crop production

Food crop production is one of the most important aspects in assuring household food security. Respondents were asked to name the major food crops they harvested in 2005/06 seasons. The major crops harvested in 2005/06 were sorghum, maize and millet (66.4%, 63.0% and 42.1%), respectively. The findings in Table 6 show that the significant difference between the FS households and NFS households was on sorghum harvests. About 51.6% respondents in FS households harvested 101 to 500kg of sorghum compared to NFS households in which majority of them (62.5%) harvested between 20–100 kg of this crop. Result for Chi-square test indicated this difference to be significant at (P<0.001). Regarding maize harvests, results show that slightly above 41.0% of total respondents in FS households and NFS households harvested between 101 to 500 kg with nearly all of the remaining percent harvested

below this amount. Concerning millet harvest, most of the respondents (more than 50%) in both groups harvested less than 101kg of this crop. It can be concluded from these results that harvests of the major crops in the season 2005/06 were generally low in both groups. This is attributed to prolonged draught that existed during that season. Therefore, people should mainly grow more drought tolerant crops such as cassava.

Table 6: Distribution of HHs respondents (N=120) by quantity of the main food crops harvested in 2005/06 and food security status

Quantity of crops harvested in kg	Food security status				Chi-Square value
	Food secure (n= 58)		Non food secure (n= 62)		
	Number	Percent	Number	Percent	
Maize (n=29)					
<20	2	11.8	0	0.0	2.547^{NS}
20 – 100	7	41.2	7	58.3	
101 – 500	7	41.2	5	41.7	
>500	1	5.8	0	0.0	
Sorghum (n=71)					
<20	4	12.9	4	10.0	11.731***
20 – 100	8	25.8	25	62.5	
101 – 500	16	51.6	11	27.5	
>500	3	9.7	0	0.0	
Millet (n=45)					
<20	3	11.5	3	15.8	2.704^{NS}
20 – 100	13	50.1	9	47.4	
101 – 500	7	26.9	7	36.8	
>500	3	11.5	0	0.0	

NS = Non significant (P>0.05), *** = Significant at P<0.001

Additionally, the findings from Table 7 show that most of the households in both FS households and NFS households (51.8% and 75.8%), respectively, usually harvest less than 2000 kg of cereals during normal year. These observations imply that own food production in the study area was normally low. This may be due to low use of technology, and unequal distribution of rainfall. However, the problem of low harvest was more serious in NFS households compared to FS households in which there is a significant proportion of FS and NFS households (24.1% vs 14.5%) which normally harvest 2000 kg – 4000kg during normal years. Due to the problem of low crop

productivity in the study area, households had to purchase food even during the normal year. Findings from Table 7 further indicate that amount of purchased food to be relatively higher in FS households compared to NFS households in which 60.8% of the households in FS households can purchase 100 kg–500kg compared to 37.1% households in NFS households, which can do so. The observed difference between the two groups was statistically significant (P<0.001). The NFS households could attribute this to low purchasing power.

Table 7: Average quantity of food obtained in normal years by HHs respondents (N=120)

Variables	Food security status				Chi-square Value
	Food Secure		Non food Secure		
	Number	Percent	Number	Percent	
Own food production in normal years in kgs	(n= 58)		(n= 62)		
<2000	30	51.8	47	75.8	7.916*
2000 – 4000	14	24.1	9	14.5	
>4000	14	24.1	6	9.7	
Purchased food in normal years in kgs	(n= 51)		(n= 35)		
<100	5	9.8	18	51.4	18.752***
100 – 500	31	60.8	13	37.1	
>500	15	29.4	4	11.5	

NS = Non significant at P>0.05, * = Significant at P<0.05, *** = Significant at P<0.001

Furthermore, the findings shown in Table 8 revealed that food crops harvested by respondents are mainly used as food for almost all respondents, (98.3% of FS and 100% of NFS households). Selling foodstuff for income was noted to be higher in households of NFS (72.6%) as compared to 37.9% of FS households. Chi–square test signifies that there is significant difference (P<0.001) between the FS households and NFS households on selling foodstuff for income. This indicates that despite low food production by NFS households, these households still sell some of the harvested foodstuff for income. This trend is due to the fact that most of NFS households depend on selling labour for income during farming season, and during off-season, they do not have reliable activities for income generation. Selling foodstuff for income is

associated with food insecurity in the district. Therefore, farmers should be facilitated to find appropriate means of income generating activities. One participant in focus group discussion was noted saying: *"We usually used to earn some money by selling labour to other people's farms during farming season and life is usually good. But life turns bitter during off season in which there are limited opportunities for income generation"*.

Table 8: Various uses of food in relation to food security status (N=120)

Uses of food	Food security status				Chi-Square value
	Food secure (n = 58)		Non food secure (n= 62)		
	Number	Percent	Number	Percent	
Food	57	98.3	62	100.0	1.078[NS]
Selling for income	22	37.9	45	72.6	14.590***
Ceremonies	6	10.3	31	50.0	22.096***
Church sacrifices	2	3.4	1	1.6	0.414[NS]
Exchange with labour	15	25.9	1	1.6	15.249***
Local brewing	4	6.9	14	22.6	5.782**

NS = Non significant (P>0.05), ** = Significant at P<0.01, *** = Significant at P<0.001

The findings in Table 8 further indicate that the use of food for ceremonies was also pronounced by half (50%) of NFS households as opposed to only 10.3% of FS households; and Chi–square test indicates that there is significant difference ($\rho<0.001$) between the two groups on use of food for ceremonies. Inappropriate uses of food lead to food insecurity in the study area. Therefore farmers should be given awareness on proper use of food. Nonetheless, exchange of food with labour was mentioned by 25.9% of FS households compared to only 1.6% of NFS households. This implies that food secure households use food to obtain more labour during farming season. Chi–square test signifies that there is statistical significant difference (P<0.001) between the two groups on exchange of food with labour. In addition, use of food for brewing dominated in NFS households (22.6%) as opposed to only 6.9% of FS households and

Chi–square test shows that there is significant difference (P<0.01) between FS households and NFS households on use of food for brewing. Local brewing as strategy to get income has negative impact to food security because in most cases it is made from farm produces like maize and sorghum. This strategy therefore, while raising income it may reduce food stocks from own production hence results to food insecurity. However, local brewing is part of the life style of rural people especially for refreshment and source of income. Furthermore, the findings were also supported by the FGDs from all the study villages that various uses of food obtained include food selling for income and use in ceremonies as well as in local brewing.

(iii)Technology used in food production

The use of improved inputs such as fertilisers, improved seeds, pesticides, biotechnology, and agricultural mechanisation are very important in food production since appropriate technology lowers costs of production; hence leads to increased productivity and efficient use of factors of production. Therefore, the technologies considered in this study were manure application, use of ox–plough, row planting, improved seeds and pesticides. The findings shown in Table 9 indicate that 72.4% of FS households reported to use improved technology where as only 35.5% of NFS households reported to use improved technology. Results for Chi–square test revealed this difference on use of improved technology in farming by FS households and NFS households to be statistically significant (P<0.001). Limited use of improved technology results to food insecurity since improved technology use is associated with the increased production of food.

Table 9: Distribution of HHs respondents (N=120) by improved technology use and food security status

Variables	Food security status				Chi-Square value
	Food secure (n= 58)		Non food secure (n= 62)		
	Number	Percent	Number	Percent	
Improved Technology use					
Use technology	42	72.4	22	35.5	16.421***
Do not use technology	16	27.6	40	64.5	
Type of Technology used					
Manure application					
Apply manure	25	43.1	13	21.0	6.786**
Do not apply manure	33	56.9	49	79.0	
Ox-plough use					
Use ox-plough	27	46.6	11	17.7	11.494***
Do not use ox-plough	31	53.4	51	82.3	
Plant in rows					
Plant in rows	4	6.9	6	9.7	0.303[NS]
Do not plant in rows	54	93.1	56	90.3	
Improved seeds					
Use improved seeds	20	34.5	2	3.2	16.685***
Do not use improve seeds	38	65.5	60	96.8	
Pesticides					
Use of pesticides	4	6.9	2	3.2	0.850[NS]
Do not use pesticides	56	93.1	60	96.8	

NS = Non significant P>0.05, ** = Significant at P<0.05, *** = Significant at P<0.001

Similar trend was also observed on the use of ox-plough and improved seed in which proportion of households not using these technologies were relatively high (82.3% in NFS households compared to FS households 53.4%). Nevertheless, the findings in Table 9 show that there was no significant differences (P>0.05) between the FS and NFS households on the use of pesticides and planting in row. Although FS households tended to be better on use of some technologies compared to NFS households, the findings show that the use of improved technologies in FS households and NFS households were generally poor, as more than 50.0% of total households in both groups did not use improved technology. Limited use of improved technologies in farming was mainly due to low availability, high costs of acquiring them, limited knowledge and low sensitisations on their use as mentioned by some of the participants during FGD. Therefore, people in the study area should be facilitated and motivated to use the available improved technologies for food production.

(iv) Storage

Storage is very important aspect concerning food security. Good storage methods and facilities enable food to last longer for future processing and utilisation. Good storage methods ensure high quality of food. The findings given in Table 10 show that the majority of FS households (86.2%) and NFS households (79.0%), store food. In addition 44.0% and 53.1% of FS households and NFS households, respectively, use sacks as their means of storage followed by *vihenge* 34.0% and of FS households and 28.6% of NFS households. This implies that most of the respondents in the study area practise the traditional means of food storage, which perhaps are not in a good condition. Poor storage facilities cause higher loss of food and some important seed varieties because of failure to maintain good seeds and other planting materials from one season to the next season. This is in agreement with FAO (1996) observation that most people in Tanzania use traditional methods in grain storage. Therefore, there is a need to improve the traditional storage methods to avoid food loss by storage pests (insects, mites, rodents as well as rotting).

