Farming Systems and Household Food Security in Tanzania: the case of Mvomero and Kishapu Districts

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<tbody>
<tr>
<td>CSI</td>
<td>Copping Strategy Index</td>
</tr>
<tr>
<td>CRRA</td>
<td>Constant Relative Risk Aversion</td>
</tr>
<tr>
<td>CUTS</td>
<td>Consumer Unity and Trust Society</td>
</tr>
<tr>
<td>DES</td>
<td>Dietary Energy Supply</td>
</tr>
<tr>
<td>DFID</td>
<td>United Kingdom Department for International Development</td>
</tr>
<tr>
<td>DFID-SLF</td>
<td>Department for International Development- Sustainable Livelihood Framework</td>
</tr>
<tr>
<td>ECOSOC</td>
<td>United Nations Economic and Social Council</td>
</tr>
<tr>
<td>ESRF</td>
<td>Economic and Social Research Foundation</td>
</tr>
<tr>
<td>EUT</td>
<td>Expected Utility Theory</td>
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<tr>
<td>FANTA</td>
<td>Food and Nutrition Technical Assistance Project</td>
</tr>
<tr>
<td>FAD</td>
<td>Food Availability Decline</td>
</tr>
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<td>FAO</td>
<td>Food and Agriculture Organisation of the United Nations</td>
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<tr>
<td>FCS</td>
<td>Food Consumption Score</td>
</tr>
<tr>
<td>FCND</td>
<td>Food Consumption and Nutrition Division</td>
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<tr>
<td>FIVIMS</td>
<td>Food Insecurity and Vulnerability Information and Mapping System</td>
</tr>
<tr>
<td>HDDS</td>
<td>Household Dietary Diversity Score</td>
</tr>
<tr>
<td>HEA</td>
<td>Higher Education Authority in Ireland</td>
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<tr>
<td>HFIAS</td>
<td>Household Food Insecurity Access Scale</td>
</tr>
<tr>
<td>HH</td>
<td>Household</td>
</tr>
<tr>
<td>HHS</td>
<td>Household Hunger Scale</td>
</tr>
<tr>
<td>IA</td>
<td>Irish Aid</td>
</tr>
<tr>
<td>IAC</td>
<td>Inter Academy Council</td>
</tr>
<tr>
<td>IAWG</td>
<td>Inter-Agency Working Group</td>
</tr>
<tr>
<td>IFAD</td>
<td>International Fund for Agricultural Development</td>
</tr>
<tr>
<td>IFPRI</td>
<td>International Food Policy Research Institute</td>
</tr>
<tr>
<td>IIA</td>
<td>The Independent Irrelevant Alternative</td>
</tr>
<tr>
<td>ILRI</td>
<td>International Livestock Research Institute</td>
</tr>
<tr>
<td>IPC</td>
<td>Integrated Phase Classification</td>
</tr>
<tr>
<td>ISS</td>
<td>Institute of Social Studies</td>
</tr>
<tr>
<td>IUCN</td>
<td>International Union for Conservation of Nature</td>
</tr>
<tr>
<td>Acronym</td>
<td>Description</td>
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<td>-------------</td>
<td>------------------------------------------------------------</td>
</tr>
<tr>
<td>MAFS &amp; C</td>
<td>Tanzanian Ministry of Agriculture, Food Security and Cooperatives</td>
</tr>
<tr>
<td>MCL</td>
<td>Mixed Crop-Livestock</td>
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<td>MDGs</td>
<td>Millennium Development Goals</td>
</tr>
<tr>
<td>MFC</td>
<td>Mixed Food Crops</td>
</tr>
<tr>
<td>MNL</td>
<td>Multinomial Logit</td>
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<tr>
<td>MNP</td>
<td>Multinomial Probit</td>
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<tr>
<td>NBS</td>
<td>National Bureau of Statistics</td>
</tr>
<tr>
<td>OECD</td>
<td>Organization for Economic Co-operation and Development</td>
</tr>
<tr>
<td>PELUM</td>
<td>Participatory Ecological Land Use Management</td>
</tr>
<tr>
<td>PMO</td>
<td>Prime Minister’s Office</td>
</tr>
<tr>
<td>REPOA</td>
<td>Research on Poverty Alleviation</td>
</tr>
<tr>
<td>SAUT</td>
<td>Saint Augustine University of Tanzania</td>
</tr>
<tr>
<td>SDGs</td>
<td>Sustainable Development Goals</td>
</tr>
<tr>
<td>SFC</td>
<td>Single Food Crop</td>
</tr>
<tr>
<td>SUA</td>
<td>Sokoine University of Agriculture</td>
</tr>
<tr>
<td>TFNC</td>
<td>Tanzania Food and Nutrition Centre</td>
</tr>
<tr>
<td>TLUs</td>
<td>Tropical Livestock Units</td>
</tr>
<tr>
<td>TPB</td>
<td>Theory of Planned Behaviour</td>
</tr>
<tr>
<td>TZS</td>
<td>Tanzanian Shilling</td>
</tr>
<tr>
<td>UCD</td>
<td>University College Dublin</td>
</tr>
<tr>
<td>UN</td>
<td>United Nations</td>
</tr>
<tr>
<td>UNDP</td>
<td>United Nations Development Programme</td>
</tr>
<tr>
<td>UNICEF</td>
<td>United Nations Children’s Fund</td>
</tr>
<tr>
<td>USAID</td>
<td>United States Agency for International Development</td>
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<td>WB</td>
<td>World Bank</td>
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<td>WFS</td>
<td>World Food Summit</td>
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<td>WFP</td>
<td>World Food Programme</td>
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<td>World Health Organisation</td>
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ABSTRACT

About three out of every four income-earners in Tanzania are small-scale farmers and food insecurity remains a chronic problem for many of them. Around 48% of households in rural areas were either moderately or severely food energy deficient in 2011 and 39% of rural children under 5 years were stunted in 2013. To improve food security in Tanzania, it is important to understand the existing farming systems and their relationship with household food security. This study was conducted in two distinctly different agro-ecological zones of Tanzania, namely Kishapu and Mvomero Districts, to determine the main factors which influence farm households’ choice of farming systems and how these associate with food security. Data were collected during both pre- and post-harvest seasons in 2014 from 506 farm households, and augmented with market surveys, key informant interviews and focus group discussions. Four main farming systems were identified based on: crops cultivated; degree of market orientation for particular crops; and the number of livestock units owned. Household food security status was measured and a combination of Expected Utility Theory and Theory of Planned Behaviour used to analyse the factors associated with household choice of farming system. The study found that households which diversified their income sources through off-farm activities were more likely to have better food access in the lean (pre-harvest) periods. The factors influencing decisions on farming systems were related to the household size, farming context and farm characteristics. In the semi-arid and remote areas of Kishapu, larger households were more likely to choose a Mixed Crop and Livestock farming system, indicating that larger family size ensured the supply of needed labour for both livestock keeping and cropping activities. In the higher rainfall and more accessible district of Mvomero, households were more likely to practice a Single Food Crop farming system and were compelled to seek out off-farm work. The study recommends that strategies to improve food security in rural areas should attempt to: enhance income from farming, promote off-farm income generating activities, and promote behavioural change communication on what is culturally regarded as food in the study area.
ACKNOWLEDGEMENTS

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I also thank leaders from Lubaga and Mwakipoya Villages in Kishapu District and from Makuyu and Milama Villages in Mvomero District who organised participants to take part in focus group discussions, key informant interviews, and household surveys. Further, I thank all focus group discussion participants, the key informants and all respondent households whose members spared their precious time responding to questions of this research.

Finally, regards and blessings go to my beloved wife, Regina and our three children: Gracious, Gian and Giana. They were always there to encourage me during good and bad times.
STATEMENT OF AUTHORSHIP

I hereby certify that the submitted work is my own work, was completed while registered as a candidate for the degree stated on the title page, and I have not obtained a degree elsewhere on the basis of research presented in this submitted work.

____________________________  _______________________
Goodluck Dastan Massawe    Date
(PhD Candidate)
CHAPTER ONE: INTRODUCTION

1.1 Overview

This chapter starts with a general overview of poverty and food security in developing countries and Tanzania. It is followed by discussion on the significance of farming in Tanzania, rationale for undertaking this study as well as its significance. Finally, the general and specific objectives, guiding research questions, overview of the study methodology and utility, and the structure of the thesis are explained.

1.2 Poverty and Food Security Status in Developing Countries

More than one-third of all people in developing countries are poor and live on less than US$ 2 a day while every one person out of six is extremely poor, living on less than US$1.25 a day (Townsend, 2015). Although the contemporary world has seen a shift towards urbanization of populations with an estimated 54% living in urban areas (UN-Department of Economic and Social Affairs, 2014), poverty remains largely a rural phenomenon (FAO, 2015). A World Bank Report estimates that, by 2010, almost three quarters of the extreme poor were living in rural areas (Townsend, 2015). The relative deprivation in rural areas is reflected in a wide range of welfare indicators. For instance, child malnutrition, as measured by wasting in children under five years of age, is worse in rural areas as compared to urban areas in nearly every country for which data were available (FAO, 2015).

Notwithstanding the multiple causes and forms of poverty, strategies to alleviate it predominantly address the problem of malnutrition with emphasis on child and maternal under-nutrition (Bundara et al., 2013; Ruel and Alderman, 2013). This is because poverty is considered as both the cause and consequence of under-nutrition (Bradshaw, 2007; UNICEF, 2013). For instance, insufficient income limits access to social and health services resulting in unhealthy individuals (Black et al., 2008). Good nutrition during the first 1,000 days between the start of a woman’s pregnancy and her child’s second birthday is considered critical to the future health, wellbeing and success of her child (Save the Children, 2012a). The unhealthy condition, in particular at this
early time of life, entraps the individual to a life cycle of poverty. It is argued that under-nutrition (e.g. stunting) has an impact on the child's cognitive and intellectual development thereby affecting the child's academic performance and ultimately escalating the cycle of poverty (Bradshaw, 2007; UNICEF, 2013).

Global statistics indicate that under-nutrition is one of the key factors contributing to more than a third of all global child deaths amounting to 2.6 million deaths per year (Save the Children, 2012b). Indeed, the Millennium Development Goals (MDGs) Report on Goal Four, which aimed to reduce child mortality indicates that one third of all child deaths in sub-Saharan Africa was caused by hunger (United Nations, 2010). It is with this understanding the United Nations MDGs considered malnutrition as an important dimension of poverty among others that were to be halved by 2015 (Alderman et al., 2006). The global renewed commitment to address malnutrition in all its forms is reflected by the newly enacted 17 Sustainable Development Goals (SDGs). The first goal aims to end poverty in all dimensions by 2030 while the second goals aim to end all forms of hunger and malnutrition by 2030 by making sure that all people, especially children and the more vulnerable, have access to sufficient and nutritious food all year round (UNDP, 2016). The second goal of the SDGs promotes sustainable agricultural practices: improving the livelihoods and capacities of small scale famers, allowing equal access to land, technology and markets (UNDP, 2016).

According to OECD-FAO Agricultural Outlook 2013-2022, global agricultural production is projected to grow by 1.5% annually, compared to 2.1% in the previous decade (OECD and FAO, 2013). It is anticipated that this low growth will be manifested in both crop and livestock sectors. The projected trend of reduced productivity globally is likely to put more pressure on the nutrition status, in particular for people living in the developing world.

1.3 Food Security in Tanzania

The Tanzania Food and Nutrition Policy of 1992 defines nutrition as “the end-result of various processes in society in which food is eaten, followed by subsequent absorption
and utilization of the food nutrients\(^1\) by the body to provide health” (Tanzanian Ministry of Health, 1992). The policy maintains that good nutrition is partly a result of staying free from infectious diseases and eating a well-balanced diet with all necessary nutrients required by the body. The policy goal is, therefore, geared towards ensuring that food, which provides all nutrients, is available and its utilization is in accordance with nutritional requirement of the body to maintain good health. On the other hand, the policy attaches the concept of food security to availability and accessibility of adequate food at all time and to all people, especially special groups such as children, pregnant and lactating women, elderly and sick. The definition of food security focuses much on quantitative aspects by ensuring that food is adequately available and accessible and it makes no mention of the quality of food.

Malnutrition, in particular under-nutrition, is one of the big challenges facing Tanzania and the problem is more severe among women and children. For example, a study conducted by the Tanzania Food and Nutrition Centre (TFNC) in 2014 indicated that 38% of children aged 0-59 months were stunted (TFNC, 2015). The Government of Tanzania places strong emphasis on issues related to food security and nutrition. In order to coordinate national efforts against malnutrition in Tanzania, the government has established a High Level Steering Committee on Nutrition with representatives from different sectors including: private sector, NGOs, academics, UN agencies and donors (TFNC, 2015). This committee is chaired by the Permanent Secretary in the Prime Minister's Office and the secretariat is managed by the Tanzania Food and Nutrition Centre. Although district steering committees for nutrition have been established, and District Nutrition Officers appointed, their capacities are still limited and offer considerable scope for improvement (TFNC, 2015). Likewise, a Tanzania National Nutrition Strategy (2011-2015) with a US$520 million budget was developed, but a recent public expenditure review on nutrition has indicated that only 0.22% of total government expenditure was allocated to nutrition in the financial year 2012/13 and, therefore, few nutrition activities are implemented (INNOVEX, 2014).

\(^1\) These nutrients include carbohydrate, minerals, proteins and vitamins (FAO, 1990)
1.4 The Significance of Farming in Tanzania

In Tanzania, the agriculture sector employs about two thirds of the total employed persons, and almost 90% of those employed in the sector are smallholder farmers living in rural areas (Tanzanian NBS, 2014a). Crop production is the dominant farming activity that engages 60% of households; followed by mixed crop-livestock production (39% of farm households) and livestock/pastoralism (1%). On average, farm households cultivate 5 acres of land (Tanzanian NBS, 2012). Farm productivity is generally low; it is estimated that production is 10% less than a decade ago (Irish AID, 2011). The main types of crops grown in Tanzania are cereals (for example: maize, rice and sorghum) which occupy 67% of the land under annual crops, followed by pulses (11%), oil seeds and oil nuts (11%), root and tubers (3%), cash crops (tobacco, cotton, pyrethrum, jute and seaweed) (7%) and vegetables and fruits (1%) (Tanzanian NBS, 2012). However, it should be noted that the land area proportions for every crop as presented here do not reflect intercropping practices. Smallholder farmers in rural areas produce most of Tanzania’s food; yet they are poorer and more food insecure than their counterparts in urban areas (Tanzanian NBS, 2012).

It is accepted that the extent to which agriculture can contribute to poverty reduction (e.g. reducing insecurity) depends on the total amount of national resources allocated to the sector (DFID, 2005). The African Union (AU) Heads of State and Government in their meeting in Maputo, Mozambique in July 2003 emphasised the need for each AU member state to place agriculture at the heart of development funding. In what later came to be known as 'Maputo Declaration on Agriculture and Food Security in Africa', they asserted that each AU member state should ensure a

‘...commitment to the allocation of at least 10 percent of national budgetary resources to agriculture and rural development policy implementation within five years’ (African Union, 2003).

It is assumed that sustaining such 10% allocations of national budgets to the agriculture sector would translate into 6% percent annual sector growth (African Union, 2003). A review of the agricultural sector budget trends in Tanzania at both national and local
government levels shows that the agricultural budget increased from 3% of the national budget in 2000/01 to 7.8% in 2010/11, but declined to 6.9% in the 2011/12 budget year (Gabagambi, 2013). Although this budget trend was generally positive, the funds allocated to the sector were still below the proposed 10% indicated by the Maputo Declaration. The proportion of funds allocated for agriculture from the national budget was inadequate to run the broad range of activities covered under the sector in order to fight poverty and under-nutrition.

1.5 Significance and Rationale of the Study

One way to achieve greater outcome in poverty reduction strategies in developing countries is to promote growth in the sectors that support the livelihoods of most people (OECD, 2006). It is generally acknowledged that broad-based development of the agricultural sector is an effective approach to reducing poverty and to facilitate the country’s economic growth (Amani, 2005; Dixon et al., 2001; Mnenwa and Maliti, 2010; OECD, 2006). Growth in the agricultural sector reduces poverty by harnessing the productive capacity of the poor people’s key assets such as land and labour, by providing labour-intensive employment for the poor, by stimulating growth in the rural economy, and by lowering and stabilising food prices (Byerlee et al., 2005; OECD, 2006).

Poverty remains an overwhelmingly rural and, by implication, an agricultural phenomenon in Tanzania, and particularly among households whose major source of income is farming (Amani, 2013). As noted earlier, almost two thirds of the total employed persons in Tanzania, and almost 90% of all agricultural employed persons are smallholder farmers living in rural areas (Tanzanian NBS, 2014a). However, agriculture is the least remunerative sector (i.e. has low return to labour remuneration) in the economy (Amani, 2013). In 2012, the basic needs poverty rate in rural areas was 33%, compared with 22% in other urban areas and 4% in Dar es Salaam (Tanzanian NBS, 2014b). Likewise, in 2011, an estimated 48% of households in rural areas compared to 39% in urban areas of Tanzania were either ‘moderately’ or ‘highly’ food energy deficient (United Nations World Food Programme, 2013). Moreover, in 2013, about 39% of children under five in rural Tanzania were stunted, in contrast to 30% in urban
The large proportion of the population engaged in agriculture in rural areas implies that agriculture has potential to do more in poverty alleviation. Therefore, addressing poverty and hunger for most people in Tanzania implies confronting problems experienced by smallholder farmers in their daily lives in making decisions about farming.

The agricultural sector in Tanzania has a number of strengths, which offer significant potential for future growth and poverty reduction. Firstly, Tanzania still has a relative abundance of natural resources (including arable land and rangeland), which can be used for productive purposes. For instance, there is about 7.1 million ha of high and medium potential land (2.3 and 4.8 million ha, respectively) suitable for irrigation (URT, 2016). Of the 2.3 million ha classified as high potential, only 461,326 ha had improved irrigation infrastructure in 2015, accounting for only 1.6% of the total land with irrigation potential. Likewise, an estimated 55% of the land may be used for agriculture and more than 51% for pasture (URT, 2016). However, only about 6% of the agricultural land is cultivated. Secondly, Tanzania has an expanding domestic and regional food market opportunities, especially for livestock products and crops with high-income elasticity of demand (URT, 2016, 2001). Similarly, Tanzania's membership in regional communities (Southern African Development Community and East African Community) and as a signatory to international trade protocols is improving market opportunities for agricultural food and none food commodities at both regional and global level. Thirdly, Tanzania has a comparative advantage in the production of traditional food crops (maize, rice, cassava, sorghum, sweet potatoes, legumes), horticultural crops, wheat and almost all traditional industrial export crops (cotton, cashew, tea, coffee, and tobacco) (Tanzanian NBS, 2012). This advantage can be improved through enhanced productivity and market efficiency.

Tanzania’s diverse farming environment (Kavishe and Mushi 1993; Mnenwa and Maliti, 2010; Thornton et al., 2010) means that household farming decisions are influenced by a numerous production challenges. The key challenges which hamper the agricultural growth and overall poverty reduction among smallholder farm households include: firstly, significant exposure to variability in weather patterns with periodic droughts (Tanzanian MAFS & C, 2013; URT, 2016). The impact of variability in
weather patterns is amplified by the dependency on rain-fed agriculture and the smallholder farmers’ limited capacity to manage land and water resources. Secondly, the use of productivity enhancing agricultural inputs among smallholder farmers in Tanzania is one of the lowest in the region. For example, Tanzanian farmers use about 8–10 kg of fertilizer per hectare compared with an average of 16 kg/ha for Southern African Development Community (SADC) countries and 279 kg/ha for China (URT, 2016); Other factors include: underdeveloped markets, market infrastructure and farm-level value addition; high transaction costs due to the poor state or lack of rural infrastructures such as rural roads, communications and electricity; inadequate agricultural finance, including public expenditure; and inadequate agricultural extension services (Tanzanian MAFS & C, 2013; URT, 2016). The challenges outlined here influence farm households’ production and resource allocation decisions (Dixon et al., 2001; Garrity et al., 2012). Part of the decisions considered by farm households include the choice of farming system, normally in terms of the enterprise pattern such as livestock, crops, non-farm businesses, foodstuffs consumed and the way farm households interact with markets. The farm household decision-making process about their farming system is usually complicated, and many factors such as institutional or farming context characteristics, farmer or household characteristics and natural or farm characteristics (see discussion in Section 2.9) are considered simultaneously (Borges et al., 2015a; Dixon et al., 2001; Edwards-Jones, 2006).

