COPING STRATEGIES AND HOUSEHOLD RESILIENCE TO FOOD INSECURITY IN CHAMWINO AND MANYONI DISTRICTS, TANZANIA

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A THESIS SUBMITTED IN FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY OF SOKOINE UNIVERSITY OF AGRICULTURE. MOROGORO, TANZANIA.

2016

ABSTRACT

Tanzania's agricultural system is rain-dependent and highly susceptible to climatic shocks, particularly in the semi-arid areas of Central Tanzania. Despite the government's efforts to improve agricultural production, food insecurity has persisted. Thus, this study investigated coping strategies and household resilience to food insecurity in Chamwino and Manyoni districts in Tanzania. The objectives were to determine the perception of farmers on the extent of food insecurity, to analyze socio-economic factors that determine households' food insecurity status, to examine the major food insecurity coping strategies employed by households in ensuring food security and analyze the factors that determine households' resilience to food insecurity in the study area. Data were collected from 200 household heads and selected key informants from five villages in Chamwino and Manyoni districts using interview schedule, researcher's diary and a checklist. Quantitative data were mainly analyzed by descriptive statistics while qualitative data were summarized along the main study questions. The empirical analysis highlighted the critical role of socio-economic characteristics in households' food insecurity, especially that households who owned livestock and cell phones were less food insecure than other households. On the other hand, the major types of food insecurity coping strategies employed included food aid, crop diversification, seasonal migration, casual labour, and off-farm activities. However, the coping strategies were not sufficient to minimize food insecurity problem in the study area. The descriptive analyses confirmed the validity of the selected components which were used to measure relative household resilience to food insecurity. It was thus recommended that government's interventions in reducing food insecurity in the study area should be based on various food insecurity related research outputs. Similarly, considering the diversity of coping strategies employed in the study area, local government should use broad based food insecurity intervention programmes to support beneficial coping strategies that support resilience. Communities at household

level should make efforts to actively support components that protect and buffer the natural resilience of households.

DECLARATION

I, **Elmerinda Faustine,** do hereby declare to the Senate of Sokoine University of Agriculture that this thesis is my own original work done within the period of registration and that it has neither been submitted nor being concurrently submitted for a degree award in any other institution.

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(Supervisor)

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ACKNOWLEDGEMENTS

I wish to extend my sincere thanks to the Volkswagen Foundation and to CETRAD (Centre for Training and Integrated Research in Arid and Semi-arid Lands Development) Nanyuki Kenya Programme for awarding me financial sponsorship to pursue PhD Degree in Agricultural Education and Extension at Sokoine University of Agriculture. This study was conducted within the framework of research funded by the Volkswagen foundation (grant 1/83 732) "semi-arid in transition: Livelihood security, socio-ecological variability and the role of development interventions in East Africa"

I am also deeply grateful to Professor Z. S. K. Mvena of the Department of Agricultural Education and Extension, Sokoine University of Agriculture for his tireless supervisory work which was expended in the development and final production of this thesis. I also benefited tremendously from the advice offered by Prof. Chinwe Ifejika Speranza of the Centre for Development and Environment (CDE) of the University of Bern and Dr. Boniface Kiteme of CETRAD, for his constant tireless supervision and heartfelt encouragement during the whole period of the study. Without his useful comments and guidance this study would not have been a success.

All members of academic staff of the Department of Agricultural Education and Extension and my colleagues are highly appreciated for their moral support and for creating a socially harmonious environment during my stay at the University. I'm also grateful to all district officials, extension officers and respondents in Chamwino and Manyoni districts for their time and co-operation in making the completion of my research fieldwork possible. Though I cannot specifically mention them by names, I remember all of them with great gratitude. Finally, I am obliged to mention my appreciation to my loving son, Aston (Oscar) and my daughter Alvina (Marygrace) for their patience during this study.

DEDICATION

This thesis is dedicated to my beloved parents the late Grace Stephano Jesaya Matowo-Mukungu and Faustine Bandiho Munubi Mukungu who laid the foundation of my education.

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LIST OF ABBREVIATIONS AND SYMBOLS

APS	Access to Public Services
CARE	Christian Action Research and Education
CETRAD	Centre for Training and Integrated Research in Arid and Semi-Arid Land Development
CFSVA	Comprehensive Food Security Vulnerability Analysis
CRS	Catholic Relief Services
$DADP_S$	District Agricultural Development Plans
DALDO	District Agricultural and Livestock Development Officer
DDS	Dietary Diversity Score
DFID	Department for International Development
FANTA	Food and Nutrition Technical Assistance
FAO	Food and Agriculture Organization
FEWS NET	Famine Early Warning Systems Network
FGD_S	Focus Group Discussions
FTF	Feed The Future
GDP	Gross Domestic Product
HBS	Household Budget Survey
HFIAS	Household Food Insecurity Access Scale
IFA	Income and Food Access
IFAD	International Fund for Agricultural Development
IIASA	International Institute for Applied Systems Analysis
LSRO	Life Sciences Research Office
MOA	Ministry of Agriculture
MoFED	Ministry of Finance and Economic Development (Ethiopia)

NBS	National Bureau of Statistics
NGOs	Non-Governmental Organizations
NS	Non Significant
NSGRP	National Strategy for Growth and Reduction of Poverty
PCA	Principal Component Analysis
PRA	Participatory Rural Appraisal
SES	Socio-Economic Status
SIS	Shock Impact Simulation
SLA	Sustainable Livelihood Approach
SNAL	Sokoine National Agricultural Library
SPSS	Statistical Package for Social Sciences
SSN	Social Safety Nets
TAFSIP	Tanzania Agriculture and Food Security Investment Plan
TANGO	Technical Assistance to Non-Government Organizations
TLU	Tropical Livestock Units
UNDP	United Nations Development Programme
URT	United Republic of Tanzania
USA	United States of America
USAID	United States Agency for International Development
WFP	World Food Programme

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background to the Problem

In Sub-Sahara Africa, agriculture plays a very important role in providing food and income for the majority of the population. Likewise, agriculture is the mainstay of Tanzania's economy. The sector provides income and employment to over 80% of the population and accounts for 24.1% of the GDP and about 60% of export earnings making agriculture to have a significant contribution to the National GDP compared to other sectors (NBS, 2013). The agricultural sector also contributes substantively to the country's economy in terms of food production, employment generation, production of raw materials for industries and generation of foreign exchange (NBS, 2013). However despite the economic importance of agriculture, a large population of Tanzanians depend on subsistence agriculture which is almost entirely rain fed.

The rain-fed agriculture is highly susceptible to climatic shocks, particularly in the semi-arid areas of central and northern Tanzania where chronic and transitory food insecurity hamper household ability to meet their food needs at all times (Rima and Rutachokozibwa, 2007). According to UNDP (2005), Tanzania is prone to a variety of sudden and slow-onset of natural disasters including drought, agricultural pests, floods and earthquakes as well as man-made hazards (e.g., cholera outbreaks) that affect livelihoods, destroy infrastructure, and cause food insecurity.

Drought and to a lesser extent floods, whose incidences have increased dramatically since the late 1990s, are recurrent shocks in Tanzania that contribute significantly to transitory food insecurity such incidences are attributed to changes in climatic pattern as well as

growing demand for arable land for cultivation of bio-fuel resulting in global warming (Kuwomu *et al.,* 2013). The populations in 32 out of 126 districts have experienced at least three episodes of large scale and acute food insecurity within one decade due to these events (Rima and Rutachokozibwa, 2007). A large part of the country and most of the high potential areas rely on unimodal rainfall regime with a long dry season between May and November. About half of the country receives less than 750 mm of rainfall a year, which is generally regarded as necessary for any intensive form of agriculture in East Africa (Mitawa and Marandu, 1995; WFP, 2007). Moreover, the central part of the country gets less than 500 mm per annum (Ngirwa, 1995). This situation calls for the need of understanding the nature and extent of food insecurity problem as they have severe impact on economic performance and livelihood of communities in the rural areas that depend on rain-fed agriculture.

Despite the efforts made by the government and other international and local agencies in achieving food security in the country, there is no doubt that food insecurity continues to be a major and recurrent phenomenon in different parts of Tanzania. According to Majule and Lema (2009) food insecurity in Dodoma and Singida regions in central Tanzania is worsening. Similar findings are reported in a study by the national Comprehensive Food Security and Vulnerability Assessment (CFSVA) which was conducted by WFP central Tanzania in October 2010-September 2011. The study findings indicated that 9% of households were food insecure and another 12% were highly vulnerable. The CFSVA identified Dodoma and Singida regions of Tanzania as having the highest proportion of food insecure households.

Households that are vulnerable to food insecurity adopt different strategies to reduce, mitigate, and cope with the risks and shocks that affect them, based on the options offered

by their internal resource endowment and their access to external assistance (Maharjan and Chhetri, 2006). Previous studies indicated that major types of food insecurity coping strategies employed in Dodoma and Singida regions include selling of labour, salt making, local brew making, and charcoal burning (Liwenga, 2003; Nyankweli *et al.*, 2007; Matunga, 2008; Majule and Lema, 2009). However, these strategies can only be helpful for food insecure households to sustain their lives rather than making them food secure. As Maxwell and Caldwell (2008) point out, though many households adopt a number of food consumption coping strategies, some of them do not contribute to improving food insecurity among the population. According to Zalilah and Khor (2008), several food coping strategies are associated with food insecurity, and they are mostly acceptable to vulnerable households in different cultures for example casual labour activities.

Farmers in Chamwino and Manyoni districts employ various coping strategies in response to food insecurity (Liwenga, 2003; Lema, 2008; Matunga, 2008; Mazengo, 2011), but these strategies are often damaging to livelihood sustainability and involve risks that may actually affect resilience to food insecurity in the long term (Beraki, 2009). It is also difficult to generalize coping strategies in response to food insecurity. The strategies are at best region specific and when ineffective, resilience of marginal groups is decreased. It is therefore critical to verify and screen the coping strategies in a particular situation to generate relevant information. Based on this, the study focused on coping strategies and household resilience to food insecurity (access).

1.2 Problem Statement

In Tanzania, food insecurity is an issue of a major concern. This is particularly so in the central zone of Tanzania (Dodoma and Singida regions), which is the study area. This zone has the highest prevalence of transitory and chronic food insecurity incidences (FAO,

1998). Chamwino (Dodoma region) and Manyoni (Singida region) districts are among 65 districts in Tanzania, which have been badly affected by food insecurity, resulting from prolonged drought, which is caused by climate change. Climate change phenomenon has affected the rain pattern in the two districts for the past ten years (Temu *et al.,* 2011).

Households, all over Chamwino and Manyoni districts, are engaged in different and often multiple coping strategies (Liwenga, 2003). Coping strategies relate to the manner in which households secure livelihoods when affected by environmental events. Therefore, households coping strategies in Chamwino and Manyoni districts attempt to minimize the intensity and duration of food insecurity crisis by maximizing limited resources. However, households vary in their capacity to mobilize and manage resources and thus ability to cope (Ericksen, 2000).

Household capacity to respond to stress is linked to complicated decision-making processes, based on opportunities available to the individual household. A number of characteristics pertaining to the household, including demographic and economic structure, gender, informal contacts and social networks, as well as skills, determine the coping strategies of a household at a particular time (Ericksen, 2000). This variation between households and over time needs to be studied in order to identify key factors or processes that influence household resilience to food insecurity in the study area. Despite that many researches (see for example, Liwenga,2003; Matunga, 2008; Majule and Lema, 2009), have been done on households' coping strategies and their vulnerability to food insecurity in Dodoma and Singida regions, little is known on socio-economic factors underlying the effectiveness of coping strategies among households and household resilience to food insecurity in Chamwino and Manyoni districts.

1.3 Justification

Previous studies (e.g. Liwenga, 2003; Matunga, 2008; Majule and Lema, 2009) show that there is an increase of awareness on the seriousness of food insecurity and its impact on the long-term livelihood of households**.** However, there are few studies that empirically describe household coping strategies employed by rural households and analyze household resilience to food insecurity in the study area. Therefore, the available evidence is critically scant as little has been done in examining the effectiveness of food insecurity coping strategies in achieving food security in Chamwino and Manyoni districts. This therefore makes it necessary to have a study that investigates the strategies employed by households in order to aid responsible organs and agencies in designing appropriate policies and programs that are dedicated in alleviating food insecurity. Such a study will also help in planning and developing interventions of improving food security at the household level. This background information was the motivation behind the current study that set out to investigate household food insecurity coping strategies and the household resilience to food insecurity.

The current study is in line with the National Strategy for Growth and Reduction of Poverty phase two (NSGRP II), cluster number one of growth for reduction of income poverty, and particularly goal number four which stresses on ensuring food and nutrition security, environmental sustainability and climate change adaptation and mitigation. It is also in line with Sustainable Development Goal (SDGs) number two of zero hunger which emphasizes on ending hunger, achieving food security and improving nutrition and promoting sustainable agriculture.

1.4 Objectives

1.4.1 Overall objective

The overall objective of this study was to investigate the coping strategies and households' resilience to food insecurity in Chamwino and Manyoni districts, Tanzania.

1.4.2 Specific objectives

The specific objectives of this study were to;

(i) Determine perception of farmers on the extent of food insecurity;

(ii) Examine food insecurity status among farming households based on HFIAS

(iii) Analyze socio-economic factors that determine households' food insecurity;

(iv) Examine the major food insecurity coping strategies employed by households in ensuring food security; and

(v) Analyze factors that determine households' resilience to food insecurity.

1.4.3 Research questions

(i) What are the farmers' perceptions on food insecurity in the study area?

(ii) What is the status of food insecurity among farming households in the study area?

(iii) What are the socio economic factors that determine household food insecurity?

(iv) What are the household food insecurity coping strategies employed by households to ensure food security?

(v) What are the factors that influence household resilience to food insecurity?

1.5 Theoretical and Conceptual Framework

Several models and approaches have been used to inform the current study. The discussion in this section begins by looking at Mortimore and Adams model which is one of the critical models for conceptualizing household shock coping strategies.

1.5.1 Mortimore and Adams model

There are admittedly many different models for conceptualizing household shock coping strategies. A study by Mortimore and Adams (1999) in the Sahel provides important insights on how people living in the semi-arid areas cope with their harsh environment organize resources. Such a model provides a useful starting point for the present study. Coping strategies are not fixed or generic across households, but rather they do vary according to particular exogenous and endogenous contexts of the households' concerned (Adams, 1992). Macro-socio-economic and political forces as well as local climate and ecology, culture and infrastructure represent exogenous factors that shape coping options; but such factors are largely beyond the control of the communities and households they affect. Factors which are endogenous to the household, such as demographic and socio-economic characteristics also influence coping strategies. Also, the impact of a particular catalyst such as drought, and the degree to which it triggers crisis, is a function of the exogenous and endogenous contexts of the household. In turn, these factors are powerful in conditioning the range of coping options at the household's disposal, access to and control over resources to pursue those options and, ultimately, decision-making about the type, range and sequence of coping strategies it employs.

The Mortimore and Adams model incorporates a wider view of household coping which considers the exogenous political, economic, social, and ecological contexts in which the household operates, as well as the particular endogenous characteristics that influence households' coping options and decisions of its members. Through the systematic consideration of a range of exogenous and endogenous factors, Mortimore and Adams' framework provides a conceptual guide to assessing the resilience of households to food insecurity crises, and evaluating the context and success of coping during crisis.

Understanding coping in this broader context emphasizes the heterogeneous character of coping strategies and their differential determinants, purposes, and effectiveness.

In particular, the framework may be useful in guiding policy-relevant research that attempts to target those at greatest risk by helping to: evaluate the relative effectiveness of different coping strategies in meeting household objectives of livelihood, consumption, health, and status, and determine which development interventions might support them to strengthen household resilience; investigate the characteristics of resilience at the local or community level with the purpose of identifying appropriate regional or national interventions.

1.5.2 Sustainable livelihood approach

There are several definitions and conceptions of livelihood. Chambers and Conway, (1992) define livelihood as the premise that a rural household has access to (or has an endowment of) a minimum amount of resource base (i.e., capital or assets), which can be utilized to fashion out a set of livelihood strategies (e.g. crop farming, livestock rearing, off farm employment) to improve household welfare. According to Ellis (2000), livelihood is the assets (natural, physical, human, financial and social capital), the activities, and access to these (mediated by institutions and social relations) that together determine the living gained by an individual or household. The multiple factors influencing household food insecurity discussed later in this study specifically draw from the Sustainable Livelihoods Approach (SLA) developed by DFID (Fig. 1). SLA provides a framework for assessing how people go about maintaining their livelihood. The key issue in household livelihoods is that its sustainability basically depends on households' ability to cope with shocks and stresses. Literature consistently reveals that a household's livelihood is sustainable if it can cope with and recover from shocks (such as crop or

livestock diseases) and stresses (e.g. recurrent adverse weather and seasonality); maintain or enhance its capabilities and assets, while not undermining the natural resource base (Chambers and Conway, 1992; Scoones, 1999; Ellis, 2000).

Furthermore, the SLA approach helps in determining how people combine the different assets to which they have access in pursuing activities to achieve a livelihood objective, within the policy and vulnerability context within-which they find themselves. The SLA is a multi disciplinary approach that contains multidimensionality of factors that determine food security. In fact, the SLA gives a way of looking at the macro, meso and micro linkages, thereby accounting for the fact that household food security is determined by not only household-level factors such as a household's food production but also by macro level factors such as inflation, devaluation and changes in the world markets. The factors are connected and interrelated. As such, the identification of appropriate type and nature of interventions for improving food insecurity requires an understanding of each of these factors, their inter-relations and their relevance to specific groups of people. However, this study focused on the micro (household factors) that influences household food insecurity status.

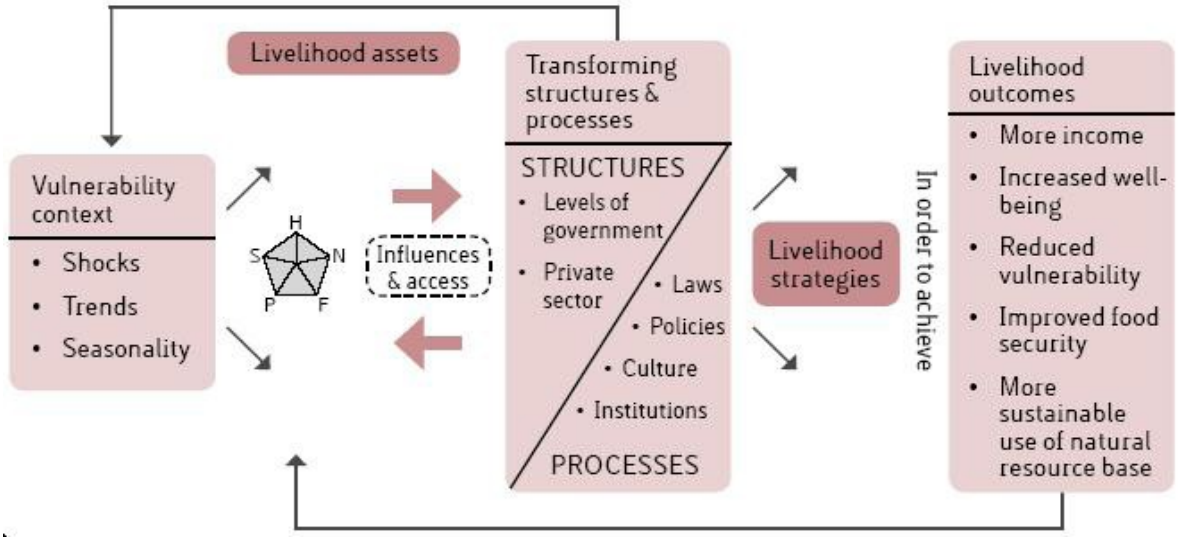

Figure 1: The DFID Sustainable Livelihood Framework.

Source: DFID (1999, pp 1)

1.5.3 Actor oriented approach and model

1.5.3.1 Actor oriented approach

The actor oriented approach was formulated to provide due space to and focus on human agency and its relation to social action. Long (1992, 2001), in a critique of structural models of development which tend to neglect the role of human actions and practices, and thus overweigh the importance of structural determination in social dynamics, proposes instead to retrieve the tradition of what he names Actor Oriented Approach (AOA) , an approach that focuses on the role of human agency in development processes. The concept of "agency" is key to the understanding of interface encounters since it highlights the fact that individual and group actions are not simply determined by structural constraints but are built upon actors" own "knowledge ability" and "capability" (Long, 1992), which allow them to process their experiences and to behave in such a way so as to obtain a margin of manoeuvre for their own objectives and goals.

1.5.3.2 Actor oriented model

The actor oriented model depicts the diversity of social life and how human beings' (social actors') actions differ within specified contexts. According to Long (2001), social action and interpretation is context specific and contextually generated. Furthermore, the model portrays that a social action such as a decision of using a certain food insecurity coping strategy cannot be determined by individual households alone. The tool helps conveying the diverse scenario at which social action takes place and could be used to understand important factors that influence the adoption of a certain food insecurity coping strategy.

According to Wiesmanns' model (Appendix 1), different actors have different objectives and thus the selection of strategies to strive for the said objectives depends primarily on the availability of resources at that particular time and place. The model further contends that variations within and between individual households exist and keep on changing with time. In view of this, it is clear that the manner in which a household copes with food insecurity changes over time to reflect changes in situations.

Despite that humans are different beings; the actor oriented approach considers everyday life experiences as a key variable in analyzing social interactions among and between actors. The approach is used to study how the differences are produced, merged, and transformed. Furthermore, the approach identifies social processes and the outcomes which are involved. From this perspective, the household setting is viewed as an arena in which household actors (individuals within the household) pursue their own short-and long-term objectives and strategies to cope with food insecurity conditions. Thus, they act and react to a specific geographical and historical context (Cramb, 2003). Therefore, there is need to find out how food insecure actors negotiate and organize themselves to cope

with food insecurity conditions, and how they strategize in their dealings with other actors within and outside the household since different actors allocate assets to different activities and choices based on some specific grounds. Household level analysis will determine the link between food insecurity coping strategies and household resilience to food insecurity.

Wiesmanns' approach can complement Mortimore and Adam's (1999) approach in that it focuses not only on exogenous and endogenous factors that influence household food insecurity crisis but also on the social relations and how these influence the adoption of a certain coping strategy. Wiesmanns' model has the potential in guiding the formulation of concrete premise when addressing specific contexts and actors in semi-arid areas of Dodoma and Singida. However, it is necessary to note that the suggested conceptual framework is used just as an entry-point and that the study aims at refining and modifying further the suggested conceptual framework into specific coping strategies and household resilience to food insecurity discourse.

Thus, the conceptual framework for this study builds from the work of Mortimore and Adams (1999), DFID (2000) and Wiesmann (1998). That is, the study adopted the integrated modified model (Fig. 2) to describe coping strategies and households' resilience to food insecurity in Chamwino and Manyoni districts.

The key assumptions in developing the conceptual framework followed in this study (Fig. 2) include the following: food insecurity coping strategies in semi-arid areas are shaped by interactions between food insecure households and their environment (social, economic, cultural and political factors). The households, however, do not just adopt a strategy but act on certain specific grounds. The household decision is influenced by their own past

experiences of what has and what has not worked and the existing opportunities as well as the constraints associated with the adoption of particular coping strategies.

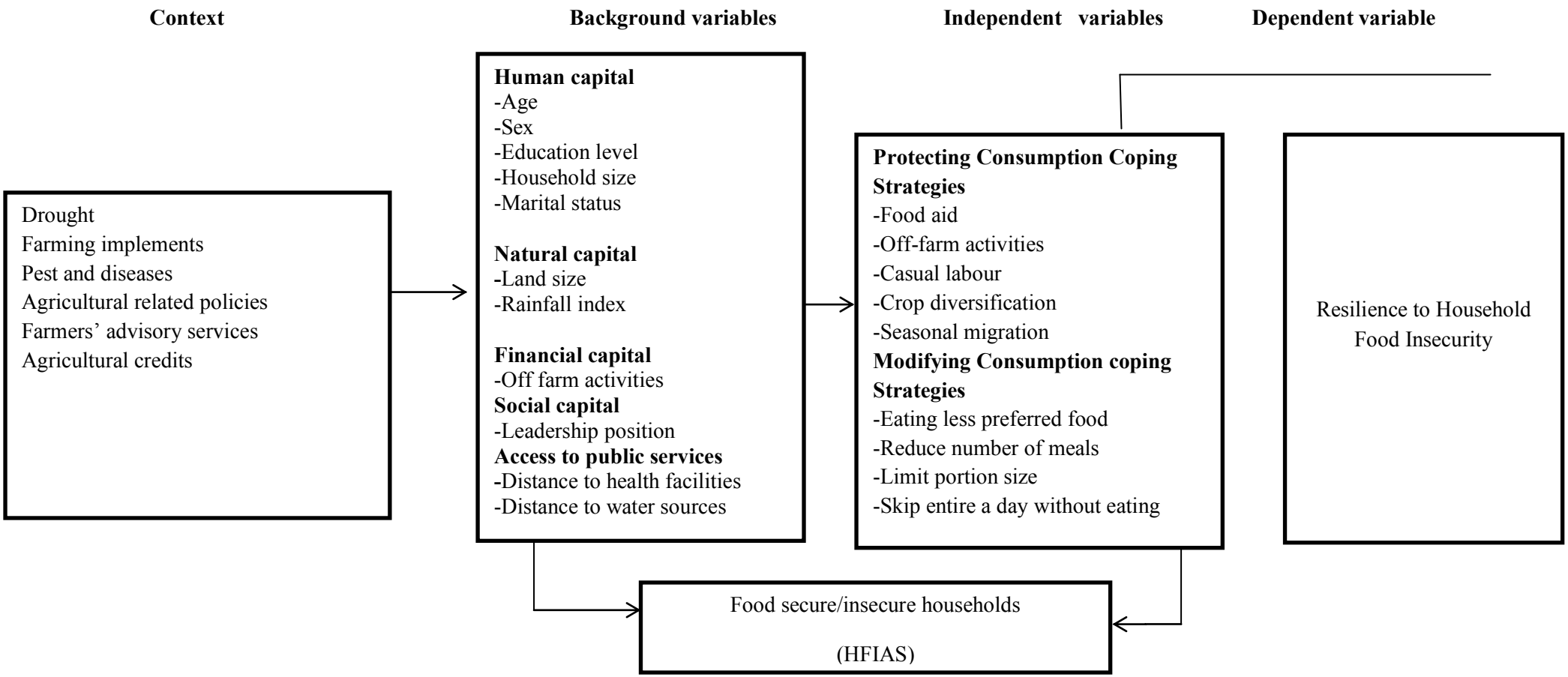

Figure 2: Conceptual Framework

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 The Concept of Food Security and Insecurity

This section focuses on the concepts of food security, food insecurity and the types of food insecurity.