Table 10: Distribution of HHs respondents (N=120) opinions on food storage by food security status

Variables	Food secure		Non food secure		Chi-square value
	Number	Percent	Number	Percent	
food Storage		(n= 58)		(n= 62)	
Store	50	86.2	49	79.0	1.068[NS]
Do not store	8	13.8	13	21.0	
Means of storage		(n= 50)		(n= 49)	
'Vihenge'	18	34.0	13	28.6	0.864[NS]
Silos	2	4.0	2	4.1	
Sacks (sulfet)	20	44.0	28	53.1	
'Vihenge' and sacks	10	18.0	6	14.2	
Food stored last until next season		(n= 58)		(n= 62)	
Last until next season	16	25.9	5	9.7	5.437[NS]
Do not last	42	74.1	57	90.3	
Add something on storage		(n= 50)		(n= 59)	
Add something	36	74.0	29	57.1	3.119[NS]
Do not add something	14	26.0	20	42.9	
What added		(n= 36)		(n= 30)	
Traditional herbs	25	67.6	20	69.0	0.015[NS]
Manufactured pesticides	11	32.4	10	31.0	
Encounter any problem		(n= 46)		(n= 45)	
Encounter	28	60.9	25	55.6	0.264[NS]
Do not encounter	18	39.1	20	44.4	
Training on food storage		(n= 58)		(n= 62)	
Have training	28	44.8	10	19.4	8.986[**]
Do not have training	30	55.2	52	80.6	

NS = Non significant $P>0.05$, ** = Significant at $P<0.01$

The HHs respondents were asked if the food stored last until the next season, the majority of FS households (74.1%) and NFS households (90.3%) answered no, as shown in Table 10, which implies that either the quantity of food produced is low or their uses of food might be on the higher side that the food is finished before next season. This pushes many households to supplement food by either purchase or other sources. The findings in Table 10 further show that 74.0% of FS households and 57.1% of NFS households admitted to add something on food during storage. When

they were further asked on what were added to the stored food, around two thirds (67.6%) of FS households and 69.0% of NFS households, respectively, reported to add traditional herbs.

Furthermore, 60.9% of FS households and 55.6% of NFS households complained to encounter problems during food storage. In addition, the respondents were asked whether they obtained training on food storage, 80.6% of NFS households reported not to have obtained training and 55.2% of FS households reported the same. This implies that many respondents in the study area do not have adequate knowledge on storage although Chi–square test indicates that there was a significant difference (P<0.01) between the groups. Therefore, people should be trained on good storage facilities, methods as well as how to control the storage pest in the study area so as to ensure food security.

The respondents who mentioned to have used the traditional herbs on food storage were further requested to indicate by names the local herbs they used on storage, types of food stored by using local herbs and the problems they encounter during storage. Further analysis revealed that 34.9% mentioned traditional herbs used to store grain as: margosa tree or neem tree *(muarubaini)*, 28.8% thorn tee (*vikunguni)* whose leaves emit unpleasant odour when squeezed) and wild cassava (*msaka)* 16.3% kitchen and cow dung ashes. Moreover, FGDs revealed that both leaves and roots of *muarobaini* can be used to store grain after crushing and drying, while kitchen and cow dung ashes are used after they have been sieved and finally mixed with grain. Other local herbs are used following the procedures of drying leaves and then grinded and used to mix with grain. Surprisingly, "NGAO" which is known for prevention of malaria mosquitoes are used with some respondents to store grains. Liquid *Ngao* is spilled on

grains and then dry or spilled on storage structure. The *Ngao* Pellet is grinded then mixed with grains. This implies that manufactured storage pesticides are not the priority in the study area, either due lack of knowledge on the use or high cost.

The study further revealed that, the major problems encountered by respondents during storage include pest damage (65%), rodents (20.4%) and mites (10.2%). A similar case is also reported by FAO (1996), stating that in Tanzania the extent of post–harvest food loses, which includes storage, has been estimated to be in the range of 15% and 45%. This implies that post harvest loss is one of the problems associated with food insecurity in the study area. Therefore, people should be trained on the good methods of post harvest loss management in order to minimise food insecurity problem in the study area.

(v) Livestock ownership

The numbers of livestock owned by FS households and NFS households were expected to indicate the economic base of the households. The HHs were asked if they owned livestock. It was found that 96.6% of FS households owned livestock and about 48.4% of NFS households owned livestock and the Chi-square test show that there were significant differences (P<0.001) between FS households and NFS households with respect to livestock ownership. Furthermore, the major types of livestock owned by respondents as it was mentioned by HHs respondents in the study area include, cattle owned by 50.9% of FS households and 38.7% of NFS households, goats (45.3%) of FS households and (58.1%) of NFS households; and chickens (88.7%) and (87.1%) of NFS households as shown in Table 11. Data in Table 11 show that about a half (50.0%) of FS households and 79.0% of NFS households had zero numbers of cattle. Chi-square test show that there were significant differences (P<0.01) between

FS households and NFS households with respect to number of cattle and chickens owned, but the difference between FS and NFS households with respect to number of goats owned was not significant (P>0.05).

Moreover, the findings in Table 11 further show that, relatively a large proportion of FS households (41.4%) owned more than ten chickens compared to NFS households (17.7%). These findings suggest the importance of livestock ownership especially cattle in assuring food security. Smallholder farmers who own livestock can sell to obtain cash for buying food or can exchange livestock with food, hence become food secure. Therefore, smallholder farmers in the study area should be advised to keep the reasonable amount of cattle and other small livestock such as chickens, sheep, goats, guinea fowls and ducks besides farming to ensure food security.

**Table 11: Distribution of HHs respondents (N=120) by livestock ownership,
number of the major livestock owned and food security status**

Variables	Food security status				Chi-square value
	Food secure (n= 58)		Non food secure (n= 62)		
	Number	Percent	Number	Percent	
Number of cattle owned					
0	29	50.0	49	79.0	13.089**
1 – 5	11	19.0	8	12.9	
6 – 10	8	13.8	3	4.8	
>10	10	17.2	2	3.3	
Number of goats owned					
0	33	56.9	42	67.7	6.132^{NS}
1 – 5	9	15.5	12	19.4	
6 – 10	9	15.5	7	11.3	
>10	7	12.1	1	1.6	
Number of chicken owned					
0	13	22.4	33	53.2	13.676**
1 – 5	11	19.0	10	16.2	
6 – 10	10	17.2	8	12.9	
>10	24	41.4	11	17.7	

NS = Non significant (P>0.05), ** = significant at P<0.01

(b) Off –farm activities

Off–farm activities are those activities besides farming which people engaged into to supplement for their income and food. They have influence on food security, as they are sometimes the direct source of food or sources of income for buying food. Furthermore, off–farm activities are very important sources of income for rural people as they help in getting money for buying non–food items, such as clothes as among the basic human needs. Therefore, HHs respondents were asked to indicate the extent to which they were engaged in off–farm activities. The particular off–farm activities engaged with by HHs respondents is shown in Table 12.

Table 12: Distribution of HHs respondents (N=120) by type of off–farm activities engaged with by food security status

Off–farm activities	Food security status				Chi-square value
	Food secure (n= 58)		Non food secure (n= 62)		
	Number	Percent	Number	Percent	
Small business/kiosk	34	58.6	6	9.7	18.933***
Local brewing	6	10.3	25	40.3	14.056***
Casual labour	18	31.0	46	74.2	22.427***
Charcoal/firewood selling	8	13.8	10	16.1	0.128 NS
Local midwife/healing	6	10.3	0	0.0	6.751**
Handicraft	7	12.1	7	11.3	0.018 NS

NS = Non significant P>0.05, ** = Significant at P<0.01, *** = Significant at   P<0.001

Data in Table 12 indicate that the major off–farm activities carried out mainly by FS households include small business (58.6%). Local brewing and casual labour was mainly noted to be engaged with by households of NFS (40.3%) and (74.2%), respectively. Chi–square test signifies that there is significant difference (P<0.001) between the FS households and NFS households on off–farm activities (small business, local brewing and selling labour). This suggests that despite involvement in off–farm activities by FS and NFS households, NFS households still experience food insecurity problems due to engagement in casual labour especially during farming season and probably using the food obtained for making local brew. Thus, increases

household food insecurity problem. Therefore, farmers should be given awareness on the importance of storing food for work during farming seasons in order to stop selling labour during farming season and to use that labour in their own farms to increase production. Also trainings should be provided to farmers on the alternative materials for local brewing as an off–farm activities rather than using the harvested food. Nevertheless, other off–farm activities such as charcoal and firewood business; increase environmental damage in the study area. Therefore, people should be provided with credit to engage in other alternative off–farm activities such as handicraft and small business rather than charcoal and firewood.

(c) Income generated from on–farm and off–farm activities

The HHs respondents were asked to estimate the amount of cash obtained by the household from crops, livestock and off–farm activities in two years time to obtain the average in twelve months (one year) as given in Table 13. The findings in Table 13 show that annual mean income obtained from crop selling were TAS 95 735 and TAS 38 895.97 for FS and NFS households, respectively. Furthermore, the mean annual income earned from livestock between the two groups was: TAS 96 915.52 and TAS 25 689.52 for FS and NFS households, respectively. The T–test statistics indicates the observed difference in mean income from selling livestock by the two groups to be significant (P<0.05). This implies that selling of live animals was usually done to supplement food and cash income in the households of respondents especially FS households.

Table 13: Mean income from the major different sources (N = 120)

Income in TAS	Mean		t-value
	Food secure	Non –food secure	
Income from crops	95 735.3	38 896.0	1.898[NS]
Income from livestock	96 915.5	25 689.5	2.230*
Income from off–farm activities	466 267.2	125 640.0	4.689**
Total Annual income	672 280.2	204 818.40	5.786**

NS =not significant (P>0.05), * =significant (P<0.05), ** = significant (P<0.01)

Moreover, the annual mean income from off–farm activities was found to be TAS 466 267.2 and 125 640 for FS and NFS households, correspondingly. The T-test statistics in Table 13 signify that the difference between FS and NFS households with respect to total annual income from off-farm activities to be significant (P<0.01). Income from off-farm activities was relatively high compared to other sources in FS and NFS households. This implies that off–farm activities were the main source of income in the study area. Moreover, results show that the average total income from different sources for the surveyed households was TAS 672 280.2 and TAS 204 818.4 for FS and NFS households, respectively. The Chi–square test signify that there is statistical significant different (P<0.01) between the group of households for total annual income. This observation suggests that FS households had relatively high purchasing power compared to NFS households. This could also contribute to food insecurity by NFS households. Therefore, households should be facilitated to diversify their income generating activities in the study area.