The Government of Tanzania recognises that agricultural extension services have great potential to facilitate informed decision-making about the choice of farming system and are crucial for reducing household food insecurity and poverty in rural areas (United Republic of Tanzania, 2015). This is because the extension services facilitate the flow of advice, information, technical know-how and transfer of technology as well as inputs to farmers which are needed to increase and sustain agricultural production (CUTS International, 2011). In Tanzania, the agricultural extension services have been vested in local government authorities for them to foster effective participation of all stakeholders including beneficiaries, and motivate private sector participation in service delivery.

2 Since decision-making processes about the choice of farming systems is usually undertaken at the farm household level, this study defines a farming system as the totality of all decisions made by a particular farm household in relation to what, how and when to produce and how to consume what is produced (Dixon et al., 2001; Köbrich et al., 2003).
While insufficient human resources hinder efficient delivery of extension services (Tanzanian MAFS & C, 2013), it is argued that even the services offered by existing staff fall short in diagnosing smallholder farmers’ problems and transferring practical knowledge due to low capacity and/ or limited understanding of the smallholder farming environment by the extension officers. Consequently, extension services have not led to significant increase in production (CUTS International, 2011). In addition, while the extension and technical services account for a substantial proportion of district spending on agriculture, the Agriculture Sector Review-Public Expenditure Review (ASR-PER) of 2014 have shown that the total routine expenditure (central level plus district level recurrent and development spending) amounts to only 1.2% to 1.7% of agricultural GDP (URT, 2016). As already discussed in Section 1.4, the proportion of funds allocated for agriculture from the national budget is inadequate to run the broad range of activities covered under the sector, including the extension service delivery.

1.6 Objectives

This section outlines the general and specific objectives that this study aimed to meet.

1.6.1 General Objective

The overall objective of the study was to establish the contribution of the farming systems applied by farm households to their food security. To achieve this, the study examined the relationships between factors influencing farm household decision-making processes about the choice of farming systems and household food security in two distinctly different agro-ecological areas of Tanzania.
1.6.2 Specific Objectives

The specific objectives of the research were:

i. To identify key characteristics of the main farming systems employed by farm households in the study area.
ii. To determine the food security status of the farm households in the study area.
iii. To establish the relationship between farming systems and farm household food security status.
iv. To assess the factors influencing farm households’ decision-making processes about their choice of farming system.

1.7 Research Questions

The study was guided by the following questions:

i. What are the characteristics of the main farming systems employed by the farm households in the study area?
ii. What are the levels of household food security status in the study area?
iii. Is household food security associated with the choice of farming systems?
iv. What influences farm households’ choices of farming systems?

1.8 Methodology

The study was conducted in two distinctly different agro-ecological zones of Tanzania, namely Kishapu and Mvomero Districts. Kishapu is a semi-arid area characterised by unimodal rains ranging between 600mm and 900mm per year. Mvomero is characterised by bimodal rains ranging between 700mm and 2,300mm per year. Data were collected during both pre- and post-harvest seasons in 2014 from 506 farm households through interview questionnaires and augmented with market price survey, elite and focus groups discussions. Farming systems were identified based on: crops grown, degree of dependence and market orientation for particular crops, and number of livestock units owned. Chapter Three provides a detailed explanation and discussion of the methods of field investigation and data analyses.
1.9 Utility of the Study

Understanding how farm households make decisions can facilitate matching of agricultural extension services to the needs of farm households. Likewise, if policy actors understand how households arrive at particular farming systems, it will help in creating appropriate policy and institutional frameworks that will help farmers make informed decision towards sustainable use of natural resources, agricultural growth and reduction of hunger and poverty. This is because understanding of the decision-making mechanism associated with choice of farming system impacts on livelihoods of farm households (Ellis, 2000). Findings from this study add value to the already existing debates among scholarly and policy literature on farming systems and food security. Indeed, the findings contribute to the resource base available for training the next generation of scholars on farming systems and food security. In addition, the findings help policy makers think critically about local and national policies related to the agriculture, food and nutrition sectors.

1.10 Organisation of the Thesis

The organisation of the thesis is as follows: this chapter provided an introduction and background information about poverty and food security at global, regional and national level. Chapter Two is on literature review and theoretical framework. Chapter Three is methodology, whereby the key methods of field investigation used for this study are explained. Chapter Four provides a general overview of the findings (mainly descriptive information) on pre-harvest and post-harvest seasons and compares the two study areas. Chapter Five discusses findings in relation to the characteristics of the main farming systems and how the characteristics influence the household food security status in pre- and post-harvest seasons. Chapter Six discusses the findings in relation to factors influencing household decision-making processes with regard to the choice of farming systems. Chapter Seven presents the synthesis of the findings presented under Chapters Four, Five and Six. Finally, conclusions and recommendations are presented under Chapter Eight.
CHAPTER TWO: LITERATURE REVIEW AND THEORETICAL FRAMEWORK

2.1 Overview

This chapter is organized into seven sections. This overview is followed by sections that review the poverty and food security concepts and key frameworks used in the poverty and food security literature. The next section explains and discusses the farming systems concept and farming system analysis and also reviews the global, regional farming systems as well as those of Tanzania. It is followed by a review of the prevailing linkage between farming systems and household food security and then, the discussion of the decision-making theories and in particular with reference to the factors influencing household choice of farming system. The final section sets out the proposed analytical model developed from the synthesis of factors emerging from the discussions under the preceding sections. The study model illustrates the factors influencing farm households’ choices of farming systems and the associated influence on household food security.

2.2 The Concept of Poverty

One of the common challenges encountered by researchers, scholars and other individuals working under the field of development is how to conceptualize the term 'poverty'. This is because conceptualization informs how poverty and the poor are to be understood, and how someone can view the causes, extent, types of poverty and the politics of policies about poverty reduction. The United Nations Economic and Social Council (ECOSOC) offered a comprehensive delineation on the concept of poverty, which can be modified depending on context. The United Nations refers to poverty as

…a denial of choices and opportunities, a violation of human dignity. It means lack of basic capacity to participate effectively in society. It means not having enough to feed and clothe a family, not having a school or clinic to go to, not having the land on which to grow one’s food or a job to earn one’s living, not having access to credit. It means insecurity, powerlessness and exclusion of individuals, households and communities. It means susceptibility to violence, and
it often implies living on marginal or fragile environments, without access to clean water or sanitation (ECOSOC, 1998).

The United Nations' definition of poverty highlights many facets of poverty which range from monetary deprivation, capability deprivation, social exclusion, lack of participation (powerlessness) and vulnerability (Chambers, 1983; Kanbur and Squire, 1999; Laderchi et al., 2003). Poverty can further be classified under structural (chronic) and transient poverty (Kanbur and Squire, 1999). Structural poverty is a permanent deprivation resulting from the prevailing social and economic structure. Transient poverty is moving in and out of poverty as reflected by vulnerability inherent in one's context.

Many attempts to analyse poverty have taken a monetary position, which sees poor people as individuals with insufficient income to pay for minimum basic needs in life (Laderchi et al., 2003). Although there is consensus that income counts, the tendency of viewing poverty mainly through monetary lenses faces criticisms within the growing body of literature. The monetary approach represents the Northern, more industrial and urban conditions where poverty is considered as material deprivation (Chambers, 1983, 1995, 2009). It is the standardised and reductionist conception that differs from poor people’s realities where poverty is seen as local, complex, diverse, dynamic and agrarian in nature (Chambers, 1983, 1995, 2009; Scoones and Thompson, 2009). Consequently, there has been a call for a more contextualised view, with poor people analysing their own poverty situation and setting their own development agenda. The sub-sections that follow analyse some of these approaches, which have dominated the poverty debate and are also useful in the analysis of food security status.

2.2.1 The Entitlement Approach

Sen's (1981) article on ‘Ingredient of famine analysis: availability and entitlement’ is mentioned as one of the innovative approaches to poverty analysis (Devereux, 2001). Sen defines poverty (famine) as entitlement failure, and was interested to understand the processes that make some people and not others fall into impoverishment. Sen used the examples of Bengal famine of 1943, Ethiopian famine of 1973 and Bangladesh famine of 1974 to challenge the idea that, those famines were simply due to
unavailability of food. He found that, while most people were exposed to the same types of risks (drought and flood), some people died of hunger while others survived. The main question to Sen was: Why did some people starve even where food was available? In addition, Sen was interested to know: Why not everyone starved when there was decline in food availability?

In response to these questions, Sen argues that social, economic, political and legal contexts determine the endowments that people have and how they can use such endowments at a time of deprivation. For example, under certain circumstances, women are not entitled to own land (or other resources), and cannot utilise their capacity in off-farm paid jobs due to cultural limitations. Sen, therefore, distinguishes four types of entitlement relations, which make some people more vulnerable than others. The first one is trade (market) entitlement, whereby a person has capability to obtain basic needs from the market. The second one is production (exchange with nature) entitlement, whereby a person can use his/her own resources (land, livestock and other assets) to produce what he/she needs to consume. The third one is ‘own’ labour entitlement, whereby a person is able to use his/her own labour power to conduct either on-farm production or off-farm paid activities. The last one is transfer entitlement, whereby a person owns or accesses resources through various processes, such as remittances and inter-generational transfers. Sen, therefore, concluded that people who are able to cope with vulnerability often are entitled to substantial and diversified endowments.

Sen’s work on entitlement inspired a new understanding of poverty away from the notion that ‘growth' will promote poverty reduction in a more holistic way. However, Sen’s work is criticised because of his failure to acknowledge the social aspects of entitlements. He also failed to explain the role of political crises in the emergence of famine (Devereux, 2001). His analytical framework focused much on economic aspects while paying little consideration to social and political processes. Neither did Sen’s work look into the role of institutions in determining the entitlements. To address such criticism it is worth turning to the most influential work by Robert Chambers in his book titled Rural Development: Putting the Last First (Chambers, 1983).
2.2.2 Clusters of Disadvantage and Deprivation/Poverty Trap

Chambers (1983) presents a framework for poverty analysis in rural households and identifies five clusters of disadvantages that lock households into deprivation (Figure 1). Firstly, a household that lacks buffer against social, economic, ecological and physical contingencies\(^3\) is *vulnerable*. Chambers argues that contingencies force poverty ratchets, which make a household to sell or lose its important assets, making it more susceptible to deprivation. Secondly, a household with little or no control over the means of production (land, livestock and other assets) is *poor*. Inadequate resources result into insufficient food production, low income, reduced consumption, poor savings and subject to the cycles of poverty. Thirdly, a household with high proportions of dependants (sick, children, seniors and people with disability) is *physically weak*. Such a household produces less food and is often susceptible to food insecurity and nutrition related problems. Fourthly, a household which is fully or partially disconnected from the basic social, economic and physical services (public, markets, infrastructures, education, health, extension) is *isolated*. Such isolation is exacerbated by cultural, ethnicity and geographical factors. Lastly, a household which is unable to influence decisions which affect its members’ livings is *powerless*. Such a household is often a victim of predation and exploitation by the powerful.

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\(^3\) Contingencies are “social conventions (dowry, bride wealth, weddings and funerals), disaster, physical incapacity (sickness, the child bearing sequence, and accidents), unproductive expenditure, and exploitation” (Chambers, 1983).
In the Chambers (1983) framework, a household is depicted as a distinct economic entity for production and consumption that can be trapped within the five clusters of disadvantage. When these clusters interlock, the household is subjected to a vicious cycle of poverty, poverty syndrome and ultimately enters the 'Poverty trap'. Figure 1 illustrates the interrelationships between the clusters of disadvantage. The figure shows how aspects within one cluster make the others unavoidable.

Chambers challenges the dominant view of poverty that primarily focuses on material wealth (income) and employments (jobs). In his 1995 article on ‘Poverty and livelihood: whose reality counts?’, He asserts that income and employment are necessary but are reductionist conceptions which ignore other dimensions of poverty.

4 Poverty trap- is a deprivation resulting from the interaction of different causal factors from each cluster of disadvantages (Chambers, 1983:112).
The realities of the poor about poverty are local, complex, diverse and dynamic. Professionals are unaware of the fact that: (i) Different members of the household in the rural area seek different sources of food, income and other support services in different ways, places and time; (ii) The poor people livings are sustained by their livelihood capabilities, tangible and intangible assets (Figure 2); and (iii) Many aspects of the rural household cannot be commoditised or captured by the consumption based or employment survey data (Chambers, 1995). Chambers called for a renewed thinking from the 'material wealth’ to 'wellbeing’, and from 'employment' to 'livelihood'. According to Chambers, this renewed focus reinforces sustainable livelihood practices.

Figure 2: Components and Flows in a Livelihood


2.2.3 Sustainable Livelihoods Approach

Chambers (1983) view on the 'deprivation trap' laid the foundation for DFID Sustainable Livelihood Framework (DFID-SLF). The five clusters of disadvantages discussed by Chambers are reflected within the DFID-SLF under the pentagon of livelihood assets (Chambers, 1983). In addition, the DFID-SLF focuses on both tangible and intangible assets and is related to the Sen's (1981) and Chambers's (1995b)
arguments that, poor people livings are sustained by their capabilities and assets endowments.

The DFID-SLF is a people-centred analysis of poverty which starts with investigating people’s strengths and weaknesses (assert endowments), livelihood objectives and strategies employed to attain such objectives. The likely outcome from DFID-SLF is: (i) to address the vulnerability context and transform the structures and processes upon which poverty is built; and (ii) to understand the livelihood outcomes and their influence on livelihood assets. Figure 3 is a representation of DFID-SLF, which indicates that five types of assets; human capital (H), natural capital (N), financial capital (F), physical capital (P) and social capital (S) differently affect poor households. The impacts of these assets on livelihoods vary with their diversity, amount and balance among households. Under vulnerability context (shocks, seasonality and trend changes), households will respond differently depending on the level of assets endowment.

![Figure 3: Sustainable Livelihood Framework](image)


The DFID-SLF is unique - it takes a holistic view of poverty and presents a point of departure from the conventional income-centric conception of livelihood to an analytical framework that pays attention to multiple sources of rural livelihoods, contexts (social, economic, physical, political and cultural) and long-term perspectives (analysis of shocks, trend changes, seasonality). One critique to this framework relates to its broadness that limits the local organisation capacity to undertake such a broad range of activities and analysis (Petersen and Pedersen, 2010). However, it should be
noted that DFID-SLF does not suggest the starting point in all livelihood analysis, but the vulnerability context will determine the entry point (DFID, 1999).

2.2.4 Intra-household Power Dynamics and Power Relations

Intra-household power dynamic is the relationship of power among people in a given household (Davies and Carrier, 1999). In this power relationship, some household members are more powerful and dominant than others in making decision. Power dynamics embraces terms such as power, gender relations, resources allocation, income, decision-making, education, occupation, seniority and the like (Daplah, 2013; Quisumbing and Smith, 2007). How men and women interact in an attempt to influence decision-making is critical in determining the structural roles that men and women play in social relations such as household decision.

The three theoretical models which can help explain the concept of intra-household power dynamics and how household resources and welfare are distributed include: the ‘Unitary Approach’; ‘Bargaining Model’; and the Non-Cooperative Model. The Unitary Model also referred as “Benevolent Dictator Model” or the “Common Preference Model” describes how the household acts as one. The main assumption in this model is that there are household welfare function in which all resources (capital, labour, land and information) are pooled together to produce commodities that generate utility for the household (Alderman et al., 1995). The model contends that in a utility maximizing household, the actions of all members of the household are being determined by the preference of the head and that, the preference of the head becomes automatically the preference of the whole household. This approach has been criticized for not being able to capture the process of household decision-making (Quisumbing and Smith, 2007). Based on its assumption that the preference of the head becomes automatically the preference of the whole household, it is questioned however, if in real life the household head is all that altruistic. Furthermore, unitary model has been criticised for failing to deal with individuals that make up the household, and its failure to recognise the role of gender and age as important aspects in structuring resource allocation within the household (Marchant, 1997).
Bargaining model also known as co-operative model treat households as collective decision units and decision-making regarding the welfare and distribution of resources is very complex. The two main assumptions of Bargaining Model are: first, the outcome of intra-household resource allocation varies based on individual household members’ bargaining power; and second, individual household members have distinct preferences and tests and these cannot necessarily be aggregated into a single welfare or utility function (Alderman et al., 1995; Katz, 1997). The model assume that the household members participate in the decision-making and that members are able to bargain and, the difference between women and men are mainly based on their bargaining power and/or willingness to bargain for their own interests, rather than who makes the decision (Handa, 1994). In this model, the process of decision-making is more democratic as compared to the unitary model but power within the process tends to favour those who have better fallback position when the arrangement does not work. However, the cooperative model has been criticized for treating individual household members symmetrically with respect to their right and ability to enter into the household bargaining process (Katz, 1997). Just like unitary approach, the key weakness of bargaining model lies on its failure to deal with individuals who make up the household and failure to recognise the role of gender and age as the key aspects in structuring household’s resource allocation (Marchant, 1997). The non-cooperative model put emphasis on the role of the gender of a person in making decisions about household resource and welfare distribution and is based on the three features of household life including: asymmetric information, enforcement problems and inefficiency (Katz, 1997). Thus, members of the same household are in most cases unaware of each other’s income, ownership of assets and time use (Zelizer, 1997).

The review of the three models suggests that the process and the decision mechanism around intra-household allocation of resources and welfare is very complex. Its understanding needs to consider the concerns of individual members of the household and the power relations, including the role of gender and age. This theoretical discussion indicates that the none-cooperative intra-household model stands the better chance in explaining the intra-household resource and welfare allocation.
In most African countries including Tanzania, inequality in household decision-making is skewed towards men and results into lack of power by many women in most traditional societies, including the smallholder farming households. Consequently, women are affected in number of ways including lack of power to control over household resources and inability to attain sufficient food and other necessities. Women’s limited access to resources, imply that children (especially, those under five years) are normally affected as their mothers lack funds and authority over household resources which could be used in caring them amongst other uses (Quisumbing and Smith, 2007). Generally, inequalities in household’s decision-making begin at home before its manifestation in societies (Kalil, 2015). Despite of key roles played by women including reproduction, production and community work, their participation in household decision-making is usually limited as a result of cultural values which are more favorably to men (Cuddy et al., 2015). Across communities and cultures, men have more rights and privileges in management and control of household resources and income than most women (Heath, 2014; Seebens, 2011).

Various studies have explored the relationship between household power dynamics, agricultural production and food security in developing countries. Rao (2006) explored the conceptual linkages between the issues of land rights for women, with household food security on the one hand and gender equality on the other. Rao (2006) found that men have been able to access the better paid, non-farm jobs, while leaving women behind to manage agricultural production. Rao (2006) argued that while a right to land for women is a positive development, it appears also to be leading to an enhancement of work burdens, without much change in terms of status or decision-making authority. Njuki et al. (2011) used data from Malawi and Uganda to analyze the influences of income distribution between men and women. The results indicate that commodities generating lower average revenues are more likely to be controlled by women, whereas men control commodities that are high revenue generators, often sold in formal markets.