2.1.1 Food security

Despite, or perhaps because of, its fundamental importance; food security is a concept whose definitions and operationalization have been numerous and varied. Indeed, a sufficiently large number of terms have been used in discussing food security; this has been posing difficulties in identifying what exactly is being discussed, measured, or intervened upon with respect to food security (Jones *et al.,* 2013). This is partially so due to the multi-disciplinary and multi-sectoral nature of food security. Many disciplines including agriculture, anthropology, economics, nutrition, public policy, and sociology, as well as numerous national and international governmental and non governmental agencies have been engaged with the term food security (Jones *et al.,* 2013).

However, the most commonly used definition of food security is based on the definition from the World Food Summit (1996) which contends that food security at the individual, household, national, regional and global levels is achieved when all people, at all times, 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 (FAO, 1996b). This definition touches many aspects including three important, interlinked components: first is the availability of food in a given country/household through any means (for example, production, imports or food aid). The second aspect relates to access to food by

people/households as reflected by their ability to get food through purchases from the market, to get the food from own stock/home production, gift or borrowing. The third component relates to the actual processing and absorption capacity of the body of the supplied nutrients. This study considered the access component; the reasons are explained later in this Chapter.

2.1.2 Food insecurity

The predominant way of thinking about food insecurity has changed considerably over time. Food insecurity has become more holistic in nature, complex and people-cantered (Nombo, 2007). Historically, food insecurity has been considered in terms of overall regional, national or even global food supplies and shortfalls in supply compared to requirements (Maxwell, 1996). A number of researchers have observed that there is an increased disparity in the sufficiency of food intake by certain groups, despite overall adequacy of supply (Sen, 1981; Omosa, 1998). Therefore, instead of focusing on food supply only, the concept of food insecurity has been broadened to include elements of access, vulnerability, and sustainability. The concept has also evolved from focusing on food availability to focusing on food utilization and adequacy, which relates food to nutrition at an individual level.

Food insecurity is defined as inability of a household or a nation to meet target consumption levels in the face of fluctuating production, prices, and incomes. The Life Sciences Research Office (LSRO) of USA defines food insecurity as the "limited or uncertain availability of nutritionally adequate and safe foods or limited or uncertain ability to acquire acceptable foods in socially acceptable ways" (Bickel *et al.,* 2000:6). Food insecurity may result in hunger which is a consequence of recurrent and involuntary lack of access to food (Owino *et al.,* 2014). It is a severe stage of food insecurity whose

measurement captures the severity of deprivation due to resource or other constraints. This situation if prolonged results in malnutrition. It can be concluded from these definitions that measuring food insecurity involves examining the current and future food availability, access to food that is available as well as issues of nutritional adequacy and social acceptability of the food and the means used to access it. What further complicates food insecurity measurement is the fact that although we have established standard pre-requisites for food insecurity, the level of access to, current and future availability and nutritional adequacy of food are determined by factors that vary from region to region and from household to household. A few of these factors can be identified as poverty, low agricultural productivity, political crisis, lack of nutritional knowledge, lack of education, over population, income inequality, poor infrastructure, covariant shocks such as droughts and earthquakes and idiosyncratic shocks such as death and disease (Qureshi, 2007).

2.1.3 Types of food insecurity

Food insecurity may be chronic or transitory. In chronic food insecurity, there is continuous inadequate diet and nutrition caused by the household's inability to acquire food. Chronic food insecurity therefore afflicts households that persistently lack the ability to either buy food or produce their own food. Chronic food insecurity is rooted in poverty (Sen, 1981). On the other hand, transitory food insecurity results from a temporary decline in household access to food mainly due to instability in food prices, production, household income or a combination of these factors (Reutlinger and Holst, 1986). According to FAO (2008), chronic and transitory food insecurity can be described and summarised in Table 1.

Table 1: Two general types of food insecurity

	Chronic Food Insecurity	Transitory Food Insecurity
Occurs when…	Long term or persistent People are unable to meet their minimum food requirements over a sustained period of time.	Short term or temporary There is a sudden drop in the ability to produce or access enough food to maintain a good nutritional status.
Results from…	Extended periods of poverty, lack of assets and inadequate access to productive or financial resources	Short term shocks and fluctuations in food availability and food access, including year-to-year variations in domestic food production, food prices and household incomes.
Can be overcome with…	Typical long term development measures also used to address poverty, such as education or access to productive resources, such as credit. They may also need more direct access to food to enable them to raise their productive capacity.	Transitory food insecurity is relatively unpredictable and can emerge suddenly. This makes planning and programming more difficult and requires different capacities and types of intervention, including early warning capacity and safety net programmes.

Source: FAO (2008:1)

The key issue in these two types of food insecurity is that they differ in their nature and extent and hence the measures, strategies and interventions used to overcome the problems depend primarily on the type of food insecurity existing in that particular area. Tanzania, specifically Singida and Dodoma regions has also been considered to be prone to transitory food insecurity, something which calls for special attention.

2.2 Measuring Food Insecurity

Food insecurity is multidimensional. There is no unique, good standard means of measuring food insecurity. Each analytical method and tool has different strengths and weaknesses and a varying ability to comprehensively embrace the multiple dimensions of food insecurity and livelihoods (Appendix 2). Qureshi (2007), identifies major reasons of

measuring food insecurity as follows: (i) for the sake of standardization and accuracy; (ii) to differentiate between the food secure and the insecure; (iii) to facilitate more cost-effective targeting of aid and development resources; (iv) to prevent the food security situation of the insecure and vulnerable from deteriorating after a crisis and; (v) to design food security and nutrition enhancement or protection programmes that are suited to the requirements and needs of the target population.

2.2.1 Context of measuring food insecurity

Food insecurity is a complex and multi-dimensional concept, which is based on multiple factors such as physical, social, economic access, availability, amount, preferences for certain foods, security, and time. The measurement of food insecurity at any given time captures one if not more of the three dimensions of food insecurity: availability, utilization, and access. The food insecurity assessment based on the availability dimension is widely used and for the most part guides the responses to food insecurity (Gebreyesus *et al.,* 2015). However, it fails to capture the unequal distribution of food and is also unable to guarantee the utilization of food in a given population. An assessment of food insecurity based on the second dimension, utilization, is well captured through various anthropometric indicators such as underweight, stunting, and wasting. Nonetheless, measurements based on the access dimension of food insecurity are not yet well established (Gebreyesus *et al.,* 2015). Thus, this study focused on access component in an attempt to fulfil the knowledge gaps in this area.

2.2.2 Level of measuring food insecurity

The complexity of analyzing food insecurity does not stem only from its context, but also from the level of measurement. Although initially it was analyzed at international and national levels, food insecurity has also been examined at the household and individual

levels. The key recognition in this shift of focus is that there are multiple factors, at all levels, that impact on an individual or household's ability to access sufficient food. These include household income, human health, government policy, conflict, globalization, market failures, as well as environmental issues (Misselhorn, 2005; Marsland, 2004; Devereux and Maxwell, 2001).

2.2.3 Rationale of measuring food insecurity at household level

Household-level measures of food security are concerned with food insecurity dynamics between and within households. Because these measures rely on data from household surveys; they are able to capture more accurately the access component of food insecurity than do measures that rely on nationally aggregated data. Food access refers to physical and economic access to food; however, many of the tools used to measure food access actually measure food acquisition or food consumption (Jones *et al.,* 2013). These concepts are commonly used interchangeably to refer to food access; yet they it is important to distinguish them for measurement purposes.

Again, the importance of measuring food insecurity at the household level stems from the fact that households at different levels of food insecurity are affected differently and thus will react differently to covariant shocks. It is acknowledged that households are important agents to consider when explaining livelihood issues and when developing the analyses of specific food insecurity problems. It is assumed that the decision making process on socio-economic matters (i.e. household food insecurity) in developing countries is less an individual question than a process whereby household members negotiate on a joint strategy. Households can be defined as identifiable groupings based on some form of kinship relations within which people live.

2.2.4 Tools for measuring household food insecurity

Measuring food insecurity is challenging as previously indicated. A wide variety of methodological approaches have been applied to food insecurity studies, determined by the purpose of the analysis, availability of data, and the background and preference of analysts (Regassa and Stoecker, 2011). Household food insecurity can be assessed using direct and indirect measurements. Food Sufficiency Status Question (Briefel and Woteki, 1992), Radimer/Cornell Hunger and Food Insecurity Instrument (Radimer *et al.*, 1992), Community Childhood Hunger Identification Project Instrument (Wehler *et al.*, 1994), Food Security Core Model (Bickel *et al.*, 2000), Cumulative Food Security Index (Maxwell, 1996), and Household Food Insecurity Access Scale (FANTA, 2005) are among questionnaire-based experiences related to food insecurity and which can be administered to the person most responsible for food and food provision in the household. The indirect measurements of food insecurity which include income-based measures of poverty, utilization of food security-related programs, indicators of financial hardship, anthropometric measurements, dietary intake, and other health and nutrition parameters indicate the level of vulnerability in which food insecurity may be reasonably inferred (Radimer *et al.*, 1990; Zalilah and Khor, 2008; Cooper, 2009). In the developing countries, the indirect indicators are commonly used to gauge the prevalence and severity of food insecurity; however, the use of direct indicators is limited to several settings (Maxwell, 1996; Lorenzana and Sanjur, 1999; Guilliford *et al.*, 2003; Oh and Hong, 2003; Perez-Escamilla *et al.*, 2008; Piaseu, 2006; Gonzalez *et al.*, 2008).

Experience-based food insecurity scales like the Household Food Insecurity Access Scale (HFIAS) represent a simple, timely and less costly method for measuring the access dimension of food insecurity based on data collected at the household or individual level. Such scales do not provide specific information on actual food consumption, diet quality

and food expenditures like household expenditure surveys and individual food intake surveys might do, but rather focus more broadly on reported food-related behaviours associated with the experience of food insecurity due to limited access to food. They (experience-based food insecurity scales) should therefore not be seen as substitutes for but rather as complements to these other important measures. Based on the study objectives, in view of the purpose of analysis and the background and preference of the researcher; this study employed HFIAS.

2.2.5 Determination of Household Food Insecurity Access Scale (HFIAS)

This study employed Household Food Insecurity Access Scale (HFIAS). The HFIAS has been developed to address the need of having simpler tools as proxy measures of food access (Webb *et al.,* 2006). The scale lists 9 questions asking respondents to describe behaviours and attitudes that relate to these various aspects, also called "domains", of food insecurity experience (Hamilton *et al.,* 1997). The questions focus on: the feeling of uncertainty or anxiety over food; the perception that food is of insufficient quantity; the perception that food is of insufficient quality; reported reduction of food intake; and reported consequences of reduced food intake. The contents of the questions were strongly related with common indicators of poverty and food consumption. These sets of questions are known to be used in several countries and appear to distinguish the food secure from the food insecure households across different cultural contexts (FAO, 2008).

The HFIAs score is a continuous measure of the degree of food insecurity (when it comes to access) in the household in the past four weeks (30 days). A HFIAs score variable is computed for each household by summing up the codes for each frequency or occurrence question. Before summing the frequency of occurrence codes, the frequency of occurrence was coded "0" for all cases where the answer to the corresponding occurrence questions

was “No”. The maximum score for a household was 27 (the household which responded to all nine frequencies of occurrence questions was *often* coded with response code of 3) the minimum score was 0 (the household responded “No” to all occurrence questions). The higher the score, the more food insecurity (access) the household experienced; the lower the score, the less food insecurity (access) a household experienced (Frayne, 2010).

The HFIAS indicator categorizes households into four levels of household food insecurity (access): food secures, mild, moderately and severely food insecure. Households are categorized as increasingly food insecure as they respond affirmatively to more severe conditions and/or experience those conditions more frequently. According to FANTA, (2005), a food secure household experiences none of the food insecurity (access) conditions, or just experiences worry, but rarely with a score of less or equal to ten. A mild food insecure (access) household worries about not having enough food sometimes or often, and/or is unable to eat preferred foods, and/or eats a more monotonous diet than desired and/or some foods considered undesirable, but only rarely. However, such a household does not cut back on quantity nor experience any of the three most severe conditions (running out of food, going to bed hungry, or going a whole day and night without eating) with a score of between eleven and sixteen.

A moderately food insecure household sacrifices quality more frequently, by eating a monotonous diet or size of meals or number of meals, rarely or sometimes. Nonetheless, it does not experience any of the three most severe conditions; the score is between seventeen and twenty two. A severely food insecure household has graduated to cutting back on meal size or number of meals often, and/or experiences any of the three most severe conditions (running out of food, going to bed hungry, or going a whole day and night without eating), even as infrequently as rarely. In other words, any household that

experiences one of these three conditions even once in the last seven days is considered severely food insecure; its score is between twenty three and twenty seven (FANTA, 2005).

2.3 Determinants of Household Food Insecurity

Determinants of household food insecurity in various developing countries especially in Africa have been documented in some literature and determinants are most often than not location-specific (Aidoo *et al.,* 2013). Studies that attempt to link household characteristics to household food insecurity have received increased attention over the past few decades and this is due to the realization that components of economic and social status that distinguish and characterize people are significant indicators of food insecurity (Dauda, 2010).

2.3.1 Household socio-economic characteristics and food insecurity

Food insecurity is a complex issue that requires multiple theories and integrative methods to fully explain it (Scanlan, 2003). Maxwell and Smith (1992) also argue that household characteristics are crucial and that food insecurity must be treated as a multi-objective phenomenon that is best explained by the food insecure people themselves. Previous studies have identified social characteristics such as sex, age, marital status, household head literacy status, livestock ownership, household size and land size that are associated with household food insecurity and has distinguished between household food insecurity categories in a society (Sikwela, 2008; Bogale and Shimelis, 2009; Aidoo *et al.,* 2013; Kumba, 2015).

2.3.1.1 Age of the household head and food insecurity

The age of household head might affect food insecurity of the household he/she manages through asset accumulation, technology adoption or risk aversion but cannot be determined *a priori* since household heads become more experienced with age and acquire more knowledge and physical assets thereby affecting food insecurity negatively. Yet it could be positively correlated with food insecurity indicating that as the age of the household head increases his/her efficiency in caring out demanding farm operations diminishes resulting in low farm production and productivity.

2.3.1.2 Sex of household head and food insecurity

Female-headed households are expected to have higher food insecurity status than their male-headed counterparts since most female-headed households in the Tanzanian rural system are formed as a result of death of husband or divorce, a situation which leaves the female with insufficient resources such as land, livestock and other productive assets. In addition, the female head, who is the main income earner, faces various disadvantages in the labour market and many productive activities. She is also responsible for maintaining the household including household chores and child care in addition to working outside; she also faces a higher dependency ratio for being a single income earner (Fuwa, 2000).

2.3.1.3 Marital Status of the household head and food insecurity

The marital status of the household head has a significant role in determining household food insecurity. Previous studies found that a household head's marital status has both negative and positive association with household food insecurity (Haile, 2005; Kaloi *et al.,* 2005) which indicates that unmarried couples were likely to be more food insecure than married headed households. While confirming the significance of marital status on household food insecurity in Ghana, Aidoo *et al.* (2013), argues that households headed

by married people were likely to be food insecure than those headed by unmarried ones. This is because households with married people may have larger households and this means many mouths to feed.

2.3.1.4 Literacy status of household head and food insecurity

Literacy status has serious consequences on the level of agricultural production and hence food insecurity at a household level. Bzugu *et al.* (2005) and Idrisa *et al.* (2006) had earlier recognized that low level of formal education among farmers make the introduction of improved agricultural technologies by extension agents difficult.

2.3.1.5 Household size and food insecurity

Household size might have effect on labour resource as well as food consumption in the household and hence affect the household food insecurity status (Demeke and Zeller, 2009). The size of a household definitely has an effect on food insecurity though its direction cannot be known beforehand. Some studies identified larger sized households as being positively associated with food insecurity since such households need more resources to fulfil household food needs whereas others read this negatively as it means that there is a larger available labour force (Demeke and Zeller, 2009). Availability of economically active human resource helps to carry out farm operations timely and effectively. The subjects might also be involved in other farm or non-farm activities thereby diversifying and increasing the income source of the household which in turn affects food insecurity in a negative way**.**

2.3.1.6 Livestock ownership and food insecurity

Livestock is an important household resource that plays a significant role as a hedge against food insecurity in the study area. Ownership of livestock resources is a centrepiece

in survival strategies and protection against indebtedness of various forms. Livestock, especially cattle, were the basic "value units" both in social and economic terms (Rigby, 1969:47 cited by Liwenga, 2003). Cattle used to gauge the value of anything from wives to children, to the seriousness of an offence, and the number of bags of grain borrowed in a food shortage season (Liwenga, 2003).

2.3.1.7 Land size and food insecurity

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 for households. The amount of land owned by the household is also an important indicator of household food insecurity status. According to Esenu (2005) the amount of land owned by households had a positive impact on food availability in Uganda. Haile *et al.* (2005) also found that land size was negatively and significantly related to the probability of a household being food insecure in Ethiopia.

2.4 Livelihood, Adaptive, Coping Strategies and Food Insecurity

2.4.1 Livelihood strategies and food insecurity

Household ability to diversify livelihoods is critical to local welfare and may be particularly important in mitigating risk, uncertainty and contingencies (Mortimore 1989; Scoones *et al.,* 1996; Ellis, 1998). Households engage in multiple activities and rely on diversified income portfolios for their livelihoods. Livelihood strategies are the combination of activities that people choose to undertake in order to achieve their livelihood goals like food security. They include productive activities, investment strategies and reproductive choices. Livelihoods approaches try to understand the strategies pursued and the factors behind people's decisions to reinforce the positive aspects of these strategies and mitigate constraints. The choice of strategies is a dynamic

process in which people combine activities to meet their changing needs. For example, in farming households, activities are not necessarily confined to agriculture, but often include non-farm activities in order to diversify income and meet household needs including food security.

2.4.2 Adaptive strategies and food insecurity

Adaptive strategies are the strategies in which a region or a sector responds to changes in their livelihood through either autonomous or planned adaptation (Senbeta, 2009). Adaptation studies have often emphasized measures to reduce sensitivity by for example, changing to forms of agriculture which are less climate sensitive thus reducing the need for coping (Siri *et al.,* 2005). In fact, there are two kinds of responses to crisis mainly resulting from food insecurity; and these are adaptive strategies and coping strategies.

2.4.3 Coping strategies and food insecurity

Households actively try to protect their livelihoods, adopting several actions and mechanisms when faced with shocks and stresses that affect their livelihood or livelihood outcomes, one of which is food insecurity. These behavioural responses are termed coping strategies and encompass a wide range of economic, social, political, and behavioural responses to declining food security or perceived threats to food insecurity (Young *et al*., 2001).

Coping strategies may develop into adaptive strategies with time (Berkes and Jolly, 2001). Coping strategies are the actual responses to crisis on livelihood systems in the face of unwelcome situations like food insecurity and are considered as short-term responses (Berkes and Jolly, 2001). They (Coping strategies) need to be understood in terms of strategies with easily reversible effects versus strategies that incur unacceptable costs

(Young *et al.,* 2001). Coping strategies are rational and calculated responses to minimize the intensity or duration of crisis, to maximize limited resources and to preserve long term livelihood security (Adams *et al.,* 1998). However, in the present study the concept of coping strategies is used to mean any action aimed at protecting consumption of the household in order to ensure that food is available.

2.5 Categorization of Food Insecurity Coping Strategies

2.5.1 Food insecurity coping strategies based on household individual characteristics

Based on their individual characteristics, households will adopt coping strategies that are different from each other. Corbett (1988) divides households' coping strategies into three distinct stages.

2.5.1.1 First stage: Non-erosive coping (insurance strategies)

The first stage of coping with food insecurity is marked by the initial shortage of food, or inability to provide sufficient quantities of food to all members of the household (Maxwell *et al.*, 2003; Senefeld and Polsky, 2005). This stage is also characterized by the following: taking out loans; reduction in dietary intake; consumption of cheaper foods and reduction of the frequency of meals (Watt, 1983; Corbett, 1988). When food access diminishes or resources wane, adaptations employed might be dietary change, reduction in the number of meals per day (rationing), relying on wild foods, seeking for wage labour to increase income, and borrowing food or money from relatives (Senefeld and Polsky, 2005; Devereux, 1993; Corbett, 1988; Maxwell *et al.*, 2003). These strategies are considered as first stage strategies (Corbett, 1988; Maxwell, 1996). During this stage, responses developed by the population are reversible and in principle do not damage livelihoods and future productive capacity and primarily aim at preventing destitution (van der Kam,

2000). Devereux (1993) more precisely names these strategies as accumulation and adaptation coping strategies.

2.5.1.2 Second stage: Erosive coping (crisis strategies)

The second stage of coping strategies is characterized by the sale of assets (non-productive and productive assets), loans, and sale of large stock of livestock, land, and tools (Frankenburger, 1992; Corbett, 1988; Watt, 1983). The responses in this stage are less reversible as households are forced to use strategies that reduce their productive assets and threaten their future livelihoods (van der Kam, 2000). During the second stage, the food crisis begins to threaten asset preservation (Corbett, 1988; Watt, 1983; Hoddinott, 2006). The assets that are sold at this stage are those related to income generation, such as farming equipment, land, and cattle.

According to Corbett (1988), stage two is indicative of productive asset sales and a shift of priority from asset prevention to food consumption (van der Kam, 2000; Hoddinott, 2006). The sale of productive assets has severe implications for the future productive potential and long-term food security of the households. The sale of productive assets leads to the last stage of coping (Frankenburger, 1992; Corbett, 1988). Erosive coping behaviours (such as selling of productive assets) cause further loss of household assets. The selling of assets in response to shocks permanently lowers future food consumption (Hoddinott, 2006). Households that resort to unsuitable coping strategies such as selling of productive assets or taking high interest loans represent a crucial area of concern for those working with the most food insecure populations (Coates *et al.*, 2006). The incidence of asset disposal shows vulnerability to food insecurity (Devereux *et al.*, 2004).

2.5.1.3 Stage three: Failed coping (distress strategies)

At stage three, the food crisis has prolonged leading to a dire situation. Destitution, dependency on charity and out-migration are indicative of this stage (Corbett, 1988). Everything at this stage could be sold. According to Frankenburger (1992), although the disposal of all assets ensures survival, it severely jeopardizes the future security of the household. At this stage, all coping mechanisms have been completely exhausted and people are dependent on food aid for immediate survival (van der Kam, 2000).

2.5.2 Food insecurity coping strategies based on consumption means

Coping strategies are employed to mitigate the effects of not having enough food to meet the household's needs. As Malleret-King (2000) points out, there are two options regarding food availability: protecting consumption and modifying consumption. Protecting consumption means that the household employs all means to ensure that food is available. Modifying consumption implies a reduction in the household's consumption, a diversification of its consumption, or a reduction in the number of consumers in the family. Reducing a household's consumption can range from limiting the size of an individual's portion to skipping whole meals. Diversifying consumption usually means eating foods that are less preferred and less expensive. Reducing the number of consumers is most often achieved by sending certain members of the family to live and/or work elsewhere. Often a food insecure household will reduce and diversify consumption simultaneously (Malleret-King, 2000). Most of the previous studies on food insecurity coping strategies such as Maxwell (1996); Legesse (1999); Liwenga (2003); Matunga (2008); Zalilah and Khor (2008); Beraki (2009); Adekoya (2009); Mjonono (2009); Mazengo (2011) generally focused on both protecting and modifying consumption strategies with little emphasis on protecting consumption strategies. Thus, the present study focuses on protecting consumption coping strategies.