In addition, adjusted consumption expenditure of the households was used to compare means of income per adult equivalent per year between FS and NFS households. The findings in Fig. 5: show that about 70.0% of NFS households obtain less than TAS 50 000 income /AE/year compared to about 7.0% of FS households. Furthermore, about 40.0% of FS households obtain income /AE/year ranging from 50000 to 100 000 TAS per annum where as 21.0% of NFS households obtain income of that range.
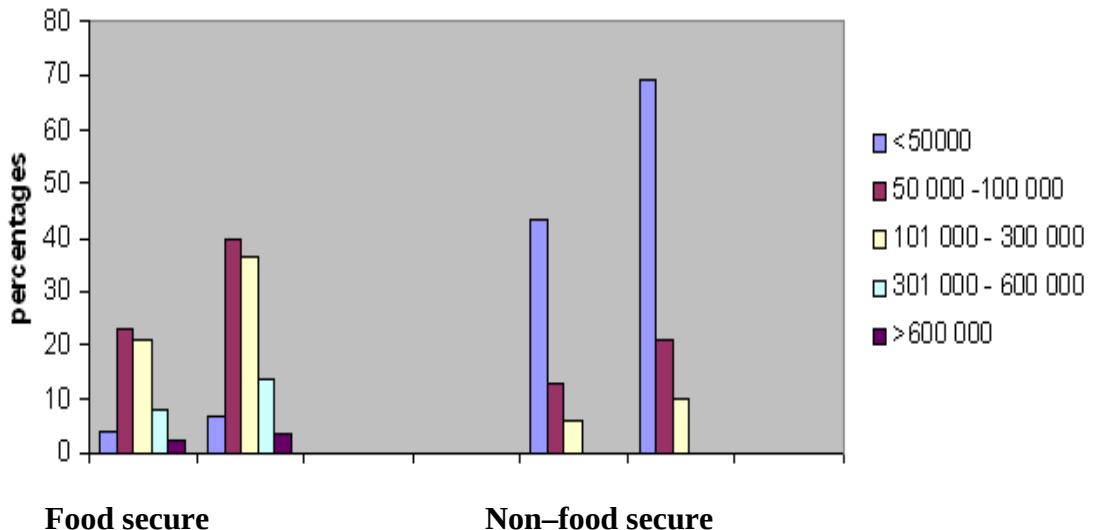
Figure 5: Distribution of respondents by annual income categories in TAS per adult equivalent by food security status

Additionally, none of the NFS households reported to obtain income/AE/year above TAS 600 000. Moreover, the mean income of FS households /AE/year was found to be TAS 187 135.4 with an average of TAS 512.70 per day while that of NFS households was TAS 5827.31 with an average of TAS 15.97 per day. T-test statistics revealed that there was statistical significant difference at $P<0.001$ between FS and NFS households concerning income per adult equivalent. The average total amount of income obtained by smallholder farmers was very low, below the basic needs of poverty line of TAS 259 per adult equivalent per day (NBS, 2002).

This implies that smallholder farmers in the study area have low income regardless of their food security status. The situation is worse in NFS households. Income distribution is associated with food insecurity in that low income hinders people's ability to purchase supplement food and other household necessities. Therefore, smallholder farmers' income should be improved by diversifying the income generating activities in the study area.

4.2.2 HHs respondents opinions related to food insecurity and coping strategies

This part deals with HHs respondents' perception and opinions on causes of food insecurity and coping strategies under two main sections: (i) HHs respondents opinions on food insecurity; (ii) HHs respondents opinions on coping strategies.

4.2.2.1 HHs respondents opinions on food insecurity

(a) Status of food insecurity

Food insecurity in the study area continues to be the major problem. Dietary energy consumption per adult equivalent was used as an indicator of food insecurity to identify food secure (FS) and non–food secure (NFS) households in the study area. This involved two main steps, as follows:

(i) First step: finding adult equivalent units (AEUs)

Calorie requirements by age and sex by Collier *et al* (1986) from Table 1 was added to obtain AEUs in each household as shown in Table 14.

AEUs $= 1.00(1) + 0.88(2) + 1.20(3) + 0.88(4) + 0.76(5) + 0.56(6) + 0.48(7) = 5.76$

Table 14: Example of household composition on calculating DEC/AE

Household members	Sex	Age	Calorie requirements	Individual No.
(a) Household head	Male	32	1.00	1
(b) Wife	Female	30	0.88	2
(c) Children:				
1	Male	15	1.00	3
2	Female	12	0.88	4
3	Female	9	0.76	5
4	Female	6	0.56	6
5	Female	3	0.48	7
Total	-	-		**7**

(ii) Second step: Adjusting the adult equivalent units (AAEUs) for economies of scale:

AAEUs are equal to the number of adult equivalent units (AEUs) times the average cost factor. From Table 2 the average cost factor corresponding to 5 AEU in Table 14 is 0.807. Therefore, for this household, AAEU = 5.76 x 0.807 = 4.65. Since the total annual income for the whole household is TAS 239 500 the total income per adult equivalent is 239 500 ÷ 4.65, which is equal to TAS 51 505.38. This procedure was done for each of the 120 households of the research to get various values per adult equivalent. The main response variable, dietary energy consumed (DEC), was calculated based on sorghum grain consumed because it is the main staple foodstuff in the research area. Moreover, it is a popular measure of dietary energy consumed, based on the fact that in Tanzania cereals supply 80% while other foods supply 20% of dietary energy (Seshamani, 1981).

By using only grains, DEC obtained had to be inflated by multiplying it by 100/80 to cater for energy from other foods. Tables for Proximate composition of foods commonly eaten in East Africa (West *et al.*, 1988) (Appendix 3) were used for the calculation. Appendix 3 shows that sorghum contains 335 kcal per 0.1 kg. Therefore, if the only grains eaten in a household for example were 0.6 kg of sorghum per adult equivalent per day, the following formula was used to calculate DEC: 335 kcal = 0.1kg, DEC = Kilograms of all grains eaten, which is 0.6 kg in this example.

Therefore, DEC would be [(335kcal x 0.6 kg)/0.1 kg] x 100/80, which is 2513 kcal per AE/day. According to NBS (2002), 2200 kcal per adult equivalent per day is the official minimum recommended dietary energy intake in Tanzania. Therefore, household members who consume less than 2200 kcal per adult equivalent per day were considered to be food insecure. The findings in Fig. 6: show that 48.3% households were FS while 51.7% households were NFS, respectively.
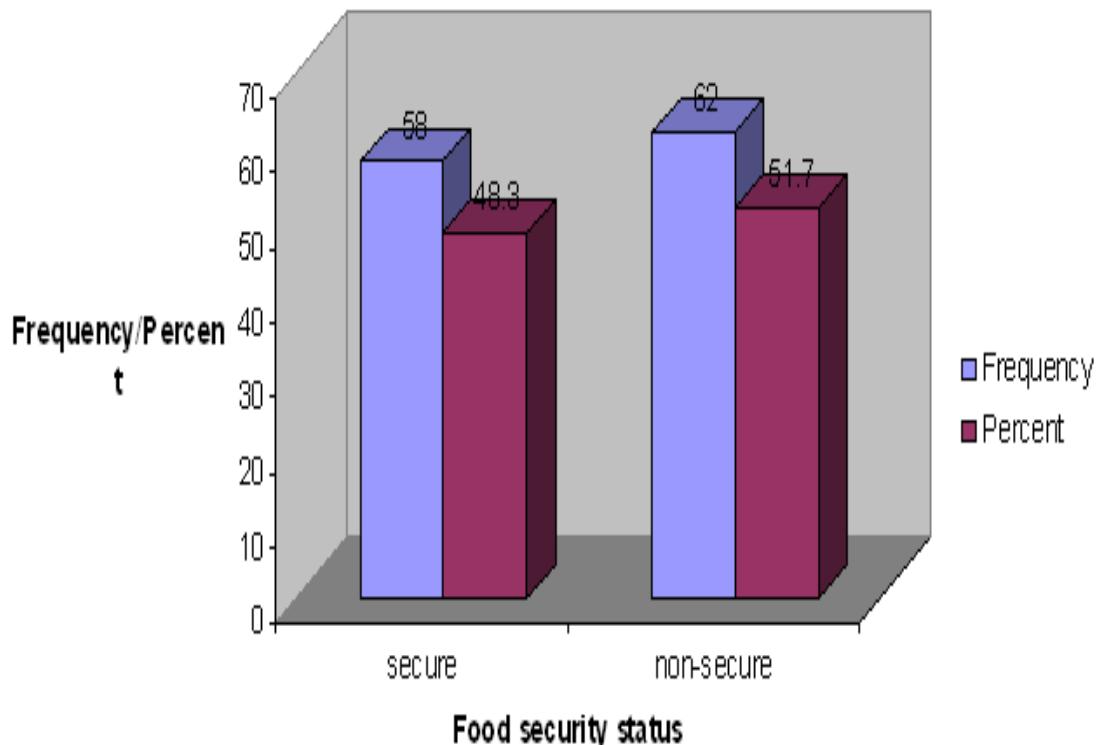
Figure 6: Distribution of respondents by food security status

Therefore, it is observed that the population of food insecure households outnumber food secure households. This depicts the seriousness of the problem. Thus an immediate action should be taken by all stakeholders to combat the problem of food insecurity in the study area. Since food insecurity is one of the bottlenecks to development.

A multiple linear regression analysis was also carried out to determine the factors that have significant influence on the dietary energy consumed per adult equivalent. The model included the variables that were predetermined to dependent variable (DEC/AE). Factors included sex of respondents, marital status of the respondents, age of respondents, education level of respondents in years, household size, size of land used for farming in hectares, total income per year and use of improved technology as shown in Table 15. The regression results given in Table 15 show some imperative

findings. In general the explanatory power of selected variables was reasonable as reflected by adjusted R^2 of 60.0%.

Table 15: Regression analysis: dependant = dietary energy consumed in the household per adult equivalent

Independent	β	S.E	t-value
Sex of respondents	23.05	208.20	0.11 NS
Marital status of respondents	-392.90	230.20	-1.71 NS
Age of respondents	5.67	6.51	0.87 NS
Education level of respondents in years	5.67	30.64	0.19 NS
Household size	-38.65	35.37	-1.09NS
Size of Land for farming	519.07	54.66	9.50***
Total income per year ('000)	0.47	0.18	2.64**
Improved technology use	924.75	190.43	4.90***

β = Regression coefficient S.E = Standard error, NS = Non-significant (P> 0.05), ** = Significant at P<0.01, *** = Significant at P<0.001, R^2 = 0.60

This implies that 60% of the variation in the dietary energy consumed per adult equivalent in a household was explained by the stated independent variables. The T–test for individual factors shows that sex of respondent has positive effect on the dietary energy consumed per adult equivalent. The sign of β_1 coefficient is positive supporting a priori expectation. However, the T–value for β_1 coefficient was not significant (P>0.05) implying that the sex of household head has no effect on dietary energy consumed in the household.

Moreover, the result shows that marital status of the household has no effect on the dietary energy consumed per adult equivalent. T–value shows that there is no significant effect of marital status on the dietary energy consumed per adult equivalent (P>0.05). A β_2 sign is not taken into consideration. Furthermore, age of respondents have positive effect on DEC/AE since the β_3 coefficient is positive. However, T–value shows that there is no significant (P>0.05) effect of age of the household head on the DEC/AE. Furthermore, the T–value indicates that education level of the household head in years has no significant (P>0.05) effect on the DEC/AE, though the β_4

coefficient is positive. The results (Table 15) further show that there is no effect of household's size on DEC/AE though the β_5 coefficient is negative this indicates that the higher the household size the lower the DEC/AE in the household. The T–value indicates that there is no significant effect of the household size on the DEC/AE.