Another study by Simiyu (2015) in Kenya highlighted the role of gender in decision-making. The results show that although men generally wielded greater decision-making power at the household level, women exploited their social spaces and gender roles to (re)negotiate significant roles in decision-making in urban gardening. Nonetheless, there
were notable gender differences in terms of the initial decision to farm, choice of crops to cultivate, and use of crop products and income. Urban gardening was mostly the initiative of women, who showed preference for and exercised greater control over subsistence crops, and dominated decisions related to the consumption use of crop products. In contrast, men’s role was more pronounced where gardening was income-oriented and economically more visible than other livelihood strategies, and in decisions related to sale of crop products. A recent study in rural areas of Tanzania by Anderson et al. (2017) investigated the variation in husband and wife perspectives on the division of authority over agriculture-related decisions within households. The study found that the level of decision-making authority allocated to wives by their husbands, and the authority allocated by wives to themselves, both vary significantly across households. In addition to commonly considered assets such as women’s age and education, in rural agricultural households, women’s health and labour activities also appear to matter for perceptions of authority.

2.3 The Concept of Food Security

Food security is a widely discussed and variously defined concept in policy and research discourse. A report published about two decades ago by Maxwell and Frankenberger (1992) summarised about 200 definitions of food security from published works, thereby reflecting the complexities attached to the concept. For many, the concepts surrounding famine, hunger and food security are blurred and, in many cases, are used interchangeably. Since the 1970s, when food security as a concept got official recognition at the World Food Summit (WFS), there has been an ever evolving attempt to refine and redefine it (World Food Summit, 1975). Table 1 summarises some of the key definitions of food security followed by its discussion.
Table 1: The Evolution of the Food Security Concept (1974-2001)

<table>
<thead>
<tr>
<th>Year</th>
<th>Source</th>
<th>Definition of food security</th>
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<tbody>
<tr>
<td>1974</td>
<td>World Food Summit</td>
<td>‘…availability at all times of adequate world food supplies of basic foodstuffs … to sustain a steady expansion of food consumption… and to offset fluctuations in production and prices’ (United Nations, 1975).</td>
</tr>
<tr>
<td>1983</td>
<td>Robert Chambers</td>
<td>Focused on five clusters of disadvantage and deprivation trap (Chambers, 1983).</td>
</tr>
<tr>
<td>1983</td>
<td>United Nations Food and Agriculture Organisation</td>
<td>‘Ensuring that all people at all times have both physical and economic access to the basic food that they need’ (FAO, 1983).</td>
</tr>
<tr>
<td>1986</td>
<td>World Bank</td>
<td>‘access of all people at all times to enough food for an active, healthy life’ (World Bank, 1986). Introduced the concepts of ‘chronic food insecurity’ and ‘transient food insecurity’.</td>
</tr>
<tr>
<td>1996</td>
<td>World Food Summit</td>
<td>‘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, 1996).</td>
</tr>
<tr>
<td>2001</td>
<td>United Nations Food and Agriculture Organisation</td>
<td>‘Food security [is] a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life’ (FAO, 2002).</td>
</tr>
<tr>
<td>2009</td>
<td>United Nations Food and Agriculture Organisation</td>
<td>The amended definition (as per FAO (2002)) was reaffirmed officially by FAO in the 2009 Declaration of the World Summit on Food Security. This document also reiterated that the four pillars of food security are availability, access, utilization and stability (CFS, 2012).</td>
</tr>
</tbody>
</table>

Prior to the 1980s, food security was largely considered as a matter of food availability (Burchi and DeMuro, 2012). This is reflected in the global concern during the 1974 World Food Summit, which emphasised increasing the volume and stability of food supplies (World Food Summit, 1975). The 1974 World Food Summit, therefore, defined the food security concept as “availability at all times of adequate world food supplies of basic foodstuffs to sustain a steady expansion of food consumption and to offset fluctuations in production and prices”. Strategies to ensure food security focused on maintaining the balance between population and food growth rates. Food growth was required to be, at least, equal to the population growth rate. As a result, policy strategies
were directed at two sides of the coin; on the demand side, attention was to reduce the rate of population growth and, on the supply side, attention was to increase agricultural productivity to ensure stability in food supply (Wuyts, 2012).

The Food Availability Decline (FAD) approach has its origin from Malthusian demographic transition theory which states that population, if unchecked, tends to grow geometrically while food tends to increase arithmetically (Foley, 2008). The Malthusians maintain that, although birth rates are higher during the first stage of population transition, most children die at their economically dependent age due to malnutrition, starvation, and diseases caused by insufficient food availability or poor health services. Unless population growth is checked, it will outstrip the food production thereby pushing people to hunger and starvation. While it is logical to imagine any shortage in food supply would result in hunger and starvation, it is now agreeable that food availability is necessary but not the only remedy to the problems of food security (Devereux, 2001; Foley, 2008).

Sen’s article on entitlement failure was one of the initial attempts to address the limitations in the FAD approach (Sen, 1981). Although Sen avoided the use of the food security concept and focused on entitlements available to individuals and households, the article put new emphasis on consumption, demand side and the issue of access to food by vulnerable people. Sen states that “starvation is a matter of some people not having enough food to eat and not a matter of there being not enough food to eat” (Sen, 1981). Burchi and DeMuro (2012:11) argue that Sen’s work significantly affected the notion of food security “by adding the access dimension” on it, and micro level policies started to ensure the entitlement base for the households. In addition, the objectives of food security policies began to overlap with those of poverty alleviation and, in many places, poverty started to be defined according to food consumption standards (Coates, 2013).

Just like Sen (1981), Robert Chambers’ framework for analysis of poverty (see Section 2.2.2), eschewed the use of food security concept (Chambers, 1983). Instead, Chambers

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5 Sen (1984:497) defines entitlement as “the set of alternative commodity bundles that a person can command in a society using the totality of rights and opportunities that he or she faces”.
introduced five clusters of disadvantages (i.e. vulnerability, income poverty, physical weakness, isolation and powerlessness) that are likely to lock households into different forms of deprivation (deprivation trap), including food insecurity. As discussed earlier in Section 2.2.2, Chambers depicts a household as a distinct economic entity for production and consumption that can be trapped within the five clusters of disadvantage. When these clusters interlock, the household is likely to be subjected to different forms (manifestations) of poverty, one of which could be food insecurity.

In 1983, FAO expanded the food security concept to include the third aspect, which was about securing access to food by all people to all available food supplies (see Table 1). The effort was geared at balancing both supply and demand sides of the food security equation. In 1986, the World Bank report of Poverty and Hunger identified two types of food insecurity: chronic food insecurity and transitory food insecurity (World Bank, 1986). Chronic food insecurity was associated with problems of low income and continuing structural poverty, while transitory food insecurity was related to periods of intensified pressure caused by conflicts, natural disasters and economic collapse. In this report, the food security concept was elaborated and embraced the phrase ‘enough food for an active, healthy life’ (see Table 1). A more complex and most influential definition of food security was offered by World Food Summit in 1996 (see Table 1). Food security was considered as not only an individual issue but also a household, national, regional and global concern, and it was broadened to encompass sufficient food that will meet both macro and micronutrient requirement for the body. This conception also introduced the food preference aspect to food security. The definition was modified later in 2001, and social aspects consideration was introduced to food security equation (see Table 1). This definition, which was modified in 2001, was reaffirmed officially by FAO in the 2009 Declaration of the World Summit on Food Security (CFS, 2012). In 2009, the FAO reiterated that the four pillars of food security are availability, access, utilization and stability.

This study applies the World Food Summit 1996 definition and its modification in 2001 (FAO, 2002; 1996), since it embraces the multidimensional picture of food security including: food availability, food accessibility, food stability and food utilisation. A glossary for all aspects of food security has been provided by WFP (2009) as follows:
food availability is considered as the amount of food that is present in a country or an area through all its forms, such as domestic production, food aid, imports and food stock. Food access is taken as household ability to command food regularly through a combination or from any of the sources, such as own production, barter trade, purchases, food assistance or gifts and borrowing. Food utilisation is the selection and intake of food as well as absorption of nutrients by the body, and this is also influenced by other factors, such as adequate diet, availability of clean water and sanitation and health care. Food stability means that individuals, households and populations should have access to adequate food at all times. Thus, there should not be any risk of losing access to food as a consequence of shocks caused by social, economic, environmental and/or seasonality in production. Therefore, food stability is associated with both availability and access dimensions of food security. Table 2 summarises the key indicators of food security status across the four dimensions of food security (FAO, 2013).

Table 2: Indicators of Food Security Status

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Food security indicators</th>
</tr>
</thead>
</table>
| **Availability** | Average dietary energy supply adequacy  
| | Average value of food production  
| | Share of dietary energy supply derived from cereals, roots and tubers  
| | Average protein supply  
| | Average supply of protein of animal origin  |
| **Access** | Physical Transport infrastructures  
| | Economic Domestic food price level index  
| | Prevalence of undernourishment  
| | Share of food expenditure of the poor  
| | Depth of the food deficit  
| | Prevalence of food inadequacy  |
| **Utilisation** | Access to improved water sources  
| | Access to improved sanitation facilities  
| | Indicators of anthropometric failures  
| | Prevalence of Anaemia among pregnant women  
| | Prevalence of Anaemia among children under 5 years of age  
| | Prevalence of vitamin A deficiencies; Prevalence of iodine deficiencies  |
| **Stability** | Domestic food price  
| | Per Capita food production variability  
| | Per Capita food supply variability  
| | Political stability/absence of violence/terrorism  |

Source: Extracted from FAO (2013).
The next part of this section reviews the framework for analysing food security status at different levels.

2.3.1 Framework for Food Security Analysis

According to Smith et al. (2000) and Carletto et al. (2013), a useful way to organise the thinking about food security indicators is to relate them to specific dimensions they measure and the level of analysis to which these indicators refer (i.e. individual, household, national and global). Figure 4 summarises this thinking about food security indicators and shows that, at the highest level of food security analysis (i.e. the global level), the main concern is global food availability that is highly influenced by global food production and stocks available at any given year. At national level, food security analysis tends to refer to national food availability, which in turn depends on both national food production and national net imports of food. Carletto et al. (2013) added that a country’s capacity to produce food depends very much on many drivers including: natural factors, such as weather, topography and soil quality; all other types of farm production capitals; and institutional setup available to support the country’s agricultural productivity. On the other hand, national net import of food may depend on a country’s national income, availability of foreign exchange as well as prevailing price conditions at the international market. According to Smith et al. (2000), international food aid may also contribute as an external addition to the national food imports (supplies).

Figure 4 indicates further that both availability of food at the national level and income generated by the household are associated with household and individual food access. The channels through which households access food may relate various entitlements available to them including: own farm food production, food purchased at the markets, and in-kind food transfers such as gifts and food aids. Likewise, intra-household relations may also determine the quantity and quality of food that can be accessed by an individual within a household. The figure indicates that there is demarcation between food security and nutrition security. Carletto et al. (2013) argue that, while food security is amongst the basic requirements that households consider when making budget and allocation of resources, individual nutrition security depends on a number of factors.
including: household food security status; care behaviour - which has effect on an individual’s nutritional status (a good example being the effect of breast feeding practices on children); health - which allows the absorption of nutrients and energy contained in the food consumed; and sanitation - which includes practices that minimise contamination of food. This study does not address the nutrition aspect of food security, and discussion is confined to the household food security level.

Figure 4: Food Security Conceptual Framework

Source: Carletto et al. (2013) and Smith et al. (2000)
The next part of this section, discusses some of the most commonly used measures of food security status.

2.3.2 Measuring Food Security Status

The multidimensional nature of food security implies that policy makers, researchers and other development practitioners are required to measure several indicators to capture various dimensions of food security (Smith et al., 2000). However, in spite of the development of many indicators of food security, there exists no single measure that captures all dimensions of food security (Carletto et al. 2013; Coates and Maxwell, 2012; Maxwell et al. 2014). This is because there is a clear hierarchy across the dimensions of food security (Barrett, 2010). For instance, while availability is considered as necessary for food security, it is not sufficient to ensure accessibility. Likewise, while accessibility is necessary, it cannot by itself ensure proper food utilization. On the other hand, food stability runs across food availability and food accessibility and, as argued under Section 2.3, it refers to variability and uncertainty in both availability and access. Therefore, a combination of food security indicators and measures is required to fully comprehend the complex nature of food insecurity in any context (Carletto et al., 2013; Maxwell et al. 2014).

The indicators for measuring food security are, therefore, organised under the following categories: undernourishment measures, dietary diversity and food frequency measures, consumption behaviour measures, experiential measures and self assessment measures (Carletto et al., 2013; Maxwell et al. 2014).

2.3.2.1 Undernourishment Measures of Food Security

Undernourishment is a commonly used measure of food security status and is done by comparing the average food availability against the minimum requirements at different levels of analysis (Carletto et al., 2013; Maxwell et al. 2014). The most commonly used indicators for measuring undernourishment include: the estimation of the per capita dietary food energy supply based on the aggregate food supply data (also known as FAO measure), estimation of undernourishment based on the grains obtained,
estimation of undernourishment using the entitlement to food approach, and estimation of undernourishment by using anthropometric indicators.

(i) FAO measure of undernourishment based on per capita dietary food energy supply

This approach is commonly applied by FAO in estimating food security status at the national level (Carletto et al., 2013; Naiken, 2003) and is based on income or consumption distribution data. There are a number of assumptions made about the distribution of food supply across households, and the proportion of undernourished population is then defined as that part of the distribution living below the minimum dietary food energy requirement level (Bashir and Schilizzi, 2012; Carletto et al., 2013). Naiken (2003) and Mernies (2003) proposed a probability distribution framework which estimates the proportion of the population below the minimum level of dietary food energy consumption as follows:

\[
P(U) = P(x < r_L) = \int_{x<r_L} f(x) \, dx = F_x(r_L)
\]

Whereas:

\( P(U) \) is the proportion of undernourished in total population,
\( (x) \) refers to the dietary energy consumption,
\( r_L \) is a cut-off point reflecting the minimum energy requirement,
\( f(x) \) is the density function of dietary energy consumption and
\( F_x \) is the cumulative distribution function.

There are two options in which the proportion of undernourished in a total population may be estimated using the FAO measure of undernourishment: first, by using Food Balance Sheet data, and second, by using the Household Budget Survey data (Mernies, 2003). The Food Balance Sheet is used to prepare annual estimates for monitoring progress in food security status at national level (Mernies, 2003). The estimate relies on the data generated from production and trade of food commodities. The proportion of
undernourished is represented by the per capita Dietary Energy Supply (DES) which refers to the availability of food for human consumption over a reference period and is expressed as kcal/person/day (energy values). The total DES is, therefore, an aggregate of food components of all commodities after they are converted into energy values.

On the other hand, the Household Budget Survey data allows the derivation of undernourishment by using data generated through surveys of large scale samples which allow estimates about food security status to be made not only at national level but also at sub-national levels, including geographical areas, households and socio-economic population groups. The use of this option is considered as a game-changer in improving on the estimates developed from the Food Balance Sheet data by collecting information on quantities of food consumed or purchased by the household, followed by their conversion into respective kilocalories using appropriate calories conversion factors for the purpose of comparing against household and/ or individual energy requirement (Carletto et al., 2013; Mernies, 2003; Naiken, 2003).

According to Naiken (2003), this focus on dietary energy in assessing food security status can be justified on two bases. First, a minimum amount of dietary food energy intake is considered as essential to maintain body weight and work performance. Second, an increase in dietary food energy, if derived from staple foods, is likely to bring along with it more protein and other nutrients, while the practice of raising intake protein and other nutrients only without ensuring that a minimum requirement level of dietary food energy has been achieved is unlikely to be of much benefit in terms of improving nutritional status. Nonetheless, by focusing on dietary food energy intake, the FAO measure is able to capture those whose food consumption level is deemed insufficient for maintaining body weight and work performance.

(ii) Estimation of undernourishment based on grain obtained

In this method, grains obtained from own farm production, purchasing, or those received in kind are recorded and then compared against the minimum recommended grain requirement per capita. The amount of such grains varies in different regions of the world. For instance, the amounts in USA, Italy and India are 800 kg, 400 kg and 200

30
kg, respectively per capita per year (Kayunze, 2008). In Tanzania, the minimum recommended amount of grains for one to be considered food secure is 270kg per adult equivalent per year (Kayunze, 2008).

(iii) Estimation of undernourishment using the entitlement to food approach

The entitlement approach is discussed under Section 2.2.1 and has useful application in understanding food security situation in many contexts. By applying the entitlement concept, food security status is estimated by calculating the amount of resources (mostly money) which an individual or household needs to obtain food that contains the recommended level of dietary food energy requirement (Kayunze, 2008). Individuals or households which are unable to obtain such amount of money are said to be food insecure (undernourished). By using this approach, it is argued that most food secure households are those which achieve adequate access to food while only using a small proportion of available resources, and most food insecure household are those that fail to achieve adequate access to food resources even by devoting a large proportion of available resources to food resources (Kayunze, 2008). Saad (1999) argues that households with access to resources, including adequate rainfall, good soil quality, water availability, forest resources, fish and sea food, livestock, infrastructure, land, farm implements and other physical assets, are more likely to be food secure than their counterparts that do not have access to such resources. Likewise, households, that have larger land areas cultivated with irrigation to produce crops, good supply of agricultural inputs, number of cropping seasons, crop diversity, higher crop yield, food crop production, cash crop production, number of sources of non-farm income, and equitable division of labour between genders are more likely to be food secure, compared to their counterparts that do not have such endowments (Saad, 1999).

(iv) Estimation of undernourishment using anthropometric indicators

Anthropometric measures assess individual’s nutrition status (de Haen et al., 2011; Hoddinott and Yohannes, 2002; Wiesmann et al., 2006). As indicated under Section 2.3.1 and Figure 4, the household level food consumption is not the only factor influencing the individual level nutritional status. Other factors include intra-household
food distribution, food losses, individual health and activity levels, sanitation and care practices (de Haen et al., 2011). While literature recognises extensive anthropometric measures that are used for nutritional status assessment (WHO, 1995), most indicators used are related to the weight and height of individuals. Given that an adult age height remains unchanged but changes among children, anthropometry therefore has different indicators for both groups (de Haen et al., 2011). However, the greatest consensus exists for anthropometric indicators for children aged between 0 to 5 years, and this has been the focus of most discussions in literature.

There are three most commonly used anthropometric indicators, which are child stunting, underweight and wasting, all of which offer insights into different dimensions of nutritional problems among individuals (de Haen et al., 2011). Stunting, also known as low height for age, is referred to as an indicator of chronic under-nutrition. Wasting (also known as low weight for height) is an indicator of acute under-nutrition and is used to monitor acute food shortages, while underweight (also known as low weight for age) is a summary indicator which combines both wasting and stunting.

2.3.2.2 Dietary Diversity and Food Frequency Measures of Food Security

Dietary diversity and food frequency measures capture the number of different types (kinds) of food/food groups that individuals eat and the frequency with which they eat these types or food groups, and sometimes involves weighting up these groups (Carletto et al., 2013). The outcome of using these measures is a score that represents the diversity of food intake, but not necessarily representing the quantity consumed, though scores obtained through the use of these measures have been shown to be significantly correlated with caloric adequacy measures discussed above (Coates et al., 2007; Wiesmann et al., 2006). The two mostly applied indicators of dietary diversity and food frequency measures are the Food Consumption Score (FCS) and the Household Dietary Diversity Score (HDDS). The FCS is a specific type of dietary diversity index that is commonly used by the World Food Programme (WFP, 2009b), while the HDDS is similar to the FCS, but relies on data generated through 24-hour recall period without capturing the frequency information or weighted categorical cut-offs (FAO, 2010;
Swindale and Bilinsky, 2006). The use of HDDS is widely promoted by FAO and USAID.