2.6 The Concept of Resilience and its Relation to Food Insecurity

2.6.1 The concept of resilience

Resilience is the ability of countries, communities, and households to manage change, by maintaining or transforming living standards in the face of shocks or stresses – such as earthquakes, drought or violent conflict – without compromising their long-term prospects (DFID, 2011). The main value of using a resilience concept lies in integrating approaches and communities of practice rather than as a novel approach to addressing food insecurity (Béné *et al.,* 2012). Building resilience requires helping people cope with change, adapt to new and changing circumstances, and facilitate governance and institutional changes that promote good policies, plans and programmes to support wider development at sufficient scale and over a long enough time period to have lasting benefits (Frankenberger and Nelson, 2013).

2.6.2 Principles for resilience measurement

Resilience is a dynamic process that involves changes over time. Thus, there is likely not one generalized way to measure resilience that is appropriate across all contexts or by all implementing actors. Rather, it may be more feasible to reach agreement on how to measure the impact of specific types of interventions on resilience of specific populations to specific types of shocks or stresses (Barrett and Constas, 2012). However, certain measurement principles are broadly applicable.

2.6.2.1 Context-specific

Resilience is context-specific, that is, it is defined by the type of change or shock experienced, as well as by the social, economic, environmental, and political context in which the shock occurred and household response decisions made. Context is dynamic, rather than static, and it changes according to how individuals or households deal with

and respond to risks and shocks (Alinovi *et al.,* 2010), which in turn results in a new set of contextual factors needing to be incorporated into resilience-building approaches and measures of impact (Frankenberger *et al.,* 2012).

2.6.2.2 Temporal considerations

Ideally, measurements of resilience should be based on time-series, preferably panel data collected from the same households over time (TANGO, 2012a). Data from panel studies in developing countries are rarely available and can be difficult to obtain. Cross-sectional data have been used for estimating empirical models of resilience (or vulnerability), but have often not shed light on the risk management strategies (for example adaptive strategies or coping strategies) used by households to adapt to shocks (Frankenberger *et al.,* 2012).

2.6.2.3 Thresholds/tipping points

Measuring resilience involves measuring household and community trajectories in coping with shocks and how those trajectories change based on household and community responses. However, a change is not constant over time, nor is it necessarily gradual; rather, it involves tipping points or critical thresholds, beyond which a change either positive or negative happens (Alinovi *et al.,* 2008). Tipping points lead to discernible shifts in behaviour and performance. It is important to identify the potential tipping points in order to determine the prevailing trajectory and well-being outcomes of households. It is also important to determine whether such transitions are structural or transitory.

2.6.2.4 Technical capacity

Resilience is a complex concept and whose measurement should reflect that complexity, which will require the technical ability to utilize sophisticated methods of analysis (for

example econometric models, factor and regression analysis) and to correctly analyze and interpret the results. In the absence of such expertise, proxy indicators that can be easily collected by local implementing partners (for example NGOs) are needed as meaningful resilience measurements. Qualitative measures are also important, as they contribute to a better understanding of the perceived significance of changes that are measured quantitatively.

2.6.2.5 Culturally-relevant

Monitoring and Evaluation systems for measuring the impact of resilience programming should prioritize approaches that engage local actors and affected communities, and include measures of success that are meaningful to them. Measures of resilience must be culturally appropriate and employ benchmarks for success that are culturally-relevant. There is no 'one size fits all.'

2.6.2.6 Community-level and higher level measurement

More research is needed on measuring resilience at the community and higher systems levels, as households may achieve some level of resilience on their own but will be limited if local and regional institutions and governance systems do not promote resilience-supportive policies and programming.

2.6.2.7 Inter-scalar relationships

Individuals, households, and communities form an interrelated hierarchy of scalar dependencies; individuals operate within households, which operate within communities, which operate within larger governance units (for example districts, departments, regions) (Barrett and Constas, 2012). Measuring resilience must take into account the functional connections and interactions that cause one level (for example household) to influence

positively or negatively another level (for example community) as well as interactions between levels. Additionally, variability is not constant over time and tends to vary according to scale (for example households, communities, wider ecosystems).

2.6.2.8 Aspirations/motivation

Attitudes, or aspirations, influence the preferences, choices, and behaviours of individuals (and groups) as well as the relationships they form within a particular community, and are shaped, in part, by socio-cultural attitudes and norms. Thus, aspirations have both a household-level and community-level component. Resilience depends not only on household access to and use of assets, but also on if and how households attempt to manage risk (including taking risks) and how their attitudes impact such decisions.

2.6.2.9 Natural resources/ecosystem health

Natural resource-based livelihoods such as agriculture, livestock, charcoal-making, wood gathering, wild-harvesting of foods and medicinal plants, and fishing are highly vulnerable to the effects of deforestation, encroachment into and degradation of fragile ecosystems, overgrazing, and improper land management, all of which undermine household and community resilience.

2.6.3 Household resilience to food insecurity

Household resilience to food insecurity is defined as a household's ability to maintain a certain level of well-being (food security) in the face of risks. It (Household resilience) depends on the options available to that household to make a living and on its ability to handle risks (Alinovi *et al.,* 2008). Household resilience refers therefore to ex-ante actions aimed at reducing or mitigating risks, and ex-post actions of coping with those risks. It also covers both short-term actions (e.g. coping) and actions that have longer-term impacts

(e.g. adaptation to structural changes to ensure household functioning). Empirical application focuses on how to measure resilience to food insecurity as a contribution to vulnerability assessment.

2.6.3.1 Measuring households' resilience to food insecurity

Achieving resilience at a significant scale will require the ability to measure resilience outcomes at an individual, household, and community levels. However, measuring resilience is not simply about measuring outcomes, but rather measuring changes in outcomes over time, particularly as a function of specific programmes or policies. To date, few measures that provide objective, verifiable information critical to assess the relative potential of different approaches to building resilience to food insecurity have been developed.

The examples below represent a sampling of methodologies being employed by NGOs, UN agencies and other actors to measure resilience and assess the impacts of their resilience programming at the household or community levels. Though not exhaustive, this list illustrates some of what is currently being done in terms of resilience measurement.

(i) Food and Agriculture Organization (FAO) index

The index developed by FAO estimates resilience as a latent variable made up of a number of context- specific components. In the first stage, an index for each component is estimated separately using an iterated principal factor analysis over a set of observed variables. In the second stage, the resilience index is derived using a factor analysis on the interacting components estimated in the first stage in which the resilience index is a weighted sum of the factors generated using Bartlett's scoring method and the weights are

the proportions of variance explained by each factor (Alinovi *et al.,* 2010). As presented in the analysis of resilience in Palestine, the components used are as follows:

(i) Assets: housing, durable index, tropical livestock units (TLU), land owned

(ii) Income and food access: income/expenditures, Household Food Insecurity Access Score (HFIAS), Dietary Diversity Score (DDS)

(iii) Access to basic services: physical access to/quality of health services, education, security, mobility/transportation, water, electricity and phone networks

(iv) Social safety nets: cash/in-kind assistance, quality of assistance, job assistance, frequency of assistance

(v) Adaptive capacity: income diversity, level of education, employment ratio, coping strategies, food consumption ratio

(vi) Stability: household jobs lost, changes to income/expenditures, safety net dependency, stability of education system, capacity to maintain stability in future

(ii) World Food Programme (WFP) Shock Impact Simulation (SIS) model

In partnership with FAO, WFP developed a Shock Impact Simulation (SIS) Model for estimating the ex-ante, current, and ex-post impacts of shocks in order to support intervention decisions, policy and planning (WFP and FAO, 2012). The model combines data from the World Bank, FAO, WFP and national sources on key household, livelihood, economic, market, and production variables that can be used to model the effects of six different shock factors (agricultural production, agricultural inputs/costs, commodity retail/wholesale prices, wage rate, remittances and transfers, and macro-economic factors and trade policies) on livelihoods and food insecurity outcomes.

(iii) USAID model

USAID supports resilience and economic growth in the Sahel and the Horn of Africa through its Feed The Future (FTF) programme. In part, USAID's resilience programming is based on the cost/benefit or value for money theory that investing in resilience is less expensive than humanitarian assistance (Collins, 2012). Logically, investments in resilience should lead to reductions in the need for humanitarian responses. This will be tested using FAO's resilience framework to identify factors that contribute to household resilience to food security shocks and stresses.

The USAID model focuses on six domains of resilience, each of which contributes to and collectively constitute resilience (Collins, 2012), income and food access, assets, social capital/safety nets, nutrition and health, adaptive capacity, and governance. Indicators of stability (over time) are included in each domain.

(iv) Catholic Relief Services (CRS) model

Faced with a potential pre-harvest food crisis for 2012 in Niger, Mali, and Burkina Faso, CRS initiated a Sahelian Resiliency Study to gain a better understanding of resilient households in Niger (TANGO, 2012b). Households on a pathway toward resilience are able to cope with shocks, to learn from past shocks and prepare for future ones while remaining food secure, ultimately moving beyond poverty and food insecurity.

(v) Oxfam GB model

In collaboration with a local partner in the Horn of Africa, Oxfam is working to increase resilience to drought among agro-pastoralist communities in Somalia (Hughes, 2011). Specifically, the programme aims at increasing availability of and community access to water and pasture resources, improving livestock health, and improving community

capacity in drought preparedness. Oxfam considers the following five dimensions to be key factors in resilience: Livelihood viability, Innovation potential, Contingency resources and support access, Integrity of the natural and built environment, and social and institutional capability:

IFAD model

Community resilience to climate-related shocks, in particular, rising sea-levels, storm surges, and floods, is being measured by the International Fund for Agricultural Development (IFAD) and the International Institute for Applied Systems Analysis (IIASA) in Phang Nga Thailand (Garbero and Muttarak, 2012). The study considers communities to be vulnerable to a shock if the risk of the shock results in a loss of well-being outcomes such that individuals or households within the community are unable to cope. In their study, resilience is a function of assets (human, financial, social), disaster awareness and preparedness, and adaptive capacity

2.6.3.2 Determination of factors influencing households' resilience to food insecurity

There are very few studies that have tried to quantitatively assess household's resilience to food insecurity (Appendix 3). The main problem with a quantitative approach to resilience measurement is that resilience is not directly observable. There are two possible strategies to overcome this problem: modelling resilience as a latent variable (Alinovi *et al*., 2008 and 2010; Mulat, 2010) or using an observable variable as a proxy of resilience (Carter *et al*., 2006; Keil *et al*., 2008). Mulat (2010) estimates household's resilience to food insecurity in a dynamic context by using micro-panel data from the Ethiopian rural households' survey. Resilience is considered as a latent variable and it is estimated through a Principal Component Analysis (PCA) run on to be based on four variables: food access, liquid assets, education, and social network. The authors also estimate a panel

fixed effect model and a dynamic panel model to find the determinants of resilience. It is interesting to notice that resilience measurement and the search for household's resilience determinants are here handled in two different phases.

Alinovi *et al*. (2008 and 2010) see model of resilience as a multidimensional latent variable, which is estimated using cross-sectional household data from the Kenya integrated household budget survey and from the Palestinian public perception survey respectively. The household resilience is supposed to be determined by various components: (i) social safety nets, (ii) access to public services, (iii) assets, (iv) income and food access, (v) stability and (vi) adaptive capacity. These components are, in turn, not directly measurable and are considered as latent variables themselves. Therefore, the authors designed a two-stage process to resilience assessment. In the first stage, the observed variables were used to estimate the first set of latent variables through a factor analysis. These latent variables are, in turn, used to compute a resilience index through the same technique. In Alinovi *et al*. (2010), the analysis is enriched by the use of cluster analysis to classify the population in six sub-groups corresponding to six livelihood strategies. In doing so it is possible to highlight how different livelihood groups (i.e. strategies) are related to different resilience levels and resilience building mechanisms. Thus, unlike in other studies Alinovi *et al.* (2010) resilience framework used cross section data to identify factors that contribute to household resilience to food insecurity. Therefore, this study uses the components provided by Alinovi *et al*. (2010) to determine factors which influence households' resilience to food insecurity.

In summary the chapter has presented a comprehensive literature review of food insecurity concepts, coping strategies and household resilience to food insecurity. It has shown the importance of examining the factors that determine household food insecurity, as this is

crucial to enhancing understanding of coping strategies, which could then lead to better future food security interventions. The literature review has also discussed different approaches used for household resilience to food insecurity analysis, and has indicated various factors that could influence household resilience processes and outcomes. Investigating food insecurity situation from the livelihood resilience is thus essential to understanding how various coping strategies contribute to food insecurity.

CHAPTER THREE

3.0 METHODOLOGY

3.1 Description of Study Area

The study was conducted in Chamwino and Manyoni districts in Dodoma and Singida regions respectively which are semiarid areas of Tanzania.

3.1.1 Chamwino District

Chamwino District is about 50 km from Dodoma town. The district shares boarders with Kiteto District to the East, Iringa Rural District to the South, Dodoma Municipality to the West, and Kondoa District to the North More than 80% of the population in Chamwino District are smallholder farmers (DALDO, 2004).. Chamwino District has 572 115 hectares of land which are suitable for agriculture; however, only 13.9% or 79 380 hectares are cultivated land. The district population, according to the 2012 National Population and Housing Census is 330 543 of which 158 882 (48%) are males and 171 661 (52%) are females (NBS, 2012). Administratively, the district comprises five divisions, 32 wards and 72 villages. The dominant ethnic groups in Chamwino District are Gogo, Maasai, Nguu and Nyambwa.

According to DALDO (2010), Chamwino District is composed of two zones (zone I and II). Features of zone I include undulating plains and hilly areas. The zone experiences low rainfall of about 400 mm per annum which is unreliable and unevenly distributed. Soil types include reddish–brown loamy sands, grey clays in depressions and dark greyish brown loams on hills. Basing on agronomic factors, the zone grows crops such as sorghum, millet, groundnuts, Bambara nuts and cassava. Due to receiving low and unreliable rainfall, zone I has low population. On the other hand, zone II is most densely

populated with low rainfall of between 500 mm and 650 mm per year which is unreliable and unevenly distributed. Soil types include reddish brown or dark loamy sands. Such agronomic factors allow the cultivation of sorghum, millet, cassava, sweet potatoes, groundnuts, Bambara nuts, sunflower, sesame, grapevines, pigeon peas, vegetables, and maize. Most of the cultivation is done in the northern part of the district where rainfall is slightly high.

The district was selected for the study due to her unique characteristics of being in the list of food insecure districts in Tanzania even when there is bumper harvest in the country (WFP, 2013). Similarly, the district is within the Volkswagen Foundation Initiative project area on "Semi-arid Areas in Transition: Livelihood Security, Socio-ecological Variability and the Role of Development Interventions in East Africa" for which this study was the part.

3.1.2 Manyoni District

The district lies between 6°7'S and 34°35'E covering an area of 28 620 square km that is about 58% of the entire area of Singida region. The district population, according to the 2012 National Population and Housing Census, is 296,763 of which 146,030 (49%) are males and 150,733 (51%) are females (NBS, 2012). Administratively, the district comprises five divisions, 30 wards and 72 villages.

The climate of Manyoni District is basically of an inland equatorial type modified by the effects of altitude and distance from the equator. The district forms part of the semi-arid central zone of Tanzania, which experiences low rainfall and short rainy seasons which are often erratic with fairly widespread drought of one year in four years (Majule and Lema, 2009). Manyoni District has a unimodal rainfall regime, which is concentrated in the

period of six months from November to April. The long-term mean annual rainfall is 624 mm with a standard deviation of 179 mm and a coefficient of variation of 28.7%. The long-term mean number of rainy days is 49 with a standard deviation of 15 days and a coefficient of variation of 30.6%. Generally, rainfall in the district is low and unreliable (Lema, 2008).

The annual mean, maximum and minimum monthly mean daily relative humidity is 80.6%, 86.0% (February) and 73.4% (July) respectively (Lema, 2008). The maximum and minimum monthly mean daily pan evaporation is 6.6 mm/day (November) and 5.2 mm /day (January) with a standard deviations of 1.2 mm/day and 0.8 mm/ day respectively (Lema, 2008). Temperatures vary according to altitude. The annual mean, maximum and minimum monthly mean daily temperatures in the district are 22.0°C, 24.4°C (November) and 19.3°C (July) respectively. The average annual daily sunshine hours are 7.9 h/day. The maximum and minimum monthly mean daily sunshine hours are 9.2 h/day (September) and 6.5 h/day (January) respectively (Lema, 2008).

Manyoni District was selected for the following reasons; first, it falls within the semi-arid areas of Tanzania where there are frequent food shortages due to rainfall unreliability. According to URT (2005) and WFP (2013) the district falls within regions with the worst assessment of food poverty. Secondly the district is within the Volkswagen Foundation Initiative project area on "Semi-arid Areas in Transition: Livelihood Security, Socio-ecological Variability and the Role of Development Interventions in East Africa" for which this study was the part.

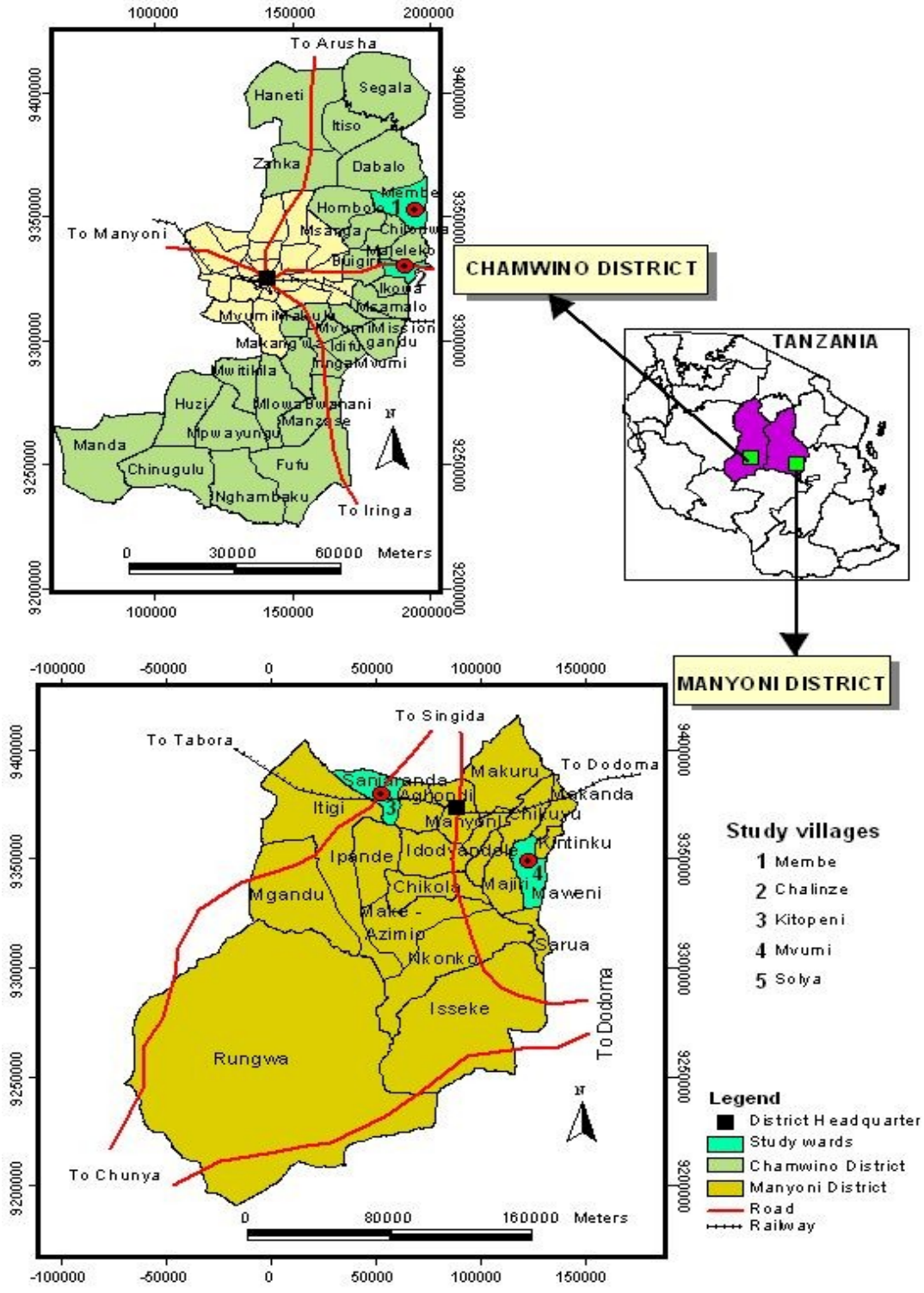

Figure 3: Map of Chamwino and Manyoni districts showing the study villages.

Source: Ministry of Lands, Housing and Human Settlements Development (2012)

3.2 Research Design

The study used a cross-sectional design and employed a survey method. A cross-sectional survey involves asking questions to a representative sample of the population at a single point in time. As Mugenda and Mugenda, (2003) argue, the design enables a researcher to investigate the existing status of behaviour. It produces statistical information about the existing status of household food insecurity and coping strategies for analysis, and as observed by Olsen and Marie (2004), the design allows the use of structured questionnaire and also produces statistical information for analysis. According to Babbie (1993), this method is suitable for a descriptive study like this one.

3.3 Sampling Procedures

Multistage sampling technique was employed in selecting regions, districts, divisions, 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 and three divisions and three wards from Manyoni district. Out of the two selected wards, two villages were selected from each ward in Chamwino district while out of three selected wards; three villages were selected from each ward in Manyoni district. Household heads were selected from the existing list of households from each village. Taking into account the high degree of homogeneity in the livelihood systems of the people of the study area, only five per cent of the households from each village were included in the survey as indicated in Table 2. As Boyd *et al.,* (1981) suggest, under certain circumstances such as resources and time constraints; five percent of the population is satisfactory. The sample of household heads was further categorized into 90 (78 males and 12 females) from food secure households and 110 (67 males and 43 females) from food insecure households using household food insecurity access scale. Thus, a sample of 200 respondents was involved in the study. All the five extension agents (3 males and 2 females) which are engaged in agricultural production at ward level serving

in the selected villages were involved in various focused group discussions and informal interviews in the study.

Table 2: Sample selection

Name of the district	Name of the village	Total number of households	Sampled households (5%)	High status	Middle status	Low status
Chamwino	Chalinze	1871	94	358(18)	717(36)	796(40)
Chamwino	Membe	467	23	146(7)	148(7)	173(9)
Manyoni	Solya	640	32	54(3)	267(13)	319(16)
Manyoni	Kitopeni	494	25	233(12)	152(8)	109(5)
Manyoni	Mvumi	526	26	64(3)	164(8)	298(15)
Total	**Total**	**3998**	**200**	**855(43)**	**148(72)**	**1695(85)**

Source: Own survey data, 2011

3.4 Data Collection Methods

3.4.1 Primary data

In order to study the coping strategies and household resilience to food insecurity, methodological pluralism was used. Methodological pluralism refers to the use of both quantitative and qualitative methods adopted from various social sciences, as well as the use of methods and data adopted from other disciplines. The use of a pluralistic methodological framework in the study of livelihoods like food insecurity has long been advocated (Carvalho and White, 1997), and is an emerging trend in development studies literature (White, 2002; Kanji *et al.,* 2005; Jansen *et al.,* 2005; 2006; Prowse, 2008; White 2008). In this study, primary data which were collected included socio-economic characteristics of the respondents as well as crop production practices and food availability, food accessibility, and food insecurity coping strategies. The primary data were collected using an interview schedule (Appendix 6), followed by key informants interview and Focus Group Discussion (FGDs). The data were collected between November 2011 and March 2012. FDG and key informants involved village leaders,

village executive officers, influential people and agricultural extension workers; a checklist (Appendix 7) was used to guide the discussion and interview. Information gathered through key informants‟ interviews provided an insight on crop production, food insecurity status and coping strategies employed by the farming households.

3.4.1.1 Quantitative data collection methods

Interview schedule with both close and open-ended questions (Appendix 6) was designed to provide answers to specific aspects regarding the study (Table 3). The following quantitative data were involved in the study; respondent's age (years), sex of the respondent, respondent's education level, family size, farm size, the total area cultivated per season, farming experience, the type of crops grown, agricultural inputs used, the number of livestock kept, the amount of income from different sources, crop productivity, the amount of various agricultural and non agricultural assets owned by households, and income spent on food. Initially, pre-testing of the interview schedule was done prior to the main survey to ensure validity and reliability of the questions.