Moreover, size of land used for farming has positive effect on the DEC/AE. β_6 coefficient reveals the positive sign and the T–value shows that there is highly significant ($P<0.001$) effect of land used for farming on DEC/AE. This implies increase of the size of land used for farming will increase the DEC/AE. Additionally, the results reveal that the total income raised per year have consequence in the dietary energy consumed per adult equivalent. The T–value shows that there is significant ($P<0.01$) effect of total annual income rise by household on dietary energy consumed per adult equivalent. Improved technology use was another independent variable which had a positive effect on the dietary energy consumed whereby T–value signify that there is significant ($P<0.001$) effect of improved technology use on DEC/AE. This implies that increased use of improved technology increases the DEC/AE.

The findings from regression analysis generally indicate that DEC/AE is influenced by size of land for farming, total income obtained per year and improved technology use. This implies that these factors contributed significantly to the extent to which households were food insecure in the study area. It is therefore recommended that there is a need for the extension system to focus on advising farmers on these factors in order to improve their food security status.

The study also sought to find out the number of meals taken by adults and children per day in the study area based on food security status and the findings are summarised in Table 16. Data in Table 16 show that 19.0% of adult members of FS households were

eating one meal per day where as 62.9% of adult members of NFS households were eating one meal per day. Eating three meals per day, which is the normal number of meals per day for adults, was reported by only 6.5% of NFS households compared to one quarter of FS households. This implies that NFS households can not afford to obtain supplement food during food insecurity due to low purchasing power for foods available in the market. The Chi-square test indicates that there is a statistical significant association (P>0.001) between FS households and NFS households based on number of meals eaten by adult members per day. This indicates high food insecurity existence in the study area. Therefore, immediate action should be taken by all stakeholders of food security to rescue the situation.

Table 16: Distribution of HHs respondents (N=120) by number of meals taken per day

Variables	Food security status				Chi-square value
	Food secure		Non food secure		
	Number	Percent	Number	Percent	
Meals eaten by adult members per day	(n=58)		(n=62)		
One meal	11	19.0	39	62.9	25.257***
Two meals	32	55.2	19	30.6	
Three meals	15	25.8	4	6.5	
Meals eaten by under – five children per day	(n= 46)		(n= 42)		
One meal	0	0.0	8	19.0	17.001***
Two meals	21	45.7	25	59.5	
Three meals	21	45.7	9	21.5	
Four meals	4	8.6	0	0.0	

*** = Significant at P<0.001

Moreover, for the households that had under–five year's children, the findings show that none of the under–five year's children in FS households eat one meal per day. In contrary none of the under–five years children in NFS households were reported to eat four meals per day (Table 16). Furthermore, the findings from the study reveals that neither of the under–five years children from FS nor NFS households reported to eat five and above number of meals per day. Eating five and above number of meals per

day is the normal number of meals for under–five children. This shows that under–five year's children were eating at the same time when adult members were eating. Thus implying that people in the study area are not familiar with how many number of meals should be taken by under–five year's children per day. Therefore, the study suggest that people should be informed on the importance of feeding the under five years children in the study area.

Furthermore, the Chi–square test signify that there is statistical significant association (P>0.001) between FS and NFS households based on number of meals eaten by under–five members per day. The possible explanation for why adult members ate meals the same as the under–five children is that many people cannot meet the expense of food to eat more than three meals per day due to what they produce being not enough to meet their requirements until the next season. However, FGDs reported that people like to eat maize but due to poor performance of maize in the area, they are used to eat sorghum and millet. Furthermore, FGDs revealed that those who have purchasing power use maize as their staple food. This connotes that poor performance of maize in the study area changed sorghum and millet to be the major staple food. But in real sense many people still like maize as the staple food and continue cultivating maize in their drought environment. This leads to food insecurity since maize is not a drought tolerant crop.

(b) HHs respondents' definition of food insecurity

HHs respondents were asked to define food insecure households in their area. It was found that the majority (89.5%) of the respondents stated that, food insecure household are the households with no enough food reserves for members, and whose members work for others as cheap labour to buy food or get something to eat. About 10.5% of HHs respondents gave their views that food insecure households are households whose

members eat few numbers of meals per day. This implies that food insecurity in the study area is understood in different perspectives or views.

However, according to FGD food insecure households were understood as households which have no food in the house and crops that bring hope at the field and can not buy adequate food to sustain their requirements at present and in the future; households which are busy searching for food all the time, you can determine them by observing their actions especially children; households which do not spend money in anything else rather than food; households whose members eat few meals per day or go without food per day; and households whose members migrate to other places for food or work to obtain cash for food. It was further noted that, the season/period of the year in which households mostly experience food insecurity problem was September to April and the most months of food shortage include December, January, February and March (FGDs). This is a critical period because it is during farming season where much energy and resources are required for work. It is therefore recommended that government or NGOs assistance related to food relief should be provided in September to April in the study area.

(c) Food insecurity trend

The HHs respondents were further asked to give their views and experience concerning the trend of food insecurity in the study area in the past, present and the possible future. Since food insecurity trend is important in understanding the history of food insecurity problem in the study area. The findings on food insecurity trend in the past, present and the possible future are given in Table 17.

Table 17: HHs respondents (N=120) opinions on food insecurity trend in study area in the past, present and possible future

Variables	Number	Percent
Food insecurity trend in the past (n=115)		
Trend was good due to low household food insecurity	103	89.6
Bad trend –high household food insecurity due to lack of transport infrastructure	4	3.3
Trend was bad due to lack of transport and food business	3	2.5
Trend was bad –high household food insecurity due to limited food availability	3	2.5
Trend was 3 years of rainfall –good low household food insecurity, 3 years of drought –bad due to high household food insecurity	1	0.8
In the past bad and good situation alternate	1	0.8
Food insecurity trend at the present (n=117)		
Bad due to high household food insecurity	109	90.8
Not very bad since with cash food is easily available	4	3.3
Not very bad since government and NGOs provide food support	2	1.7
Situation is good since many people involve off farm activities	2	1.7
Food insecurity trend in the possible future (n=116)		
Unpredictable	72	62.1
Situation can be good if it rains in good distribution	24	20.7
Can be bad with no rains	8	6.9
Can be bad if no action taken on environment conservation	6	5.2
Can be bad with high household food insecurity due to floods	4	3.4
Can be good if people practice good farming methods	2	1.7

The findings in Table 17 show that about 89.6% of the respondents answered that in the past food insecurity trend was good due to low household food insecurity, while the majority (90.8%) of respondents affirmed that the trend of food insecurity at the present was bad due to high household food insecurity and 62.1% responded that the future trend of food insecurity in the study area was unpredictable.

According to the FGD in the study area, food insecurity trend in the study area in the past years before *el nino* rainfall was worse because there was no transport access to the area, no any food business, no use of drought animals and the government and NGOs assistance was limited. It was noted that this situation has changed since food insecure groups could be identified and given food relief during the critical situation. However, the findings in Table 17 generally suggest that food security situation has

been worsening in the study area over the years, despite the government and non–government effort to improve the situation. Therefore, there is a need for identification of appropriate strategies for improving food security in the study area.

(d) Causes of food insecurity

HHs respondents' opinions were sought on their experience on food shortage. About 91.4% and 96.8% of FS and NFS households, respectively, reported to have experienced food shortage at least for the past three years. Respondents were further asked to give their opinions on the causes of household food insecurity and their responses are as shown in Table 18.

Table 18: HHs respondents (N=120) opinions on the causes of food insecurity

Causes	Number	Percent
Low crop production	106	88.3
Low income and purchasing power	68	56.7
Labour shortage	66	55.0
Inadequate knowledge on food storage	53	44.2
Inadequate extension services	50	41.3
Overselling the produce for income	30	25.0
Inappropriate use of food	12	10.0
Large number of dependants	11	9.2

The causes of food insecurity, which were mentioned by more than 50% of the respondents, were low production of food crops (88.3%), low income and purchasing power (56.7%) and shortage of labour (55.0%). Other causes of food insecurity in the study area including inadequate knowledge on food storage and inadequate extension services were mentioned by less than 50% of the respondents. Therefore, the study suggests that more emphasis should be set on advising farmers on how to improve crop production, increase income and utilisation of labour resource properly.

(e) Factors contributing to causes of food insecurity

HHs respondents were asked to give factors contributing to each of the causes of food insecurity given in Table 18. Low crop production was among the major factors reported by respondents to cause food insecurity in the study area. Major factors leading to low crop production as stated by HHs respondents include inadequate rainfall (92.5%) and limited use of improved technology (62.3%) as compared to other factors (Table 19). According to FGDs, inadequate rainfall in the study area is caused by environmental destruction, farming on water sources, clearing natural forest, climate change (low/excessive rains) and traditional beliefs (belief on supernatural power to stop rainfall). It was further noted during FGDs that limited use of improved technology is due to increased price of farm inputs and implements, unavailability of these inputs and implement, as well as lack technical know how. Generally, smallholder farmers are aware of the causes of food insecurity in their area. Therefore, they should be facilitated so as to access credit for improved farm inputs and implements to increase production and trained on the appropriate farming methods.

Table 19: Distribution of HHs respondents (N=120) by opinion on the factors
contributing to the major causes of food insecurity

Variable	Number	Percent
Factors contributing to low crop production (n=106)		
Inadequate rainfall	98	92.5
Limited use of improved technology	66	62.3
Reluctance to plant drought resistant crops	50	47.2
Field pest and diseases outbreak	32	30.2
Poor farming methods (*kuberega)*	27	25.5
Low soil fertility	21	19.8
Untimely planting	11	10.4
Excessive rainfall	4	3.8
Low income and purchasing power (n=68)		
Lack of permanent cash crops for income	36	52.9
Lack of permanent off -farm activities for income	35	51.5
Lack of good market for crops	25	36.8
Widower and old age	2	2.9
Labour shortage (n=66)		
Selling labour during farming season	36	54.5
High cost for hiring labour	32	48.5
Women heavy work load	26	39.4
Migration of youths and men for wage work	12	18.2
Inadequate extension services (n=50)		
Lack of extension agent in the village	35	70.0
Irresponsibility of extension agent	23	46.6
Only one extension agent in the village	20	40.0
Inadequate knowledge on food storage (n=53)		
Never attended any training or seminar on food storage	40	75.5
Lack of formal education	11	20.8
Lack of farmer training centre	13	24.5
Low education level	6	11.3
Overselling the produce for income (n=30)		
Inadequate production of cash crop	16	53.3
High demand of household items (village and school needs)	12	40.0
Inappropriate use of food (n=12)		
Use of food in ceremonies	6	50.0
Exchange of food with other items (*kanga*)	5	41.7
Use of food for making local brews	3	25.0
Large number of dependants (n=11)		
Orphans	6	54.5
Limited knowledge of family planning skills	4	36.4
Polygamy	3	27.3

It was also noted that the major factors contributing to low income and purchasing power was lack of permanent cash crops and lack of permanent off–farm activities in the study area as mentioned by 52.9% and 51.5% of HHs respondents, respectively. This entails that the food crops produced in the study area were also used for selling to obtain cash income to carter for other household needs, as a result the food become

inadequate for the household until next season. Therefore, it is recommended that permanent cash crops such as vineyard should be established and improved for cash income. Furthermore, farmers should be advised and facilitated by the government and NGOs to establish permanent and profitable off–farm activities for income generation in the study area.