2.3.2.3 Consumption Behavioural Measures of Food Security

The consumption behavioural measures capture food security status indirectly by measuring behaviours that are likely to relate to food consumption (Carletto et al., 2013). A good example of these measures is the Coping Strategies Index (CSI) (Maxwell and Caldwell, 2008). The CSI counts the frequency and severity of behaviours in which people engage when they do not have adequate food from own farm production or money to buy food from the market (Carletto et al., 2013). Maxwell et al. (2008) have identified a more “universal” sub-set of coping behaviours found to be relevant in 14 different context-specific CSI instruments. According to Maxwell et al. (2008), CSI tends to measure only the less severe coping behaviours, and has been widely adopted by WFP, FAO, and the Global Integrated Phase Classification (IPC) team, amongst others. The Household Hunger Scale-HHS (see below) is also considered as essentially a behavioural measure, but tends to capture more severe behavioural conditions (Carletto et al., 2013).

2.3.2.4 Experiential Measures of Food Security

Experiential measures are those which combine behavioural indicators with psychological indicators of food security status. The best known indicator under this category is the Household Food Insecurity Access Scale (HFIAS) (Coates et al., 2007; Swindale and Bilinsky, 2006). The HFIAS is designed to capture household behaviours which relate to aspects of food insecurity, such as anxiety about food supply as well as insufficient access to food quality and quantity (Coates et al., 2007). On the other hand, HHS was derived from the HFIAS as a culturally-invariant subset of questions, and includes three specific questions, but none of which are psychological in nature (Deitchler et al., 2010). The use of HFIAS and HHS has been adopted and promoted by USAID, FAO, and other international organisations which address the problem of food insecurity.
2.3.2.5 Self-assessment Measures of Food Security

The self-assessment measures are highly subjective measures of food security (Carletto et al., 2013). With this measure, respondents are asked to assess themselves and/or their households’ current food security status in a specified recall period and any change in their own and/or their households’ livelihood status over a specified longer period of time (Headey, 2013, 2011; Headey and Ecker, 2013). There are varieties of questions used to capture individual self-assessment of food security status, but the most commonly used one is the Consumption Adequacy Question (Migotto et al., 2005). This question is generally worded as follows: ‘Concerning your food consumption, which of the following is true?’. Answers to the question are generally coded as: 1) more than adequate, 2) just adequate, and 3) less than adequate.

2.4 Farming Systems

The concepts ‘farm system’ and ‘farming system’ are often used interchangeably, and the practice has been to apply the meaning of one referring to the other. However, these are two different concepts. Farm system is essentially the structure of an individual farm and is defined as ‘the household, its resources, and the resource flows and interactions’ (Dixon et al., 2001:2). It is the totality of all decisions made by a particular farm household in relation to what, how and when to produce and how to consume what is produced (Köbrich et al., 2003; Weatherhogg et al., 2001). Garrity et al. (2012) assert that the main objective of a farm system is to provide household goods such as food, cash and other livelihoods. Each individual farm system has unique attributes influenced by decisions made by the household, the natural resource endowment of the farm, and the dominant pattern of households’ livelihood activities, including the link to the market and the intensity of production activities (Dixon et al., 2001).

The collection of the individual farm systems leads to a typical or dominant ‘farming system’ of an area. In this case a farming system is defined as a population of individual farm systems, which share the same characteristics in terms of livelihood opportunities, constraints and consumption patterns of which similar development and intervention strategies would be appropriate (Dixon et al., 2001). There are two main components of
farming systems (Keating and McCown, 2001). The first one is the ‘biophysical production system’, which includes crops, pastures, animals, soils and climate, together with certain physical inputs and outputs. The second component is the ‘management system’, which includes people, values, goals, knowledge, resources, monitoring opportunities and decision-making. Mądry et al. (2013) asserts that the best typology of farming systems must reveal maximum heterogeneity between categories and maximum homogeneity within categories.

Farming systems are classified based on: natural resources endowment, agro-climatic conditions, landscape characteristics, farm size/tenure and organization, household livelihood, and main technology used in the production activities (Dixon et al., 2001; Garrity et al., 2012; Mnenwa and Maliti, 2010; Reenberg and Paarup-Laursen, 1997). The following sub-sections review global, regional and Tanzanian farming systems.

### 2.4.1 Global Farming Systems

Dixon et al. (2001) identified eight broad categories of farming systems throughout the developing world as: irrigated farming systems, which embrace a broad range of cash and food crop production; wetland rice based farming systems, which rely upon monsoon rains supplemented by irrigation; rain-fed farming systems, which are mainly found in humid areas of high resource potential; and rain-fed farming systems in steep and highland areas, which are often mixed crop-livestock systems. Other systems as identified by Dixon et al. (2001) include: rain-fed farming systems in dry or cold low potential areas, with mixed crop-livestock and pastoral systems merging into sparse and often dispersed systems with very low current productivity or potential because of extreme aridity or cold; dualistic (mixed large commercial and small holder) farming systems, across a variety of ecologies and with diverse production patterns; coastal artisanal fishing, often mixed farming systems; and urban based farming systems, typically focused on horticultural and livestock production. Dixon et al. (2001) noted that, even with this broad classification, there were still sufficient differences within each of the eight broad farming systems and when the above criteria were applied to the six regions of the developing world it further resulted into 72 sub-types of farming.
systems which had an average population of around 40 million (ranging between less than a million to several hundred millions).

2.4.2 Farming Systems in Sub Saharan Africa

Dixon et al. (2001) have identified 15 major farming systems in sub-Saharan Africa (see Figure 5 and Table 3). Figure 5 shows the location of each farming system in the region and indicates that most of the regional land area falls under six main farming systems, which are: sparse (arid), forest-based, root crop, cereal-root crop mixed, maize mixed, and pastoral farming systems.

Figure 5 indicates further that the sub-Saharan Africa farming systems are immensely diverse, implying that any development initiative targeting African agriculture has to deal with the diverse nature of farming systems to enable innovation that adequately serves the needs of the majority. It is clear from Figure 5 that there is rarely a single farming system that covers the entire country. Likewise, there is rarely a single farming system that is limited to a single country only. Taking Tanzania as an example, this figure shows that the country has two major farming systems: maize mixed and root crops, and that the two systems are not limited to Tanzania only. Maize mixed farming system extends to the neighbouring countries of Kenya and Uganda in the North and Zambia, Zimbabwe, Malawi and Mozambique in the South. Likewise, root crop farming system extends to neighbouring countries of Mozambique, the Democratic Republic of Congo and Zambia.
Figure 5: Major Farming Systems of Sub-Saharan Africa

Source: Dixon et al. (2001).
Table 3 presents the main characteristics of each identified farming system including: agricultural population as a proportion of regional totals, the land area covered, principal livelihoods, prevalence of poverty and agro-ecological zones. The table indicates that, despite the role that agriculture plays in the sub-Saharan African region, most part of it has marginal conditions. About 43% of sub-Saharan Africa land is found in the semi-arid and arid agro-ecological zones; 13% is in dry sub-humid zones and 38% is jointly covered by humid and sub-humid zones (Dixon et al., 2001; IAC (Inter Academy Council), 2004; Weatherhogg et al., 2001). The semi-arid, arid and dry sub-humid areas are characterised by large marginal areas, and experience very high temperatures as well as very low and highly variable rainfall regimes; all these factors limit agricultural productivity. The major farming systems which support most of the farm households in the region and, in particular, in Southern Africa, are located in the semi-arid zone (agro-pastoral, millet), dry sub-humid zone (cereal-root mixed, maize mixed, large commercial and smallholder systems) and arid zone (pastoral).
Table 3: Major Farming Systems of sub-Saharan Africa

<table>
<thead>
<tr>
<th>No</th>
<th>Farming Systems</th>
<th>Agric. Popn. (% of region)</th>
<th>Land Area (% of region)</th>
<th>Principal Livelihoods</th>
<th>Prevalence of Poverty</th>
<th>Agro-ecological zone</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Irrigated</td>
<td>2</td>
<td>1</td>
<td>Rice, cotton, vegetables, rain-fed crops, cattle, poultry</td>
<td>Limited</td>
<td>Various</td>
</tr>
<tr>
<td>2</td>
<td>Tree Crop</td>
<td>6</td>
<td>3</td>
<td>Cocoa, coffee, oil palm, rubber, yams, maize, off-farm work</td>
<td>Limited-moderate</td>
<td>Humid</td>
</tr>
<tr>
<td>3</td>
<td>Forest Based</td>
<td>7</td>
<td>11</td>
<td>Cassava, maize, beans, cocoyams</td>
<td>Extensive</td>
<td>Humid</td>
</tr>
<tr>
<td>4</td>
<td>Rice-Tree Crop</td>
<td>2</td>
<td>1</td>
<td>Rice, banana, coffee, maize, cassava, legumes, livestock, off-farm work</td>
<td>Moderate</td>
<td>Moist humid and humid</td>
</tr>
<tr>
<td>5</td>
<td>Highland Perennial</td>
<td>8</td>
<td>1</td>
<td>Banana, plantain, enset, coffee, cassava, sweet potato, beans, cereals, livestock, poultry, off-farm work</td>
<td>Extensive</td>
<td>Sub-humid and humid</td>
</tr>
<tr>
<td>6</td>
<td>Highland Temperate Mixed</td>
<td>7</td>
<td>2</td>
<td>Wheat barley, tef, peas, lentils, broadbeans, rape, potatoes, sheep, goats, livestock, poultry, off-farm work</td>
<td>Moderate-extensive</td>
<td>Sub-humid and humid</td>
</tr>
<tr>
<td>7</td>
<td>Root Crop</td>
<td>11</td>
<td>11</td>
<td>Yams, cassava, legumes, off-farm work</td>
<td>Limited-moderate</td>
<td>Moist Sub-humid and humid</td>
</tr>
<tr>
<td>8</td>
<td>Cereal-Root Crop Mixed</td>
<td>15</td>
<td>13</td>
<td>Maize, sorghum, millet, cassava, yams, legumes, cattle</td>
<td>Limited</td>
<td>Dry sub humid</td>
</tr>
<tr>
<td>9</td>
<td>Maize Mixed</td>
<td>15</td>
<td>10</td>
<td>Maize, tobacco, cotton, cattle, goats, poultry, off-farm work</td>
<td>Moderate</td>
<td>Semi-arid and dry sub humid</td>
</tr>
<tr>
<td>10</td>
<td>Large Commercial and Smallholder</td>
<td>4</td>
<td>5</td>
<td>Maize, pulses, sunflower, cattle, sheep, goats, remittances</td>
<td>Moderate</td>
<td>Semi-arid and dry sub humid</td>
</tr>
<tr>
<td>11</td>
<td>Agro-Pastoral Millet/Sorghum</td>
<td>8</td>
<td>8</td>
<td>Sorghum, pearl millet, pulses, sesame, cattle, sheep, goats, poultry, off-farm work</td>
<td>Extensive</td>
<td>Semi-arid</td>
</tr>
<tr>
<td>12</td>
<td>Pastoral</td>
<td>7</td>
<td>14</td>
<td>Cattle, camels, sheep, goats, remittances</td>
<td>Extensive</td>
<td>Arid and semi-arid</td>
</tr>
<tr>
<td>13</td>
<td>Sparse (Arid)</td>
<td>1</td>
<td>17</td>
<td>Irrigated maize, vegetables, date palms, cattle, off-farm work</td>
<td>Extensive</td>
<td>Arid</td>
</tr>
<tr>
<td>14</td>
<td>Coastal Artisanal Fishing</td>
<td>3</td>
<td>2</td>
<td>Marine fish, coconuts, cashew, banana, yams, fruit, goats, poultry, off-farm work</td>
<td>Moderate</td>
<td>Humid</td>
</tr>
<tr>
<td>15</td>
<td>Urban Based</td>
<td>3</td>
<td>&lt;1</td>
<td>Fruit, vegetables, dairy, cattle, goats, poultry, off-farm work</td>
<td>Moderate</td>
<td>Various</td>
</tr>
</tbody>
</table>

Source: Dixon et al. (2001).

The farming systems classification approach presented above is a generalization of the vast diversity of agriculture in the sub-Saharan African Region. It represents a realistic...
approach showing farming system areas in a geographical manner in order to simplify the dissemination of analytical results to policy makers, investors and programme planners who tend to rely on relatively large-scale tendencies for planning. Each farming system category, however, has distinctive characteristics and contains a substantial degree of subsystems heterogeneity. Likewise, it is important to note that sharp boundaries between farming systems on the ground rarely exist, and thus the boundaries are actually soft gradations. To bring more insight to this discussion, the next part of this section discusses farming systems in the Tanzanian context.

2.4.3 Farming Systems in Tanzania

Classification of the farming systems in Tanzania can be traced back to Kavishe and Mushi (1993), who outlined the seven main farming systems in Tanzania as: coffee-banana system; pastoralist system; sorghum-millet-livestock system; cassava farming system; maize surplus system; urban areas farming system; and mixed farming and consumption patterns. A study by Thornton et al. (2010) of agriculture systems in East Africa showed that about 56% of farm land in Tanzania was under the ‘mixed crop-livestock systems’, followed by ‘livestock only’ (33%), and the rest was under ‘non-livestock oriented systems’. They argue that, as the East African countries are facing a continuing population increase, specialisation of the farming systems will be inevitable if food security is to be assured. Consequently, they call for an increase in farm productivity which needs to come not only from the more intensive mixed systems which are close to the markets, but also from extensive mixed systems where there is considerable potential for increasing yields.

Mnenwa and Maliti (2010), in an examination of the links between poverty and farming systems in Tanzania, presented a more refined classification of the farming systems and identified ten major systems (Table 4). They found that poverty incidence differed considerably between the farming systems. Banana-coffee system had the lowest percentage of poor households (46%) while cashew-coconut system had the highest percentage of poor households (72%), followed by sorghum/millet (69%) and pastoralist-agro-pastoralist households (66%).
The works of Bryceson et al. (1986), Mnenwa and Maliti (2010) and Thornton et al. (2010) represent the broad classification of farming systems in Tanzania, leading inevitably to considerable variations even within any single system. In light of this, several studies on farming systems have been conducted elsewhere in Tanzania to delineate discrete and micro-level systems. Due and Anandajayasekeram (1984) explored the principal farming systems in Kilosa and Mgeta areas of Morogoro Region, to understand the ecological, social and economic settings prior to making any decision on what new crop variety to introduce. The study found that, although the average farm size, levels of education, household size and value of total production per household were similar, the farming systems in the two study areas differed significantly. Households in Kilosa cultivated primarily cereal crops such as maize, rice and sorghum for both home consumption and cash earning. In contrast, the households in Mgeta cultivated horticultural crops such as cabbage, green beans, cauliflower and lettuce for cash earning, and crops such as maize, rice and sorghum for home consumption. The study underscored the need for farming system researchers to put more emphasis on total cropping and food systems instead of concentrating on one aspect of a particular crop, as this would help to better understand the problems associated with the overall systems and which limit agricultural production in an area. A study on livelihood patterns in Morogoro Region by Ellis and Mdoe (2003) noted that maize was the dominant food and cash crop across the farming systems in the study area. A study on culture and food habits by Lyana and Manimbulu (2014) found that people living in Western Lake Victoria basin of Tanzania have developed a unique indigenous banana-based farming system. They noted that culture influences food habits in the study area and households have accumulated deep knowledge on banana production, distribution and utilisation.
## Table 4: Farming Systems in Tanzania

<table>
<thead>
<tr>
<th>Farming system</th>
<th>Region</th>
<th>Major characteristics</th>
<th>Major farming activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Banana-coffee-horticulture system</td>
<td>Arusha, Kagera Kigoma, Kilimanjaro and Mbeya</td>
<td>Land scarcity, Volcanic soil with high fertility, Intensive land use.</td>
<td>Tree crop, banana, coffee, maize, horticultural crops</td>
</tr>
<tr>
<td>Maize-legume system</td>
<td>Arusha, Ruvuma, Kagera, Shinyanga, Rukwa, Iringa, Kigoma, Mbeya, Tabora, Morogoro, Tanga, Biharamulo, Kahama.</td>
<td>Land not scarce, Shifting cultivation</td>
<td>Maize and legumes, beans and groundnuts, intercropped, Arabic coffee</td>
</tr>
<tr>
<td>Cashew-coconut-cassava system</td>
<td>Coast Region, Eastern Lindi, Mtwara</td>
<td>Low rainfall, Low soil fertility, Land is not scarce, Shifting cultivation</td>
<td>Cassava, coconut and cashew</td>
</tr>
<tr>
<td>Rice-sugar cane system</td>
<td>River valleys in most regions</td>
<td>Alluvial soils</td>
<td>Rice and sugar cane</td>
</tr>
<tr>
<td>Sorghum/bulrush millet/livestock system</td>
<td>Sukuma land, Shinyanga and Rural Mwanza</td>
<td>Intense population pressure, Declining soil fertility</td>
<td>Sorghum, maize millet, rice, cotton and oilseeds.</td>
</tr>
<tr>
<td>Tea-maize-pyrethrum system</td>
<td>Njombe and Mufindi Districts in Iringa Region</td>
<td>Loamy and volcanic soils</td>
<td>Tea, Irish potatoes, maize, beans, pyrethrum, wheat, sunflower and wattle trees.</td>
</tr>
<tr>
<td>Horticulture based system</td>
<td>Lushoto District, Morogoro Rural, Iringa Rural</td>
<td>Volcanic soils</td>
<td>Various vegetables and fruits, maize, coffee, Irish potatoes, tea and beans</td>
</tr>
<tr>
<td>Wet and irrigated rice system</td>
<td>Occupies river valleys and alluvial plains, Kilombero, Wami Valleys, Kilosa, Lower Kilimanjaro, Ulanga, Kyela, Usangu and Rufiji.</td>
<td>Alluvial soils</td>
<td>Rice</td>
</tr>
<tr>
<td>Pastoralists and agro pastoralists system</td>
<td>Semi-arid areas, Dodoma, Singida, parts of Mara and Arusha; Chunya Districts, Mbeya and Igunga District in Tabora.</td>
<td>Moderate population density, Limited resource base, Poor and variable rainfall</td>
<td>Deep attachment to livestock and simple cropping system, Shifting cultivation of sorghum millet</td>
</tr>
</tbody>
</table>

Source: Mnenwa and Maliti (2010).

As indicated earlier in Section 2.4 farming systems are classified based on: natural resources endowment, agro-climatic conditions, landscape characteristics, farm...
size/tenure and organization, household livelihood and, the main technology used in the production activities. Therefore, the household choice of farming systems is shaped by these aforementioned factors.

The discussion on the types of African farming system presented in Section 2.4.2 and those in Tanzania as presented in Section 2.4.3, shows that farming systems are highly dynamic and change over time in response to a number of determinants. Garrity et al (2012) identified several determinants, which shape the development of farming systems in sub-Saharan Africa as: population; natural resources and climate; markets and trade; energy; technology and science; human capital; and institutions and policies. The relative importance of these drivers, in particular, how they interact and how they manifest, varies between farming systems and they need to be considered in developing policy options, which have potential to improve food security and reduce poverty among smallholder farmers. The following sections highlight some these drivers of farming system with particular focus on the impacts of population pressure and natural environment/climate on farming systems.