Table 3: Study objectives, data collected and analysis used

Study objective		Data collected	Analysis
i.	Determine perception of farmers on the extent of food insecurity;	Perceived meaning of food insecurity, opinion on causes of food insecurity and trend of food insecurity obtained from the respondents	Descriptive statistics (frequencies and percentage)
ii.	Examine food insecurity status among farming households based on HFIAS	Household food insecurity indicators (HFIAS) responses obtained from the respondents	Household Food Insecurity Access Scale Descriptive Statistics (frequencies and percentage)
iii.	Analyze socio-economic factors that determine households' food insecurity;	Households' social economic factors (Human, Natural, Social, Financial, Physical, Access to social services factors) obtained from respondents	Descriptive statistics (chi square and mann-whitney u test) Binary logistic regression model
iv.	Examine the major food insecurity coping strategies employed by households in ensuring food security;	List of protecting consumption coping strategies obtained from the respondents	Descriptive statistics (chi square and mann-whitney u test)
v.	Analyze factors that determine households' resilience to food insecurity.	Households' factors {components: income and food access (*IFA*), assets (*A*), access to public services (*APS*), social safety nets (*SSN*), stability (*S*), and adaptive capacity (*AC*)}	Descriptive statistics (chi square and mann-whitney u test)

3.4.1.2 Pre – testing of the instruments

Pre- testing was done under field conditions. Thirty household heads were randomly selected from Loje, Chinangali 1 and Mvumi Makulu villages in Chamwino District, and these households were not included in the actual survey. Pre testing was done to check for any ambiguities in the wording of items (that is, check for clarity, redundancy, meaningfulness and comprehensiveness), to ensure that the amount of time required for completing the interview was not excessive and to assess the reaction of the respondents

with respect to certain items. During the pre-testing of this interview schedule, the time taken to interview one person was one hour. After pre-testing, it was found that no major changes in the content was necessary, except that there were certain items that were not clear and some were found to be repetitive. Some of these were modified and others were omitted. After modification and omission of some of the items, the time for interviewing one person was adjusted to fifty minutes. The interview schedule was revised and later used for actual data collection.

3.4.1.3 Qualitative data collection methods

Qualitative data collection included the following methods: Participatory Rural Appraisal (PRA) techniques (such as seasonal calendar, wealth ranking and transect walking), direct observations and focused group discussions. A checklist (Appendix 7) was used during focus group discussions. Participants for focus groups discussion were purposively selected based on their experience, skills and their influence in the community. About 5 to 10 persons were involved in the focus group discussion in each village. Key informants were selected based on the organization/groups and individual enterprises they represent.

3.4.2 Secondary data

Secondary data on food insecurity, household resilience and coping strategies were collected by going through relevant documents available at Manyoni and Chamwino Districts and in their respective regions. Secondary data sources provided basic information regarding livelihood and food insecurity situation; the data also provided essential contextual information about rural households and communities in the study area. Other sources of secondary data included Sokoine National Agricultural Library (SNAL), the Ministry of Agriculture, Food Security and Cooperatives and the Prime Minister's Office-Disaster Management Department.

3.5 Data Collection Procedures

The household farming head was the main respondent for questions on coping strategies and household resilience to food insecurity. The respondents were visited in their homes for interview sessions conducted through the use of interview schedule administered by the researcher and research assistants. There were elaborations and probing as was deemed necessary. Interview responses were filled in the interview schedule. Observations were done after the interview sessions. Information on observed phenomena was filled in the researcher's diary. What was observed included: the sizes of the farm lands, the type of food cultivated in the season, the type of houses in the homestead, household assets, the types of food available in the household, the foodstuff sold at the nearest market, the prices of foodstuff at the markets, the nearest water source, and the presence of water in the household.

3.6 Data Analysis

The completed interview schedule was coded and where applicable data from open-ended responses were sifted and categorized for further analysis. Similarities as well as differences in the responses were viewed and noted. These were compiled and analyzed. While qualitative data were subjected to content analysis with thematic organization framework, the quantitative analysis reported in this study was conducted using routine procedures of the Statistical Package for Social Science (SPSS) computer programme. Descriptive and inferential statistics were used in this study.

With regard to descriptive statistics, frequencies and percentages were used in presenting information on household socio-economic characteristics and factors influencing household food insecurity. This kind of organizing data was particularly useful in

visualizing data implications and drawing conclusions. The choice of this kind of data analysis procedures was done due to the descriptive nature of the study.

3.6.1 Determination of Household Food Insecurity using (HFIAS)

The Household Food Insecurity Access Scale (HFIAS) was used to determine food insecurity status of households. The HFIAS, a nine-item food insecurity scale developed by the USAID FANTA project measures anxiety about food supply, followed by questions about food quality, questions on food quantity, and, lastly, questions on going to sleep hungry or going all day and night without eating (Deitchler *et al*., 2010). The HFIAS score is then calculated as a continuous measure of the degree of food insecurity (access) in the household in the past four weeks (30 days). The score adds up to a maximum score of 27 for a household if food insecure and a minimum of 0 when the household is food secure

3.6.2 Determination of socio-economic factors influencing household food insecurity

3.6.2.1 Human capital factors

Human capital represents the skills, knowledge, education, ability to labour and good health that together enable people to pursue different livelihood strategies and achieve their livelihood objectives like food security. At a household level, human capital is a factor of the amount and quality of labour available; this varies according to household size, skill levels, leadership potential and health status (Carney, 1998 and DFID, 1999). In this particular study, human capital assets like sex, education level, marital status, age and household size of the sample households are discussed.

3.6.2.2 Natural Capital Factors

Natural capital is a term used for the natural resource stocks from which resource flows and services useful for livelihoods are derived. None of us would survive without the help

of key environmental services and food produced from natural capital (DFID, 1999). In this study, natural capital comprises land size held by the household and rainfall index scores in the study areas.

3.6.2.3 Social capital factors

Social capital refers to community and wider social claims on which individuals and households can draw by virtue of their belonging to social groups of varying degrees of inclusiveness in the society at large. Social capital may be defined as the ability of an actor to secure benefits by virtue of membership in social networks or social structures (Krishna and Shrader, 2000). It entails reciprocity within communities and between households based on trust deriving from social ties (Moser, 1998). Social capital can translate into access to relevant market information and buyers, wage employment and business opportunities, formal and informal loans, cash advances, inputs on credit, skills, shared resources for production and marketing, and migration opportunities (Davis, 1996).The study identified different forms of social relations that mediate access to other livelihood resources. Based on the theoretical as well as empirical findings, the variable included in this study is leadership position of household head in the sampled households.

3.6.2.4 Financial capital factors

Financial capital refers to stocks of money to which the household has access. This mainly involves access to credit and involvement in off-farm activities and receiving remittances. Based on the theoretical as well as empirical findings, the variable included in this study is the engagement of household in off-farm activities.

3.6.2.5 Physical capital factors

Physical capital comprises capital that can be created by economic production processes. Physical capital includes: shelter of adequate quality and durability, productive assets that enhance income (for example bicycles, rickshaws, sewing machines, and agricultural equipment), household goods, utensils, and equipment (such as radios and refrigerators). Under this variable, livestock ownership and possession of cell phone will be described.

3.6.2.6 Access to social services

In many developing countries, policies and institutions discriminate against those with few assets and disadvantaged poor people. Such discrimination policies undermine development efforts to eradicate poverty and food insecurity (Adugna, 2008). In the context of this study, institutional support variables were measured based on how household accessed various social services such as health and water.

An important measure of access to public services is the distance between the residence of the households and the facility at hand. This measure is particularly useful for large countries like Tanzania where transport network is not quite efficient (URT, 2002). The survey questionnaire recorded information on the distance between various facilities and the residence of households. Among various social services, health and water facilities are important in determining access to assets and food security status of households. In practice, the way households use safe water and a health facility often depends upon the ease of physical access.

3.6.3 The binary logistic regression model

A variety of statistical models can be used to establish the relationship between these household characteristics and food insecurity. Conventionally, linear regression analysis is

widely used in most economic and social investigation because of availability of simple computer packages, as well as the ease of interpreting the results. However, the results derived from linear regression analysis may lead to fairly unreasonable estimates when the dependent variable is dichotomous. Therefore, the use of the logit or probit models is recommended to mitigate the drawback of the linear regression model. Which model to choose between logit and probit is, however, difficult for they are similar in most applications, the only difference being that the logistic distribution has slightly flatter tails.

Both probit and logit analysis are well-established approaches in the literature in estimating dummy dependent variables (Feder *et al.,* 1985). However, when there are many observations at the extremes of the distribution then logit is preferred over probit (Liao, 1994). Also, as Sharma (1997) observes, the logit model is computationally easier to use than the other type. This means that there is no binding reason to choose one over the other but for its comparative mathematical and interpretational simplicity many researchers tend to choose the logit model. Therefore, this study employed the logit model following the footstep of these researchers. The dependent variable in this case, food insecurity, was a binary variable which took a value one (1) if the household was found to be food insecure, and zero (0) if otherwise. According to Gujarati (1995), the functional form of the logistic model is presented as follows:

$$P_i = F(Z_i) = \frac{1}{1 + e^{-(\alpha + \sum \beta_i X_i)}} \qquad (1)$$

Where P_i is the probability that household is being food insecure given X_i

X_i represents the i^{th} explanatory variables

a & b_i are regression parameters to be estimated.

e is the base of the natural logarithm

For ease of interpretation of the coefficients, a logistic model could be written in terms of the odds and log of odd. The odds ratio is the ratio of the probability that a household would be food insecure (P_i) to the probability of a household would not be food insecure ($1- P_i$). That is,

$$\left(\frac{P_i}{1-P_i}\right) = e^{Z_i} \quad (2)$$

and taking the natural logarithm of equation (2) yields:

$$\ln\left(\frac{P_i}{1-P_i}\right) = Z_i = \alpha + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_m X_m \quad (3)$$

If the disturbance term U_i is taken into account, the logistic model becomes:

$$Z_i = \alpha + \sum_{i=1}^{m} \beta_i X_i + U_i \quad (4)$$

The parameters of the model, α and β, can be estimated using the maximum likelihood (ML) method

In this study the explanatory variables used in the model included:

$X_{1=}$ Age of household head (in years)

$X_{2=}$ Household size (number of persons)

$X_{3=}$ Distance to health facilities (in km)

$X_{4=}$ Distance to water sources (in km)

$X_{5=}$ Rainfall index (total scores)

$X_{6=}$ Land size (in acres)

$X_{7=}$ Livestock ownership (number of cattle)

$X_{8=}$ Sex of household head (Male=1, Female=0)

$X_{9=}$ Possession of cell phone (Yes=1, No=0)

$X_{10=}$ Involved in off-farm activities (Yes=1, No=0)

X_{11} =Marital status of household head (Married=1, Otherwise=0)

X_{12} =Education of household head (Literate=1, Illiterate=0)

X_{13} =Participated in leadership (Yes=1, No=0)

Based on the sustainable livelihoods approach (see sections 1.5.2 and 3.5.3) the present study relates the explanatory variables in regression model to households' endowment with different forms of capital. Again, the selection of indicators in this study was driven by food insecurity literature drawing mainly from Haddad*, et al.* (1994); Hoddinott (1999); Hoddinot and Yohannes (2002), Liwenga (2003), Alene and Manyong (2006); Smith and Subandoro (2007), Qureshi (2007), Matunga (2008), Maxwell and Caldwell (2008), Sikwela (2008), Aidoo *et al.* (2013) and Bogale and Shimelis (2015) as well as data availability. The following, is the description of the variables and prior expectations about their relationship with food insecurity.

i Age of household head

Age of the household head is taken as an indicator of experience in agricultural production. Older people are therefore more likely to have more farming experience and hence more output resulting in their families having a lower probability of being food insecure (Romer, 1986; Uzma and Muhammad, 2004; Haile *et al.,* 2005). Although household food insecurity seemed to decrease with an increase in the age of the respondents, this relationship was not consistent therefore, the role of age in determining household food insecurity was not clear. Other research findings have demonstrated this inconsistency, by showing the age of the household head as having a significant impact on food insecurity and according to Babatunde *et al.* (2007) young and energetic household heads are expected to cultivate larger farms compared to older and weaker ones, and are

also expected to seek and obtain off-farm jobs to improve their food insecurity status. Similar results are expected in this study.

ii Household size

Household size is measured by the number of persons living at the same address having meals prepared together and with common housekeeping (Fiegehen and Lansley, 1976). Literature provides conflicting results on the relationship between household size and household food insecurity. While Lewis (1954) and Fei and Ranis (1961) are of the view that there is surplus labour in developing countries hence the marginal productivity of labour is zero thus making a small household better-off than a bigger one; Solow (1957) asserts that production increases with labour supply implying that bigger households produce more. Similar results are expected in this study.

iii Access to health facilities

Access to health facilities during peak agricultural periods (wet seasons) is important for maintaining labour productivity. During these times, households are prone to diseases. The distance to health facilities (measured in km), therefore, becomes a critical determinant of the household's success or failure of that seasons' agricultural production. Thus, this study envisioned that an increase of distance to the health facility can increase the likelihood of a household being food insecure.

iv Access to water source

Access to water source is a continuous variable that captures the distance from the water source. Distance from the water source (measured in km) can be expected to affect food insecurity of the rural poor by diverting the labour of particularly women from agriculture. Distance from the water source was measured for the surveyed households, and this study

expected that the increase of distance to the water source would increase the likelihood of household being food insecure.

v Land size

Land size (measured in acres) captures the size of the land available to the household for food production. Land can be leased in return for food or money thereby increasing the household financial resources thus enhancing access to food. Therefore, households with more land are likely to be less food insecure than those with less.

vi Subjective rainfall index

The subjective rainfall index is calculated to represent households' perceived rainfall adequacy in the preceding agricultural season. It is therefore expected that households who scored more on rainfall index were perceived to have adequate rainfall and less likely to be food insecure than their counterparts who scored less on rainfall index.

vii Livestock ownership

Livestock ownership is a continuous variable that captures the number of cattle owned by a household. Livestock are vital for food security as a source of food (meat and milk) and also as the providers of manure and draught power in production (Ndlovu, 1989). In times of drought, households either sell livestock or exchange it for cereals; hence they (livestock) act as an investment for future consumption. Households with more livestock are thus more likely to be less food insecure than those with less or no livestock.

viii Sex of household head

Sex of household head is a dummy variable taking a value of one (1) for a male headed household and zero (0) otherwise. According to FAO (1999), lack of access to resources

like land, inputs and support services limit the capacity of women as opposed to men of contributing significantly to their families' food basket. In this regard, male headed households are expected to be more food secure than female headed ones.

ix Cell phone ownership

Asset ownership and/or disposal provided valuable information for identifying food insecure households. Asset levels and changes in asset ownership over time are indicators of prevailing vulnerability, particularly if it is possible to clearly identify distress sales (Ellis, 2003; Devereux and Maxwell, 2001). Cell phone ownership is a variable that was assigned the value of one (1) if household head owned cell phone and zero (0) if otherwise. Households with cell phones are expected to be less food insecure than their counterparts with no cell phones.

x Off-farm activities

Off-farm activities are a dummy variable which takes a value of one (1) if the household head is engaged in off-farm activities and zero (0) if otherwise. Off-farm activities help farmers to diversify and stabilize their incomes, while providing capital for investment in technology and acquisition of critical inputs (Jayne *et al.,* 1994). Engaged in off-farm activities is therefore expected to reduce the likelihood of a household being food insecure.

xi Marital status

Marital status is a variable which takes a value of one (1) if the household head is married and zero (0) if otherwise. This implies that households heads who were married had a higher likelihood of being food secure. It is therefore implied that both the husband and the wife contribute their labour and other resources to improve the household food

security. According to Yusuf *et al.* (2015), married household heads have a higher incidence of food security compared to single, divorced, or widowed heads. This could be attributed to the fact that married household heads are likely to have larger households which are engaged in income generating activities, therefore, contributing more to household income compared to households headed by either singles or widowed.

xii Education level

The education level of a household head is significant in a household; education level may determine the absorption of extension information, the type of off-farm employment one can undertake and the income earned. These, in turn, influence access to food, land and other resources. Education is a dummy variable taking a value of one (1) for literate headed households and zero (0) if otherwise. According to Najafi (2003), education attainment by household heads helps them to quickly adopt new technology and understand farming instructions. It is therefore expected that households with literate heads are more likely to be food secure than their counterparts with little or no education.

xiii Leadership status

Leadership status is a dummy variable which takes the value 1 if the household head participates in any of the social leadership and 0 if otherwise. This variable entails social political role of the household within the community. The person's affiliation and involvement in social leadership activities will have a higher exposure for social power and utilization than those who did not involve. It is an asset that links an individual or a group to power structures and policy outside the locality (Baumann, 2000). Therefore, this variable was expected to improve household's access to social and financial capital. This in turn, increases the likelihood of the household's participation in various off farm

activities. Therefore, this variable was expected to be negatively related to household food insecurity.

3.6.4 Determination of factors influencing household resilience to food insecurity

In order to understand the key determinants of household resilience to food insecurity, the study used an updated version of the resilience framework developed by Alinovi *et al.* (2008) using data from Palestinian households. The resilience to food insecurity of a given household at a given point in time is assumed to depend primarily on the options available to that household to make a living, such as its access to assets, income generating activities, basic services and social safety nets. These options represent a precondition for the household response mechanisms to a given risk that is, its ability to handle it. In the original framework, Alinovi *et al.* (2008) proposed to assess the resilience to food insecurity for the i-th household as a latent variable defined according to the following components: income and food access (IFA), asset (A), access to public services (APS), social safety nets (SSN), stability (S), and adaptive capacity (AC).

3.7 Limitations of the study

Several problems were encountered during data collection; information on crop production, farm size and age suffers more from problems of respondent recall and incomprehension rather than deliberate manipulation. On the other hand information on livestock numbers was more often than not manipulated and understated. Thus the estimates were taken, making some of the data to be just estimates and not the actual ones. Many respondents (aged) had problems in understanding Swahili language, this required translation of Swahili language to Gogo/Nyaturu by the person who is competent in both languages in the study area.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Perception of Farmers on the Extent of Food Insecurity in the Study Area

The FGDs showed that there were different perceptions on the definition of food insecure households among key informants. Some of the key informants who participated in the discussions defined a food insecure household as one which has no food in the house and crops that bring hope at the field and cannot buy adequate food to sustain their requirements at present and in the future. On the other hand, some respondents defined food insecure households as those which are busy collecting wild fruits and vegetables for food all the time, and which could be determined by observing their actions, especially children; households which do not spend money on anything else rather than food; households whose members eat few meals (one or two) 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 from September to April, and the month with severe food shortage was February (Table 4). This is a critical period because it is during farming season when much energy and resources are required for work.

Table 4: Months of food shortage reported by respondents

Month	Frequency	Percent
January	1	0.5
February	190	95
March	5	2.5
April		
May	1	0.5
June	1	0.5
July		
August		
September	1	0.5
October	1	0.5
November		
December		
Total	**200**	**100**

The study further wanted to get views and experiences concerning the trend of food insecurity in the study area in the past, present and the possible future. Food insecurity trend is important in understanding the history of food insecurity problem in the study area.

According to the FGD, food insecurity trend in the study area in the past 15 years was worse because the area was largely inaccessible, there was no food business, there was no use of draught animals and the government and NGOs assistance was limited. It was noted however that this situation has changed since food insecure groups could be identified and given food relief during the critical situation. However, in the FGDs it was reported further that food insecurity situation has been worsening in the study area over the years, despite the government and non–governmental organizations' efforts to improve the situation. Accordingly, low production was cited as the major cause of food insecurity in the study area.

Table 5: Respondents opinions on the causes of low production (n=200)

Causes	Number	Percent
Drought	179	89.5
Shortage of labour	13	6.5
Shortage of draught animal	1	.5
Shortage of farming implements	2	1.0
Inadequate farmers advisory services	2	1.0
Lack of agricultural credit	1	.5
Pest damage	1	.5
Land degradation	1	.5

The causes of low production, which were mentioned by the majority of the respondents were frequent occurrence of drought (89.5%), shortage of labour (6.5%), shortage of farming implements (1.0%) and inadequate farmers advisory services(1.0%). Other causes of low production in the study area including shortage of draught animal, lack of agricultural credit, pest damage and land degradation were cited by less than 1% of the respondents (Table 5).

4.2 Food Insecurity Status among Surveyed Households based on HFIAS

As seen in Table 6, affirmative responses for the items ranged from 54% to 78.5% among the surveyed households. It was found that affirmative responses were the highest for items showing mild to moderate forms of food insecurity such as worry about food, unable to eat preferred foods, eating a limited variety of food items, and eating smaller or fewer meals a day. Affirmative responses for items 7, 8, and 9, which indicate severe forms of food insecurity, were low (54%, 56% and 55% respectively). Of the nine items, item 7 (no food to eating any kind of food in the household) received the lowest affirmative responses among the surveyed households.

Table 6: Distribution of respondents based on HFIAS questions

Response	Frequency	Percentage
Did you worry that your household would not have enough food?		
Yes	157	78.5
No	43	21.5
Were you or any household member unable to eat the kinds of foods you would have preferred to eat because of lack of resources?		
Yes	143	71.5
No	57	28.5
Did you or any household member have to eat a limited variety of foods because of lack of resources?		
Yes	141	70.5
No	59	29.5
Did you or any household member have to eat some foods that you really did not want to eat because of lack of resources?		
Yes	141	70.5
No	59	29.5
Did you or any household member have to eat a smaller meal than you felt you needed because there was not enough food?		
Yes	141	70.5
No	59	29.5
Did you or any household member have to eat fewer meals in a day because there was not enough food?		
Yes	142	71
No	58	29
Did it happen that there was no food to eat of any kind in your house, because of lack of resource to get food?		
Yes	108	54
No	92	46
Did you or any household member go to sleep at night hungry because there was not enough food?		
Yes	112	56
No	88	44
Did you or any household member stay for a whole day and night without eating anything at all because there was not enough food?		
Yes	110	55
No	90	45

The analysis of the HFIAS data in (Table 7) shows that only 45% of the households were categorized as food secure using this indicator; 11.5% of the households were categorized as mildly food insecure, about 15.5% were categorized as moderately food insecure while 28% of all the households surveyed were found to be severely food insecure.

Table 7: Household food insecurity categories (n=200)

Food security status	Frequency	Percentage
Food secure	90	45
Mildly food insecure	23	11.5
Moderately food insecure	31	15.5
Severely food insecure	56	28
Total	**200**	**100**

The HFIAS allows a researcher to make a basic distinction between food secure and food insecure households. For the purposes of this analysis, it was decided to include the three categories (mildly, moderately and severely) in the food insecure category. A dichotomous indicator for household food insecurity score of 10 or more was created. The two categories of food insecurity were useful in simplifying the presentation of the data without significantly changing the study area's food insecurity picture that the survey revealed (Table 8).

Table 8: Household food insecurity status (n=200)

Response	Frequency	Percentage
Food Secure(0-9 score)	90	45
Food Insecure(10-27 score)	110	55
Total	**200**	**100**

The sample survey shows that 53% of the headed households in Chamwino district were food secure and 63% of them were found to be food insecure. On the other hand, out of Manyoni household heads interviewed, 47% reported being food secure and 37 % reported being food insecure (Table 9). More than half of the household heads in

Chamwino district were not food insecure whereas, about half of the Manyoni district counterparts were food insecure. The statistical result indicate that there was no significant association between the two study areas and food insecurity status of the households ($p>0.05$). This information implies that, livelihoods of most of the people in these two districts are relatively similar and depend much on subsistence farming and livestock keeping which are reported by the previous studies (Kangalawe and Lyimo, 2013; Majule, 2009) to have been affected significantly by the unpredictable amount of and rainfall patterns in the respective areas.

Table 9 Food insecurity status by district

Variable	Food Secure (n=90)		Food Insecure (n=110)		Chi-square value
	No	%	No	%	
Study area					
Chamwino	48	53.3	69	62.7	1.023^{NS}
Manyoni	42	46.7	41	37.3	

NS= $P < 0.05$

4.3 Socio-economic Factors that Determine Households' Food Insecurity in the Study Area

The study compared the food insecure and food secure households on each of the independent variables. Chi-square analysis was used for categorical variables and Mann-Whitney U test for continuous variables. The Mann-Whitney U Test is used to test for differences between two independent groups on a continuous measure. This test is a non-parametric alternative to the t-test for independent samples. Instead of comparing means of the two groups, as in the case of the t-test, the Mann-Whitney U Test actually compares medians (Pallant, 2011). It converts the scores on the continuous variable to ranks across the two groups. It then evaluates whether the ranks for the two groups differ significantly. The following section cross-tabulates levels of food insecurity with a number of key

demographic, social and economic variables. An attempt was made to select about 13 best fitting predictors (age of household head, household size, rainfall index, land size, distance to the water sources, sex of the household head, educational level of the household head, marital status, leadership position, off-farm activities, livestock ownership, cell phone possession and distance to the health facilities) based on both a theoretical base and an empirical model fitting procedures.

4.3.1 Human capital factors

4.3.1.1 Sex of respondents

Access to critical economic resources and power to make choices that affect their lives vary according to gender relations that exist in a given society. The direct result of this is seen in the unequal roles and responsibilities of women and men. Women are a critical component of the rural economy and are engaged in agricultural production. They contribute significantly to cash and food crops, subsistence farming, and reproduction of male agricultural labour forces (Ellis, 2000 and MoFED, 2002).