Labour shortage was also mentioned as a constraint to the increased crop production and hence food insecurity. The findings from Table 19 reveal that labour shortage for farming activities by a household was attributed to selling labour for farming activities in other people's farms, high cost of hiring labour, women heavy work load and to some extent migration of youth and men for wage work. These were indicated by 54.5%, 48.5%, 39.4% and 18.2% of total respondents, respectively. Although labour selling contributes as the major off-farm activity for food/income especially during farming season where food shortage is more pronounced, it has a negative side of reducing labour force since many people in the study area depend on the family labour and usually the household head is the main actor on bread weaning and is the one who is taking part in doing casual labour.

The study further found that selling labour during farming season contributed to shortage of labour, which leads to household food insecurity in the study area. This connotes that people in the study area depend on the household manpower for crop production, which is inadequate to provide enough labour power for own food production and cash for food during farming season. In addition, during critical need for labour power men and youths normally move to other places for wage work or casual labour. This leads to high labour shortage in the household and heavy workload to women in the study area. Thus, there is a need for households to adopt the available

improved technologies to increase crop production. This implies that smallholder farmers are aware of the major factors contributing to low crop production which contribute significantly to food insecurity. It is recommended that extension system and other stakeholders should involve farmers in dealing with such factors in order to improve food security.

Generally, the study findings reveal that farmers are aware of various factors contributing to causes of food insecurity in the study area. The factors mentioned in Table 19 could be dealt with at different levels (household to national). It is therefore recommended that different stakeholders should play their roles in dealing with the identified factors in order to improve food security in the study area.

The HHs respondents were further asked to give steps they take to minimize causes of food insecurity as shown in Table 20. Data in Table 20 shows that the HHs respondents were aware of various steps that could be taken to address different causes of food insecurity identified in order to improve food security. It is recommended that the steps identified be incorporated in the government's programme on improvement of food security in the study area.

Table 20: Steps taken by HHs respondents (N=120) to minimize causes of food insecurity

Causes	Steps	Number	Percent
Low crop production (n=106)	Use traditional methods of pest & diseases control	59	55.7
	Planting drought, pest & diseases tolerant crops	48	45.3
	Timely planting	32	30.2
	Use of manure, improved seeds and ox-plough	29	27.4
	Practice tillage method of farming	15	14.2
Low income and purchasing power (n=68)	Increase engagement on off–farm activities	40	58.8
	Growing seasonal cash crops	21	30.9
	Sell crops during period of high demand at good price	10	14.7
Labour shortage (60)	Reduce time for labour selling during farming period	34	56.7
	Organize for group labour	20	33.3
	Hire labour	15	25.0
In adequate extension services (n=42)	Attend the village meetings	30	71.4
	Consult other farmers	16	38.1
	Learn through radios, leaflets and newsletters	5	11.9
Inadequate knowledge on food storage (n=53)	Learn from other farmers	35	66.0
	Attend village meetings	20	37.7
	Consult extension agent	12	22.6
Overselling the produce for income (n=22)	Selling labour	18	81.8
	Engage in off–farm activities	15	68.2
Inappropriate use of food (n=12)	Use alternative materials for brewing	6	50.0
	Reduce use of food in ceremonies	8	66.7
Large number of dependants (n=11)	Orient grownup children on farming activities	6	54.5
	Ask help from relatives and friends	5	45.5
	Increase production of both cash and food crops	3	27.3
	Attend training on family planning	1	9.1

4.2.2.2 HHs respondents opinions on food insecurity coping strategies

a) Types of coping strategies

Households employ various coping strategies in order to cope with food insecurity

problem. As it has been recognised earlier in this study that households experienced

food insecurity problem in the past three years and food insecurity dilemma continues

to be more prominent in the area. Therefore, households have established different

coping strategies to tackle the problem of food insecurity. Thus, respondents were

asked to point out the different coping strategies employed during food insecurity. The

findings are summarised in Table 21.

Table 21: Distribution of HHs respondents (N=120) on types of coping strategies to food insecurity

Types of Coping strategies	Number	Percent
Skipping meals	88	73.3
Selling labour power	79	65.8
Reduce quantity of consumption per meal/day	57	47.7
Get support from governments/NGOs	57	47.5
Eat inferior foods/famine foods (foods normally not eaten)	55	45.8
Reduce expenditure on non food needs	52	43.3
Borrowing food from friends or relatives	44	36.7
Selling livestock which could not have been sold under normal circumstances	44	36.7
Borrowing food/cash from merchants that have interest	39	32.5
Diet change	37	30.8
Get support from relatives and friends	28	23.3
Migrate for wage work	17	14.2
Selling household assets	11	9.2
Mortgage/rent household land	11	9.2
Sale household land	4	3.3

Data in Table 21 indicate that the major coping strategies employed by households

during food shortage include skipping meals (73.3%), which involve eating one or two

meals; followed by selling labour power (65.8%); reducing the quantity of meal

consumption per day (47.7%); and getting support from governments/NGOs (47.50%).

Although selling labour power was observed to be the commonest coping strategy on

food insecurity, but on the other hand, it is not an effective coping strategy since it

constraints production by labour shortage in the individual household's farm. Food

insecurity problem is amplified because many people who take part in providing

family labour work on other people's farms, especially during the period when labour

is required for own production. Furthermore, eating less than three and five meals for

adults and under–five children, respectively, leads to poor health status and general body weaknesses, hence, low production. It was concluded that although households employ different food insecurity coping strategies, such coping strategies are not sufficient to minimise food insecurity problem in the study area. Therefore, it is recommended that the government, NGOs and other stakeholders should play an important role to ensure that food is available in a sustainable way and that people (especially vulnerable) have access to it.

(b) How food insecurity coping strategies are carried out

HHs respondents' opinions were sought on how food insecurity coping strategies are carried out and their opinions are given in Table 22. It could be concluded from the data summarised in Table 22 that HHs respondents were aware of food insecurity coping strategies and how coping strategies are carried out. Therefore, it is recommended that the government, NGOs and other stakeholders should play their part in assisting farmers in establishment of programmes which will enable the availability and sustainability of food to eliminate food insecurity problem in the study area.

Table 22: Frequency distribution of HHs respondents (N=120) opinions on how coping strategies are carried out

Opinions on how coping strategies are carried out	Number	Percent
Borrowing food from friends or relatives (n=44)		
Borrow cash or food and repay without interest	40	90.9
Borrow cash or food with low interest	9	20.5
Selling household assets (n=11)		
Sell assets such as radio/bicycle at low price to buy food	8	72.7
Exchange assets such as radio with food	4	36.4
Get support from government and NGOs (n=57)		
Buy grain from government at low price (50/= per kg)	41	71.9
Get support from both government and NGOs	16	28.1
Get free support in terms of food from NGOs as target group	11	19.3
Selling labour power (n=79)		
Work in agreement for cash or food/kind	79	100.0
Get support from relatives (n=28)		
In terms of food or cash for food	19	67.9
Obtain remittances from children/parents	12	42.9
Diet change (n=37)		
Drink porridge only or with vegetables	25	67.6
Eat rice and other foods rather than (*ugali*)	15	40.5
Reduce quantity of consumption of food per meal per day (n=57)		
Reduce size of food (ugali) prepared per meal and eat little	57	100.0
Skipping meals (88)		
Eat one meal per day (lunch or dinner) only	57	64.8
Eat two meals instead of three meals per day	36	40.9
Going without food per day	22	25.0
Prepare porridge to children at lunch and eat dinner	5	4.2
Reduce expenditure on non –food needs (n=52)		
Stop buying any item and luxury food such as fish and rice	33	63.5
Reduce expenditure on alcohol and buy food	19	36.5
Eat inferior foods (foods normally not eaten) (n=55)		
Eat wild roots, fruits and vegetables (*zambarau, msaka, ubuyu*)	37	67.3
Grind '*ubuyu*' seeds and mix with flour to prepare *ugali*	26	47.3
Selling livestock which could not have been sold under normal circumstances (n=44)		
Sell livestock even with pregnancy/calves at low price for food	37	84.1
Sell drought animals (*maksai*) or exchange with food at low rate	12	27.3
Borrow grain or cash from merchants with high interest (n=39)		
Borrow cash or food with high interest (*songoreda*)	39	100.0
Mortgage/rented household land (n= 11)		
Mortgage/rented household land to obtain cash for food	11	100.0
Migrate for wage work (n=17)		
Migrate to other places for work to get food or cash (*kuhemea*)	17	100.0
Sell household land (n=4)		
Sell at low price to get cash for food	4	100.0

4.3 Extension agent respondents characteristics and their opinions on causes of food insecurity and coping strategies

Aspects related to village extension agents (VEAs) and their opinions were examined in order to find out causes of food insecurity and coping strategies in the study area. These aspects are presented in two main parts: (a) extension agents' personal characteristics; and (b) extension agents' opinions related to causes of food insecurity and coping strategies.

4.3.1 Extension agent respondents personal characteristics

Personal characteristics were those that were expected to influence extension agents' performance in extension activities at village level. Among the more important personal characteristics dealt with in this part are: sex, age, marital status, personal experience in working in the villages, and level of education. Both the two extension agents involved in the study were male with age of 51 and 58 years. They were married with seven and eight children, respectively. Therefore, it is observed that both of the extension agents' respondent in the study area have the family responsibility apart from extension work. Furthermore, the field experience of the two extension agents was 30 and 37 years, respectively. Examination of data on level of education and pre–service training revealed that all the respondents had secondary education and diploma in agriculture and only one had attended in–service training once in the last ten years. This suggests that there is a need for in–service training for improving extension agents' performance capacity in the study area. In–service training is also essential in view of managing farm technologies, the system operations and approaches and techniques used in extension.

4.3.2 Extension agent respondents opinions related to food insecurity and coping strategies

4.3.2.1 Extension agent respondents opinions on food insecurity

(a) Causes of food insecurity

Extension agents were asked whether households in their area have experienced food insecurity in the last three years. All of them reported that households have experienced food shortage in their area in the last three years. It was further stated by the respondents that food insecurity situation alternate in the study area. HHs respondents also reported this experience. Thus, food insecurity problem seems to have been persisted in the study area and farmers as well as extension agents are aware of the problem. Therefore, there should be a collaborative effort of farmers and extension agents as well as other stakeholders to work on food insecurity problem in the study area.