2.5 Population Pressure and Farming Systems

The effects of the population pressure on farming systems and, ultimately, food supplies is highlighted in the seminal work by Boserup (1975), which discussed the impact of population growth on agricultural output. Boserup (1975) has shown that farm households farming behaviour is associated with the degree of population pressure of an area where they live. Thus, according to Boserup, farming behaviours differ between: sparsely and densely populated areas; and between rural areas where governments have promoted investment in various economic infrastructures that offer incentives to farmers to modernize their farming and rural areas where farmers have only the choice between adapting to population growth by either labour migration or labour-intensive investment in traditional agriculture. Boserup (1975) therefore sees farming systems of an area as an adaptation to the historical differences in the population pressure, which tend differ widely between areas. In areas with a low population pressure, farmers tend to farm extensively and are likely to allow large tracts of pasture, fallow and forests. However, when the local population is growing, more
and more of this pasture, fallow and forests land is cleared, improved, and taken into cultivation.

The augments laid by Boserup (1975) prompted a scholarly works on the relationship between population pressure and farming systems. A more recent study by Jayne et al. (2014) on land pressures, the evolution of farming systems, and development strategies in Africa revealed that, an increase of rural population is affecting farming systems and ultimately the region’s economy. The increase in population escalates the competition for land and water resources between different user groups, including: wealthy urban-based elites who prefer to invest on rural land; smallholder rural communities, which continue to experience the rapid population growth; state/national governments that have varying interests on rural land; and foreign companies attracted to land in rural areas. In the face of increasing rural population, smallholder farmers’ behavioural responses to land scarcity are likely to take any of the following pathways, including: land intensification though not necessarily sustainable intensification; shifting labour from farming to rural non-farm activities; rural–rural migration; rural–urban migration; and fertility changes.

A more recent studies conducted in East Africa showed that population density is closely associated with evolution of farming systems. Ebanyat et al. (2010) study of drivers of land use change and household determinants of sustainability in smallholder farming systems of Eastern Uganda from 1960 to 2001 showed that, policy-institutional factors next to population growth have driven land use changes. The study indicated that fraction of land under crop farming has increased from 46 to 78%, and that of communal grazing lands nearly completely disappeared. Likewise, cropping diversified over time; cassava overtook cotton and millet in importance, and rice emerged as an alternative cash crop. Muyanga and Jayne (2014) study of how increasing rural population density is associated with household farming behaviour found that, farm productivity and incomes tend to rise with population density up to 600-650 persons per square kilometre. Beyond this threshold, rising population density is associated with sharp declines in farm productivity. Similar study in Ethiopia by Josephson et al. (2014) showed that higher rural population density is associated agriculture
intensification through cultivation of smaller farm sizes, and this has a positive effect on input demand, increased productivity and household food security status.

2.6. Natural Environment, Climate and Farming Systems

In many systems, farming is challenged by variable annual rainfall, temperature and poor soil quality, which result into high risk of crop failure, variable yield and lack of pasture or fodder for livestock (Garrity et al, 2012). For instance, a decline in soil fertility and increase in land degradation in all farming systems of sub-Saharan Africa have become major development issues. As a result, there is a growing evidence that agriculture productivity is declining because most farmers use little or no fertilizer (Garrity et al, 2012). According to Garrity et al (2012), climate change is forecast to have some of its most severe effects in parts of sub-Saharan Africa. With increasing population, higher temperatures and rainfall variability, farmlands will be more susceptible to uncertain yields.

Establishing the relationship between climate change/variability and rain-fed crop and livestock farming systems is not an easy task. It is however, true that some countries (including Tanzania) and in certain years, have experienced declining food production in the face of increasing temperature and decreasing precipitation and, ultimately, an increase in the frequency and severity of droughts (Nhemachena, 2009). These changes have significant impacts on the arid, semi-arid and dry sub-humid agro-ecological zones of Africa, including Tanzania. It is anticipated that the impacts would translate into widespread crop failure, low and falling livestock prices, high and rising cereal prices, distress sales of animals, impoverishment, hunger and eventually famine (Dixon et al., 2001; Nhemachena, 2009; Weatherhogg et al., 2001).

Studies related to the relationship between climate change/variability and smallholder-agriculture in developing countries indicate that farmers are already adapting their farming practices to the impacts of climate change and variability. For instance, Paavola (2008) examined farmers’ livelihood responses and vulnerability to climate variability and other stressors in Tanzania, to understand their implications for adaptation to climate change by agricultural households. The study found that, farm
households have extended cultivation, intensified agriculture, diversified livelihoods and migrated to gain access to land, markets and employment as a response to climatic and other stressors. Some of these responses have depleted and degraded natural resources such as forest, soil and water resources, which will complicate smallholder farmers’ living with climate change in the future. Likewise, Mongi et al. (2010) vulnerability assessment of rain-fed agriculture to climate change and variability in semi-arid parts of Tanzania indicated that, the amount of rainfall was declining while its distribution was varying both in time and space. The study also found that, temperature has shown an increasing trend and inter-seasonal dry spells appeared to increase in both duration and frequency. The major implications of these climate changes and variability on rain-fed agriculture has been possible shrinking of the growing season, increasing moisture and heat stress to most food and cash crops, increased pests and insects and eventually low income and high food insecurity levels.

2.7 Farming Systems and Food Security

The relationship between farming system and food security can better be understood by exploring the role that agriculture has on food security and nutrition in developing countries. This linkage can either be direct or indirect (Dorp et al., 2012). The direct linkage between agriculture and food security is observed through increased availability and accessibility of better quality foods obtained as a result of improved farm production, farm diversification, the use of improved breeding stock and post-harvest technologies that ultimately lead to the improved household food consumption, either through subsistence level consumption or via income (Dorp et al., 2012). Indirect effects of agriculture on food security might occur through the growth of the agricultural sector as a whole, freeing up labour forces for alternative economic activities, through lowering food prices because of increased availability and accessibility to food, or changing food policy at national level (for instance, those policies which influence food prices) (Haddad, 2000).

Generally, there are five pathways through which agriculture and food security are linked (Dorp et al., 2012; Haddad, 2000; Hawkes and Ruel, 2006; Hawkes and Ruel, 2008; World Bank, 2007). First, increased (nutritious) food production for own
consumption. Food and (micro) nutrient consumption is directly affected by the types and quantities of foods that households produce, especially in the case of subsistence agriculture. Second, increased income from the sale of agricultural commodities and greater farm productivity. This pathway only contributes to improved nutrition if the greater farm income is translated into adequately purchasing of nutritious foods. Third, increased empowerment of women as key contributors to household food security and to the health and nutrition status of household members. Through greater control and decision-making powers by women in both the productive and domestic domains, women’s preferences and priorities are more reflected in the agriculture-nutrition chain; fourth, lower food prices resulting from increases in food supply. A decrease in food prices leads to a de facto increase in income. This could lead to improvements in nutrition if this means households are actually purchasing more nutritious foods. Fifth, macroeconomic effects of agricultural growth (i.e. increased national income, macroeconomic growth and poverty reduction). Economic growth might contribute to improvements in the food and nutrition status. However, the impacts of growth can be distributed unevenly across households, with many poor not benefiting. The pathways outlined above are dynamic and overlap in time as a result of changes in technologies, agricultural policy, food consumption patterns and markets (World Bank, 2007).

Many development initiatives in agriculture focus on promoting direct effects, in particular, by increasing both farm production and households’ incomes. The indirect effects of agriculture on food security and nutrition potentially occur through the resulting lowering of food prices and/or farmers’ income increase. Many food insecure farmers in rural areas are net food buyers and thus benefit from lower food prices. The additional farm income might be spent on food purchases, differentiation of food purchase, or on education, clean water, hygiene and preventive and curative health care. In practice, however, many studies have shown that an increase in household income does not necessarily translate into increased household food security and/or nutritional wellbeing (Haddad, 2000; World Bank, 2007). Income controlled by women is more likely to be spent on feeding the household than income that is controlled by men (World Bank, 2007). Increasing farmers’ incomes might even have negative effects on food and nutrition security if they are accompanied by additional labour needs,
especially for women, and interfere with (child) care. Additional income might not be spent on food, but households might prefer non-food uses such as education, improved housing or productive assets. Additional labour needs and/or status might also lead to a different food basket, including food products that can be easier prepared, but are also of lower quality (fast food, noodles and white bread).

2.8 Household Decision-making Processes around the Choice of Farming Systems

Farm households present the point where most household decisions related to production, investments, marketing, conservation, resource allocation and responsibilities of household members are made (French, 1995). Household decision-making does not take place in a linear fashion; rather, it results from the interaction of many factors. Understanding and modelling the processes and consequences associated with decision-making among farm households has been one of the primary concerns for researchers and scholars in the field of development studies (Borges et al., 2015a; DFID, 1999; Malawska and Topping, 2016; Willock et al., 1999). Available resources on theories of farm household decision-making processes are diverse and tend to reflect specific context/discipline (Pannell et al., 2006). For instance, a scoping review of the theories of behaviour by Davis et al. (2015) identified about 82 theories which exist across the disciplines of psychology, anthropology, sociology and economics. As a result, most of the theoretical models which explain farm household decision-making process have provided discipline-guided explanations ignoring the fact that decisions undertaken by the farm household usually result from the multifaceted factors (Borges et al., 2015a; Edwards-Jones, 2006). It is argued that the discipline-guided explanations of household decision-making process have created a theoretical gap in the literature by failing to provide a theoretical model with formal integration of variables from all disciplines (Borges et al., 2015a). To understand how households arrive at such decisions, this part discusses some of the theories related to farm household decision-making process, with particular reference to Expected Utility Theories (EUT) and the Theory of Planned Behaviour (TPB).
2.8.1 The Expected Utility theory

There are three economic theories which can help explain the farm household production choices namely: Profit Maximisation Peasant theory, Utility Maximisation Peasant theory and the Risk Averse Peasant theory (Borges et al., 2015a). The Profit Maximization Peasant theory contends that farm households in developing countries are poor but efficient (Schultz, 1964). Schultz considers the peasant production mode as profit-maximization behaviour, where efficiency is defined in a context of perfect competition. This theory has been criticised on the basis that profit maximisation depends both on motivation of the households (behavioural content) and the economic performance of the farm as a business enterprise (technical economic content) (Mendola, 2007). Most work in the area of efficiency infers about the behaviour of the farm household (behavioural content) by investigating the economic performance of the farm. Thus, there has been less emphasis on how a farm household reaches its decision than on the outcomes of those decisions for the efficiency of the farm. Another criticism about this theory is that there is a trade-off between profit maximisation and other farm household goals, and the role of uncertainty and risk in farm household production decisions (Mendola, 2007).

Utility Maximization Peasant theory contends that the farm household’s main objective is to maximize the future stream of expected utility from an array of consumable goods purchased from the market and those made at home while taking into consideration the constraints surrounding the farm households production environment (de Janvry et al., 1991). The Utility Maximization Peasant theory differs from the Profit Maximization Peasant theory in that it puts emphasis on the dual character of the peasant household as both a family and an enterprise and, therefore, takes into account the consumption aspect of household decision-making process (Mendola, 2007). Critics have argued that the Utility Maximisation Peasant theory tends to ignore the household’s behaviour towards risks and uncertainties and does not address the social context in which the farm household production is operating by assuming that farm households are risk-neutral (Mendola, 2007; Taylor and Adelman, 2003). On the other hand, Risk Averse Peasant theorists argue that farm households are operating under an environment characterised by uncertainties induced by both socio-economic environment, institutions
and natural hazards such as diseases, pests and unreliable weather (Ellis, 1992). All these conditions pose risk to farm household production and make them carry household decisions cautiously (Walker and Jodha, 1986). As a result, it is assumed that farm households will exhibit risk aversion when making production decisions. The three theories are sometimes referred to, collectively, as ‘Expected Utility Theory (EUT)’ (Borges et al., 2015a).

The most famous example of the Expected Utility Theory was published by von Neumann and Morgenstern (1944). The Expected Utility Theory assumes that an individual acts rationally and is more likely to choose an alternative that provides the highest utility (Friedman and Savage, 1952). According to Briggs (2015), the expected utility of an act is considered as a weighted average of each of its possible outcome utilities, whereas, the utility of an outcome expresses the degree to which that outcome is preferable to the alternatives. Briggs (2015) maintains that the utility of each outcome is weighted according to the probability that the act will lead to that outcome. Briggs (2015) indicates that the expected utility of an act A (for instance, choosing a particular farming system) depends on two features of the problem: the value of each outcome measured by real numbers called utility; and the probability of each outcome conditional on A. Given these pieces of information the expected utility function of an act ‘A’ may be defined by the following function;

\[
EU(A) = \sum_{o \in O} P_A(o)U(o)
\]

Whereas

- \( O \) is the set of outcomes,
- \( P_A(o) \) is the probability of outcome \( o \) conditional on \( A \), and
- \( U(o) \) is the utility of \( o \)

2.8.1.1 Application of the Expected Utility Theory

There is broad scholarly literature that has contributed to the emergence of the Expected Utility Theory (EUT) as an approach to explain actual behaviour of farmers. An article by Friedman and Savage (1948) is one of seminal works that demonstrate EUT
usefulness in explaining diversifying behaviour and apparently absurd phenomena (for example, when a person both gambles and holds insurances) through a general functional form of the $u(x_i)$ representation. Tobin (1958) relied on Friedman and Savage's seminal work and developed a major literature on portfolio analysis, while Buschena and Zilberman (1994), established basic notions and concepts which are related to the emergence of insurance contracts (for example, moral hazard). Rothschild and Stiglitz (1970) have developed theoretical foundations which have been useful in quantifying and measuring risk in decision-making.

Moreover, there is extensive literature on the application of EUT in analysing decision-making in the field of agriculture. Zuhair (1988) has used EUT to predict farmers’ behaviour in relation to harvesting perennial cash crops in Sri Lanka and revealed that farmers fear of theft and pressing money needs were among the key factors leading to premature harvesting. In a study by Herath (1980) in Sri Lanka, expected utilities of different allocations of land to high-yielding varieties and traditional varieties were computed and then compared with actual land allocation to the two crop varieties by farmers. It was found that the application of EUT offered a more accurate prediction of the actual behaviour of farmers than the minimization of the square of the coefficient of variation.

Likewise, Humphrey (2004) reported an experimental test of individual decision-making behaviour under risk which was conducted in rural East Uganda and found that the risk preferences of East Ugandan farmers were likely to exhibit systematic and predictable deviations from the expected utility maximization including: violations of the independence and transitivity axioms of EUT, and reference-dependent preferences. A much more recent study conducted in Mozambique by de Brauw and Eozenou (2014) explored farmers risk preferences associated with sweet potato production. After exploring correlations between wife and husband preferences, de Brauw and Eozenou (2014) explicitly tested whether farmers’ preferences followed EUT or farmers followed the constant relative risk aversion (CRRA) utility function or tend to rank dependent utility theory in generating their own preferences. They rejected the null hypothesis that farmers' preferences are associated with the CRRA utility function, in favour of the more flexible power risk aversion preferences.
2.8.1.2 Limitation of the Expected Utility Theory

In spite of the major progress that has been made in understanding decisions about choices under risk and uncertainty by applying the expected utility approach, studies have revealed some notable limitations in this theory. The first limitation of EUT is that it represents rational choices, and in particular, not taking into account the impacts of psychological factors (for example, anxieties and worry) associated with random choices or expertise and/or other efforts that might be needed for making optimal selection (Buschena and Zilberman, 1994). It is assumed that an individual will completely optimise his or her decisions regardless of the importance and any difficulty associated with making such decisions or cost that he or she is likely to encounter in the process (Buschena and Zilberman, 1994). Buschena and Zilberman (1994) argue that, for individuals who are not troubled by psychological factors such as anxieties or fears, the EUT seems to be a useful normative model since it determines choices under risk, ignoring the effects of these irrational factors. However, the EUT may not always be a useful model for assessing actual behavioural patterns when the psychological factors such as anxiety and/or other decision costs are likely to affect choices.

Another limitation of the EUT is related to its failure to incorporate elements other than income in the utility equation. For instance, the EUT has been criticized for failure to recognize the full complexity of farmers’ decisions and its assumption that a farm household has only a single objective of utility maximization (Austin et al. 1998; Borges et al., 2015a; Willock et al. 1999). Buschena and Zilberman (1994) argue that the EUT disregards discrete variables that have a strong impact on the quality of life, the ones which are likely to be affected by the randomness of income and, consequently, that have a strong impact on risky decision-making. For instance, it is argued that a farmer's utility from a certain income level is likely to be quite different in situations depending on whether the farmer is solvent or not, but this is not regularly incorporated in the EUT function (Buschena and Zilberman, 1994). Development of more realistic theories which incorporate aspects of farmer’s psychology and variables which have impact on the quality of life has been one of the key concerns of scholars dealing with decision-making about discrete choices. The next part of this section discusses the Theory of Planned Behaviour.
2.8.2 The Theory of Planned Behaviour

The ‘Theory of Planned Behaviour (TPB)’ presented by Ajzen (1991), is one of the psycho-social theories that consider a farmer’s behaviour as an outcome of psychological constructs (Borges et al., 2015a). This theory was modified from its earlier version known as ‘Theory of Reasoned Action’ (Fishbein and Ajzen, 1975), and it considers people’s behaviour as a subject of salient beliefs about that behaviour. Figure 6 indicates a distinction between three types of salient beliefs as: behavioural beliefs (those influencing certain attitudes towards the behaviour); normative beliefs (the underlying determinants of the subjective norms); and control beliefs (which provide the basis for perception of the behavioural control). According to Ajzen (1991), the three types of beliefs form antecedents for attitudes to behaviour, subjective norms and perceived behavioural control. This relationship according to Borges et al. (2015a), may be presented by the following mathematical function:

\[ BI = A_{act} + SN + PBC \]

Whereas:

- **BI** is considered as the intention to perform the behaviour;
- **A_{act}** is the degree to which execution of the behaviour is evaluated positively or negatively (This is an attitude to behaviour and is a degree to which an individual has favourable or unfavourable remarks about the behaviour in question);
- **SN** refers to people’s perceptions of the social pressures upon them to perform or not a behaviour; and
- **PBC** is the perceived own capability to successfully perform a behaviour.

Ajzen (1991) defines an attitude to behaviour as the degree to which an individual has favourable or unfavourable remarks about the behaviour in question. Subjective norm is

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6 Attitude is a positive or negative response toward an attitude object. An attitude object may be anything like person, idea, concept, innovation, practice, etc. Attitudes are grounded on the meaning that an individual attaches to the object (Willock et al., 1999).
a perceived social pressure that makes an individual either to perform or not to perform certain behaviour. Perceived behaviour control refers to the seeming easiness or hardness of performing certain behaviour—where an individual tends to refer to his/her past experiences as well as anticipated future. The Theory of Planned Behaviour focuses on the individual’s intention to perform certain behavioural practices. This is because intention has ability to capture the individual motivational factor behind certain behaviour. Moreover, intention indicates how hard people are willing to try and the effort they are planning to apply in order to implement the behavioural practices. The theory stresses that ‘the stronger the intention to engage in certain behaviour, the more likely it should be its performance’.

![Figure 6: Theory of Planned Behaviour](image)

Source: Ajzen (1991)

### 2.8.2.1 Application of the Theory of Planned Behaviour

The Theory of Planned Behaviour is insightful to frameworks which analyse the farm household decision-making process. For instance, the Willock et al. (1999) framework for analysing the relationship between personal factors, attitudes, objectives and farming behaviours shares some ideas from the Theory of Planned Behaviour. The framework (Figure 7) indicates that personal traits, such as neuroticism, extraversion, openness, agreeableness and conscientiousness are the sources of individual differences in
thinking, acting and feelings. These traits can influence the farming behaviours either directly or indirectly through their impacts on the farmers’ attitudes and objectives to farming. In turn, farmers’ attitudes to risk, stress, off-farm employment, production, management practice, agricultural policy and innovation have impact on certain farming behaviour to be adopted.