The sample survey accounted for 53.8% of male headed households who were food secure and 46.2% of these were found to be food insecure. On the other hand, out of the total 55 female headed households interviewed, 21.8% reported of being food secure and 78.2 % reported of being food insecure (Table 10). Majority of female headed households were food insecure whereas, only about half of the men counterparts were food insecure. Female headed households were concentrated in the food insecure stratum. The statistical result indicate that there was a significant association between sex category and food insecurity status of households ($p<0.001$).

4.3.1.2 Literacy status of household head

The incidence of food insecurity was high (73%) among households whose household were illiterate, but the incidence was less among households headed by literate persons (27%). For the surveyed sample, the findings indicated that there was a significant association between literacy status of the household head and food insecurity status of the households ($p<0.01$) (Table 10). This conforms to the findings which suggest that literacy status of the household head might have an effect on household food insecurity (Amaza *et al.,* 2006).

4.3.1.3 Marital status of household head

The survey results indicated that 54.9% of married household heads were food secure; this was against 45.1% of the household heads from the same category who were found to be food insecure. When we compare food insecurity status across unmarried households, out of the total sample household heads, 19.6% were from food secure and 80.4% were from food insecure households. The statistical test shows that there was a significant association between marital status and food insecurity status of the households ($p< 0.001$) (Table 10). The findings revealed that majority of unmarried respondents came from food insecure households. This can be attributed to the fact that married couples have large family size as a factor is overridden by an increased family labour, which becomes an asset to increased food security.

Table 10: Distribution of respondents by various human capital factors (categorical) by food insecurity status (n=200)

Variable	Food Secure (n=90)		Food Insecure (n=110)		Chi-square value
	No	%	No	%	
				Sex (n=200)	15.205***
Male	78	53.8	67	46.2	
Female	12	21.8	43	78.2	
Literacy status					
Literate	73	53.3	58	46.7	11.022**
Illiterate	17	27	46	73	
Marital Status					
Married	79	54.9	65	45.1	18.808***
Not married	121	19.6	45	80.4	

*** = P < 0.001, **= P < 0.01

4.3.1.4 Age of respondent

It is argued that younger farmers are more likely to be more productive than older farmers (Tesfaye, 2003). Thus, age is expected to positively affect food insecurity status. In the survey, the average age of the respondents was 44.5 years for food secure households and 55 years for food insecure households respectively. The statistical analysis revealed that there was significant difference in the age of household head of food secure households and food insecure households ($p<0.001$) (Table 11). This implies that the older the household heads, the higher the chances of the household being food insecure. The positive correlation is supported by a study done by Matunga (2008), but is contrary to the results of a study by Demeka and Zeller (2009) who reported that more food secure households tended to have relatively older household heads than relatively younger household heads.

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4.3.1.5 Household size

In the present study, the mean size of the sample households is six for food secure and five for food insecure. The results revealed that there was a significant association between

household size and food secure and food insecure households ($p< 0.01$) (Table 11). This implies that, as the mean household size increases from five to six and from six to seven the probability of a household to be food insecure decreases contrary to the initial expectation. Based on the results, it might be worthy to note that the more resource rich the household is the higher the incentive of having more children (Liwenga, 2003; Matunga, 2008). Moreover, better off households often adopt children of their poor relatives to have additional labour (extended family). These results conform with the results reported in a study by Bezemer and Lerman (2002); Tesfaye (2003); Berhanu *et al.,* (2007). Specific to the study area, Matunga (2008) observed that large household sizes were common in both groups of food secure and food insecure households. This is due to the fact that many people in the study area practice polygamy (having more than one wife). This is particularly the case with people who own many cattle herds which enable them afford to marry many wives and sire children, hence more household members (Matunga, 2008). During focus group discussions, it was observed that large household size with more able bodied members provided more labour for production.

Table 11: Distribution of respondents by various human capital factors by food insecurity status (n=200)

Variable	Food Secure (n=90)	Food insecure (n=110)	Z-Value
Age	44.5	55	-3.544***
Household size	6	5	-3.357**

*** = P < 0.001, **= P < 0.01

4.3.2 Natural Capital Factors

4.3.2.1 Land size

Land is one of the most important factors and means of agricultural production. The findings revealed that the mean land size of the surveyed households were 8 and 3 acres for food secure and food insecure households respectively. The analysis showed that there was a significant association in land size and household food insecurity ($p < 0.001$) (Table 12). This implies that access to land enables production of both food and cash crops for individuals as well as for households (Sikwale, 2008; Bogale and Shimelis, 2009; Aidoo, 2013; Kumba, 2015)

Table 12: Surveyed households mean land size by food security status (n=200)

Variable	Mean		Z-value
	Food Secure (n=90)	Food Insecure (n=110)	
Land size	8	3	-6.178***

*** = P<0.001

4.3.2.2 Rainfall index

With respect to natural capital, the crucial role of rainfall in the life of agricultural households in Tanzania is widely recognized; any irregularity in its timing and/or fluctuation in the amount results in adverse welfare consequences. The present study examined how household food insecurity is associated with rainfall variation over time. It should be recognized that in developing countries like Tanzania, meteorological stations are sparse and hence reliable rainfall data at micro-level are scarce (Majule, 2009). Given this difficulty, the present study used a subjective index measure of rainfall. A Mann-Whitney U test was conducted to compare the rainfall index scores for food secure and food insecure households. There was no significant difference in scores for food secure

and food insecure (P > 0.05) (Table 13). These results confirm the importance of reliable rainfall in the household food production systems in the study area. The FGDs and key informants reported that farming activities in the study area have been affected significantly by the unpredictable amount of and rainfall patterns in the respective areas. Poor rainfall distribution coupled with drought periods, particularly inter-seasonal dry spells have amplified the problem of moisture stress (Mhita, 2006) and put at risk between 20 and 30% of human population living in semi-arid areas (DFID, 2001). Climate change and variability have increased the burden on food security and income among many farming families.

Table 13: Surveyed households mean rainfall index by food insecurity status (n=200)

Variables	Mean		z-value
	Food Secure (n=90)	Food Insecure (n= 10)	
Distance to water source	6	5	1.013^{NS}

NS = P > 0.05

4.3.3 Social capital factors

4.3.3.1 Leadership position

The involvement of heads of the households in different local administrative positions is expected to enable such heads to access a variety of information sources on different strategies to enhance access to various resources. Thus, households who are involved in such positions are more likely to be food secure than their counterparts who are not involved. The results indicated that among the households' heads with leadership position, 49.3% were food secure and 50.7 % were food insecure. The findings also showed that for those not involved in leadership, 42.9 % were food secure while 57.1% were food insecure (Table 14). The study results showed that there is no significant association

between the two groups of food secure and food insecure with respect to their social leadership participation ($p>0.05$). This is contrary to the expectations, one possible reason may be that food aid has been distributed for many years in the study areas and household heads with leadership position have been engaged in food aid distribution in their respective areas. It is natural that household responses to enquiries were very much influenced by their expectations created by the long-term presence of aid agencies.

Table 14: Respondents leadership participation by food insecurity status (n=200)

Variable	Food Secure (n=90)		Food Insecure (n=110)		Chi-Square
	No	%	No	%	Value
Leadership participation					0.501^{NS}
Yes	33	49.3	34	50.7	
No	57	42.9	76	57.1	

NS = P > 0.05

4.3.4 Financial capital factors

4.3.4.1 Off-farm activities

Off–farm activities are those activities besides farming which people are engaged in to supplement their income and food. Such activities have some influence on food insecurity, 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. If, however, farmers spend more of their time on off-farm activities, there is less time for farm operations and particularly if the wages they earn are not commensurate with the forgone farm income, their food insecurity situation will be in jeopardy. The findings indicate that of the households engaged in off-farm activities 44.6% were food secure and 55.4% were food insecure. Furthermore, the results indicate that of the households who reported not to

be engaged in off-farm activities 45.6% were food secure and 54.4% were food insecure (Table 15).

The statistical test indicated that there was no significant association between involvement in off farm activities and food security status (P > 0.05) (Table 15). On the contrary, some scholars argue that households with more access to off-farm activities or higher paying work are more food secure than households who do not have these benefits (Anderson, 1998). According to Aidoo *et al.* (2013), off-farm income generating activities have a paramount significance in diversifying the sources of farm households' livelihoods. Off-farm income generating activities enable farmers to modernize their production by giving them opportunity of reducing the risks of food shortage during periods of unexpected crop failures. Income from these off-farm activities is also invested in agriculture to increase production and food availability at the household level.

Table 15: Distribution of respondents by off-farm activities engagement status and household food insecurity status (n=200)

Variable	Food Secure (n=90)		Food Insecure (n=110)		Chi-Square
	No	%	No	%	Value
Off farm activities					1.000^{NS}
Yes	54	44.6	67	55.4	
No	36	45.6	43	54.4	

NS = P > 0.05

4.3.5 Physical capital factors

4.3.5.1 Livestock ownership

Livestock is one of the most important and crucial assets that farmers heavily depend on to safeguard their households from any sort of crisis. Livestock ownership being an important physical capital is expected to have negative effects on food insecurity since

livestock are an important source of household capital and a means to cope with difficult times. The results showed that out of the sampled households who owned livestock 56.4% were food secure and 43.6% were food insecure. The results also revealed that of the households who reported not to have livestock 28.9% were food secure and 71.1% were food insecure (Table 16). The statistical analysis showed a significant association between household livestock ownership and food insecurity status ($p< 0.001$). This information implies that livestock is an important household resource that plays a significant role as a hedge against food insecurity in the study area. Ownership of livestock resources is a centrepiece of the survival strategies and protection against indebtedness of various forms. Livestock, especially cattle, were the basic "value units" both in social and economic terms (Rigby, 1969:47). Livestock is used to gauge the value of anything from wives to children, to the seriousness of an offence, and the number of bags of grain borrowed in a food shortage season (Liwenga, 2003).

4.3.5.2 Possession of cell phone

The findings indicated that of the households who owned cell phones 71.6% were food secure and 28.4% were food insecure. Again, the results showed that of the households who reported not to have cell phones 24.1% were food secure and 75.9% were food insecure(Table 16). The statistical analysis revealed that there was a significant association between household cell phone ownership and food insecurity status ($P < 0.001$). This implies that cell phones could have significant potentials in helping the poorest farmers towards greater income and food security. Previously in most rural part of Tanzania, it was common for people to walk more than 50km, spending a day or more to relay simple messages such as notices for meeting or important information on agricultural projects (Temu *et al.,* 2005). With the emergency of cell phones, market information and other

important agricultural information, such as early warnings weather forecasts reach rural smallholder farmers in time.

Table 16: Distribution of respondents according to livestock ownership and cell phone possession by food insecurity status (N=200)

Variables	Food Secure (n=90)		Food Insecure (n=110)		Chi-Square Value
	No	%	No	%	
Livestock ownership (n=200)					**13.740*** **
Yes	66	56.4	51	43.6	
No	24	28.9	59	71.1	
Possession of Cell Phone (n=200)					
Yes	63	71.6	25	28.4	
No	27	24.1	85	75.9	

*** = P<0.001

4.3.6 Access to social services

4.3.6.1 Distance to health facilities

One important service which is highly correlated with food security is health service. Health services are also crucial for households and community stability. The survey result showed the mean distance for reaching the nearest health centre was 2.9 km or less for 42.7% of food secure and 57.3 % of food insecure households. Also 47.8 % of food secure and 52.2 % of food insecure had a mean distance of 3 km or above for reaching the nearest health centre (Table 17). The national mean distance to health facilities is 2.9 km (NBS, 2009). The statistical analysis indicated that there was no significant association between the distance to health facilities and household's food insecurity status ($p>0.05$). On contrary, Beraki (2009) found that distance to the health service positively affect the food insecurity status of the households in rural areas of Ethiopia. Access to health facilities during peak agricultural periods (wet seasons) is important for maintaining labour

productivity. During these times, households are prone to diseases. The distance to the health facilities, therefore, becomes a critical determinant of the household's success or failure of achieving that seasons' targeted agricultural production.

Table 17: Distribution of surveyed households by distance to health facilities and food insecurity status (n=200)

Variables	Food Secure (n=90)		Food Insecure (n=110)		Chi-Square Value
	No	%	No	%	
Distance to health facility					0.326^{NS}
Equal less than 2.9 km	47	42.7	63	57.3	
3 km and above	43	47.8	47	52.2	

NS = P>0.05

4.3.6.2 Distance to water source

The mean distance to the source of water for the surveyed households was 3 km for food secure and 8 km for food insecure households (Table 18). The statistical analysis showed that there was a significant association between the distance to the water source and food insecurity ($p<0.05$). From FGDs, it was revealed that the distance to the source of water positively affect household food insecurity of households in the study area by diverting the labour of particularly group (women) from agriculture.

Table 18: Surveyed households mean distance to water source by food insecurity status (n=200)

Variables	Mean		z-value
	Food Secure (n=90)	Food Insecure (n= 10)	
Distance to water source	3	8	-2.014*

*= P<0.05

4.4 Results of Logit Analysis

4.4.1 Diagnostic tests

The collinearity diagnostics test showed that there was no evidence of multicollinearity. The Reset Test had a Chi squared statistic of 8.772 with p-value 0.362 indicating that the model was correctly specified. The Log likelihood was equivalent to -192.920 showing that the model was appropriate for the study. The significant LR Chi-Square statistic of 81.136 with 13 degrees of freedom means that at least one of the regression coefficients in the model was not equal to zero.

Table 19: Binary logistic model results

Variables	B	S.E.	Wald	df	Sig.	Exp(B)
Age	.025	.014	3.296	1	.069*	1.025
Household size	-.055	.061	.808	1	.369	.947
Access to health facility(distance in km)	.005	.027	.030	1	.863	1.005
Access to water source(distance in km)	.143	.139	1.047	1	.306	1.153
Land size	-.018	.019	.925	1	.336	.982
Rainfall pattern index	-.093	.181	.261	1	.609	.912
Number of cattle	-.048	.024	4.042	1	.044**	.953
Sex	-.265	.901	.086	1	.769	.767
Possession of cell phone	-1.790	.393	20.757	1	.000***	.167
Off farm activities	.302	.406	.555	1	.456	1.353
Marital status	-.479	.889	.291	1	.590	.619
Literacy status	-.503	.494	1.036	1	.309	.605
Leadership status	.660	.398	2.752	1	.097*	1.935
Constant	.959	1.098	.763	1	.382	2.608

***, ** and * is significant at 1%, 5% and 10% probability level, respective

The sign of the coefficient of age of the household head shows a positive relationship with food insecurity. This means that an increase in the age of the household head increases the likelihood for the household to become food insecure. This is possible because young and energetic household heads are expected to cultivate larger farms compared to older and weaker ones, and seek and obtain off-farm jobs to improve their food security status. This

is in contrast with the findings in a study by Arene and Anyaeji (2010) who found that older household heads are more food secure than the younger ones because they are more knowledgeable in farming activities. The odds ratio, keeping other factors unchanged, in favour of food insecurity increases by a factor 1.025 when the age of the household head increases by one year. This result agrees with the prior expectation.

The household size factor revealed a negative relationship with food insecurity indicating that the odds ratio in favour of the probability of being food insecure decreases with an increase in the family size. More specifically, the odds ratio in favour of food insecurity decreases by a factor of 0.947 as the household size increases by one member. The likely explanation is that in an area where households depend on family labour, the production increases with labour supply implying that bigger households produce more. Access to health facility was found to be positively related to food insecurity in the study area. Distance to the health centre will increase the likelihood of a household being food insecure by the factor of 1.005. This may be due to the fact that the proximity to the health service can affect the wellbeing of the households such as food insecurity. This finding is also consistent with the findings by Bogale and Shimelis (2009) in his study in Ethiopia

Land size was hypothesized to influence food insecurity negatively. The results of the logit model indicated that sample households which had larger farm size had less risk of being food insecure. This is confirmed by negative coefficient of the variable. The odds ratio in favour of food insecurity decreases by 0.982 when the household land size increased by one acre. The possible explanation is that farming households with larger land sizes had better chances of producing more, of diversifying the crop they produce and also of getting larger volume of crop residues. This outcome is consistent with the finding from a research conducted by Bogale and Shimelis (2009) in Ethiopia. It is however in

contrast with the finding by Sikwela (2008) who found land size to be positively related to food insecurity in Zimbabwe.

The relationship between rainfall pattern index and household food insecurity is negative. An additional score of rainfall index decreases the probability of a household being food insecure by the factor of 0.912. This result implies that, the two groups (food secure and food insecure households) differ in their experience of rainfall adequacy in that the more food secured households experience relatively adequate rainfall outcome than the less food secured counterparts. Again, the results confirm the importance of rainfall in household food production system in the study area and in line with the common knowledge that the prevalence of adverse weather conditions are the underlying causes of food insecurity.

The relationship between the number of livestock holding and food insecurity turned out to be negative and statistically significant. This is an indication that ownership of livestock acts as a hedge against food insecurity in the study area. Livestock, besides its direct contribution to subsistence need and nutritional requirement, is a vital input into crop production by providing manure and serves to accumulate wealth that can be disposed during times of need, especially when food stock in the household deteriorates. The odds ratio in favour of food insecurity decreases by a factor of 0.953 when the number of livestock owned by the household rises by one cattle.

Household headship is often defined as a source of authority which is determined by culture and economic contribution to the household, among other factors. The coefficient of sex of the household head was negative indicating that there is a negative relationship between sex of the household head and food insecurity. The negative relationship implies

that households headed by males were less likely to be food insecure than those headed by females. The odds ratio in favour of food insecurity decreases by a factor of 0.767 with the male headed household. In the study area, however, female headship is complicated by the fact that only males are allowed to inherit land and this situation makes females unwilling to own up as household heads, even where they are. The result implies that, there is unequal participation of women and men in socio-economic activities and this gender disparity affects women in terms of control, ownership and accessibility to productive resources and participation in decision making and hence they become vulnerable to food insecurity

The result of the logistic model showed that possession of cell phone has a significant and negative influence on food insecurity in the study area. This result is completely in agreement with the prior expectation. The odds ratio in favour of food insecurity decreases by 0.167 as the household head owned a cell phone. Cell phones could have significant potential in helping the poorest farmers towards greater income and food security. With the emergency of cell phones, market information and other types of important agricultural information, such as early warnings weather forecasts reach rural smallholder farmers in time.

The off farm activities was hypothesized to have negative influence on food insecurity. This is because engagement in these activities might bring about more money thereby corroborating the food security situation of the household. In contrary with the hypothesis, its coefficient came out to be positive. The odds ratio in favour of food insecurity increases by a factor of 1.353 for household engaged in off farm activities. The likely explanation is that farmers spend much of their time on off-farm activities, leaving little

time for farm operations and if the wage they earn is not corresponding with the forgone farm income; their food security situation will be in danger.

Marital status coefficient indicated that households headed by married people are less likely to be food insecure than those headed by unmarried people. This finding is consistent with the findings by Haile *et al.* (2005) in Ethiopia and Kaloi *et al.* (2005) in Uganda. The odds ratio in favour of food insecurity decreases by the factor of 0.619, and this may be due to the fact that households headed with married people may have more members who are engaged in income generating activities, therefore, contributing more to household income compared to households headed by either singles or widowed.

The relationship between the education level of the household head and household food insecurity was found to have a negative relationship. This is because education enhances skills and ability to make decisions which can enable an individual to access better economic opportunities or better utilization of information including the use of technology and farming practices to improve agricultural production hence food security. The odds ratio in favour of food insecurity decreases by a factor of 0.605 for household with a literate household head. These findings compare favourably with those of several studies (e.g. Asogwa and Umeh, 2012; Olayemi, 2012) which indicated that the years of formal education were significantly related to household food security. According to Kumba *et al.* (2015), more educated farmers in the study area were found to be engaged in cash crop production compared to less educated ones, and this boosted their food insecurity status.

The involvement of the head of the households in different local administrative positions is expected to enable the household access a variety of information sources on different strategies of enhancing access to various resources. Thus, households who are involved in

such positions are less likely to be food insecure than their counterparts who are not involved in leadership roles, the sign of the coefficient of leadership status of the household head shows a positive relationship with food insecurity. The odds ratio in favour of food insecurity increases by 1.935 with the leader household head. This implies that a leader household head increased the likelihood for the household to be food insecure. This is contrary to the expectations, one possible reason may be that food aid has been distributed for many years in the study areas and household heads with leadership position have engaged in food aid distribution in their respective areas. It is natural that household responses to enquiries were very much influenced by their expectations created by the long-term presence of aid agencies.

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4.5 Major Food Insecurity Coping Strategies

During focus group discussions, a number of strategies were identified in the case of food insecurity situations. A range of coping mechanisms were reported, and these include: skipping meals, casual labour, reducing quantity of consumption per meal/day, getting food aid from government/NGOs, eating what is considered to be inferior foods/famine foods (foods normally not eaten), diversifying crops, selling charcoal, borrowing food from friends or relatives, borrowing food/cash from merchants with interest, diet change, get support from relatives and friends, seasonal migration for wage work, selling household assets and selling firewood. These strategies are almost similar to those identified in other empirical studies (Maxwell *et al.,* 1999; Malleret-King, 2000; Liwenga, 2003 and Matunga, 2008).

Coping strategies screening, aimed at ensuring that only major coping strategies which are protecting consumption in nature were retained for use in further analysis, led to the dropping of all coping strategies except five (Table 20). The five included food aid, crop

diversification, seasonal migration, casual labour, and off-farm activities. Only the five retained coping strategies were used for the empirical cross tabulation which was run using chi square statistical test.

Table 20: Percentage distribution of households by reported coping strategies used (n=200)

Coping strategies	Frequency	Percent
Received Food Aid	159	79.5
Diversifying Crops	61	30.5
Seasonal Migration	63	31.5
Casual labour	104	52.0
Off-farm activities	121	60.5

Multiple responses existed; hence column tallies may exceed 200 and 100% respectively

4.5.1 Coping strategies and household wealth status

It is difficult to generalize on coping strategies in response to food insecurity. The strategies are at best region specific and when ineffective, vulnerability of marginal groups is increased. It is therefore critical to verify and screen the coping options in a particular situation to generate relevant information. Based on this, the study compared food insecurity coping strategies across three wealth categories.

Wealth status is an important social category whose definition, in most societies, may vary across cultures and villages. It is one of the most important variables in social science research since it plays a significant role in the planning and execution of development programmes (Tiwari *et al.,* 2005). The household's wealth category status would mean the ranking of the household in the location to which it belongs, with respect to defined variables such as physical assets, economic status, education, occupation, social position, social participation, political influence, among others (Tiwari *et al.,* 2005). Some elements of these variables have a tendency to go together. In agriculture, wealth category status

affects labour availability, money to expend on purchasing inputs, savings and investment decisions, and the types, amounts and uses of crops grown. It also affects the numbers and variety of animals a livestock farmer could keep as well as their management tactics and use. Given his/her varied needs and problems, a farmer's wealth category status could also influence his/her ability or otherwise to cope with food insecurity.

4.5.1.1 Received food aid and household wealth status

The study area faced chronic shortages of food and thus perpetually depended on relief food aid. According to FGDs, many households had developed a dependency syndrome. It was further noted during FGDs that food aid programmes had caused some changes in the eating habits which had led to preference for maize which does not agronomically perform well in the study area. The habit and tradition of eating millet and sorghum as staples had been seriously reduced, whereas these were the crops most suitable for the semi-arid environment in the study area.

The survey results indicate that from the total sample households, 79.5% reported to receive food aid while 20.5% had not received food aid at all. When food aid reception was compared across wealth categories, out of the total sample household 12.0%, 27.5% and 40.0% were from high status, middle status and low status households respectively. Among the households which had not received food aid, 9.5%, 8.5%, and 2.5% were from high status, middle status and low status households respectively (Table 21). The statistical test indicated that there was a significant association between wealth status and reception of food aid. This implies that food aid plays a role in giving relief to those households who are perceived to be most at risk of severe food insecurity.

Table 21: Distribution of respondents by reported food aid received and households' wealth status (n=200)

Coping Strategy Variable	Wealth Status							
	High Status (n=43)		Middle Status (n=72)		Low Status (n=85)		Total (n=200)	
	No	%	No	%	No	%	No	%
Received Food Aid								
Yes	24	12.0	55	27.5	80	40.0	159	79.5
No	19	9.5	17	8.5	5	2/5	41	20.5
χ^2								26.374***
P-value								0.000

*** = P<0.001

4.5.1.2 Diversification of crops and household wealth status

Crops diversification is based on cultivating more than one variety of crops belonging to the same or different species in a given area. Crop diversification brings about higher spatial and temporal biodiversity on the farm and increases resilience. The survey results indicate that from the total sample, 30.5% of the respondents reported to have diversified crops while 69.5% reported not to have done so. When compared crops diversification across wealth categories, out of the total sample household 8.5%, 10.0% and 12.0% were from high status, middle status and low status households respectively. Among households which reported not to employ crops diversification strategy, 13.0%, 26.0% and 30.5% were from high status, middle status and low status households respectively (Table 22). The statistical test showed that there was no significant association between wealth status and crops diversification status. These findings agree with that of Njeru (2013) which showed that in developing countries the use of crop diversification as a strategy to increase food production by farm household has not been well adopted. This could be attributed to the fact that conventional agriculture is dependent on the use of specific crop varieties or hybrids that have been bred specifically to exploit high-input conditions.