Furthermore, extension agent respondents revealed that the major causes of food insecurity in the study area include low crop production, labour shortage, inadequate knowledge on food storage, inappropriate use of food, large number of dependants and post harvest losses as shown in Table 23. HHs respondents also mentioned most of the causes identified by extension agent respondents in Table 23. Nevertheless, HHs respondents did not identify post harvest losses as one of the major causes of food insecurity mentioned by extension agent respondents. This entails that HHs respondents were not aware of some of the major causes of food insecurity in the study area. Therefore, it is suggested that awareness on the effects of post harvest losses and how to minimise them should be created to smallholder farmer households in the study area.

Table 23: Extension agent respondents (N=2) opinions on causes of food insecurity

Causes of food insecurity	Response
Low crop production	XX
Labour shortage	XX
Inadequate knowledge on food storage	XX
Overselling the produce for income	XX
Inappropriate use of food	XX
Large number of dependants	XX
Post harvest losses	XX
Low income and purchasing power	X
Inadequate extension services	X

X= Reported by one extension agent, XX= Reported by all extension agents

(b) Factors contributing to causes of food insecurity

The extension agents were further asked to give their opinions on which factors that contribute to persistent food insecurity in the study area. The factors mentioned by extension agents respondents to be associated with low production include field pest and diseases outbreak, poor farming methods (none tilling practices), migration of youths and men for casual labour, living behind women and children was the major problem leading to labour shortage and heavy work load to women hence low production in the study area. Low production was also associated with poor farming methods, use of poor technology such as local seeds, hand hoes and low use of fertilisers/manure. Improved technology is used at a limited extent whereby all of the extension agents reported that only a bout 10% use oxenisation and manure application, hence, results to food insecurity. Low production was also due to low acreage and inadequate rainfall due to environment destruction. Many people cut down trees even in water sources for charcoal, building and firewood as well as overstocking of livestock and farming in water sources. This is due to various factors mentioned by extension agent respondents in the study area to be associated with low production. Therefore, smallholder farmers should be supported by credit for inputs and implements to increase production.

Inadequate knowledge of food storage was associated with low understanding of farmers due to low education level or negligence. According to extension agent respondents, one extension agent provides services to at least 2581 households with farmers, rather than the normal 150 households with farmers per year. This makes it difficult to attend individual farmers hence, little knowledge to farmers. Factors mentioned by extension agent respondents to be associated with post harvest losses include: poor harvesting methods, which include physical loses during collection, transportation and during drying of crops; harvesting before the crop maturity; poor processing and storage methods. Other factors mentioned by extension agents were likewise mentioned by HHs respondents.

(c) The effects of food insecurity

Extension agent respondents were asked to mention the effects of food insecurity in the study area and the most affected groups by food insecurity problem. The aim was to understand the menace of food insecurity problem in order to draw the policy implications based on target groups. According to the respondents, the mostly affected group by food insecurity include old age, pregnant women, lactating mothers and children under five years. Since these groups require much attention on special diets according to their body requirements. The effects of food insecurity were given as: poor education, health problems such as malnutrition, low income and purchasing power, death (especially for children and old ages), out migration of people especially of youth and men, increased poverty, low production and family conflicts that leads to marriage breakdown and divorces. The FGDs and the key informants also provided the same opinions. Therefore, the government should establish the policy to reduce the effects of food insecurity in rural communities, which favours the vulnerable groups, particularly under-five year's children, pregnant women, old age and the disabled.

4.3.2.2 Extension agent respondents' opinions on food insecurity coping strategies

Extension agent respondents were asked to give their opinions on the most coping strategies employed by the households during food insecurity and their responses are given in Table 24. The data in Table 24 indicate that normally households reduce both the number of meals they eat per day and the meal sizes, and change the meal compositions. Some households eat one or two meals instead of the normal three meals per day, or they reduce meal sizes by about half or changing meal composition. For example, soft porridge or increased relish replaces main dishes (particularly hard porridge). In other cases, people switch to alternative crops. For instance, purchases of dry cassava where dry cassava is not normally consumed. Households mortgage assets to borrow food, in case of widespread shortage of food and other means to access food. Food borrowing increases in the area where trust is limited.

Table 24: Extension agent respondents' (N=2) perception and opinion on coping strategies

Type of coping strategy	How coping strategies carried out
Selling labour	In agreement to be paid in cash or kind. While selling labour, they fail to work on their fields at appropriate time. This leads to low production hence food insecurity.
Eating inferior foods	People eat wild fruits, roots and vegetables this helps at least to cope with food insecurity
Skipping meals	Eating one meal, two meals per day or going without is the common practice to cope with food insecurity.
Selling livestock	Normally selling livestock or exchange with are done at low price
Migration for wage work	Men and youths migrate for wage work
Engagement in off –farm activities	e.g Charcoal and firewood business increases at low price, local brew selling increases. Other farmers engage in small business to obtain income for food
Borrowing from friends and relatives	This is done without or with low interest at any time
Borrowing from merchants	This is done at a higher interest rate, repay twice or more times the amount borrowed. It is locally known as "*Songoreda*"
Migrate for wage work	Some people migrate for wage work especially men and youth in other area –*miraba*. This leads to inadequate labour and women heavy workload.

Therefore, food borrowers are compelled to mortgage some of their assets. The most common assets include: radios, mattresses and bicycles. Borrowing from merchants is done at very high interest rate. For example, borrow one tin of grain during food insecurity and repay four to six tins during harvest season.

Although households employ different coping strategies to cope with food insecurity problem in the study area, the coping strategies employed by the households during food shortages are not sufficient to solve their problems effectively. Since other coping strategies increase household food insecurity. For instance, selling draught animals at low prices, selling labour during farming season and borrowing food or cash from merchants at high interest rate causes households to use all the resources available in order to obtain food at that particular time. Therefore, it is recommended that households should be provided with the mechanisms/programmes, which could help to assure sustainability of food in the study area. Extension agent respondents further stated that they normally advise farmers on how to cope with food insecurity situation particularly on: de–stocking of livestock during the period of good price to purchase enough food; proper use of food obtained; proper storage; harvesting and processing of food to minimise post harvest loses; and how to establish other income generating activities for purchasing food and other household needs. Generally, there should be collaborative efforts for extension agents, farmers and all other stakeholders to establish appropriate mechanisms to fight out food insecurity problem in the study area.

Extension agents were also asked to point out the challenges they face on working with farmers on food insecurity coping strategies. The major challenges identified include large working area and lack of working tools/facilities such as transport and training materials. The extension agent respondents further stated that they meet the challenges through:

farmers' group discussion; establishment of sub–village agricultural communities to monitor agricultural activities; village meetings; demonstration plots; and farm/home visits. In general, it is recommended that extension agents' working environment should be improved and they should be facilitated by different stakeholders to enable the smooth provision of extension services to farmers. The following Chapter gives conclusions and the policy implications based on the major findings of the study.

4.4 Summary

The overall objective of this study was to assess the causes of food insecurity and coping strategies of smallholder farmers in Chamwino district. The findings show that about half of the households in the study area were food insecure and there was no significant different between FS households and NFS households based on the background variables such as sex, age, marital status, level of education and household size. The causes of food insecurity identified by the study include inappropriate use of available food; poor storage methods and facilities; small farm size; low income and use of poor technology. The major coping strategies in the study area were found to be skipping meals and selling labour and these were not sufficient to minimise food insecurity problem but rather increase it. The following Chapter gives conclusions and the policy implications based on the major findings of the study.

CHAPTER FIVE

5.0 CONCLUSION AND POLICY IMPLICATIONS

5.1 Overview

Based on the study findings, a number of lessons regarding causes of food insecurity and coping strategies in Chamwino district were drawn. These lessons are important because of their implications for the improvement of food security in the study area. In this Chapter, as conclusions of the study are presented, their related recommendations are also discussed. This integrated approach is based on the relationships among conclusions and policy implications, as follows: (a) causes of food insecurity; (b) household food insecurity coping strategies; and (c) suggestions for further research.

(a) Causes of food insecurity

FS and NFS households had relatively similar household size of 5.9 and 5.5 respectively, which was higher than the average 4.2 of Dodoma Rural district including Chamwino district. It can be concluded that despite the fact that households depend on family labour in the study area, still their food production is very low due to

use of poor technology such as hand hoes as well as inadequate rainfall. It is therefore advisable that there is a need for extension agents to advise farmers on the use of available appropriate technologies for food production in the study area and growing of drought resistant crops such as sorghum, millet and cassava to ensure enough food for household consumption throughout the year.

It was noted that inappropriate uses of food such as using food for local brewing, ceremonies and selling food for income as well as poor storage methods and facilities lead to food insecurity. It could be concluded that improper use of the available food; and poor storage methods and facilities contribute to household food insecurity in the study area. Therefore, it is advisable that awareness on proper use of food and good storage methods such as an establishment of food banks (*benki mazao)* to be used during farming season should be given to smallholder farmers in the study area.

It was observed that about half of the households in the study area were food insecure based on the DEC/AE/day. The factors identified to have significant influence on DEC/AE/day as revealed by linear regression model include size of land used for farming, total income earned in the household per year and improved technology use. It can be concluded that food insecurity becomes a serious development problem in households with small farm size, low income and use of poor technology in the study area. Therefore, it is advisable that the government, NGOs and other stakeholders should put more emphasis on smallholder farmers' agricultural production through advising farmers on appropriate farm size, planning and implementation of diversified income generating activities and appropriate technologies.

(b) Household food insecurity coping strategies

It was found that households employ various food insecurity coping strategies. The major types of food insecurity coping strategies employed include skipping meals and selling labour. Skipping meals such as eating one meal per day or going without food leads to general body weaknesses and malnutrition hence reduces the production capacity of an individual. Additionally selling labour for income or kind during farming season results to inadequate labour for own food production. It can be concluded that despite the food insecurity coping strategies employed by households, food insecurity situation still becomes a serious problem since the coping strategies employed by households are not sufficient to minimise food insecurity problem, but increases food insecurity problem in the study area. Therefore, it is advisable that the government, NGOs and other stakeholders should play an important role to ensure that food is available in a sustainable way and that people (especially vulnerable) have access to it.