The Willock et al. (1999) framework indicates further that the farmer’s ability to think about the future makes them objective (goal) oriented towards: (i) the economic values whereby the main farming objective is on profit maximization and business expansion, (ii) The social values whereby the main objective is to maintain the prestige of continuing farming tradition, (iii) The expressive value whereby the main objective of farming is to maintain the pride of ownership and meeting farm challenges, and (iv) The intrinsic value whereby the main objective is to enjoy the farming job and being independent. The combined impacts of farmers’ personality traits, intentions, objectives and the physical/external factors make the ultimate farming behaviours diverse. Farmers’ behaviours range from environmental orientated practices, production practices, farming diversifications, coping strategies, information gathering, undertaking off-farm employments, to the easiness or hardiness in the adoption of agricultural technologies, just to mention few. Willock et al. (1999) stress that farmers are not motivated by monetary success alone to undertake a particular form of farming.

![Figure 7: Schematic Relationship among Individual Differences in Personality Traits, Attitudes, Objectives and Behaviour](image)

Several other studies which have attempted to explain the farm household decision-making process are in agreement with the frameworks developed by Ajzen (1991) and Willock et al. (1999). A study by Holloway and Ilbery (1996) on farmers’ attitudes towards the effect of climate change found that the decisions to adopt a particular farming pattern are influenced by an individual farmers’ attitudes, goals and institutional structures. In the first instance, farmers’ attitude and goals towards climate change are focused on short-term plans and measures. These factors influence the farm management practices adopted by farmers to offset the impacts of climate change, which in turn determine the spatial change in cropping patterns (Holloway and Ilbery, 1996).

A study conducted with peach farmers in Greece by Theocharopoulos et al. (2012) to assess the factors affecting peach farmers’ decisions to either adopt organic farming practice or integrated crop management revealed that conventional farmers do not adopt integrated crop management because of economic reasons, lack of technical skills and scientific support networks. They found that organic farmers do not adopt integrated crop management because they perceive it as being similar to the conventional farming practices in both the environmental and economic aspects. Thus, environmental, economic, ideological and institutional factors either are influencing the household decisions to adopt the organic farming practice or the integrated crop management.

The frameworks presented in Figures 6 and 7 suggest that individual farm households make decisions based on multiple factors to reflect the specific change in their wellbeing. While economic issues still dominate the decision-making process, it is now agreed that other non-financial factors are increasingly becoming influential to farmers. Edwards-Jones (2006) identified five sets of the non-financial factors which affect the farmers’ adoption decisions. These include: farmers’ characteristics (age, education, gender, attitude to risk and personality); household characteristics (stage of family cycle, level of pluriactivity and the work pattern of the spouse); farm structure; the wider social milieu and the characteristics of the innovation to be adopted.
2.8.2.2 Limitations of the Theory of Planned Behaviour

Beedell and Rehman (2000) have criticised the Theory of Planned Behaviour for not explicitly including in the model background variables such as age, social class and gender. Borges et al. (2015a) added that the Theory of Planned Behaviour does not explicitly consider the role of information on household production choices. Likewise, although some authors, such as Bergevoet et al. (2004) and Willock et al. (1999), have tried to include variables such as objectives and goals in the TPB model, the role of these variables in explaining the behaviour is not explicitly stated.

2.8.3 Combining the Expected Utility Theory and the Theory of Planned Behaviour

In order to bring useful insights, this study combined the Expected Utility Theory and the Theory of Planned Behaviour to analyse the factors responsible for households’ choices of farming system. Borges et al. (2015) argued that a combination of the Expected Utility Theory and the Theory of Planned Behaviour will overcome the limitations associated with each theory when taken separately.

As it has been argued above, the EUT’s main assumption is that the farm household acts to maximise its future stream of expected utility. However, this utility function is considered as unobserved and difficult to measure (Adesina and Zinnah, 1993; Batz et al., 1999; Edwards-Jones, 2006). Therefore, in this study, the relationship between the expected utility of a farm household choosing a particular farming system is postulated to be a function of observed predictor variables, such as those related to: institutional/farming context characteristics, farmer/household characteristics and natural/farm characteristics. Batz et al. (1999) suggest that the impact of these factors on farm household decision-making process around farming systems should, therefore, be studied using econometric models such as probit, tobit and logit.

Although it is assumed that farm households in the study area will apply a farming system, which offers more utilities than others, it should also be noted that farm households’ choices of farming systems are not only dictated by utility maximising behaviour; other factors related to psychological constructs such as attitudes, norms and
perceptions are also responsible, but they are not explicitly addressed by the EUT (Borges et al., 2015a). Therefore, the use of TPB supplements this information by looking at the role of psychological constructs, such as attitudes, norms and perceptions on farm household decision-making process about the choice of farming system.

### 2.9 The Study Analytical Model

In order to determine the contribution of farming systems to the household food security in Tanzania, the study analytical model (Figure 8) was developed to bring together, in a coherent way, the elements that combine to deliver the study aim and objectives. In this model, the farming system encompasses the totality of decisions made by a particular farm household in relation to what, how and when to produce and how to consume what is produced (Dixon et al., 2001; Köbrich et al., 2003; Weatherhogg et al., 2001). It includes the choice of enterprise(s), such as livestock keeping, cropping and/or non-farm business as well as food consumed and the way farm households interact with markets. The proposed model is developed from theories discussed in the preceding sections, which see poverty and its manifestations as an outcome of diverse, complex and dynamic forces (Chambers, 1983; Chambers, 1995b; DFID, 1999; FAO, 2000; Sen, 1981; UNICEF, 1991). Figure 8 places the household at the centre of all farm decision-making processes. In agrarian economies, households form a focal point where a network of decisions interact about land utilisation, conservation and production (Dixon et al., 2001; French, 1995). The study model presented in Figure 8 indicates that factors influencing household farming decisions may broadly be categorised at three levels, namely: the institutional/farming context level; farmer/household level factors; and natural/farm level factors (Dixon et al., 2001; Edwards-Jones, 2006; Borges et al., 2015a).

#### 2.9.1 Institutional/Farming Context Factors

The institutional/farming context (as shown in Part 1 of Figure 8) represents those factors above the farm level (district and national), of which households have little or no control. These factors include: access to credit (input) services; access to agricultural information; membership to organisations (social capital); land access and ownership
(tenure system) and access to markets. Access to credit facilities allows households to hire labour and cover input costs (Byerlee et al., 1982). Availability of agricultural inputs and technologies depend on the extent to which agriculture, marketing, distribution and pricing policies are technology promoting. Inability to access required technologies results in poor farm productivity (Chambers, 1983; UNICEF, 1991). Lack of adequate extension services is one of the constraining factors for adoption of particular farming practices (Titus and Adefisayo, 2012). Access to information about farming is likely to promote an increased use of external inputs, such as fertiliser and improved seeds (Pender and Gebremedhin, 2007). Likewise, extension services bring to farmers useful messages about new technologies, including improved farming practices (Rogers, 1995).

A farm household participating in social relationships, such as participation in local organisations, is likely to have better access to information about farming practices, increasing household awareness and access to improved agricultural technologies and inputs, obtain more yields, and earn higher returns from improved market accessibility (Pender and Gebremedhin, 2007). Land tenure defines the patterns under which households access and own essential productive resources, such as land and water. A land tenure system that allows fragmentation of land into small plots makes some farming practices impracticable (Titus and Adefisayo, 2012). According to Titus and Adefisayo (2012), insecure land tenure limits the amount of land that households are willing to invest in farming.

Improved access to input and output markets is considered as an important factor that can transform subsistence farming to more profitable and commercial farming (Salami et al., 2010). Markets and roads promote production of higher valued crops, increase the local prices of agricultural products, and promote more intensive use of agricultural inputs (Pender and Gebremedhin, 2007; Reardon et al. 1994; Titus and Adefisayo, 2012). Better access to roads and markets is also associated with off-farm work opportunities, something that may reduce the intensity with which households participate in farming activities (Pender and Gebremedhin, 2007).
2.9.2 Farmer/Household Factors

The second category (part 2 of Figure 8) comprises all factors which a household has more control. They include psycho-social characteristics, household demographic characteristics and household economy characteristics. Psycho-social characteristics include: attitudes, norms and perceptions. Ajzen (1991) argues that an individual’s behaviour is a subject of salient beliefs, which influence his or her own attitudes, objectives and intentions towards a certain form of behaviour. Psycho-social characteristics affect household preferences for food and consumption patterns and, therefore, also influence types of crops or livestock that a farm household is willing to raise (Chambers, 1983; FAO, 2000; UNICEF, 1991). In addition, psycho-social factors influence attitudes of households towards risk factors and other farming practices (Holloway and Ilbery, 1996; Theocharopoulos et al., 2012; Willock et al., 1999).

Demographic and household characteristics influencing household farming choices include: household size, farming experience, education level of the household head and sex of the household head. With regard to household size, it is argued that a household with a greater number of people is likely to farm land more intensively and conduct critical farming operations at the right time than those with fewer (Chambers, 1983; Pender and Gebremedhin, 2007; Boru et al., 2015: Swai et al., 2012). A household with more experience in farming accumulates more wealth, uses better planning and, ultimately, increases its chances of becoming more successful in farming (Bogale and Shimelis, 2009). Education attainment contributes to transmission of specific information, development of generic skills or proficiencies, and influences individuals’ beliefs, attitudes and habits towards farming (Weir, 1999). Likewise, better education influences the decision-making process, particularly in adopting improved farming practices (Edwards-Jones, 2006; Rogers, 1995). The sex of the household head has been associated with different forms of farming systems in developing countries. For instance, women tend to have fewer assets and poorer access to productive resources such as land, are less likely to migrate to other areas for income generating activities, and work fewer hours in lower-paid jobs that are more compatible with their domestic responsibilities (Buvinic and Gupta, 1997; Jayamohan and Kitesa, 2014).
The household economy factors associated with farming choices include farm size, income earning strategies and ownership of assets (Chambers, 1983; DFID, 1999; Sen, 1981). Households with larger farm sizes are associated with multiple cropping patterns and/or mixed crop-livestock activities (Hassan and Nhemachena, 2008). Households with diverse income sources are associated with different forms of farming practices, mainly caused by differences in households access to cash, credit services and market information (Pender and Gebremedhin, 2007; Reardon et al., 1994). Participation in off-farm activities may increase households’ labour opportunity costs and ultimately reduction in labour intensity of agriculture and overall household income (Reardon et al., 1994). Households that own oxen are more likely to use animal power in farming activities and cultivate bigger land areas than those not owning oxen, and generate more household income (Pender and Gebremedhin, 2007). Likewise, households with better access to land and other forms of physical and financial assets are more likely to purchase different forms of external inputs and boost farm production (Pender and Gebremedhin, 2007).

### 2.9.3 Natural Environment Factors

This third category (reflected in Part 3, Figure 8) includes the influencing natural factors such as soil type, topography, and climatic characteristics (rainfall, temperature and humidity). The natural factors impose biological constraints with regard to what plant and animal species to raise within particular areas (Dixon et al., 2001). Natural factors determine the production feasibility of particular areas and the management practices to be followed in raising crops and livestock. Natural factors which make agriculture riskier in certain zones is likely to discourage investment in cropping activities (Reardon et al., 1994). As a whole, these factors, when kept in good balance with other non-natural factors (such as institution/farming context and farmer/household factors), may positively influence the production of food. Willock et al. (1999) suggest that natural factors together with farmers’ attitudes, objectives and intentions influence certain behaviours on farming.
2.9.4 Factors Influencing Household Food Security Status

The analytical model for this study (Figure 8) indicates that farm household food security status is influenced by two types of factors (Dorp et al., 2012): those with a strong direct influence (as indicated by bolded arrows) and those with indirect influence (as indicated by dotted arrows). It shows that farming systems applied by farm households have a strong direct influence on their food security status, and this happens in two pathways: firstly, the farming system forms a focal point for targeting interventions through improved farming practices, which ultimately result in increased farm production, farm productivity and/ or profitability (Dixon et al., 2001). This, in turn, may influence the amount and diversity of food available to farm households from their own production. Dorp et al. (2012) have indicated that food and micro-nutrient consumption are directly associated with the amount and types of foods that farm households have produced and, in particular, within subsistence agriculture. Secondly, farming systems have a strong direct influence on household food security status through an increased income generated from the sale of agricultural commodities and greater farm productivity. However, it has been argued that this pathway may only contribute to improved household food security status when greater farm income is used to purchase nutritious food (Dorp et al., 2012; Haddad, 2000; Hawkes and Ruel, 2006; Hawkes and Ruel, 2008; World Bank, 2007).

Many studies have shown that an increase in household income does not necessarily translate into increased household food security (Haddad, 2000; World Bank, 2007) and, according to Devereux (2001), food productivity is necessary but not the only solution to the problems of food security. It is argued that people can cope with food shortage by using their diversified endowments, which range from own production to tangible assets, intangible assets and markets, just to mention some (Chambers, 1983, Chambers, 1995b; DFID, 1999; Sen, 1981).

Figure 8 indicates that there are other factors, besides the farming system applied by the farm household which, influence household food security status, but their influences are indirect. First, lower food prices resulting from an increase in food availability and supply are expected to lead to a de facto increase in income and, therefore, an
improvement in household food security status, only if it means that households actually purchase more food. Many food insecure farmers in rural areas in developing countries are net food buyers and, therefore, tend to benefit from lower food prices (Dorp et al., 2012; Haddad, 2000). Second, as discussed in Section 2.7, increased empowerment of women has an indirect influence on food security status of the household. According to the World Bank (2007), women are more likely to let their income be spent on feeding the household than men. Third, macroeconomic effects of agricultural growth have indirect impact on household food security status, which might occur either through freeing up labour forces for alternative economic activities, through lowering food prices because of increased availability and accessibility to food, and changing food policy at national level (for instance, those policies which influence the food prices) (Haddad, 2000).
Figure 8: Study Analytical Model of the Factors that Impact on Household Food Security
CHAPTER THREE: METHODOLOGY

3.1 Overview

The key method of field investigation used for this study was farm-based interviews with farmers and their spouses. This chapter is organised under seven sections: first, the overview section which is then followed by the methodological approach and research design section which discusses the relevance of research approach used in this study. The third section describes the study area while the fourth describes the study population and sampling procedure. The fifth section offers a detailed description of the data collection procedures starting with pre-test survey, pre- and postharvest household surveys, pre- and postharvest focus group discussions, key informant interviews, local market price surveys and the use of secondary data. The sixth section discusses the data management procedure while the final section provides a discussion of ethical considerations as applied to this study.

3.2 Methodological Approach and Study Design

This study uses pragmatism as the research approach in which qualitative and quantitative data are collected and analysed sequentially or concurrently in a single study to allow a holistic and comprehensive understanding of the phenomenon under investigation (Creswell et al., 2003; De Lisle, 2011; Duram, 1998). Tashakkori and Teddlie (2003) emphasize that pragmatism debunks the concept such as ‘truth’ and ‘reality’ and instead focuses on ‘what works as truth’ with regard to the phenomenon being studied. In this way, pragmatism rejects taking a position between the two opposing viewpoints (positivism\textsuperscript{7} or interpretivism\textsuperscript{8}) and, therefore, devotes to the application of the mixed research methods.

\textsuperscript{7} Positivism paradigm holds that research object has inherent qualities that exist independently of the researcher (Mason, 2002).

\textsuperscript{8} Interpretivism paradigm hold that research object is interpreted in light of meaning structure of researcher’s lived experience (Mason, 2002).
According to Creswell et al. (2003) and Kristensen et al. (2008), the move towards combining qualitative and quantitative methods has the following advantages: first, it is one way to offset the limitations of one method by another since each approach has its own inherent weaknesses. For instance, quantitative research methods enable the generation of data through either enumeration or taking measurements. However, such approaches have limited potential to reveal processes involved in societal changes. On the contrary, qualitative research methods have potential to explore events and processes in a society, but these approaches can hardly allow measurements to be made on different attributes that are likely to account for the structural differences between different groups in the complex social world.

Second, mixing different types of methods has potential to strengthen a study, in particular, taking great advantage when the findings of using one approach corroborate the other. For example, while qualitative research can inform quantitative research by providing conceptual aids, facilitating data collection processes, validating or clarifying concepts, and illustrating results; quantitative research can support qualitative data by providing elements for the design and systematic data, and by avoiding the ‘elite bias’ which results from interviewing only the most educated or talkative individuals (Vargas and Penny, 2010).

Third, some phenomena being investigated (for example, farm household decision-making and household food security status) have complex dimensions which link with a range of variables and, therefore, can only be understood by applying diverse methods of enquiry. For example, in studying farm household decision-making processes, a qualitative approach can help understand the dynamics of power in the household and, therefore, enrich the understanding of intra-household decision-making process, while including in a quantitative approach, such as household surveys, may help understand patterns of decision-making (Frankenberg and Foley, 2003). In assessing household food security status, qualitative approaches are useful to gain conceptual and methodological insights on issues related to food insecurity patterns, food insecurity related-beliefs, food insecurity perceptions and notions on concepts, such as ‘food’ and ‘balanced diet’ (Vargas and Penny, 2010). On the other hand, quantitative methods, such as household surveys, use well-specified sampling frames, and this allows precise
statements on food security situation to be made about wider geographical coverage (Devereux et al., 2004). According to Devereux et al. (2004), if a household survey is properly designed it may provide detailed information on different components of household expenditure, and, based on this information, total expenditures can be calculated and caloric intakes can be estimated.

Pragmatism as a research approach has wider recognition in literature as an appropriate way to understand how farm households make decisions in the complex social world and as a way to uncover problems related to livelihood, poverty and subsequent food insecurity. On farm household decision-making, Nettle et al. (2010) combined focus group discussions at regional level and national survey to determine Australian farmers' perceptions of the genetic information system overall and the key features of bull selection decisions. A study in Mali by Laris et al. (2015) combined satellite image analysis, household and in-depth interviews with farmers to determine causes of agricultural change from cotton to growing maize. With regard to livelihoods, poverty and food insecurity analysis, Ellis (2000) combined focus group discussion, participatory wealth ranking and sample survey to study livelihoods and poverty in rural Tanzania. White (2002) combined secondary demographic statistics and ethnography to analyse poverty in rural Africa. Ege and Aspen (2003) combined ethnography, household survey and mapping land-use patterns to study poverty and famine in Wello, North-Eastern Ethiopia. Barrett (2004) combined household survey, focus group interviews and key informant interviews to study livelihood and poverty in Rural Kenya. Howe and McKay (2007) used participatory poverty assessment and a single-round household survey to study chronic poverty in Rwanda.

Creswell et al. (2003) have outlined four pathways in which researchers are able to mix qualitative and quantitative data, depending on the degree of dominance and sequential relations of either of the methods as: first, the use of qualitative methods to help develop quantitative measures and instruments; second, the use of quantitative methods to elaborate a primarily qualitative study; third, the use of qualitative methods to help explain quantitative findings; and fourth, the concurrent or equal use of both qualitative and quantitative methods to explore the phenomenon under investigation.
In this study, pragmatism as the research approach was applied as follows: first, a qualitative study through the use of focus group discussions was conducted and generated information relevant to the topic. This together with pre-test survey, helped to shape the development and validation of the household survey questionnaire. Second, it was followed by a quantitative study through the use of questionnaire-based household surveys from the same respondents in pre- and post-harvest periods. This practice which allows data to be collected from the same respondent more than once over a predetermined period is normally referred to as a panel study design (Trivellato, 1999), and its application in this study helped the exploration of the relationship between farming systems and household food security before and after main crop harvests. In addition to household surveys, local market price surveys were conducted on a monthly basis for various commodities consumed by farm households in 2014. Finally, a qualitative study proceeded through the use of focus group discussions and key informant interviews to generate additional information relevant to the topic under investigation and to comment on the data generated through questionnaire-based household surveys in pre- and post-harvest conditions and local markets price surveys.