Conversely, crops varieties used in high – input systems are not often adapted to low input farming, a key element of many farm households in the study area.

Table 22: Distribution of respondents by diversifying crops and households' wealth status (n=200)

Coping Strategy Variable	Wealth Status							
	High Status (n=43)		Middle Status (n=72)		Low Status (n=85)		Total (n=200)	
	No	%	No	%	No	%	No	%
Diversification of Crops								
Yes	17	8.5	20	10.0	24	12.0	61	30.5
No	26	13.0	52	26.0	61	30.5	139	69.5
$\chi 2$								2.113^{NS}
P-Value								0.348

NS = P>0.05

4.5.1.3 Seasonal migration and household wealth status

Migration refers to a situation where one or more family members leave the resident household for varying periods of time, and in doing so are able to make new and different contributions to its welfare, although such contributions are not guaranteed by the mere fact of migrating (Ellis, 2000). Migration may be temporary or permanent; as a critical strategy to secure off-farm employment, or stimulate economic and social links between areas of origin and destination. Migration have implications for the asset status of those left behind, for the role of women and for on-farm investments in productivity. Seasonal and circular migration of labour for employment has become one of the most coping strategies in the study area.

The survey results revealed that from the total sample 31.5% had experienced seasonal migration among the members of households in the previous 3 years and about 68.5% had no such experience. By comparison, households with seasonal migration experience

across wealth categories, out of the total sample of households, 2.5%, 14.5% and 14.5% were from high status, middle status and low status households respectively. Among households which had no experience of seasonal migration, 19.0%, 21.5% and 28.0% were from high status, middle status and low status households respectively (Table 23). The statistical test showed that there was a significant association between wealth status and seasonal migration status. Although the association was significant across the three categories, the results reflected that most households despite their wealth status (68.5%) did not depend on seasonal migration. According to most respondents, the importance of seasonal migration and household food security decreases with time. This means that recently, seasonal migration strategy has relatively had little contribution to reducing households' food insecurity status in the study area.

Table 23: Distribution of respondents by reported seasonal migration and households' wealth status (n=200)

Coping Strategy Variable	Wealth Status							
	High Status (n=43)		Middle Status (n=72)		Low Status (n=85)		Total (n=200)	
	No	%	No	%	No	%	No	%
Seasonal migration								
Yes	5	2.5	29	14.5	29	14.5	63	31.5
No	38	19.0	43	21.5	56	28.0	137	68.5
$\chi 2$								10.711**
P-Value								0.005

**= P<0.01

4.5.1.4 Casual labour and household wealth status

The survey results revealed that from the total sample, 52.0% reported to have been involved in some casual labour activities in the previous season while about 48.0% reported not to have been engaged in any casual labour activities. When the engagement in casual labour activities is compared across wealth categories, out of the total sample

households, 2.5%, 19.5% and 30.0% were from high status, middle status and low status households respectively. Among the households which had not been engaged in casual labour activities, 19.0%, 16.5%, and 12.5% were from high status, middle status and low status households respectively (Table 24). The statistical test showed that there was a significant association between wealth status and engagement in casual labour activities. Although casual labour was observed to be the major coping strategy on food insecurity especially among low status households, it was 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.

Table 24: Distribution of respondents by reported engagement in casual labour activities and households' wealth status (n=200)

Coping Strategy Variable	Wealth Status							
	High Status (n=43)		Middle Status (n=72)		Low Status (n=85)		Total (n=200)	
	No	%	No	%	No	%	No	%
Casual labour								
Yes	5	2.5	39	19.5	60	30.0	104	52.0
No	38	19.0	33	16.5	25	12.5	96	48.0
$\chi 2$								39.981***
P-Value								0.000

*** = P<0.001

4.5.1.5 Off-farm activities and household wealth status

The survey results revealed that from the total sample, 60.5% reported to have been engaged in off-farm activities while 39.5% reported not to have been doing so. When involvement in off-farm activities is compared across wealth categories, out of the total sample household 12.5%, 23.5% and 24.5% were from high status, middle status and low

status households respectively. Among households which reported not to have been involved in off-farm activities, 9.0%, 12.5% and 18% were from high status, middle status and low status households respectively (Table 25). The statistical test shows that there was no significant association between wealth status and engagement in off-farm activities. This information implies that regardless of differences in household wealth status, there are relatively equal opportunities for the households across all wealth status in are engaged in off-farm activities in the study area. In contrast, some studies (Qureshi, 2007; Maharjan and Chhetri, 2006) reported positive correlation between wealth status and engagement in off farm activities.

Table 25: Distribution of respondents by reported off-farm activities and households' wealth status (n=200)

Coping Strategy Variable	Wealth Status							
	High Status (n=43)		Middle Status (n=72)		Low Status (n=85)		Total (n=200)	
Off-farm activities	No	%	No	%	No	%	No	%
Yes	25	12.5	47	23.5	49	24.5	121	60.5
No	18	9	25	12.5	36	18	79	39.5
χ^2								1.078^{NS}
P-Value								0.583

NS = P>0.05

4.5.2 Coping strategies and household food insecurity

Households that are vulnerable to food security adopt different strategies to reduce, mitigate, and cope with risk and shocks that affect them, based on the options offered by their internal resource endowment and their access to external assistance. Households are found to depend on different strategies to cope with food deficit situation. Based on this, the study focused on the food insecurity situation of the household and the options considered when the security is threatened.

4.5.2.1 Food aid and household food insecurity status

The findings indicated that about 68.9% of the food secure households and 88.2% of food insecure households received food aid during the survey period (Table 26). There was a significant association ($p < 0.01$) between the household food security status and the reception of food aid. This association, however, implies that the food insecure households are less resilient and are likely to receive food aid in the study area. This is because there are special food aid programmes implemented in the study area which focus on the most vulnerable households to food insecurity in the study area.

4.5.2.2 Crops diversification and household food insecurity status

The findings indicated that 34.4% of food secure households and 27.3% of food insecure households had diversified crops just before the survey period. However, there was no significant association between the food insecurity status of the household and household crops diversification status (Table 26). The result revealed that the utilization of crops diversification as a strategy to reduce food insecurity situation is not associated with the household food insecurity status. This conforms to the results by other studies (e.g. Liwenga, 2003; Matunga, 2008) which reported that most of the rural households in the semi-arid areas depend on rain-fed agriculture and tend to be susceptible to drought and other climate related problems. Again, as a matter of fact, most of the climate related effects are not idiosyncratic (personal) in nature and thus affect almost the whole community.

4.5.2.3 Seasonal migration and household food insecurity status

It was found that about 23.3% of food secure households and 38.2% of food insecure households had migrant members in the previous 3 years (Table 26). The result showed further that there was a significant association ($p < 0.01$) between household food

insecurity status and the seasonal migration strategy used by the households in ensuring food security. This implies that the more food insecure households are, the more the chances for the household of having a member who migrates to other places. The results are similar to those in a study by Crush and Frayne (2007) who revealed that, at the household level, migration has played an important role in terms of income diversification and is often considered as an important food insecurity coping strategy within the contemporary context of rural areas in most of the African countries. However, the findings are in contrast with those by Frayne (2010) who reported that having a migrant member in the household makes no difference to the food insecurity situation.

4.5.2.4 Casual labour and household food insecurity status

Casual work is particularly associated with food insecurity. The households which do not engage in casual labour are seen as being food secure, while those households which are engaged in casual labour are considered as food insecure. It has been argued that rural households rely mainly on the use of their labour as their main productive asset for earning their livelihoods and gaining access to food; the reliance on family labour is also a result of having limited access to other productive assets and limited coverage of social protection (FAO, 2012). It is further noted that income that rural workers derive from their labour depends to a large extent on their portfolio of assets, including physical and financial assets, human and social capital, as well as on the quantity of labour with which the household is endowed (FAO, 2012). If either the quantity or the rate of return to labour is low, a worker is likely to live in poverty and hence becomes less resilience to food insecurity.

The findings showed further that about 32.2% of food secure households and 68.2% of food insecure households participated in casual labour activities during the survey period.

There was a significant association ($p<0.001$) between household food security status and the possibility of the household being engaged in casual labour activities. Although casual labour was observed to be the most common coping strategy for food insecure households in the study area, it is not an effective coping strategy since it constraints production by labour shortage in the individual households' farms. 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.

4.5.2.5 Off- farm activities and household food insecurity status

Off-farm activity is an additional work engaged in by households besides farming to supplement household income. The level of off-farm activity can influence households' food insecurity, but this can either be positive or negative depending on the level and gains from the activity (Babatunde and Leliveld, 2007). This is because engagement in an activity can bring in money thereby helping improve the food insecurity situation of the household. On the other hand, if farmers spend more of their time on off-farm activities at the expense of working on their farms, and particularly if the wages they earn are not commensurate with the forgone farm income, their food insecurity situation could be worsened. Therefore, the expected effect on food insecurity could be positive or negative.

Off- farm activities is among the most popular coping strategy used in the study area. The findings showed that about 60% of food secure households and 60.9% of food insecure households were engaged in off-farm activities during the survey period. There was no significant association between food insecurity status and the households' engagement in off-farm activities (Table 26). This means that there are relatively equal opportunities of off-farm activities in the study area.

Table 26: Distribution of respondents by coping strategies and food insecurity status (n=200)

Variables	Food Insecurity Status				Chi-Square value
	Food secure (n= 90)		Food Insecure (n= 110)		
	No	%	No	%	
Received Food Aid					
Received food aid	62	68.9	97	88.2	10.152**
Do not received food aid	28	31.1	13	11.8	
Crops diversification					
Diversify crops	31	34.4	30	27.3	0.887^{NS}
Do not diversify	59	65.6	80	72.7	
Seasonal migration					
Migrate	21	23.3	42	38.2	4.393**
Do not migrate	69	76.7	68	61.8	
Casual labour					
Do casual labour	29	32.2	75	68.2	24.224***
Do not do casual labour	61	67.8	35	31.8	
Off-farm activities					
Involved in off-farm Activities	54	60.0	67	60.9	0.000^{NS}
Do not involved in off-farm activities	36	40.0	43	39.1	

NS = P>0.05, ** = P<0.01, *** = P<0.001

4.6 Factors that Determine Households' Resilience to Food Insecurity in Study Area

In order to understand the key food insecurity resilience factors of each household food security status and to make a comparison between them, the study used components proposed in an updated version of the resilience framework developed by Alinovi *et al.* (2008). The resilience to food insecurity of a given household at a given point in time is assumed to depend primarily on the options available to that household in making a living, such as its access to assets, income-generating activities, basic services and social safety nets. These options represent a precondition for the household response mechanisms to a given risk such as food insecurity that is its ability to handle it. In the original framework, Alinovi *et al.* (2008) proposed to assess the resilience to food insecurity for the *i*-th

household as a latent variable defined according to the following components: income and food access (IFA), assets (A), access to public services (APS), social safety nets (SSN), stability (S), and adaptive capacity (AC).

This study associates the high, middle and low status households on each of the key factors. Chi-square analysis was used for categorical variables and mann-Whitney U test for continuous variables. The following section cross-tabulates households wealth status with a number of key factors of resilience to food insecurity. An attempt was made to select the indicators based on both a theoretical basis and an empirical model fitting procedure.

4.6.1 Income and food access (IFA)

This indicator is directly related to a household's access to food. Economic access to food is considered to be the main food insecurity concern in Tanzania. The traditional indicator for measuring food access capacity is income; but this study includes *Access to credit*: as a dummy variable, which is equal to 1 for having access to credits and 0 if otherwise.

4.6.1.1 Access to credit

Credit is considered as an important source of investment and helps to improve income of households, and households who have better access to credit can have better investments which in turn can improve food insecurity status. In this study, it was hypothesized that credit service will have a positive link with household resilience to food insecurity. It was found that about 18.9% of foods secure and 11.9% of food insecure households accessed credit during the survey period (Table 27). The Chi-square test showed that there was no significant association ($p>0.05$) between household food security status and access to

credit. This means that regardless of food insecurity status, households have relatively equal opportunities of accessing credit in the study area.

Table 27: Distribution of respondents access to credit by food insecurity status (n=200)

Variable	Food Insecurity Status				
	Food Secure (n=90)		Food Insecure (n=110)		Chi-Square Value
	No	%	No	%	
Access to credits					
Yes	17	18.9	13	11.9	1.362^{NS}
No	73	81.1	97	88.1	

NS = P>0.05

4.6.2 Access to public services (APS)

Public service provision is beyond households' control, but is a key factor for enhancing a household's resilience, such as improving the effectiveness of that household's access to assets. As a result, better access to public services affects a household's capacity to manage risks and respond to crisis and hence increases household resilience. The following public service was considered in the analysis:

Distance to Primary school: it is a continuous variable measuring the actual distance (km) to the closest primary school.

(a) Distance to primary school

Distance to primary school is one of the potential determinants of rural households with scarce labour who use child labour in domestic and agricultural work. To see this association, distance to the primary school for the surveyed households was analyzed and A Mann-U test revealed that there was no statistically significant difference between distance to primary school and household food security status (p>0.05). The food secure

households recorded mean rank and food insecure households recorded mean values (Table 28). This confirms the view of key informants that accessibility to public services does not always depend on households' social stratification like food security status and it also indicates relatively an equal opportunity to access public services among the surveyed households.

Table 28: Respondents reported distance to primary school by food insecurity status (n=200)

Variable	Mean		Z-Value
Distance to primary school	Food Secure (n=90)	Food Insecure (n=110)	
	105.95	94.23	1.457^{NS}

NS = P>0.05

4.6.3 Assets (A)

Assets are part of a household's capital, and their availability is an important coping mechanism during periods of hardship. They therefore have to be considered as a key factor in assessing resilience. Assets play a crucial role in determining the household's risk coping mechanisms. This study includes both agricultural and non-agricultural assets, namely:

(a) *Number of bicycles*: it is a continuous variable measuring the actual number of bicycles owned by the household.

(b) *Plough*: this is a dummy variable which is equal to 1 if the household owned a plough over the survey period and 0 if otherwise.

(a) Number of bicycles

Number of bicycles owned by households is one of the potential determinants of African rural households' well-being. A bicycle is regarded as a solution to transport problems. This measure is particularly useful for large countries like Tanzania where the efficiency of transport network is quite low (URT, 2007). Bicycles are mainly used by rural households for travel purposes – most commonly for going to the market places or for running errands. Bicycle usage positively impacts on the well-being and more specific on a household food security by facilitating access to economic and social services such as water, markets and health facilities. A Mann-Whitney U test revealed a significant difference in the number of bicycles of food secure households and that of food insecure households ($p<0.001$) (Table 29). This implies that, as the number of bicycles increases, so is the probability of household resilience to food insecurity.

Table 29: Respondents number bicycles by food insecurity status (n=200)

Variables	Median		Z-Value
Number of bicycles	Food Secure (n=90)	Food Insecure (n=110)	
	1.0	0	-5.190***

*** = P<0.001

(b) Ownership of the plough

Asset ownership and/or disposal provide valuable information for identifying food insecure households. According to Monde (2003), characteristics of a more successful rural household are the fact that they own more and improved agricultural implement. Households using ploughs are expected to have better production capacity than the non-users. The use of plough improves productivity per unit area and helps the household to meet food needs. The use of modern farm implements such as plough can result into a

significant increase of an income for the farmers (Beyene, 2000). Thus, this study hypothesized that households with farm implements are likely to have positive impacts on household resilience to food insecurity. In other words, a household which could have a plough was hypothesized to have a positive relation with resilience to food insecurity.

With special emphasis to plough ownership, out of the total sampled households, 55.6% of food secure and 10.9% of food insecure households owned ploughs during the survey period (Table 30). The Chi-square test showed that there was ac significant association ($p<0.001$) between household food security status and plough ownership status. Generally, the low ownership of agricultural implements is a cause of concern. Households indicated that farming was their major source of income. This might imply that households relied on hired implements. These results are in line with the assumptions made by the present study.

Table 30: Distribution of respondents plough ownership by food insecurity status (n=200)

Variable	Food Insecurity Status				
	Food Secure (n=90)		Food Insecure (n=110)		Chi-Square
	No	%	No	%	Value
Plough ownership					
Yes	50	55.6	12	10.9	34.208***
No	40	44.4	98	89.1	

*** = P<0.001

4.6.4 Social safety nets (SSN)

Social safety nets are a crucial aspect of mitigating crises in the study area. More and more households were becoming dependent on assistance from international agencies, charities and non-governmental organizations (NGOs). The help received from friends and relatives

was also substantial. Safety nets can therefore be considered to represent the system's capacity to mitigate shocks, and a general indicator for the households to be included in the estimation of resilience. The variable used to analyze the *SSN* indicator was: *Received remittances*: this is a dummy variable which was equal to 1 if the household received remittance over the survey period, and 0 if otherwise.

(a) Remittances

Receiving remittance refers to relatives' economic support in the form of money or food to the household from abroad and within the country, mainly from urban to rural dwellers. Remittances play an increasingly big role in the economies of many countries, contributing to economic growth and to the livelihoods of the needy people (though generally not the poorest of the poor) (Ellis, 2000). Getting relatives' economic support from abroad and within the country was expected to positively relate to the resilience of the household to food insecurity.

The results indicate that about two-fifths (39.3%) of food secure and 30.6% of food insecure households received remittance during the survey period (Table 31). The Chi-square test showed that there was no significant association ($P > 0.05$) between food insecurity and reception of remittance. The findings from the study revealed that both food secure and food insecure households had low number of respondents who reported to have received remittances. Receiving remittance is not a common phenomenon in the study area. The possible explanation for this is that most of the household member's relatives lived in the same or nearby villages. Therefore, such relatives have been equally affected by the problem of food insecurity. These findings are not consistent with those of other studies (Mendola, 2008) in developing countries, which reveal that remittances are a

significant component of household income and enable recipient families to smoothen their consumption and increase resilience to food insecurity.

Table 31: Distribution of respondents received remittance by food insecurity status (n=200)

Variable	Food Insecurity Status				
	Food Secure (n=90)		Food Insecure (n=110)		Chi-Square
	No	%	No	%	Value
Remittance					
Yes	35	39.5	34	30.6	0.274^{NS}
No	55	60.7	76	69.4	

NS = P>0.05

4.6.5 Adaptive capacity

Adaptive capacity (AC) indicates a household's capacity to cope with and adapt to a certain shock, enabling that household to keep performing its key functions. In other words, *AC* represents the households' capacity to absorb shocks. For example, having more coping strategies means having more probability of mitigating food insecurity after, say, losing a job. The characteristic of adaptability is the buffer effect on household key functions. *AC* is measured by the following variable.

Literacy status: this is a dummy variable which is equal to 1 if the household head is literate, and 0 if otherwise.

(a) Literacy status

Literacy status is associated with access to employment and higher incomes and hence resilience of the household. Literate household heads also have the greatest proportion of food secure households; the reverse is true for illiterate household heads. For the study area, the findings showed that 81.1% of food secure and 58.2% of food insecure

household heads were literate (Table 32). The Chi-square test showed that there was a significant association ($P < 0.01$) between household food insecurity status and literacy status of household heads. Similar findings are reported by Babatunde *et al.* (2007) who reveal that households with illiterate heads are more likely to be food insecure than those with literate heads.

Table 32: Distribution of respondents literacy status by food insecurity status (n=200)

Variable	Food Insecurity Status				
	Food Secure (n=90)		Food Insecure (n=110)		Chi-Square
	No	%	No	%	Value
Literacy status					
Literate	73	81.1	64	58.2	11.022**
Illiterate	17	189	46	41.8	

** = P<0.01

4.6.6 Stability (S)

Stability is a widely used concept in food security literature, although it is usually used to describe the stability of food supply. This study considered stability to be a cross-sectoral dimension of resilience. The following variable was used to measure stability:

Household assets stability: (increased; decreased): This is a dummy variable which is equal to 1 if the households perceived increased assets over time and 0 if otherwise.

(a) Household assets stability

It was found that about two-thirds (66.3%) of food secure and 43.5% of food insecure households were reported to have increased assets in their respective households (Table 33). The Chi-square test showed that there was significant association (P<0.001) between household food security status and household assets stability. This implies that if

households' assets possession was increased, their resilience to food insecurity would also respond positively in the study area.

Table 33: Respondents household assets stability by food insecurity status (n=200)

Variable	Food Insecurity Status				
	Food Secure (n=90)		Food Insecure (n=110)		Chi-Square
	No	%	No	%	Value
Stability of household assets					
Yes	60	66.3	36	45.5	18.182***
No	30	33.7	36	56.5	

*** = P< 0.001

In summary, the overall objective of this study was to investigate the coping strategies and households' resilience to food insecurity. The findings show that about half of the households in the study area were food insecure based on HFIAS. Again, there was significant different between food secure households and food insecure households based on household socio-economic factors such as sex, age, marital status, literacy status, household size, possession of cell phones and livestock ownership. The major types of protecting consumption food insecurity coping strategies employed include receiving of food aid, diversifying crops, seasonal migration, engaging in casual labour and off-farm activities. It is further demonstrated that there are clear significant differences between food secure and food insecure households in the various components used to measure resilience. The following Chapter gives conclusions and recommendations based on the major findings of the study.

CHAPTER FIVE

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The general objective of this study was to investigate the coping strategies and households' resilience to food insecurity in order to understand farmers' perceptions on the nature and extent of food insecurity, analyze socio-economic factors that determine households' food insecurity status, coping strategies employed by farm households, and factors that determine household resilience to food insecurity in order to understand how coping strategies applied by the households increase or decrease the household resilience to food insecurity in Chamwino and Manyoni districts of Tanzania.

(i) Household food insecurity in the study area is persisting regardless of the efforts made by the government and other agencies to provide food relief in the time of seriously food shortage.

(ii) From the findings, food insecurity is still a serious problem in the study area. It was observed that about half of the households in the study area were food insecure based on the HFIAS.

(iii) The results indicate further that, the possession of assets like cell phones, livestock and land have a negative influence on the household food insecurity situation.

(iv) It is noted that there are socio-economic variations in terms of the adoption of various coping strategies. While perceived poor households depend on casual

labour activities, food aid and seasonal migration, there is no variations on the adoption of off-farm activities and diversification of crops across all the three household wealth categories.

(v) The study indicates further that some strategies work better than others. Strategies like engagement in casual labour activities prolonged food insecurity problems instead of reducing them. The study reveals further that people expect aids from the government and other agencies, as they believe that the government is there for them, even if they do not have food the government will give them food.

(vi) It is demonstrated that there are clear significant differences between food secure and food insecure households in the various components used to measure resilience. Thus, the households vary in some of the resilience components in the study area, and they therefore vary relatively in their resilience status to food insecurity.

5.2 Recommendations

(i) To improve food insecurity situation in the study area, it is suggested that the Government of Tanzania through Ministry of Agriculture, Food Security and Cooperatives should incorporate different research outputs to design programs for food insecurity intervention. The local government and other stakeholders should create awareness among the people so as to enable them understand the importance of self-dependency so that they can struggle themselves to solve their problems of food insecurity, instead of depending on the central government.

(ii) Therefore, establishing and or strengthening grain banks at district level and village level could be one of the decentralized food security initiatives that enable people to locally store the food grain produced in the village for consumption during the lean season.

(iii) Policy-makers should reflect on the most suitable ways of supporting diversity of food insecurity coping strategies. This needs to design policies that recognize the importance of beneficial strategies such as off-farm activities.

(iv) This can be achieved by establishing viable mechanism through which the potential or the existing operators of off-farm activities can access financial services for starting and improving their production levels and hence, contribute significantly in improving household food security. More emphasis should be placed on the promotion of savings and credit schemes

(v) Community at the household level should make efforts to actively support components such as the possession of assets (agricultural and non-agricultural), as this study has confirmed that the possession of assets have a substantial contribution in ensuring that households remain resilient to the fragile and unpredictable situations in which they exist.