(c) Suggestions for further research

This study has assessed the causes of food insecurity and coping strategies of smallholder farmers in selected rural communities in Chamwino district, Dodoma region. The specific objectives of the study were to: identify and examine the causes of food insecurity in household of smallholder farmers; identify and examine various coping strategies employed by smallholder farmers in situation of food insecurity; and suggest possible ways that would be used to reduce food insecurity in household of smallholder farmers. These objectives have been achieved. However, this study has not exhausted all aspects related to food insecurity in Tanzania. This is due to the fact that causes of food insecurity and coping strategies of smallholder farmers may differ and vary geographically. Therefore, the study suggests the following areas for further research:

(i) There is a need for similar research on causes of food insecurity and coping strategies in other parts of the country based on gender to ascertain the extent to which the findings of this study are applicable in other areas.

(ii) There is a need to carry out studies on the socio-economic impact of household food insecurity to the community.

(iii) There is a need on assessment of the role of indigenous, traditional and appropriate storage methods and practices on food security.

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APPENDICES

Appendix 1: Tanzania administrative map
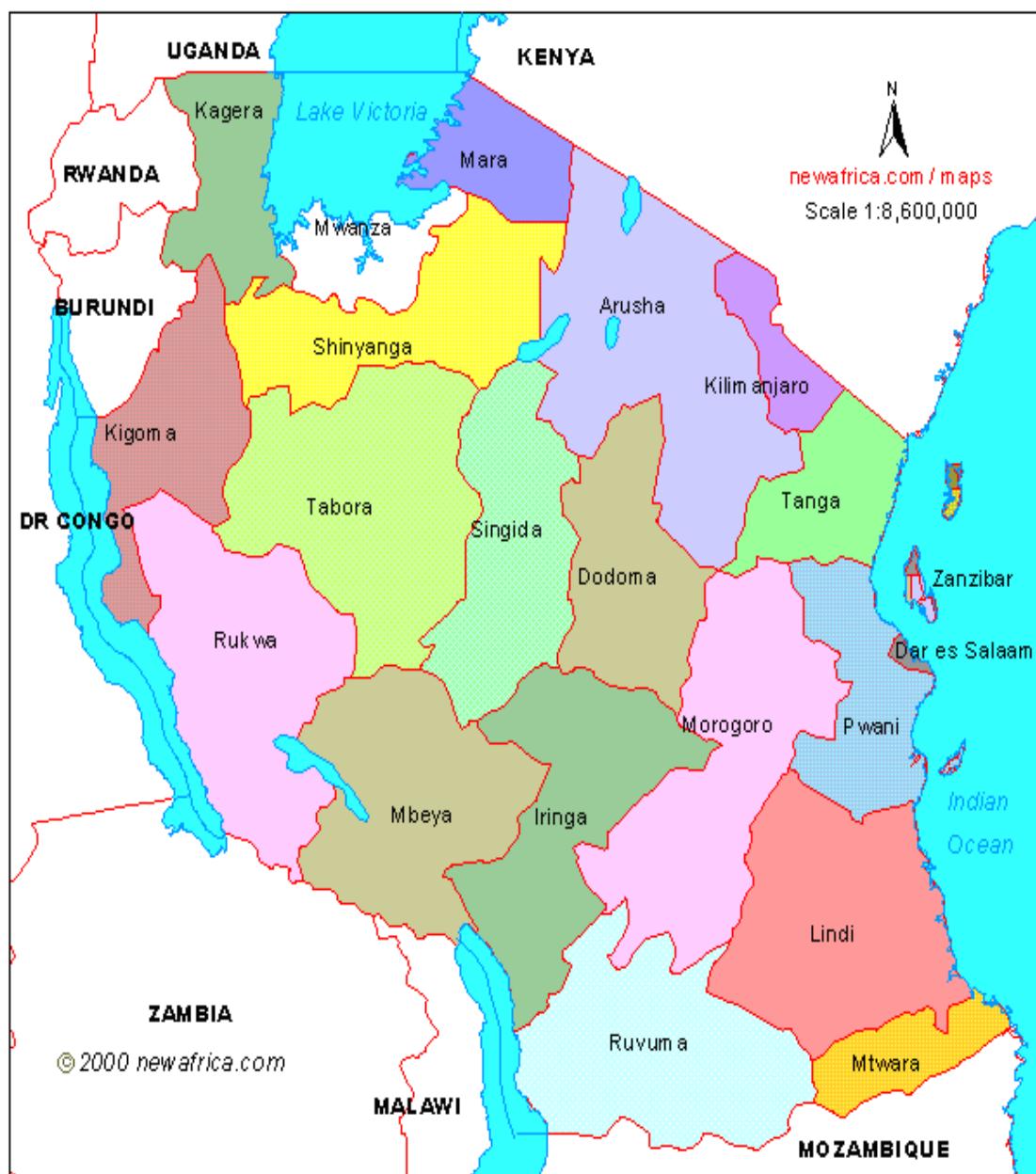
Appendix 2: Definition of the key variables

Variables	Operational Definition
Age	Number of years of the household head
Sex	Biological determination of male or female
Marital status	Married or not
Household	People who live together and sleeping under the same roof
Household size	Number of people in the household
Household head	The person who is responsible for making day–to–day decisions regarding activities of the household
Income	Money earned per month
Education	The highest level of formal education attained
Technology	Technology used in agriculture production by respondents
Food storage knowledge	Food storage method used by the household
Land	Acreage under cultivation
Food production	Amount of food crops products harvested per year
Food Security	Daily Recommended intake of diets per adult equivalent for health life.
Food insecurity	Failure to meet Dietary Energy Consumed Per Adult Equivalent
Inferior foods	Foods not normally consumed
Smallholder farmers	Are those who own or rent a small piece of land for farming
Adjusted Adult Equivalent Unit (AAEU)	The number of household (HH) members adjusted for composition (by sex and age) and nutrient requirements so that all the members are equivalent to adults. The number is normally smaller than the HH size and even smaller in HHs with more children and the old since they need less nutrients.
Coping strategies	Strategies that communities adopt when faced with food insecurity

Appendix 3: Proximate composition of foods commonly eaten in East Africa (per 100 grams edible portion)

							fat						Carbohydrates					
		Waste	Moisture	kj	kcal	Protein	total	SFA	MUFA	PUFA	Lin	Chol	total	mono	poly	fibre	Alcohol	Ash
		g	%			g	g	g	g	g	g	mg	g	g	g	g	g	g
	Cereals & grain products																	
1	Maize, yellow, immature on cob, fresh	30	58	695	165	5	2.1	0	1	1	1	0	34	2	32	0.8	0	0.7
2	Maize, white, whole kernel, dried	0	12	1445	345	9.4	4.2	0	2	2	1.8	0	72	5	67	1.9	0	1.2
3	Maize, Maize, yellow, whole kernel, dried		10	1480	355	10	4.8	0	2.3	2.3	1.8	0	72	5	67	2	0	1.2
4	Maize, white, on cob, toasted		7	1525	365	8	4.8	0	2.3	2.3	2	0	77	5	72	1.9	0	1.2
5	Maize, white, flour, 60 - 80% extraction	0	12	1395	335	8	1	0	0.5	0.5	0.4	0	77	3	74	0.6	0	
6	Maize, yellow, meal (unga wa mahindi)	0	12	1430	340	9.3	3.8	0	1.8	1.8	1.6	0	72	5	67	1.9	0	1.3
7	Maize, white, meal (dona)	0	12	1435	345	10	4.5	0	2.1	2.1	1.9	0	70	-	-	1.9	0	1.3
8	Millet, finger, whole grain	7	11	1320	315	7.4	1.3	-	-	-	-	0	73	-	-	4.3	0	2.7
9	Millet, finger, flour	0	13	1320	320	5.6	1.4	-	-	-	-	0	74	-	-	2.6	0	3.4
10	Millet, bullrush, whole grain	0	12	1420	340	10	4	0.9	1	1.9	1.7	0	70	-	-	1.9	0	2
11	Millet, bullrush, flour	0	16	1395	335	5.9	3.5	-	-	-	-	0	71	-	-	0.6	0	3
12	Rice, lightly milled, parboiled	0	12	1390	335	7	0.5	-	-	-	0	0	80	0	80	0.4	0	0.6
13	Rice, milled, polished	0	12	1395	335	7	0.5	0	0	0	0	0	80	0	80	0.4	0	0.6

No.	Item																	
14	Sorghum, whole grain	5	10	1435	345	11	3.2	980	0	1.5	1.5	1	0	72	4	68	2.4	0	1.9
15	Sorghum, flour	0	11	1410	335	9.5	2.8		-	-	-	-	-	73	0	73	2.1	0	1.4
16	Wheat, whole, parboiled	0	12	1380	330	12	1.8		0.3	0.2	0.9	0.9	0	71	2	69	22	0	1.4
17	Wheat, flour, 85% extraction	0	12	1425	340	11	2		0.3	0.2	0.9	0.9	0	74	2	72	0.8	0	0.9

Source: West *et al*., (1988)

Appendix 4: Household heads questionnaire

Confidential
Questionnaire: Personal Interviews
Study Topic: Causes Of Food Insecurity And Coping Strategies In Tanzania: A Case Of Smallholder Farmers in Chamwino District

Household Identification
Region……………District………………… Division…………………………….
Ward……………..Village………………No. of respondent………Date…..………

1.0   Household Characteristics
Household characteristics will deal with personal and situational characteristics.

1.1   Personal characteristics
1.1.1   Sex: 1. Male……………   2. Female………………………………….
1.1.2   Marital status
        1. Single;   2. Married;   3. Divorced;   4. Widowed;   5. Separated
1.1.3   Age…………………….   (Years)
1.1.4   Level of education

Education	Final level obtained
None	
Adult literacy	
Primary	
Post -primary	
Others (specify)	

1.1.5   What is the total number of your household members?

Age (years)	Sex	
	1. Male	2. Female
1.		
2		
3.		
4.		
5.		

1.2   Situational Characteristics
1.2.1   Does your household own any farmland?
        1. Yes………………..   2. No ……………………
1.2.2   If yes in question 1.2.1 above, how many lands do you
        own?……………………acre/ha.
1.2.3   How much land is used for farming activities?   …………………..Acre/ha
1.2.4   How was land of your holding acquired?
        1. By inheritance   2. Bought   3. Village offers   4. Lease;
        5. Clear natural forest   6. Reverting fallow
        7. Others (specify)……………………………………………
1.2.5   Who owns and control the land?   1. father   2. mother   3.   both
        4. all members of the family   5. others (specify)……………………….