3.3 Study Area

The study was conducted in two distinctly different agro-ecological zones of Tanzania, namely Kishapu District and Mvomero District. The two districts were selected based on three criteria, namely: nutritional vulnerability, presence of major farming systems for Tanzania, and absence of major nutrition interventions in recent years. Kishapu District is a remote semi-arid area in Shinyanga Region in the North of Tanzania (Appendix 1), while Mvomero District is in Morogoro Region in the Eastern part of Tanzania, and it is close to the major urban centre of Morogoro and just over 200 km from the business city of Dar es Salaam (Appendix 2). The two districts differ in many aspects, such as rainfall patterns, the amount of annual rains, total land area, number of people, number of farm households and main farming activities. However, they both have high levels of nutrition vulnerability with average stunting rate for children less than 5 years of age higher than the national average of 42% (Table 5).
Table 5: Basic Characteristics of the Study Area

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Kishapu</th>
<th>Mvomero</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rain pattern</td>
<td>Unimodal</td>
<td>Bimodal</td>
</tr>
<tr>
<td>Rainfall (mm/year)</td>
<td>600 - 900</td>
<td>700 - 2,300</td>
</tr>
<tr>
<td>Temperature</td>
<td>28°C (Minimum 22°C, Maximum 30°C)</td>
<td>26°C (Minimum 18°C, Maximum 30°C)</td>
</tr>
<tr>
<td>Altitude</td>
<td>1100</td>
<td>300-2300</td>
</tr>
<tr>
<td>Area (km²)</td>
<td>4,333</td>
<td>7,325</td>
</tr>
<tr>
<td>Number of people (2012 census)</td>
<td>272,990</td>
<td>312,109</td>
</tr>
<tr>
<td>Farm households (2008 sample census)</td>
<td>48,258</td>
<td>56,520</td>
</tr>
<tr>
<td>Main farming activity</td>
<td>Crop and livestock farming</td>
<td>Crops, mainly maize farming</td>
</tr>
<tr>
<td>Stunting (% children aged &lt; 5 years)</td>
<td>43% in Shinyanga Region</td>
<td>44% in Morogoro Region</td>
</tr>
</tbody>
</table>


3.4 Study Population and Sampling Procedure

The study population comprised all agricultural households with mothers and children less than 5 years of age in Mvomero and Kishapu Districts of Tanzania. Women and children are among the most vulnerable groups to food and nutrition insecurity in most communities. Improving food security and nutrition status of mothers and children in early days of life has the power to determine a child’s long-term health, wellbeing and success (UNSCN, 2012).

In each of the two districts, a simple random sampling technique was used to obtain one division, followed by two wards from each division and finally one village from each ward. The study villages were Lubaga and Mwakipoya in Kishapu District, and Makuyu and Milama in Mvomero District. With the help from the village and hamlet leaders, a list of all agricultural households with mothers and children less than 5 years of age was created for each village.

The sample size ($n_h$) for the household survey was estimated using the following formula obtained from United Nations (2005).

$$ n_h = \frac{Z^2 \cdot r \cdot (1 - r) \cdot f \cdot k}{p \cdot n \cdot e^2} $$

Where: $n_h$ is the parameter to be calculated and is the sample size in terms of number of households to be selected; $z$ is the statistic that defines the level of confidence desired; $r$
is an estimate of a key indicator to be measured by the survey; \( f = 1.2 \) is the sample
design effect, \( deff \), assumed to be 2.0 (default value); the design effect is included
because the sampling procedure is not purely random; \( k \) is a multiplier to account for the
anticipated rate of non-response; \( p \) is the proportion of the total population accounted
for by the target population and upon which the parameter, \( r \), is based; \( n \) is the average
household size (number of persons per household); and \( e \) is the margin of error to be attained.

The value of \( Z \) is determined by the confidence level that is required for the two tailed
test which is \( Z = 1.96 \) for 95% precision and \( Z = 1.65 \) for 90% precision. As suggested by
United Nations (2005) the non-response parameter for developing countries is usually
set at \( k = 1.1 \) which is 10 percent non-response. From the 2012 Tanzania’s national
population and housing census report, it was indicated that the non-response rate
averages at a 7 percent; that is, 96 percent response rate for women and 89 per cent
response rate for men (Tanzania. NBS, 2013). Since the target population is that which
contains mothers and children below the age of five for the household survey, the
parameter \( p \) was estimated as \( p = 0.03 \times 5 = 0.15 \). The average household size \( n \) for
Kishapu is 5.8 while that for Mvomero is 4.3. With the level of precision at 10 per cent,
the margin of error \( e \) is estimated at 0.1 (United Nations, 2005). The following is
deduced from the above parameters

\[
\begin{align*}
n_h &= \frac{Z^2 \cdot r \cdot (1-r) \cdot f \cdot k}{p \cdot n \cdot e^2} \\
n_h &= \frac{1.96^2 \cdot r \cdot (1-r) \cdot (1.2) \cdot (1.1)}{p \cdot n \cdot (0.1r)^2} \\
n_h &= \frac{3.59(1-r)}{0.01pnr}
\end{align*}
\]

For the purpose of this study, the value of \( r \) is the prevalence of food insecurity.
According to the Comprehensive Food Security and Nutrition Assessment Report, the
level of food insecurity is 7 percent in Kishapu and 3 percent in Mvomero (Tanzanian
PMO and MAFS & C, 2012). Therefore, based on the calculation above, the sample size
for household survey in Kishapu and Mvomero were \( n_h = 122 \) and \( n_h = 165 \),
respectively. One of the major challenges associated with studies in which data are
collected from the same respondent more than once over a predetermined period is high attrition rate (Trivellato, 1999). In this study, the problem of attrition was taken into account by elevating the sample for each district to 277 in order to overcome any drop-out in the second round of survey (post-harvest).

Using a list of farm households from each of the four villages obtained, proportionate stratified sampling, followed by simple random sampling technique, was used to select 554 farm households which participated in the first round (pre-harvest) of household survey. A half of the 554 households were selected from each District (277 were selected in Kishapu, and the other 277 were selected in Mvomero). In the end, the effective sample size for households which participated in all rounds of surveys (both pre- and post-harvest) was 506; 255 of them were from Kishapu and 251 were from Mvomero (see Table 6).

The household was used as a unit of analysis for this study. Although household as a unit of analysis is subject to considerable criticism (Alderman et al., 1995; Katz, 1997; Marchant, 1997; Zelizer, 1997), it has perennially resurfaced as a concept and a unit of analysis in studying many aspects of smallholder farmers life in developing countries. The use of household as analytical unit in this study enables us to consider household as an agency of social actors and the way in which they may use all forms of work in organizing their lives (Wallace, 2002). According to Wallace, when large parts of the economy are informal (as is the case of smallholder farming in Tanzania), household is likely to become more important unit of analysis. This is because households have to draw upon a wide array of resources both from within and outside the household for it to manage their social and economic reproduction.

In this study, a household was considered as a group of persons related or not, living together and share the same centre of production and consume from that centre, under the responsibility of a head whose authority is acknowledged by all members (Tanzanian NBS, 2014). The Tanzanian government recognises two types of marriage: a monogamous marriage - a union between one man and one woman to the exclusion of all others; and a polygamous marriage - a union in which the husband may, during the subsistence of the marriage, be married to or marry another woman or women. A study
conducted in 2015 in Kishapu and Mvomero showed that around 18% and 2% women respectively were under polygamous marriage. Moreover, around 20% and 3% of men in Kishapu and Mvomero, respectively were married polygamous (Mtae, 2015). In this study, a polygamous household where all the spouses did not live in the same concession as their husband, each of the spouses living elsewhere was listed as a separate household with the persons they live with (the spouse was then considered the head of that household).

### Table 6: Selection of Households for Household Survey in Kishapu and Mvomero Districts

<table>
<thead>
<tr>
<th>District</th>
<th>Division</th>
<th>Ward</th>
<th>Village</th>
<th>Total households</th>
<th>Surveyed pre-harvest</th>
<th>Surveyed post-harvest</th>
<th>Drop out</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kishapu</td>
<td>Kishapu</td>
<td>Mwakipoya</td>
<td>Mwakipoya</td>
<td>596</td>
<td>156</td>
<td>143</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lubaga</td>
<td>Lubaga</td>
<td>392</td>
<td>121</td>
<td>112</td>
<td>9</td>
</tr>
<tr>
<td>Mvomero</td>
<td>Mvomero</td>
<td>Mvomero</td>
<td>Makuyu</td>
<td>878</td>
<td>166</td>
<td>149</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dakawa</td>
<td>Milama</td>
<td>514</td>
<td>111</td>
<td>102</td>
<td>9</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>Total</strong></td>
<td><strong>Total</strong></td>
<td><strong>Total</strong></td>
<td><strong>2380</strong></td>
<td><strong>554</strong></td>
<td><strong>506</strong></td>
<td><strong>48</strong></td>
</tr>
</tbody>
</table>

#### 3.5 Types of Data and Data Collection Procedures

Both quantitative and qualitative data were collected. The use of mixed data allows the researcher to have in-depth understanding of indigenous patterns, traditions and practices, while at the same time enjoying the advantages of generalisation of research findings over a large population (De Lisle, 2011).

There were two rounds of household surveys. The first survey (pre-harvest) took place between February and March 2014 and reflected the period of most severe food shortage. The second survey (post-harvest) took place between August and September 2014 and reflected the period of greatest food surplus. Data were collected through questionnaire-based surveys and were augmented with key informant interviews, focus group discussions, monthly market price surveys and document analysis. The data collected through the household surveys included information on household demographics, the household economy, farming practices and productivity, and food security and dietary diversity.
3.5.1 Pretesting of Questionnaire

A pre-test survey was conducted in Kiroka Village in Morogoro Rural District to check the reliability and validity of the data collection tools prior to starting the household surveys. Kiroka Village was selected for the pre-test survey because it had almost similar characteristics as the villages sampled for this study. Therefore, pre-testing in this context was a way of building confidence on the clarity of questions and items within the questionnaire. For instance, the findings from the pre-test exercise were used to simplify some of the questions which were difficult, to reduce unnecessary repetitions of the questions, and to help understand the proper timing of the interview exercise.

3.5.2 Pre-harvest Household Survey

The first survey (pre-harvest) took place in February-March 2014, and reflected the period of most severe food shortage. The pre-harvest survey questionnaire collected information on the demographic characteristics, household economy, institutional factors related to farming, household farming practices and information related to household food security status (Appendix 3). The survey further identified the risk factors associated with each farming practice, strategies employed by the household to ensure they remained food secure throughout the year and options for improvement on the major farming practices of the study area. The survey interviews were tailored to both the household head and spouse in case the pair existed, and to the household head and/or another adult who was responsible for preparing food in case it was a single-headed household. It was farming season in both Kishapu and Mvomero Districts and households were at different farming stages, such as land preparation, planting and weeding.

In Kishapu District, the research team was based at Mhunze town centre, which is about 20 minutes and 40 minutes travel to Lubaga and Mwakipoya villages, respectively. Most of the farming activities were conducted near home premises and, therefore, some of the household heads chose to be interviewed near their farm plots, but this was preceded by first visiting the living premises to see the housing condition. Most of the
households in Kishapu are widely spaced, so the researchers had to walk for a long time from one household to another and spent a significant amount of time in the process. Thursday is a market day for Kishapu and most people in the study villages tend to participate in a weekly market at Mhunze town centre. Therefore, the study team ended up surveying fewer households than it was expected on non-market days. Appointments were made to visit those households which were not surveyed during their scheduled weekdays and were interviewed on Sunday when most members were at home. Some of the heads of household, especially most of the elderly do not understand and could not speak Kiwahili for a conversation. Fortunately, most of these people have younger members living with them, or spouses who happen to know Kiwahili and acted as translators. In some other cases, a person who was not a relative (for example a hamlet leader) acted as a translator.

In Mvomero District, the research team was based at Dumila town centre, which is about 45 minutes and 25 minutes travel to Makuyu and Milama villages, respectively. Unlike in Kishapu, most of the households in Mvomero had their farm plots located far away from their home premises; as a result some of the sampled household heads (mainly a male spouse) migrated temporarily to their distantly located farms. The possibility of meeting the pair at home was either very small or none at all. However, it was found that most of the household heads that were absent during weekdays would visit their families during weekends (Sundays). Appointments were made to interview them on Sunday. In case they did not return to the village on Sunday, the next approach was to randomly sample another household from the list. Locations of households in some of the hamlets in the study villages of Mvomero District were fairly close. In order to ensure confidentiality, freedom and uninhibited discussion, it was emphasised that the location for the interview had to be appropriate. This was explained to participants so that they would ask their neighbours/relatives to stay away during the interviewing process.

In both areas, some of the sampled households declined to participate in the pre-harvest survey on various grounds. Some of the reasons given were: first, they did not see the value of research because various researchers had been collecting information from them, but the villagers had not seen any change to their wellbeing. Second, there was a
myth that sampled households were the HIV positive suspects mainly because the study, as part of AGRIDIET research project, involved the collection of blood samples for nutrition status assessment. Third, some of the sampled households that declined to be interviewed were in bad terms with the hamlet or village chairpersons. Therefore, this situation affected the research process. Fourth, some of the households that declined to be interviewed were from the livestock keeping community. According to the village informants, these households were suspicious of the research, especially when they heard that researchers would also ask them questions related to livestock numbers and sales. They feared that this study was a government census which was being carried out to establish the number of livestock per household for administrative purposes, which could marginalise the livestock keeping community. Where practical, the purpose of the study was re-explained. As stipulated in the ethical guidelines, participation in the research was entirely voluntary and, therefore, the study adhered to the guidelines. All households that declined to be interviewed were randomly replaced by others from the list.

3.5.3 Post-harvest Household Survey

The second survey (post-harvest) took place between August and September 2014 and reflected the period of food surplus. The post-harvest survey questionnaire did not include as much detail on background information and ownership of resources. However, it incorporated input/output data on crops and livestock, with immediate post-harvest sales and prices, amounts stored and estimated supplies versus needs until the subsequent harvest (Appendix 4).

The post-harvest survey was the continuation of pre-harvest survey carried out in the same villages and same households between February and March 2014. All households that participated in the pre-harvest survey formed the sample for post-harvest survey. The research team aimed to interview both the household head and the spouse, in case the pair was available and the household head for those households with no spouse. It was insisted that, at least, one of the persons interviewed during the pre-harvest survey must be available during the post-harvest interviewing. In case none of them was present at home, appointment was made for another visit. Most households in Kishapu
had already finished harvesting all the crops, while in Mvomero some of the households were still at the final stages of harvesting.

Twenty two households in Kishapu and 26 households in Mvomero did not participate (drop out) in the post-harvest survey (Table 6). Some of the reasons pointed out for drop out were: first, some households did not see the value of continuing with research as they wanted first to see the outcome resulting from the first survey; second, just like for pre-harvest survey, some households had bad relationships with the hamlet leaders; third, the survey was taking too much of their time without any payment; fourth households that participated in nutrition status assessment wanted first to know the results for the urine sample collected in February/March 2014; and fifth, some of the persons who were interviewed during the pre-harvest survey had travelled, passed away, were sick and admitted at the hospital, while others had moved to other villages, or were visited three times but still could not be found at home.

3.5.4 Focus Group Discussions

Twelve focus group discussions (FGDs) were conducted in the study area; four for women only, four for men only and four combining both men and women. The FGDs were conducted in two phases, and the group size ranged from 8 to 14 participants (Table 7). The discussions lasted for about 90 minutes. The first phase involved six FGDs which took place in February 2014 prior to the first household survey in order to inform the survey design and development of data collection tool. In Kishapu, the FGDs were conducted in Lubaga Primary School in Lubaga Village, while in Mvomero they were carried out in Milama Village office. Participants were selected from a list of farm households in participating villages. An invitation letter was sent to each selected participant by Village Executive Officer a day before the discussion schedule. Prior to starting the discussion, a short meeting was convened, and the Village Executive Officer introduced the researcher and the research assistants to invited FGD participants. The FGDs were guided by a pre-determined list of open-ended questions centred on topics related to constraints and innovations around local farming systems, factors influencing household choices of farming systems, and the local food economy (Appendix 5).
Table 7: Distribution of Focus Group Discussion Participants by District in Pre- and Post-harvest season

<table>
<thead>
<tr>
<th>Group composition</th>
<th>FGDs Participants (Pre-harvest)</th>
<th>FGDs Participants (Post-harvest)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Kishapu</td>
<td>Mvomero</td>
</tr>
<tr>
<td>Women only</td>
<td>8</td>
<td>12</td>
</tr>
<tr>
<td>Men only</td>
<td>8</td>
<td>11</td>
</tr>
<tr>
<td>Mixed (women &amp; men)</td>
<td>10</td>
<td>11</td>
</tr>
</tbody>
</table>

The second phase involved the remaining six FGDs and was conducted in December 2014 after the post-harvest household survey, with the aim of commenting on and validating the data collected through the household surveys. The focus group discussions identified the main farming practices in the study area and discuss the main factors influencing household farming behaviour (Appendix 6).

3.5.5 Key Informant Interviews

There were one-to-one in-depth interviews with selected key informants in each study area, which were conducted in December 2014. One limitation about the in-depth interview method is that its in-depth nature limits it to the use of a small number of people and some time to a small geographical area, and it tends to reduce the representativeness of findings. The key informants were purposively selected from the village officials, elders, health centre representatives and agro-dealers based on their knowledge of farming systems, the local economy, food security and nutrition. A total of 22 key informants were identified and interviewed (Table 8).

Table 8: Distribution of Key Informants by Study Area

<table>
<thead>
<tr>
<th>Category</th>
<th>Kishapu</th>
<th>Mvomero</th>
<th>Both Study Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agricultural extension officers</td>
<td>2</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Village elders</td>
<td>2</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Village executive officers</td>
<td>2</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Health centre representatives</td>
<td>2</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Farm input suppliers (agro-dealers)</td>
<td>2</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>10</strong></td>
<td><strong>12</strong></td>
<td><strong>22</strong></td>
</tr>
</tbody>
</table>
Key informants were informed and invited to participate in the interview a day before the interview meetings. Interview meetings tailored to the interviewee context were held by the researcher and lasted for about an hour. Discussions were guided by a pre-determined list of open-ended questions centred on topics related to constraints and innovations around local farming systems, factors influencing the household choice of farming systems, and the local food economy (Appendix 7). In addition to the checklist, probing questions were used to explore various points emerging from the respondents’ answers. The research assistant recorded the discussions using both handwriting and a digital recorder. The interviews were conducted in Kiswahili, the national language spoken by the majority in the study area.

3.5.6 Monthly Market Price Survey

The average prices of each crop, livestock and farm related products were derived from monthly prices collected over a 12 months period during the 2014 local market survey in the study area. Prices were collected from three market places namely Mhunze in Kishapu District and Makuyu and Dakawa in Mvomero Districts. Three locally based research assistants were identified, trained and hired to collect the monthly prices for each item as identified in Appendix 8.

3.5.7 The Use of Secondary Data

This study reviewed secondary data (documents) to identify and understand factors within agricultural systems, above the household level (district level), which are associated with local food security. One of the limitations of using documents as a source of data, is the difficulty involved in accessing them (Sarantakos, 2004). The situation may be compounded by the bureaucratic nature of many departments and institutions. To overcome this challenge, situational data were limited to publicly available documents including: district profiles, the most recent agricultural and population census data, and other published and unpublished reports.
3.6 Data Management Procedure (Data Analysis)

The study combined both qualitative and quantitative data analyses. The data from interviews with key informants and focus group discussion participants were transcribed and translated into English. The key points were marked with series of codes and grouped into themes to facilitate qualitative analysis. Quantitative data were analysed using the Statistical Package for Social Scientists (IBM SPSS Statistics 20). Chi-square test, ANOVA and regression models were employed to establish relationships between variables.