5.3 Suggestions for Further Research

This study investigated the coping strategies and household resilience to food insecurity in Chamwino and Manyoni districts which are located at central Tanzania. Its specific objectives were to examine the socio-economic characteristics of households in the study area, to determine the perception of local people on the nature and extent of food insecurity in the study area, to analyze factors that determine households' food security

status in the study area, to examine the major food insecurity coping strategies employed by households in ensuring food security and analyze the factors that determine households' resilience to food insecurity in the study area. 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 farm households may vary geographically. Therefore, the study suggests the following areas for further research:

(i) There is a need to carry out studies on the socio-economic impact of food aid programmes in the study area

(ii) there is need to investigate the contribution of off-farm activities to household food insecurity in the study area

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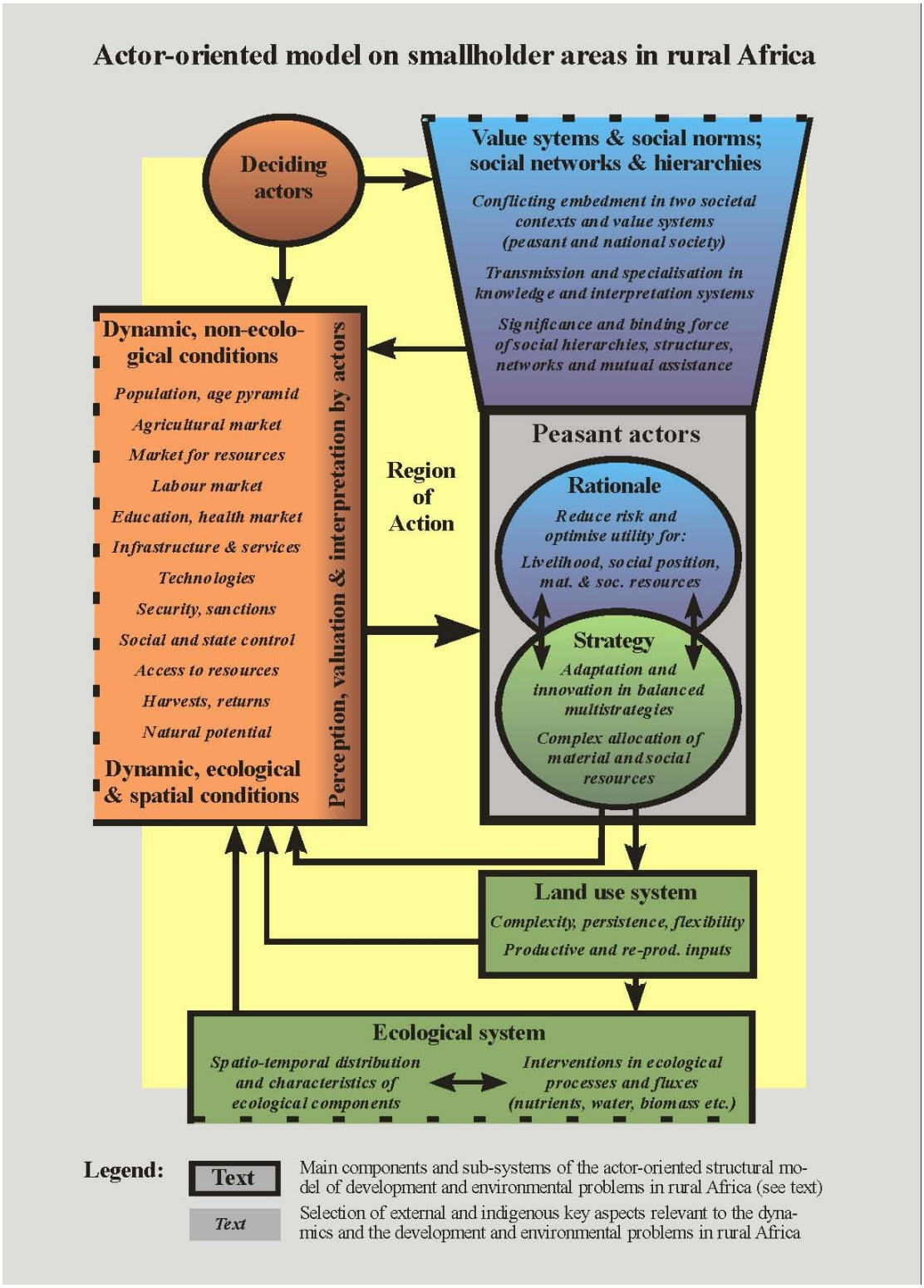
APPENDICES

Appendix 1: Actor Oriented Model



Appendix 2: Food security metrics, their measured domains, and the purposes for which they are commonly used

Metric	Measurement	Scale	Domains/loci measured	Date source	Purpose(s)	Recall period
Prevalence of undernourishment	Calculates food availability using nationally aggregated food supply and food utilization data	National	Physical availability or access	Food balance sheets	Monitor hunger Millennium Development Goal Provide cross-national comparisons Facilitate global and regional governance of food security Serve as advocacy tool	1 y
Share of food expenditure by the poor[1]	Average share of total expenditures spent on food by households belonging to the lowest income quintile	National	Economic access	HCESs	Provide cross-national comparisons Facilitate global and regional governance of food Security Serve as advocacy tool	Variable
Relative dietary supply index[1]	Ratio of the dietary energy supply in the country (per capita), normalized by the country's average dietary energy requirement (i.e., the average caloric needs of the population based on age, sex, and height distributions)	National	Physical availability or access	Food balance sheets	Provide cross-national comparisons Facilitate global and regional governance of food security Serve as advocacy tool	1 y
Domestic food price volatility[1]	Index of observed variability in the annual food price level index	National	Economic access	FAO/ILO food price data	Provide cross-national comparisons Facilitate global and regional governance of food security Serve as advocacy tool	1 y
GHI	Ranks countries on a 100- point scale using 3 equally weighted indicators: 1) undernourishment; 2) child underweight; and 3) child mortality	National	Physical availability or access Nutritional status	Food balance sheets WHO Global Database on Child Growth and Malnutrition Demographic and Health Survey data Multiple Indicator Cluster Survey data	Compare differences in hunger across countries	Variable (Continued)

Metric	Measurement	Scale	Domains/loci measured	Date source	Purpose(s)	Recall period
			Physical availability or access Economic access Food quality Food quantity Food safety			
GFSI	Index of 30 indicators within 3 domains of food security: affordability (6 indicators), availability (10), and quality and safety (14)	National		Quantitative (e.g., food consumption as proportion of total household expenditure, micronutrient availability) Qualitative (e.g., government commitment to increasing nutritional standards, existence of adequate crop storage facilities) Expert consensus	Provide cross-national comparisons of food security status, determinants, and outcomes	Variable
FEWS NET	Monitors a variety of information including data on long-term and real-time satellite rainfall records, the NDVI, temperature, agricultural production, prices, trade, economic shocks, political instability, and local livelihoods	National Regional	Physical availability or access Economic access	Various (e.g., weather, climate, agriculture production, prices, trade, political stability, economic shocks)	Serve as early warning system (scenario development to forecast food emergencies 6–12 mo in advance) Assist governments and food relief agencies in planning for food emergencies Monitor changes over time via monthly reports on current and projected food insecurity	Variable

Metric	Measurement	Scale	Domains/loci measured	Date source	Purpose(s)	Recall period
CFSVAs	Combines secondary data analyses with collection of primary data from 13 core modules to assess food security status and examine underlying causes of vulnerability	National Regional	Physical availability or access Economic access Food quantity	Household surveys Secondary data	Assess baseline food security status of country or region to inform intervention planning Examine underlying causes of food vulnerability	Variable
HCESs	Collect data on all foods acquired by household, including food purchases, foods from own production and foods received in kind; often limited to monetary value of these foods	National Regional Household	Economic access Food quantity Food quality	HCESs	Measure income, consumer price indices, socioeconomic status, and food and non-food expenditures Provide complementary data to food balance sheet data to facilitate cross-national comparisons and sub national analyses	Variable (e.g., 1 wk, 1 mo, 12 mo)
FCS	FCS = a1x1+ a2x2+ .+ a8x8,where 1.8 = food group, a = frequency (7-d recall), x = weight. Weight: meat, milk, and fish = 4, pulses = 3, staples = 2, vegetables and fruits = 1, sugar and oil = 0.5). Cut-off values: poor FS = 0– 21, borderline FS = 21.5–35, acceptable FS = .35.	National Regional Household	Food quality	CFSVAs WFP Emergency Food Security Assessments Household surveys	Establish prevalence of food Insecurity Monitor changes in food Security Assist in determining food needs to calculate food rations	7 d
HDDS	Sums equally weighted response data on the consumption of 12 food groups; score obtained from 0 to 12	National Regional Household	Food quality	Household surveys	Serve as a FS impact indicator for USAID Title II funded programs Help establish prevalence of FS Assess household-level dietary diversity Assess changes in DD/FS over Time	24 h

Metric	Measurement	Scale	Domains/loci measured	Date source	Purpose(s)	Recall period
CSI						30 d
	Locally adapted list of coping strategies and the frequency of their use is enervated through focus group discussions with stakeholders; severity weightings are assigned to each strategy	National Regional Household	Economic access Food quantity Food quality	Focus group interviews and Discussions	Target food aid and monitor its impact Identify vulnerable house-holds (original) Facilitate comparisons across contexts (comparative) Estimate long-term changes in FS	
HEA	Broadly assesses livelihoods using geographic patterns of shared livelihood strategies, and wealth and assets		Physical availability or access	Rapid rural appraisal techniques (e.g., semi structured interviews, focus group discussions)	Assess poverty and livelihood Vulnerabilities Identify appropriate, context- specific interventions	Variable
		Regional Household	Economic access	Review of various secondary data sources		
HFIAS						30 d
	Sums responses to 9 questions related to four domains of food security including 4-level frequency response questions; a score from 0 to 27 is obtained and may be cat-	Regional Household	Anxiety Food preferences Economic access Food quantity	Household surveys	Assess FS status within regions or households Monitor and evaluate the impact of FS interventions	
HHS	Sums responses from three questions related to hunger and lack of food including 3-level frequency response questions; a score from 0 to 6 is obtained and may be categorized into a 3-level variable	Regional Household	Economic access Food quantity	Household surveys	Assess hunger status within and across contexts Target interventions Monitor and evaluate the impact of interventions on household hunger	30 d

Metric	Measurement	Scale	Domains/loci measured	Date source	Purpose(s)	Recall period
Months inadequate household food provisioning	Sums total number of months in the past year the house-hold did not have enough food to meet the family's needs	Regional Household	Economic access Food quantity	Household surveys	Evaluate impact of interventions to improve food access (e.g., program to improve agricultural production, storage, and household purchasing power) Measure seasonal differences and/or changes in house-holds' abilities to address food vulnerability	12 mo
Anthropometry	Examples include height, recumbent length, weight, MUAC, and skin fold measurements (combined with age and sex data to create anthropometric indices)	National Regional Household Individual	Individual nutritional status	Demographic and Health Survey data Multiple Indicator Cluster Survey data Household surveys	Assess prevalence of malnutrition Identify at-risk populations or individuals Monitor changes in nutritional status over time Evaluate nutritional impact of interventions	N/A

Appendix 3: Empirical Approaches to Resilience Measurement

Authors	Aliniovi et al (2010) Alinovi et al (2008)	Mulat (2010)	Keil et al(2008)	Carte et al (2006)
Resilience Definition	Resilience as a latent variable based on several pillars (i)Social safety nets(ii) Access to public services(iii)Assets(iv)income and food access(v)Stability and (vi) Adaptive capacity	Resilience considered as a latent variable based on (i) access to food(ii) Liquid assets (iii) Education and (iv) Social capital	Resilience defined as variation in basic consumption due to a shock	Resilience defined as household' incapacity of smooth their consumption by depleting their assets stock
Measurement Technique	Two Stage Factorial Analysis and CART	Principal Component Analysis	Principal Component Analysis	Livestock Assets
Separability of Measurement and Determinants Detection	NO	YES	YES	YES
Data Requirement	Cross Sectional Data	Panel Data(3 or more period to apply A-B estimator)	Panel and recall data	Panel Data
Model for Determinants detection		Static and Dynamic Panel Model	Tobit Model	
Resilience to what?	General Resilience to Idiosyncratic and covariate shocks	General Resilience to Idiosyncratic and covariate shocks	Specific covariate shocks	Specific Continuative or Punctual covariate shocks

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Appendix 4: Criteria used for wealth ranking (Chamwino District)

Criteria Chalinze village	High status households	Middle status households	Low status households
Livestock numbers	10< cattle 10-30 goats 7< pigs 20< chicken	Less than 10 cattle Less than 10 goats Less than 7 pigs 5-20 chicken	None
Type of house	Block/Tin roofed	Traditional house(tembe) big enough for the family	Traditional house not enough for the family
Transport facilities	Car/motorcycle	Bicycle	None
Agricultural machinery	Tractor/power tiller Kobota	Hand hoes(for every family member)	1 hoe/none
Economic activities	Owned kiosk 200,000< Hired labour for charcoal making	Owned mgahawa	Not specific
Type of cooking energy	Charcoal& fire wood	Fire wood	Fire wood
Type of secondary school	Private secondary schools	Government (ward) secondary schools	None
Member village			
Livestock numbers	More than 50 cattle	10-50 cattle	None (stayed with others livestock) NKOZWA
Land size	More than 20 acres	2-20 acres	Less than 2acres
Stored food	Available in all time	Available in some times	No stored food
Off farm activities	Owned kiosk Owned mashine ya kusaga	Maize selling	Charcoal making
Other sources of income	Selling of livestock	Selling of food products	Weaving(vikapu)

Appendix 5: Criteria used for wealth ranking (Manyoni Disrict)

Criteria	High status households	Middle status households	Low status households
Kitopeni village			
Cattle number	15< cattle	Less than 15 cattle	none
Agricultural machinery	Owned tractor	Owned plough	None Hand hoe
Transport facilities	Car/motorcycle	Bicycle	none
Casual labour	Hire labour	Hired for labour in order to get cash	Hired for labour in order to get food and cash(basic needs)
Type of cooking energy	Charcoal& fire wood	Fire wood	Fire wood
Type of secondary school	Send children to private secondary schools	Send children to government (ward) secondary schools	none
Land size	Farmland more than10 acres,	Farmland 2 - 10 acres	Farmland less than 1 acre
Food security status	Self-sufficient in food security.	Sometimes experience food insufficient	No food at all
Solya village			
Cattle number	More than 5 cattle	Less than 5 cattle	none
Agricultural machinery	Owned tractor	Owned plough	None
Transport facilities	Car/motorcycle	Bicycle	none
Type of business	Selling livestock/crops	Charcoal making	none
Casual labour	Hire labour	Hired for labour in order to get cash	Hired for labour in order to get food and cash(basic needs)
Source of energy	Electricity	Kerosene	None
Type of secondary school	Send children to private secondary schools	Send children to government (ward) secondary schools	none
Land size	Farmland more than10 acres,	Farmland less than 10 acres	Farmland less than 2 acre
Food security status	Food secure	Seasonal food insecure.	Food insecure
Mvumi village			
Livestock numbers	More than 10 cattle	Less than 10 cattle	None takes care of other people's cattle
Food security status	Available in all time	Available in some times	Food insecure
Type of off-farm activities	Cattle selling	Maize selling Charcoal making Selling of food products	Weaving(vikapu)
Source of labour(farm activities)	Hire labourers	Sometimes hire labourers	Hired for labour
	Independent	Not seeking assistance	Dependent
Number of wives	More than 2	One/two wives	One/none

Appendix 6: Interview Schedule on Coping Strategies and Household Resilience to Food Insecurity in Chamwino and Manyoni Districts, Tanzania

Household Identification

Date of Interview	Division	Wards	Village
sub-Village names	Household Code	Name of HHH	Ethnicity

SECTION 1: HOUSEHOLD SOCIO-DEMOGRAPHIC DATA

1.1 Age of HHH(Years)	1.2 Sex of HHH	1.3 Marital Status	1.4 Origin of HHH
	[1]=Male [2]=Female	[1]=married [2]=Single [3]=Widow [4]=Divorced [5]=Separated [6]=Immature	[1]=Native [2]-Immigrant

1.5 Household Roster-Please classify the household members under the following:

No	1.5.1 List names of all individuals in the household Name	1.5.2 Sex Male Female Code	1.5.3 How old is "……" Years	1.5.4 What is "……" relationship the household head? Code	1.5.5 What is "……." Educational level? Code	1.5.6 What is "……." Occupation? Code
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8.						
9.						
10.						
11.						
12.						
13.						
14.						
15.						

Note: list all the people in the household first and then ask questions 1.5.2 to 1.5.6. The household is defined as all people living under one roof who share daily expenses.

Codes for question 1.5.4		Codes for question 1.5.5		Codes for question 1.5.6	
Head	1.	Illiterate , no schooling	1.	Farmer	1.
Wife/husband	2.	Primary education incomplete	2.	Trade/Business	2.
Son/daughter	3.	Primary education complete	3.	Employed in the government private sector	3.
Father/mother	4.	Secondary education incomplete	4.	Manufacturing sector (artisan)	4.
Sister/brother	5.	Secondary complete	5.	Retired	5.
Stepson/stepdaughter	6.	Vocational training	6.	Pupils/student	6.
Stepfather/stepmother	7.	College training	7.	Others (specify)	7.
Grandchild	8.	University	8.		
Grandparent	9.	Other	9.		
Father/mother- in-law	10.				
Son/daughter –in –law	11.				
Sister/brother – in – law	12.				
Nephew/niece	13.				
Uncle/aunt	14.				
Cousin	15.				
Other relative	16.				
Children from another family	17.				
Other non – relative	18.				

1.6 What is the major source of income for your household?
[1]=Farming
[2]=Farming and Off-farming
[3]=Off-farm only
[4]=Others (Specify)…….

1.7 Members of household permanently or mostly away
1.7.1 Do any of your family members residing elsewhere?
[1]=Yes
[2]=No

1.7.2 If yes please specifies
[1]=Head of household
[2]=Spouse of head
[3]=Child/Children
[4]=Grandchild
[5]=Parents
[6]=Other family members

1.7.3 Do you receive any assistance from them?
[1]=Yes
[2]=No

1.7.4 If yes, how frequent?
[1]=Weekly
[2]=Monthly
[3]=Every three months
[4]= Every six months
[5]=Annually

1.7.5 What kind of assistance do they contribute to your household?
[1] Cash
[2] Food
[3] Other things needed by the household (Specify)

SECTION 2: HOUSEHOLD ASSETS, BASIC FACILITIES

2.1 Which of the assets listed below does the household own (only items in working order)

2.1.1 Type of Asset	2.1.2 Possession [1]=Yes [2]= No	2.1.3 How many?	2.1.4 Who owns these assets? (member id)	2.1.5 Current value(if sold today) *(Tsh)*
1. Primary residence made of stone, concrete or brick and tin roof material				
2. Primary residence with mud and tin roof material				
3. Primary residence with mud and grass roof material				
4. Business building				
5. Solar panel				
6. Toilet (pit)				
7. Toilet (modern flush)				
8. Car(s)				
9. Motorcycle				
10. Refrigerator				
11. Television				
12. Radio				
13. Cell phone				
14. Bicycle(s)				

2.1.6 Do you think the assets and items you own have increased or decreased or remained the same over the past five years?
[1]= Increased
[2]= Decreased
[3]= Remained the same

2.1.7 If decreased, why?……

2.2 Access to Basic Facilities

2.2.1 Type of Facility	2.2.2 Do you currently have access? [1]=Yes [2]= No	2.2.3 If no, why? ***(Code)***	2.2.4 If yes, distance *(km)*	2.2.5 Did you have access in last three years? [1]=Yes [2]=No
Electricity				
Telephone (land line)				
Primary School				
Secondary School				
Medical center				
Water source				

Codes for 2.2.3 If no access, why?

1. Government did not provide
2. Financial constraints
3. Not available
4. Cultural belief
5. Religious belief
6. No need
7. Other, specify_____

2.3 Domestic Water Use

2.3.1 Sources of domestic water	2.3.2 Distance to source	2.3.3 Seasonal use	2.3.4 How do you consider quality	2.3.5 Used for	2.3.6 If for drinking, how?	2.3.7 Payment for use?	2.3.8 If yes how much?	
Code	**Km**	**Code**	**Code**	**Code**	**Code**	**[1]=yes [2]=No**	**Tsh/month**	**Tsh/litre**

2.4 Source of energy for cooking

2.4.1 What is your main source of energy for cooking? **Code**…….

Codes for 2.3.1 -Source of water
1.River or Lake
2.Borehole
3.tap water
4.rooftop rainwater
5.vendor water
6.irrigation canal
7.micro dam
8. Other specify……..

Codes for 2.3.3 -Seasonal use
1. Rainy season
2. Dry season
3. All year

Codes for 2.3.4 -Quality
1.Very good
2.Good
3.Fair
4. Bad
5.Very bad

Codes for 2.3.5 -used for
1.Drinking
2.Livestock watering
3.Washing
4.Cleaning
5. Other (specify)…….

Codes for 2.3.6 -If drinking
1.Yes, directly
2.Yes, after boiling
3.Yes, after adding tablets to clean
4. Only if no other source available
5. No

Codes for 2.4.1- energy source
1.Own woodlot
2.Neighbours woodlot
3.Buy wood from market
4.Own charcoal
5.Buy charcoal
6. Electricity
7.Kerosene
8.Animal dung
9.Biogas
10.Generator
11.Solar panel
12.Other, Specify……

SECTION 3: AGRICULTURE

3.1 Land ownership and its holding in the last 3 Years

3.1.1 Does your household own any farmland?
[1]=Yes
[2]=No

3.1.2. How did you obtain your land?
[1]=Inherited
[2]=Purchased
[3]=village government
[4]=Borrowed

3.2 Total Land Owned by the Household

3.2.1 Field	3.2.2 Area	3.2.3 Ownership	3.2.4 Rent in Land	3.2.5 Rent out Land	3.2.6 Major Crops	3.2.7 Production Domains
	Area of each field or plot(acres)	[1]=owned(idle) [2]=owned(used) [3]=own(rented out) [4]=rented in [5]=borrowed	Amount Paid (Tsh.)	Amount Received (Tsh.)	Crops	[1]=Dry Season [2]=Rain season
1						
2						
3						
4						
5						
Total number of plots (sum codes 1-3 under ownership)			Total area owned		Total area used for farming(including land rented in or out)	

3.3 Crop land Owned and Operated by the Household
Please tell me the cultivated land for each crop specified below last year (2010)

3.3.1 Major crops	3.3.2 Area (acres)	3.3.3 Production (kgs)	3.3.4 Sold (kgs)	3.3.5 Price kg/Tsh
Sorghum				
Maize				
Millet				
Cassava				
Bambaranuts				
Cowpeas				
Groundnuts				
Other(specify)				

3.4 Vegetable Production
3.4.1 Do you grow any vegetables?
[1]=Yes, for home consumption
[2]=Yes, for sale only
[3]=Yes, for consumption and sale
[4]=No

3.4.2 Describe the vegetable production for the last season (2009/2010)

3.4.2.1 Vegetables grown	3.4.2.2 Area (acre)	3.4.2.3 Production (kg)	3.4.2.4 Quantity sold (kg)
Tomatoes			
Onions			
Spinach			

3.5 Crop protection

3.5.1 What types of protection did you apply on your crop products harvested?

3.5.1.1 Crop Product	3.5.1.2 Means of protection [1]=pesticides [2]=Natural ways [3]=No protection	3.5.1.3 Reasons
Sorghum		
Maize		
Millet		
Cassava		
Bambaranuts		
Cowpeas		
Groundnuts		
Other(specify)		

3.6 Farm tools and equipment used

3.6.1 Tool/Machinery/ Implements	3.6.2 How many units?	3.6.3 *Ownership* [1]=Owned [2]=Hired [3]=Borrowed	3.6.4 Total value of units(Tsh.)	3.6.5 *Purpose* [1]=Weeding [2]=Digging [3]=Ploughing [4]=Slashing [5]=Any other	3.6.6 *Gender Suitability* [1]=Women only [2]=Men only [3]=Youth only [4]=All
Farming tools					
1.Machete(pangas)					
2.Hand hoe					
3.Spade/shovel					
4.Pick ax					
5.Winnower					
6.plough and yoke for animals					
7.Reaper/sickle					
8.Manual sprayer					
9.rake					
10.wheelbarrow					
11.carts					
12.Pitch fork					
13.Planting stick					
14.Slasher					
15.Shears(for pruning)					
16.Other tools(specify)					
Machinery					
17.Tractor					
18.Trolley/Trailers					
19.Thresher					
20.Fodder cutting machine					
21.Generator/Diesel pump					
22.Spraying machines					
23.Harvester					
24. Other heavy machinery(Specify)					
25.Bulls/Oxen					
26.Donkeys					
27.Other animal power(Please specify)					

SECTION 4: LIVESTOCK

4.1 Do you have any livestock?
[1]=Yes
[2]= No

4.2 Livestock and livestock products

	4.2.1 Number currently owned by all household members	4.2.2 Approximate value of livestock (Tsh.)	4.2.3 Number sold during past year	4.2.4 Total income from animal sales during past year (Tsh.)	4.2.5 Animals slaughtered for food in past year	4.2.6 Animals slaughtered for festivities in past year	4.2.7 Number that died in previous six months	4.2.8 Total income form product sales? E.g eggs, skin, manure, milk (Tsh. in past year)
Cattle								
Goats								
Sheep								
Pigs								
Chickens /ducks								
Donkey/ horses								
Other: specify								

SECTION 5:

5.1 Apart from crop and livestock production (farm activities) what are the other sources of income from nonfarm activities during the last season? (all HH members combined)

SN	5.1.1 Sources	5.1.2 Ownership [1]=Yes [2]= No	5.1.3 Amount earned per last season [1]= Below Tshs 100,000 [2] Between Tshs 100,001 – Tshs 500,000 [3] Above Tshs 500,000	5.1.4 Place of Work [1]=Nearby [2]=District [3]=Town(name) [4]=City(name)
1	Petty business/street vending			
2	Retailer /shopowner			
3	Marketer/hawker			
4	Carpentry			
5	Builder			
6	Local brewing			
7	Beekeeping			
8	Butchery			
9	Tailor			
10	Bicycle repair			
11	Firewood/charcoal production			
12	Seed selling (cereals, vegetables, herbs)			
13	Weaving			
14	Blacksmithing			
15	Traditional doctor			
16	Fishing & selling			
17	Milling			
18	Oil processing			
19	Agro processing			
20	Other specify (specify)			
	Total Non-Farm Income earned by household members(sum of years total for all non-farm earners in the household(Tsh.)			