1.2.6   Do you have any livestock?
        1. Yes……………….   2. No……………………

1.2.7 If yes in question1.2.6 above, what types of livestock do you have?

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

1.2.8 Do you engage in any off –firm activities?
   1. Yes……………….   2. No…………………………….

1.2.9 If yes in question1.2.8 above, indicate the type of off–farm activity you engaged with

Type of off–farm activity	yes	no
Small business/kiosk		
Local brewing		
Casual labour		
Charcoal and firewood selling		
Local midwife/traditional healing		
Livestock selling and crop middle man		
Handicraft		
Others (specify)		

1.2.10 Indicate income from the following farm and off-farm activities for the last two years

Enterprise	2004			2005		
	Quantity sold	Price/unit	Amount	Quantity sold	Price/unit	Amount
Crop sales						
Maize						
Millet						
Sorghum						
Groundnuts						
Sunflower						
bambara nuts						
Cowpeas						
Pigeon peas						
Grapes						
simsim						
Livestock sale						
Cattle						
Sheep						
Pigs						
Chicken						
Guinea fowl						
Off–farm activities						
Small business/kiosk						
Charcoal/firewood						
Local brew sales						
Charcoal & firewood sales						
Local midwife/traditional						
Handicraft						
Honey sales						
Remittance						
Others (specify)						

1.2.11 What is your source of food supply?

Source and type of food	Quantity (in kg, bags, tins)

Own production in normal years	
1	
2	
3	
Purchased	
1	
2	
3	

1.2.12   If own production, how much food crops did your household harvest in 2005/06?

Crop	Quantity harvested in kg
Maize	
Sorghum	
Millet	
Cassava	
Others (specify)	

1.2.13   Was the amount harvested enough to feed your family until the next season?
          1. Yes………   2. No………………
1.2.14   What are the sources of labour for production of food?
          1.   Family labour 2. Hired labour 3. Group labour 4. Others (specify………
1.2.15   Do you use any improved technology in food production?
          1. Yes……..   2. No……
1.2.16   if yes which technology?...
1.2. 17 if no Why?..
1.2.18 Do you store any of your foods?
          1.   Yes…………..   2.   No……………………
1.2.19 If yes in question 1.2.18 above, what is your means of food storage?
          1. "Vihenge" ….. 2. Silos. ……3. Sacks. ……… 4. Others (specify)……….
1.2.20   If no in question 1.2.19 above why?...
1.2.21 Does the amount of food stored last until next season? 1. Yes……2. No…….
1.2.22 Do you add something to the foodstuffs during storage?
          1. Yes…………………….   2. No…………………………………

1.2.23 If yes in question 1.2.21 above, what do you add to your food staff and   why?

Type of food	What added?
1	
2	
3	

1.2.24 if no in question 1.2.21 above, why?………………………………
1.2.25 Do you encounter any problem during food storage?
          1.   Yes………………   2.   No………………….
1.2.26 If yes in question 1.2.24 above, please list the problems encountered during
          storage……………………………………………………………………………
1.2.27 What are the major uses of food grains produced in your household?
          1. Food   2. Ceremonies   3. Selling for income.
          4. Others (specify)…………………………………………………………….
1.2.28 Do you have any knowledge/training on food storage?
          1.   Yes………………..   2.   No……………………..

2.0 Causes of Food Insecurity

The second section will enquire about your knowledge on the causes and opinion of Food insecurity

Food Insecurity indicators

2.1 How many meals do adult members of your household eat per day?
…………………………………………………………………….

2.2 How many meals do under five children of your household eat per day?
……………………………………………………………………

2.2 Amount of food staffs consumed per month

Foodstuffs	During food shortage in kgs	During food availability in kgs	Average in kgs
sorghum			
millet			
maize			
cassava			
sweet potatoes			
beans			
cowpeas			
groundnuts			
Rice			
others (specify)			

2.4 How do you define food insecure households in your area?…………………

2.5 Have you ever experienced food shortage in your household at least the past three years?
1. Yes ……………... ……… 2.No ……………………………..

2.6 If yes in question 2.6 above, what were the causes of food shortage? Indicate Yes/No as follows:

Type of Cause	Yes	No
Low food crop production		
Low income and purchasing power		
Labour shortage		
Inadequate extension services		
Inadequate knowledge on food storage		
Overselling of the produce for income		
Inappropriate use of food		
Large number of dependants		
Others specify		

2.7 If yes in question 2.7 above, give factors contributing to each of the cause you are aware of:

Type of cause	Contributing factors
Low food crop production	
Low income and purchasing power	
Labour shortage	
Inadequate extension services	
Inadequate knowledge on food storage	
Overselling of the produce for income	
Inappropriate use of food	
Large number of dependants	
Others specify	

2.8 What steps do you take to minimize causes of food insecurity given in question 2.3 above?

Type of cause	Steps
Low food crop production	
Low income and purchasing power	
Labour shortage	
Inadequate extension services	
Inadequate knowledge on food storage	
Overselling of the produce for income	
Inappropriate use of food	
Large number of dependants	
Others specify	

2.9 What is the trend of food insecurity in your area?
Past……………………..present ……………………… Future ………………..

3.0 Coping Strategies during Food Shortage
The third section will enquire about your knowledge on the coping strategies you employ during food shortage
3.1 What are the coping strategies you employ during food shortages?
Indicate yes/no as follows:

Type of coping strategy	Yes	No
Borrowing from relatives and friends		
Selling assets and buy food		
Get support from the government and NGOs (Receive relief)		
Selling labour power		
Get support from relatives		
Diet change		
Reduce quantity of consumption per meal per day		
Skipping meals		
Reduce expenditure on non food needs		
Eat inferior foods/famine foods (foods normally not eaten)		
Selling livestock which could not have been sold under normal circumstances		
Borrowing grain or cash from merchants that had interest		
Mortaged/Rented household land		
Migrate for wage work		
Sold household land		
Others (specify)		

3.2. Explain how strategies you employ in question 3.1 above are carried out

Type of coping strategy	How carried out
Borrowing from relatives and friends	

Selling assets and buy food	
Get support from the government and NGOs (Receive relief)	
Selling labour power	
Get support from relatives	
Skipping meals	
Reduce quantity of food consumption per day	
Diet change	
Reduce expenditure on non food needs	
Reduce quantity of meals per day	
Eat inferior foods/famine foods (foods normally not eaten)	
Selling livestock which could not have been sold under normal circumstances	
Borrowing grain or cash from merchants that had interest	
Mortaged/Rented household land	
Migrate for wage work	
Sold household land	
Others (specify)	

THANK YOU FOR YOUR COOPERATION

Appendix 5: Extension agents' questionnaire

Confidential

Questionnaire: Personal Interviews

Study Topic: Causes of Food Insecurity and   Coping Strategies in Tanzania: A Case of Smallholder Farmers in Chamwino District.

Region …………………… District ………………Division… ……………………
Ward……………Village………….No. of respondent………… Date ….………

1.0 Extension Agents Characteristics

1.1   Personal Characteristics

1.2   Sex: 1. Male   2. Female…………………………….
1.3   Age………………………(years)
1.4   Marital status
         1. Single………………..   2. Married………………………………….
1.5   Do you have any children? Yes/No.
1.6   If yes in question 1.5 above, indicate number……………………………….

1.7   Level of formal education: (V) Final level and year obtained

Formal education	Tick (V)	Year
Std VII/VIII		
Form IV		
Form VI		
Others (specify)		

1.8   Professional training: complete as follows:

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

1.9   In –service training: Complete as follows:

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

3.0   Causes of Food Insecurity
3.1   Have households experienced food insecurity situation in your area?
        1.   Yes. ……………..   2.   No. ……………………
3.2   If yes in question 2.1 above, what were the causes of food insecurity? Indicate
        Yes/No as follows:

Type of Cause	Response	
	Yes	No
Low food crop production		
Low income and purchasing power		
Labour shortage		
Inadequate extension services		
Inadequate knowledge on food storage		

Overselling of the produce for income		
Inappropriate use of food		
Large number of dependants		
Others specify		

3.3 If yes in question 3.2 above, give factors contributing to each of the cause you are aware of:

Type of cause	Contributing factors
Low food crop production	
Low income and purchasing power	
Labour shortage	
Inadequate extension services	
Inadequate knowledge on food storage	
Overselling of the produce for income	
Inappropriate use of food	
Large number of dependants	
Others specify	

3.4   Who are mostly affected by food insecurity situation in your area?

………………………………………………………………….

3.5   What are the effects of food insecurity situation in your area?

………………………………………………………………….

4.0   Coping Strategies during Food Shortage

The third section will enquire about your knowledge on the coping strategies employed by farmers during food shortage

4.1   What are the coping strategies you employ during food shortages? Indicate yes/no as follows:

Type of coping strategy	Yes	No
Borrowing from relatives and friends		
Selling assets and buy food		
Get support from the government and NGOs (Receive relief)		
Selling labour power		
Get support from relatives		
Diet change		
Reduce quantity of consumption per meal per day		
Skipping meals		
Reduce expenditure on non food needs		
Eat inferior foods/famine foods (foods normally not eaten)		
Selling livestock which could not have been sold under normal circumstances		
Borrowing grain or cash from merchants that had interest		
Mortgaged/Rented household land		
Migrate for wage work		
Sold household land		
Others (specify)		

4.2 Explain how strategies you employ in question 4.1 above are carried out

Type of coping strategy	How carried out
Borrowing from relatives and friends	
Selling assets and buy food	
Get support from the government and NGOs (Receive relief)	
Selling labour power	
Get support from relatives	
Skipping meals	
Reduce quantity of food consumption per day	
Diet change	
Reduce expenditure on non food needs	
Reduce quantity of meals per day	
Eat inferior foods/famine foods (foods normally not eaten)	
Selling livestock which could not have been sold under normal circumstances	
Borrowing grain or cash from merchants that had interest	
Mortgaged/Rented household land	
Migrate for wage work	
Sold household land	
Others (specify)	

4.3   Do the coping strategies employed by the households during food shortages efficient to solve their problems effectively?
1.   Yes………………..   2.   No………….

4.4   If no in question 4.3, what advices do you normally give to farmers during food shortages to cope with the situation?
 …………………………………………………………………...

4.5   What challenges do you face during your extension services to household?……………………………………………………………

4.6   How do you meet the challenges you mention above to improve the situation?
…………………………………………………………………

THANK YOU FOR YOUR COOPERATION

Appendix 6: Checklist for key informants

Village…………………….Ward………………………Division……………………

District…………….,…….Date……………………Checklist no…………………

1.   What is your designation?…………………………………………………

2.   Have you experienced food insecurity problem in your village?

3.   Can you give the general idea on the causes of food insecurity problem in your

        area?

4.   What do you think are the reasons for the causes of food insecurity?

5.   What is the trend of food insecurity problem in your area? i.e past, present and the

        possible future?

6.   What strategies used in the village to cope with the problem?

7   Who owns and control resources in household in your village?

8.   What technology are mostly used by people on food production and why?

9.   What are your comments on the coping strategies employed by the household

        during food shortages?

10.   What advice do you suggest to solve the problem of household food

        insecurity among the smallholder farmers?

THANK YOU FOR YOUR COOPERATION