SECTION 6: FOOD SECURITY

6.1 Availability

Questions		Answers
6.1.1	How do you get most of the food for your household?	[1]=Farming [2]=Purchasing [3]=Food help and gifts
6.1.2	If farming, how do you get seeds for planting?	[1]=Buying from input shop [2]=From previous harvest [3]=From a relative or friend
6.1.3	What are the sources of labour for production of food?	[1]=Family labour [2]=Hired labour [3]=Group labour [4]=Others (specify)……
6.1.4	Was you crop (sorghum, pearl millet) production last year 2010	[1]=Normal [2]=Above normal [3]=Below normal
6.1.5	How long do the food stocks for household consumption from your harvest last?	[1]=Less than 3 months [2]=Between 3 to 6 months [3]=More than 6 months
6.1.6	Which months do you usually experience food shortage in your household?	
6.1.7	If production was not sufficient year-round, please specify the main reasons by severity levels as nil, moderate and severe. Put in the box the severity level as 0 for nil, 1 for moderate, and 2 for severe	Drought Shortage of labour Shortage of draught animals Shortage of farming implements Inadequate farmers' advisory services Lack of agricultural credit Inadequate irrigation practice Pest damage nfestation egradation lence on single harvest f cash income e off-farm income rvest losses (malaria) problem f veterinary service
6.1.8	How much does your household normally spend on food per month?	Tsh.
6.1.9	Has your household ever benefited from food aid?	[1]=Yes [2]=No
6.1.10	If yes, type of aid(check all that type)	[1]=Food for work [2]=Food , Emergency Relief [3]=Food Subsidized
6.1.11	Who receive the aid?(Member id)	

6.1.12	Institutional responsible	[1]=Central government [2]=District Council [3]=Village government [4]=NGOs [5]=Private sector(e.g Red Cross) [6]=Other(Specify)……				
6.1.13	How frequently did you receive food aid in the past six months	[1]=Every week [2]=Monthly [3]=Quarterly				
6.1.14	How much was the monthly distribution rate?	Cereals (kgs) ☐	Pulses ☐	Oil(litres) ☐	Salt (kgs) ☐	
6.1.15	Did you share the food aid with others	[1]=Yes [3]=No				

6.3 Accessibility

For each of the following questions, consider what has happened in the past 30 days. Please answer whether this happened never, rarely (once or twice), sometimes (3-10 times), or often (more than 10 times) in the past 30 days?

Question		Response Options	Code
6.3.1	Did you worry that your household would not have enough food?	0 = Never 1 = Rarely (once or twice in the past 30 days) 2 = Sometimes (three to ten times in the past 30 days) 3 = Often (more than 10 times in the past 30 days)	….|___|
6.3.2	Were you or any household member not able to eat the kinds of foods you preferred because of a lack of resources?	0 = Never 1 = Rarely (once or twice in the past 30 days) 2 = Sometimes (three to ten times in the past 30 days) 3 = Often (more than 10 times in the past 30 days)	….|___|
6.3.3	Did you or any household member eat just a few kinds of food day after day due to a lack of resources?	0 = Never 1 = Rarely (once or twice in the past 30 days) 2 = Sometimes (three to ten times in the past 30 days) 3 = Often (more than 10 times in the past 30 days)	….|___|
6.3.4	Did you or any household member eat food that you preferred not to eat because of a lack of resources to obtain other types of food?	0 = Never 1 = Rarely (once or twice in the past 30 days) 2 = Sometimes (three to ten times in the past 30 days) 3 = Often (more than 10 times in the past 30 days)	….|___|
6.3.5	Did you or any household	0 = Never	

	member eat a smaller meal than you felt you needed because there was not enough food?	1 = Rarely (once or twice in the past 30 days) 2 = Sometimes (three to ten times in the past 30 days) 3 = Often (more than 10 times in the past 30 days)	….|___|
6.3.6	Did you or any other household member eat fewer meals in a day because there was not enough food?	0 = Never 1 = Rarely (once or twice in the past 30 days) 2 = Sometimes (three to ten times in the past 30 days) 3 = Often (more than 10 times in the past 30 days)	….|___|
6.3.7	Was there ever no food at all in your household because there were not resources to get more?	0 = Never 1 = Rarely (once or twice in the past 30 days) 2 = Sometimes (three to ten times in the past 30 days) 3 = Often (more than 10 times in the past 30 days)	….|___|
6.3.8	Did you or any household member go to sleep at night hungry because there was not enough food?	0 = Never 1 = Rarely (once or twice in the past 30 days) 2 = Sometimes (three to ten times in the past 30 days) 3 = Often (more than 10 times in the past 30 days)	….|___|
6.3.9	Did you or any household member go a whole day without eating anything because there was not enough food?	0 = Never 1 = Rarely (once or twice in the past 30 days) 2 = Sometimes (three to ten times in the past 30 days) 3 = Often (more than 10 times in the past 30 days)	….|___|

SECTION 7: ADVERSITIES TO THE HOUSEHOLDS

7.1 Has this household been affected by a serious shock (an event that lead to a serious reduction in your asset holdings, caused your household income to fall substantially or resulted in a significant reduction in consumption) during the last 5 years?

7.1.1 Type of shock	7.1.2 When was the shock(year in last 3 years)	7.1.3 What the shock result in	7.1.4 Who in the household is the most affected by the shock (member id)	7.1.5 What did you do?	7.1.6 Who took the action (Member id)	7.1.7 How widespread was the shock	7.1.8 Estimate of the amount of loss to the household

Codes for 7.1.1 types of shocks

Production Shocks

1.Pest infestation

2.Crop loss during storage

3.Animal disease

Market Shocks

1.Large increase in input prices

2.Large decline in output prices

3.Inability to sell agricultural products

4.Inability to sell non-agricultural products

Criminal shocks

1.Theft of crops

2.Theft of livestock

3.Destruction or theft of tools or inputs for production

Climate uncertainties

1.Drought

2.Flood

3.Erratic rainfall pattern

4.Hailstorm

5.Fire outbreak

Political and Social Shocks

1.Expropriation of land by government

2.Ethnic Violence

3.Forced migration/Relocation

4.Discrimination for political reasons

5.Forced contribution

6.Arbitrary taxation

7.Discrimination for social reasons

Idiosyncratic(personal) shocks

1.Loss of job by family member

2.Death of family member

3.Illness of family member

4.Separation of family member(s)

5.Dispute with extended family

6.Dispute with others in village

7.Imprisonment

8.Other(Specify)

Codes for 7.1.3 Outcome of shocks

Loss of assets

1.Loss of income

2.Decline in crop yield

3.Loss of entire crop

4.Death of livestock

5.Food shortage/insecurity

6.Other, Specify

Codes for 7.1.5 Action

1.Did nothing

2.Sold livestock

3.Sold crops

4.Sold land

5.Sold assets

6.Borrowed from relatives or friends

7.Borrowed from bank

8.Borrowed from private money lenders

9.Received food aid

10.Participated in food for work

11.HH head migrated to other rural areas

12.HH head plus others migrated to other rural areas

13.Migrated to urban areas

14.Sought off-farm employment

15.Bought food

16.Ate less

17.Ate less preferred food

18.Kept children home from schools

19.Other,(Specify)……

Codes for 7.1.7 How widespread

1.Only my household

2.Some households in the village

3.Most households in the village

4.All households in the village

5.Many households in the District

6.All households in the District

7.2 Perception of Drought

7.2.1When was the last drought you experienced?.....year

7.2.2 During the last drought, did you change your farming practice (crop and livestock)?

[1]=Yes

[2]=No

7.2.3 If yes, What did you do? Code	7.2.4 If yes, How? Code	7.2.5 If yes, Who (member id)

Codes for 7.2.3	Codes for 7.2.4 specify change	17.Change from crop to livestock production	Codes for specify change
1.No change		18.Change from livestock to crop production	
2.Change crop variety	Specify from what to what	19.Change pattern of crop consumption	
3.Change crop type	Specify from what to what	20.Change pattern of animal consumption	
4.Change planting dates	Specify whether farmer plants earlier or later	21.Increase the number of livestock	
5.Increase amount of land under production		22.Decrease the number of livestock(de-stocking)	
6.Reduce amount of land under production		23.Diversify Livestock feeds	
7.Change field location		24.Change livestock feeds	
8.Implement soil and water management techniques	Specify technique	25.Supplement livestock feeds	
9.Change fertilizer application	Specify whether increase or decrease, change of type	26.Change veterinary interventions	
10.Build a water harvesting scheme	Specify for what: domestic consumption, crops, livestock	27.Change portfolio of animal species	
11.Build a diversion ditch		28.Change animal breeds	
12.Plant trees for shading		29.Move animals to another site	
13.Irrigate		30.Seek off farm employment	
14.Irrigate more		31.Migrate to another piece of land	
15.Buy insurance		32.Set up communal seed banks/food storage facilities	
16.Mix crops and livestock production		33.Other (Specify)……	

7.2.6 If you did not change your farming practices in response to drought, why?.....Code

Codes for 7.2.6 why did you not change your farming practices

No access to money
No access to credit
No access to land
No inputs
Shortage of labour
No information on rainfall variability
Other specify

7.3 Households' perceived rainfall adequacy in the preceding agricultural season.

During the growing season preceding the last main harvest	Codes
7.3.1 Did the rainfall come on time?	[1]=On time [2]=Too early [3]=Too late
7.3.2 Was there enough rain on your fields at the beginning of the rainy season?	[1]=Enough [2]=Too little [3]=Too much
7.3.3 Was there enough rain on your fields during the growing season?	[1]=Enough [2]=Too little [3]=Too much
7.3.4 Did the rains stop on time on your fields?	[1]=On time [2]=Too late [3]=Too early
7.3.5 Did it rain near the harvest time?	[1]=Yes [2]=No

7.3.6 Have you noticed a change in the number of rainfall days over the last 20 years?
[1]=Increased [3]=Stayed the same
[2]=Decreased [4]=Do not know

7.3.7 Have you noticed any long term changes in rainfall variability over the last 20 years?
[1]=Yes
[2}=No
[3]=Do not know

7.3.8 If yes, what changes have noticed (Check all that apply)
[1]=Rains have become more erratic [5]=Longer periods of drought
[2]=Rains come earlier [6]=More floods
[3]=Rains come later [7]=Other (Specify)……..
[4]=Rains are heavier

SECTION 8: FOOD INSECURITY COPING STRATEGIES

8.1 Crops Diversification Strategies

8.1.1 Do you plant diversity of crops and crop variety as food security risk management strategies?
[1]=Yes
[2]=No

8.1.2 If yes, indicate types of crops planted for risk management strategies

Name Items	Crops	
	[1]=Groundnuts	[7]=Maize
	[2]=Sorghum	[8]=Rice
	[3]=Millet	[9]=Sunflower
	[4]=Bambara nuts	[10]=Cowpeas
	[5]=Cassava	[11]= Groundnuts
	[6]=Cowpeas	[12]=sweet Potatoes
Number of Varieties [1]<2 [2]3-4 [3]>4		
Name of Varieties		
Category [1]=indigenous [2]=Exotic [3]=Mixed		
Origin of seeds [1]=Own seeds [2]=from neighbour [3]=Brought from shops [4]=from other village(s)		
When Planted [1]=early in the season [2]=late in the season [3]=Throughout the year [4]=Others		
Where planted [1]=home garden [2]=farms [3]=Other(specify)		
Allocate land size		
Estimated yield [1]=During rain season [2]=During dry season		

8.2 Migration Strategy
8.2.1 Have any members of this household left the area for over a month in the past years?
[1]= Yes
[2]=No

8.2.2 If yes, go to migration form;

Migration form

8.2.2.1 Name of migrant (Member id)	8.2.2.2 Destination	8.2.2.3 Time interval (months)	8.2.2.4 Activity / motivation

8.2.3 (If only one or several household member has left the area in the past five years, then ask :)
Could you describe the household situation (food/labour/cash) in years that s/he (or you) left the area?

[1]= Increased income [6]= Low income
[2] = Better employment [7]= no employment
[3]= improved food access [8]= other_____
[4]= food shortage

8.2.4 Has the importance of migration and remittances from migrant for the household
[1]= Increased [2]= Decreased [3]= stayed the same over time

8.2.5 In general do you believe that migration is better alternative to escape from food shortage?
[1]=Yes,
[2]=No

8.2.6 If yes, justify your reason_____ _____
8.3 Participation in Casual Labour
8.3.1 Do you do casual labour work?
[1]= Yes
[2]= No
8.3.2 If yes, which types of activities you are involved in?

8.3.2.1 Activity	8.3.2.2 Where? place of work	8.3.2.3 Days worked(2010) [1]=Male	[2]=Female	8.3.2.4 Wage per day [1]=Male	[2]=Female
Land preparation					
Planting					
Weeding and cultivation					
Harvesting					
Domestic work in town					
Construction work					
Others					

8.3.3 The access of daily labour is better
[1]= within the village [3] = similar
[2] = outside the village [4]=Don't know

8.3.4 The wage rate of Daily labourer is perceived
[1]= extremely low [4] = High
[2]= low [5] = very high
[3]= medium

8.3.5 Who decides the amount of wage
[1]= Employer [3] = Negotiation
[2]= Wage labourer [4] = Other (specify)_____

SECTION 9: LOCAL SOCIAL INSTITUTIONAL FACTORS

9.1 Social Networks

9.1.1	Can you tell me, when necessary to whom *(Relationship*) do you turn to for food help?	[1]= Relatives [2]= Friends [3]=Neighbours [4]= Other (specify)…….
9.1.2	Are most of these people of similar/higher/lower economic status?	[1]=Similar [2]=Higher [3]=Lower
9.1.3	If you have faced a long term emergence such as harvest failure, how many people beyond your immediate household could you turn to who could be willing to assist you?	[1]=No one [2]=One or two people [3]=Three or four people [4]=Five or more people
9.1.4	How many times have they been able to assist you?	[1]=Few times [2]=Reasonable [3]=Many times
9.1.5	What kind of assistance do people usually offer to those faced with chronic food insecurity?	[1]=Financial help [2]=Food help
9.1.6	In the past three months, how many people with food problems have turned to you for assistance?	[1]=No one [2]=One or two people [3]=Three or four people [4]=Five or more people
9.1.7	What and how much did you offer to others in the last month?	[1]=Cash [2]=Food [3]=Labour (hours per day) [4]=Nothing
9.1.8	If nothing, what are the reasons which made you unable to help others?	[1]=Have nothing to help [2]=No one came for help [3]=Other (specify)……
9.1.9	What is your main reason for helping others?	[1]=Others can help in future [2]= It is a moral obligation [3]= People who belong to the same tribe/church/group [4]=Others (specify)……

9.2 Social Groups/Organization

9.2.1	Are you aware of the existence of groups or associations in the village? *These could be formally organized groups or just groups of people who get together regularly to do an activity.*	[1]=Yes [2]=No	
9.2.2	If yes, are you or any individual of your household a member of any group/s in this village?	[1]=Yes [3]=No	
9.2.3	If no, why are you not a member of any group?	[1]= No information [2]= No interest	[3] No cooperatives in the village [4] Other specify _____
9.2.4	Do groups help you get access to any of the following services?		[1]=Yes [2]=No
		[1]=Agricultural input or technology	[ ]
		[2]=Markets	[ ]
		[3]=Credit or saving	[ ]
		[4]=Access to food	[ ]
		[5]=Health services	[ ]
		[6]=Job and business opportunities	[ ]
		[7]=Education or training	[ ]
9.2.5	Are you satisfied with the benefits you have obtained from the groups?	[1]=Yes [2]=No	
9.2.6	If no, why not?		
9.2.7	What problems do you think limit your participation in group activities?	[1]=No time to participate in group activities [2]=Conditions are difficult to fulfill [3]=Refused by husband/wife [4]=No/few groups of my interest	

9.3 From question 9.2.2 if yes, I like to ask you about the groups or organizations, associations to which you or any member of your household belong.

9.3.1 Types of organization or groups	9.3.2 Name of organization or group	9.3.3 Position in the organization or group 1. Leader; 2. Member; 3. Committee member	9.3.4 Who is the (member id)
Production groups			
Trade or business associations			
Professional association			
Religious groups			
Burial or festival groups			
Saving and credit groups			
Cultural groups			
Sports groups			
Political groups			
Women groups			
Youth groups			
Ethnic-based community group			
NGO or civic group			
Others (specify)			

9.4 Social leadership participation
9.4.1 Did you participate in any social leadership in the past 12 months?
[1]= Yes
[2]=No

9.4.2 If yes, specify among the following
[1]= traditional group
[3]= Religious
[4]= political
[5]= Other (Specify)
9.4.3If yes, what benefit do you gained from the leadership role?
[1]= Salaried
[2]= Social prestige
[3]= Access to assets
[4]= Other (Specify)……

SECTION 10: Access to Information, Extension, Training, Market and Credit

10.1 Information

Crops and Livestock production Information	a. Crop information		b. Livestock information	
	1a.Information on Crop production	2a.Who receives the information (member id)	1b.Information on Livestock production	2b.Who receives the information (member id)
10.1.1 Do you receive information/advice from extension agent *If yes, answer* 10.1.2 What type of information is provided? Key	[1]=Yes [2]=No		[1]=Yes [2]=No	
10.1.3 How do you receive the information? Key 10.1.4Which is the most accessible source? Key 10.1.5 How often did you receive this information in the last year? 10.1.6 Does the information you receive meet your needs for crop and livestock production? [1]=Yes [2]=No [3]=Sometimes [4]=Don't know 10.1.7 If not, what type of information would you like to receive? Specify				

Codes for 10.1.2a information on crop production	Information on indigenous breeds
Information on crop protection	Information on livestock-crop integration
Information on new crop varieties	Other (Specify)
Information on crop utilization	Codes for 10.1.3 and 10.1.4 How do you receive the information? And Which is the most accessible source?
Information on crop conservation tillage	Extension officers
Information on indigenous crops	Television
Information on crop-livestock integration	Radio
Information on soil and water conservation	Newsletter
Information on tree management/agroforestry	Neighbour/Friends
Other (Specify)	Shopkeepers/Traders
Codes for 10.1.2b information on livestock production	Agricultural shows
Information on destocking	Field days
Information on new breeds	Other(Please, specify)

Extension 10.2

Extension	a. Crops		b. Livestock	
	1a.Information on Crop production	2a.To whom do the extension agents give this information/advice (member id)	1b.Information on Livestock production	2b.To whom do the extension agents give this information/advice (member id)
10.2.1 Do you receive information/advice from extension agent [1]=Yes [2]=No	[1]=Yes [2]=No		[1]=Yes [2]=No	
If yes, answer 10.2.2 What type of extension approach was used? Code				
10.2.3 How frequent did extension agents contact you last year? Code				
10.2.4 The extension agents visit/ contact you are from which organizations? Code				
10.2.5 Does the information you receive from extension agents meet your needs [1]=Yes [2]=No [3]=Sometimes [4]=Don't know				
10.2.6 How can extension services be improved? Specify				

Codes for 10.2.2 what type of extension agent is used	Codes for 10.2.3 From which organization
[1]=farm visit	Government Agency
[2]=Farmers research groups	Agriculture research Station
[3]=Farmer Field Schools	NGOs
[4]=farmer to Farmer exchange visits	Community based Organization
[5]=Common interest groups	Religion groups
[6]=Other, specify	Civil society groups Private companies Other (Specify)…….

10.3 Training

Training	a. Crop training		b. Livestock training	
	1a.Training on Crop production	2a.Who attended the training (member id)	1b.Information on Livestock activities	2b.Who attended the training (member id)
10.3.1 Has someone in your household attended training for farmers in the last three years? *If yes, answer*	[1]=Yes [2]=No		[1]=Yes [2]=No	
10.3.2 Specify type of training				
10.3.3 Which organization provided the training?				
10.3.4 How often do you receive training?(no. of times per year)				
10.3.5 Does the information you receive meet your needs for crop and livestock production? [1]=Yes [2]=No [3]=Sometimes [4]=Don't know				
10.3.6 If not, what type of training would you like to receive? Specify				

Codes for 10.3.2a training on crop production	Training on livestock-crop integration
Training on crop protection	Training on Pasture management
Training on new crop varieties	Training on Feed storage
Training on crop utilization	Training on Feeding regimes
Training on crop conservation tillage	Training on Vet interventions/livestock health
Training on indigenous crops	Other (Specify)
Training on crop-livestock integration	Codes for 10.3.3Who provide the training?
Training on soil and water conservation	Government Agency
Training on tree management/agroforestry	Agriculture research Station
Other (Specify)	NGOs
Codes for training 10.3.2b on livestock production	Community based Organization
Training on stock management	Religion groups
Training on new breeds	Civil society groups
Training on indigenous breeds	Private companies
	Other (Specify)…….

10.4 Markets

10.4.1 Where do you sell your farm products? (Multiple answer possible)

[1]= On farm (local assembler)

[2]= Taking to the local market

[3]= Through service cooperatives

[4]= Others (specify)

10.4.2 Who determines the prices?

[1]=Farmers [3]=Middlemen

[2]=Government [4] =Other (Specify)

10.4.3 Is there a nearby market place?

[1]=Yes

[2]=No

10.4.4 If yes, how far is it to the nearest market from your residence?

(a) In distance……..km or In time……..hrs

10.4.5 What means of transport do you use to get to market?

[1]= Trucks [2] = Animal power

[3]= Human power [4] = Others (specify) _____

10.4.6 What is the major cash crop(s) in your area?.....

[1]=Groundnuts [7]=Maize

[2]=Sorghum [8]=Rice

[3]=Millet [9]=Sunflower

[4]=Bambara nuts [10]=Cowpeas

[5]=Cassava [11]= Groundnuts

[6]=Cowpeas [12]=Sweet Potatoes

Do the farmers depend on it completely?

[1]=Yes

[2]=No

10.4.7 What is the market destination of this cash crop?.....

10.4.8 Who determines the prices of these cash crops?

[1]=Farmers [3] =Middlemen

[2]=Government [4] =Other (Specify)

10.4.9 What are the problems in marketing your products?
[1]= Transportation problem [4] = Too far from market place
[2]= Low barging power [5] =other specify……
[3]= Low price of Agricultural produce

10.4.10 Do you get reasonable price for your produce at this particular time?_____
[1]= Yes;
[2]=No
10.4.11 If no, what are the reasons? (Multiple answerers possible)_____
[1]= No (demand) for the produce [3] = More supply of the produce
[2]= Lack of access to potential market [4] = others (specify)

10.4.12 Why did you sell at that particular time of lower (unreasonable) price?_____
[1]= To settle debts [4] = To pay tax
[2]= Social obligations (wedding, funeral, iddir, etc) [5]= others (specify)
[3]= To meet family requirements
10.4.13 what do you think should be done to solve this problem? _____
10.5 Credit and Cash Loans
10.5.1 Have you borrowed money in the past 12 months?

10.5.1.1 Credit sources	10.5.1.2 Source [1]=Yes [2]=No	10.5.1.3 Purpose of loan (see codes below)	10.5.1.4 Number of loans
a) Money lender			
b) NGOs			
c) Friends/relatives			
d) Bank			
e) Cooperatives			
f) Community Based Orgs./Groups			
g) Others (specify)			

Codes for 10.5.1.3 Purpose of loan:

[1]= To buy farm machinery;	[10]=To buy building material
[2]= To buy farm inputs (seeds, fertilizers, pesticides);	[11]=To pay for travel costs
[3]=To buy livestock	[12]=To pay for wedding
[4]=To pay hired labour	[13]=To pay for funeral
[5]=To pay rent or taxes	[14]=To repay other debts
[6]=To start non-farm activities	[15]=To buy land
[7]=To buy food/household goods	[16]=To buy a car
[8]=To pay for education	[17]=To buy a business vehicle
[9]=To pay for health expense	

10.5.2 If you did not obtain a credit/loan during year 2009/2010, Why not……. (Code)

Codes for 10.5.2 constraints to credit

[1]=Already have it	[6]=Too risky
[2]=Don't need it	[7]=Too high interest rates
[3]=No collateral	[8]=Don't belong to any organization
[4]=Not aware of sources of credit	[9]=Request was denied
[5]=Social stigma	[10]=Other (Specify)……

Thank You for Your Cooperation

Appendix 7: Checklist for FDG on Coping Strategies and Household resilience to Food Insecurity in Chamwino and Manyoni Districts, Tanzania

1. What do people in the study area understand on food insecurity?
2. Have you experienced food insecurity problem in your village?
3. What is the trend of food insecurity problem in your area? i.e. has the situation improving, Worsening or Staying the same? Why?
4. Can you give the general idea on the causes of food insecurity problem in your area?
5. What are the coping strategies employed by households during food insecurity situation?