3.6.1 Describing the Main Characteristics of the Study Area and Sample

In order to identify and understand the key characteristics of the study area, publicly available documents were reviewed and information contained in them was organised into themes, including: demographic information, agro-ecological descriptions, natural resources endowment, agricultural practices and infrastructures. Descriptive statistics, particularly means and percentages were computed to understand the main characteristics of the sampled households in the study area.

3.6.2 Determination of Farm Household Income

Farm household income comprises income accrued from both farming and off-farm activities. Household income computation followed six procedures described below. First, the average price of each crop, livestock and farm related product was derived from monthly prices collected over a 12 months’ period during the 2014 local market survey in the study area. The average price for each item as revealed from the three local market places are as indicated in Appendix 9.

Second, total cash farm income was obtained by summing up cash receipts from sales of crops, livestock and farm related products, such as milk and eggs. The total non-cash farm income was obtained by summing up market values for all crops products, livestock and farm related products, which were consumed at home from self-production. Third, the total cost of farming was obtained by summing up the farming expenses incurred by the household on renting land, hired labour, artificial fertilisers,
manure, pesticides, herbicides, improved seeds, breeding stock, veterinary medicines, animal feeds and concentrates, and mechanisation services (e.g. hiring a tractor).

With regard to labour, this study used a ‘man-day’ equivalent as common denominator for expressing the amount and cost of labour in the study area. Man-day of work was defined by the amount of work that can be accomplished by an adult male in an 8-hour work duration. A conversion factor of 1.0 was applied to both children and women who reported amount of work in days and hours meaning that they were performing farm activities in the same capacity as an adult male. The nature of farming in the study area suggests that the work output between adult male and females is equivalent. Likewise, children’s involvement in farming is effective just like for adults, given the fact that only children of advanced age were involved in the farming activities. Information from informed persons indicates that the costs of labour in Kishapu and Mvomero were TZS\(^9\) 2,500 and TZS 3,500 per man-day, respectively. Fourth, net farm income was obtained by summing up total cash farm income and total non-cash farm income less the total cost of farming. Fifth, off-farm income was obtained by summing up income accrued from self-employment, salaries and/or wages, small scale mining, sales of charcoal and/or fuel wood, remittances received from within and outside Tanzania, pension payments, income received through leasing land and/or other farm items, and income received as interest (through giving out loan). Lastly, household income was obtained by summing up net farm income and off-farm income.

### 3.6.3 Determination of Adult Equivalent Units

The adult equivalent scales were developed to provide adequate comparative figures for households of different sizes and with members of different sex and age categories. If variables such as food consumed and income generated are expressed per capita, they do not provide adequate comparative figures for households with different sizes and composition by age and sex (Kayunze, 2008). Therefore, adult equivalent scales were calculated by following the procedure developed by Collier et al. (1990). First, each household member was assigned his or her adult equivalent unit as indicated in Table 9

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\(^9\) 1 Euro was equivalent to TZS 2,223 as of 28\(^{th}\) February 2014 (Bank of Tanzania, 2014)
and also taking into consideration the respective age and sex. The individual members' adult equivalents were aggregated for each household to get adult equivalents per household.

Table 9: Adult Equivalent Scales Constants for East Africa

<table>
<thead>
<tr>
<th>Age group</th>
<th>Adult equivalent by Sex</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 2</td>
<td></td>
<td>0.40</td>
<td>0.40</td>
</tr>
<tr>
<td>3 - 4</td>
<td></td>
<td>0.48</td>
<td>0.48</td>
</tr>
<tr>
<td>5 - 6</td>
<td></td>
<td>0.56</td>
<td>0.56</td>
</tr>
<tr>
<td>7 - 8</td>
<td></td>
<td>0.64</td>
<td>0.64</td>
</tr>
<tr>
<td>9 - 10</td>
<td></td>
<td>0.76</td>
<td>0.76</td>
</tr>
<tr>
<td>11 - 12</td>
<td></td>
<td>0.80</td>
<td>0.88</td>
</tr>
<tr>
<td>13 - 14</td>
<td></td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>15 - 18</td>
<td></td>
<td>1.20</td>
<td>1.00</td>
</tr>
<tr>
<td>19 - 59</td>
<td></td>
<td>1.00</td>
<td>0.88</td>
</tr>
<tr>
<td>Above 60+</td>
<td></td>
<td>0.88</td>
<td>0.72</td>
</tr>
</tbody>
</table>

Source: Collier et al. (1990).

Second, the fact that households of different sizes require different amount of resources, the computed adult equivalents were adjusted for economies of scale as suggested by Collier et al. (1990). Each household adult equivalent unit obtained in the first step above was multiplied by the average cost corresponding to the household size (Table 10).

Table 10: Household Economies of Scale Constants

<table>
<thead>
<tr>
<th>Household size</th>
<th>Average cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.000</td>
</tr>
<tr>
<td>2</td>
<td>0.946</td>
</tr>
<tr>
<td>3</td>
<td>0.897</td>
</tr>
<tr>
<td>4</td>
<td>0.851</td>
</tr>
<tr>
<td>5</td>
<td>0.807</td>
</tr>
<tr>
<td>6</td>
<td>0.778</td>
</tr>
<tr>
<td>7</td>
<td>0.757</td>
</tr>
<tr>
<td>8</td>
<td>0.741</td>
</tr>
<tr>
<td>9</td>
<td>0.729</td>
</tr>
<tr>
<td>Above 10+</td>
<td>0.719</td>
</tr>
</tbody>
</table>

Source: Collier et al. (1990).
3.6.4 Identification of Farming Systems

For this study, farming systems were identified based on crops cultivated, degree of dependence and market orientation for particular crops, and the number of livestock units owned by the household. According to Notenbaert et al. (2009), classification based on the types of crops grown and livestock kept by households simplifies the understanding of what types of development interventions might be applicable under the area studied. The degree of household dependence on a particular crop was expressed as a percentage of total land area cultivated by the household that was allocated to that particular crop. A household was considered dependent on a particular crop if it had, at least, 70% of total cultivated land area allocated to that crop. The Household Commercialisation Index (HCI) for each crop was computed to decide whether the household had market (cash) orientation towards cultivation of a particular crop. The HCI ranges from 0 to 1, and it is the ratio between gross value of each crop sold and gross value of total crop produced (Gebremedhin and Jaleta, 2010). In this study, any crop that scored an HCI greater than 0.5 was considered as a ‘cash crop’; otherwise, it was considered a ‘food crop’, which was mainly for household consumption. Livestock units owned by the households were expressed as Tropical Livestock Units (TLUs), whereby, in sub-Saharan Africa, one TLU is considered equivalent to one mature cow weighing 250 kg (Njuki et al., 2011). Table 11 contains the conversion factors of surveyed livestock species/types into TLUs. The average number of livestock units in the study area was 7.3 TLUs.

Table 11: Conversion Factor of Livestock Type into TLU (1 TLU = 1 mature cow of 250kg)

<table>
<thead>
<tr>
<th>Livestock species/type</th>
<th>TLU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calve</td>
<td>0.41 (taken as average of male=0.38 &amp; female=0.43)</td>
</tr>
<tr>
<td>Heifer</td>
<td>0.78</td>
</tr>
<tr>
<td>Dry cow</td>
<td>1.00</td>
</tr>
<tr>
<td>Mature cow</td>
<td>1.00</td>
</tr>
<tr>
<td>Bull</td>
<td>1.20</td>
</tr>
<tr>
<td>Oxen</td>
<td>1.42</td>
</tr>
<tr>
<td>Goat</td>
<td>0.20</td>
</tr>
<tr>
<td>Sheep</td>
<td>0.20</td>
</tr>
<tr>
<td>Donkey</td>
<td>0.80</td>
</tr>
<tr>
<td>Poultry</td>
<td>0.04</td>
</tr>
</tbody>
</table>

Source: Njuki et al. (2011)
The total animal holding by the household are therefore computed as follows:

\[
\text{Total animal holding} = \sum_{i=1}^{n} TLU_i
\]

Where: \(n\) = number of types/species, \(TLU_i = TLU\) for type/species

The placement of households into farming system categories was based on the 2013 farming year data as reported in the pre-harvest survey (Feb-March 2014). A household was categorised as having a ‘Single Food Crop’ (SFC) farming system if it had allocated \(\geq 70\%\) of total household’s cultivated land area to a single food crop only, and if that crop had a HCl \(\leq 0.5\). A household was categorised as having a ‘Mixed Food Crops’ (MFC) farming system if: (i) it grew several food crops but none occupied \(\geq 70\%\) of the total household’s cultivated land area; (ii) the proportion of land under food crops when added up together was \(\geq 70\%\) of the total household’s cultivated land area; and (iii) the household had a HCl \(\leq 0.5\) for each food crop. A household was categorised as having a ‘Cash Crop’ (CC) farming system if it allocated \(\geq 70\%\) of total household’s cultivated land area to a cash crop(s). In addition, these households had a HCl \(> 0.5\) for the crop(s) involved. A household was categorised as having a ‘Mixed Crop-Livestock’ (MCL) farming system if in addition to crop cultivation, it possessed > 7.3TLUs. It was assumed that a household with livestock units above the area average of 7.3TLUs generated a substantial proportion of household income from livestock keeping activities.

3.6.5 Determination of Factors Associated with Household Choice of Farming Systems.

Multivariate analysis of data collected through household surveys was done to establish the contribution of various factors on household decision-making processes about their choice of farming system. Two commonly used multivariate analytical approaches in studies involving farm households decisions about discrete multiple choices are multinomial logit (MNL) and multinomial probit (MNP) models (Greene, 2000; Kropko, 2008). The two models are considered to be technically very similar except that they differ in how the error terms are distributed (Kropko, 2008). The MNP errors are not necessarily independent and follow the normal distribution while MNL errors are
independent and identically distributed (Greene, 2000). The advantage of MNL over MNP is that the choice probabilities related to MNL model are relatively simple to compute and have ability to maximize the likelihood function obtained almost at instant, even where there is a large number of choices involved (Hassan and Nhachchena, 2008; Kropko, 2008). The main drawback of MNL is related to its assumption called ‘the independent of irrelevant alternatives (IIA)’, which requires that an individuals’ evaluation of an alternative relative to other choices should not change if an irrelevant alternative is added to/ dropped from the analysis (Greene, 2000). To the contrary, MNP has the advantage of not making a IIA assumption. However, MNP is computationally intensive as it requires that the multivariate normal integral be evaluated before estimating unknown parameters (Edwards-Jones, 2006; Hassan and Nhachchena, 2008; Kropko, 2008). This study used the MNL to estimate the contribution of a set of predictor\textsuperscript{10} variables on the dependent categorical variable (household choice of farming system), since it is a much more stable model because of its computational simplicity as compared to MNP (Hassan and Nhachchena, 2008; Kropko, 2008).

In describing the MNL model, let $Y_i$ be the dependent variable representing the farming system practised by a farm household. It was assumed that each household faces a set of livelihood activities that make it belong to only one category of farming system and that these categories are not ordered. The choice of farming system was assumed to depend on a number of factors such as farmer/ household, institutional/ farming context and natural/ farm factors $X$ (Borges et al., 2015; Dixon et al., 2001; Edwards-Jones, 2006). The MNL model for household decision-making specifies the following relationship between probabilities of a household to adopt farming system $Y_i$ and of predictor variable $X$ (Greene, 2003).

$$P(Y_i = j) = \frac{e^{\beta_j x_i}}{\sum_{k=0}^{J} e^{\beta_k x_i}}, \ j = 0, 1 \ldots J$$

\textsuperscript{10} In this study, a predictor variable refers to any factor which is likely to be associated with farm household decision-making process about their choice of farming system.
Where: \( i = \) cases, \( j = \) farming system categories, \( k = \) predictor variables. Both continuous and dummy predictor variables were included in the MNL model. Dummy variables were used to avoid any unreasonable assumption that the original numerical values for the predictor variable categories (i.e. values 1, 2, ..., \( k \)) correspond to any specific interval scale. All predictor variables used in the analysis as listed in Table 12 were checked for multicollinearity\(^{11}\) and presence of any outliers before they were introduced into the MNL model. The dependent variable (\( Y \)) used in this analysis was a ‘farming system’, which the study has categorised according to characteristics of the system and subsequently derived four clear and distinct systems as they relate to the surveyed farm households. These systems are: Single Food Crop (SFC) households, Mixed Food Crops (MFC) households, Cash Crops (CC) households and Mixed Crops and Livestock (MCL) households (see Section 3.6.4 for details). There is no clear guidance from the literature on how to select the base (reference) category for MNL analysis. However, this paper used MCL and SFC farming systems as base categories for Kishapu and Mvomero, respectively, since they constituted the largest groups for each respective study district and because it makes the interpretation of the coefficients easier and more intuitive. Therefore, the remaining three categories of farming systems in Kishapu and Mvomero were compared against the MCL and SFC households, respectively.

\(^{11}\) Multicollinearity exists where there is strong correlation between two or more predictor variables in the regression (Field, 2009), which make it difficult to obtain the correct estimates of the regression coefficient.
Table 12: Predictor Variables for Household Decision-making about Choice of Farming System Used in the MNL Model

<table>
<thead>
<tr>
<th>Predictor variable</th>
<th>Coding</th>
<th>Category</th>
<th>Expected Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Household size</td>
<td>Adult equivalent units</td>
<td>Continuous</td>
<td>+/-</td>
</tr>
<tr>
<td>Education of the household head</td>
<td>Years</td>
<td>Continuous</td>
<td>+/-</td>
</tr>
<tr>
<td>Age of the household head</td>
<td>Years</td>
<td>Continuous</td>
<td>+/-</td>
</tr>
<tr>
<td>Farm size owned</td>
<td>Acres</td>
<td>Continuous</td>
<td>+/-</td>
</tr>
<tr>
<td>Access to off-farm work income</td>
<td>TZS</td>
<td>Continuous</td>
<td>+/-</td>
</tr>
<tr>
<td>Sex of the household head</td>
<td>0=Female; 1=Male</td>
<td>Dummy</td>
<td>+/-</td>
</tr>
<tr>
<td>Access to loan (credit) services</td>
<td>0=No; 1=Yes</td>
<td>Dummy</td>
<td>+/-</td>
</tr>
<tr>
<td>Access to extension services</td>
<td>0=No; 1=Yes</td>
<td>Dummy</td>
<td>+/-</td>
</tr>
<tr>
<td>Membership in organisation</td>
<td>0=No; 1=Yes</td>
<td>Dummy</td>
<td>+/-</td>
</tr>
<tr>
<td>Land tenure system</td>
<td>0=Not own land; 1=Own land</td>
<td>Dummy</td>
<td>+/-</td>
</tr>
</tbody>
</table>

Table 12 provides information for all predictor variables included in the MNL model along with their expected outcome. With regard to household size, it is argued that a household with a greater number of people is likely to farm land more intensively and conduct critical farming operations at the right time than those with fewer household members (Boru et al., 2015; Swai et al., 2012). Education attainment contributes to transmission of the specific information, development of generic skills or proficiencies and is associated with individual beliefs, attitudes, and habits towards farming (Weir, 1999). A household with more experience in farming accumulates more wealth, uses better planning, and ultimately increases the chances of becoming more successful in farming (Bogale and Shimelis, 2009). A household with larger farm size is associated with multiple cropping patterns and/or mixed crop-livestock activities (Hassan and Nhemachena, 2008). Participation in off-farm income earning activities may increase a household’s labour opportunity cost and ultimately reduction in labour intensity of agriculture and overall household income (Reardon et al., 1994).

The sex of household head has been associated with different forms of farming systems in developing countries because of women’s lack of access to productive resources (Pender and Gebremedhin, 2007; Jayamohan and Kitesa, 2014). Access to credit facilities allows a household to hire labour and cover input costs (Byerlee et al., 1982). Access to information about farming is likely to promote increased use of external inputs such as fertiliser and improved seeds by the household (Rogers, 1995; Titus and Adefisayo, 2012). A farm household participating in social relationship, such as
participation in local organisations, is likely to have better access to information about farming practices, increasing household awareness and access to improved agricultural technologies and earn higher returns (Pender and Gebremedhin, 2007). Insecurity of land tenure limits the amount that households are willing to invest in farming (Titus and Adefisayo, 2012). A household with better access to land and other forms of assets is more likely to purchase different forms of external inputs and boost farm production (Pender and Gebremedhin, 2007).

3.6.6 Determination of Household Food Security Status

Household food security status was reflected by: the Household Food Insecurity Access Scale (HFIAS) and the Household Dietary Diversity Score (HDDS).

3.6.6.1 Determination of Food Security Based on Household Food Insecurity Access Scale

Household’s direct experience of food insecurity during the previous 30 days for both pre- and post-harvest seasons was measured by the use of HFIAS. Respondents were asked to respond to nine HFIAS generic questions. The responses were recorded as: '0' if food insecurity had never happened in the previous 30 days; '1' if food insecurity had rarely happened (once or twice) in the previous 30 days; '2' if food insecurity had sometimes happened (three to ten times) in the 30 days and '3' if food insecurity had often happened (more than ten times) in the previous 30 days. Four indicators were computed to understand the characteristics as well as changes in household food insecurity (access) in the study areas by applying procedures developed by Coates et al. (2007). The four indicators include: 'Household Food Insecurity Access-related Conditions', 'Household Food Insecurity Access-related Domains', 'Household Food Insecurity Access Scale Score' and 'Household Food Insecurity Access Prevalence'.

(i) Household food insecurity access-related conditions

Households’ experience of food insecurity access related conditions at any time during 30 days recall period is expressed as a percentage of households which responded affirmatively to each of the nine questions regardless of the frequencies of occurrence.
Households experiencing food insecurity condition at any time during 30 days recall period. = Number of households which experienced food insecurity condition addressed by each question / Total number of households responding to each question X100

The information obtained above was further disaggregated to examine the frequency (i.e. rarely, sometimes and often) of experience of food insecurity access related conditions across the surveyed households. For instance, households which rarely experienced food insecurity, addressed by specific questions, were computed as follows:

Households which rarely experienced any of the food insecurity conditions = Number of households which rarely experienced food insecurity condition as addressed by each question / Total number of households responding to each question X100

(ii) Household food insecurity access-related domains
The surveyed households were summarized into three food insecurity access domains, reflected in the HFIAS generic questions. The first domain is for households which experienced anxiety and uncertainty about food supply in the previous 30 days. It includes all households which responded affirmatively to the first question in the list. The second domain is for households which experienced insufficient food quality (including variety and preferences of types) in the previous 30 days. It summarizes households which responded affirmatively to any of question two, three or four. The third domain is for households which experienced insufficient food intake and its physical consequence in the previous 30 days. All households with positive responses to any of question 5, 6, 7, 8 or 9 are summarized under this domain. Percent of households experiencing any of the condition at any level of severity in each domain (For example, percent of households with insufficient food quality) was calculated as:

Households experiencing any of the conditions at any level of severity in each domain = Number of households with positive response to Q2 OR Q3 OR Q4 / Total number of households responding to Q2 OR Q3 OR Q4 X100

Where; Q stands for question.

(iii) Household food insecurity access scale score
Total scores as accumulated from HFIAS generic questions were computed for each household. The responses for each question were coded as: 0 if a household had never experienced food insecurity, addressed by a specific question; 1 if a household had rarely experienced food insecurity, addressed by a specific question; 2 if a household had sometimes experienced food insecurity, addressed by a specific question; and 3 if a household had often experienced food insecurity, addressed by a specific question. The
total HFIAS scores were obtained by adding values for all the nine questions. The minimum score was 0 and the maximum score was 27. The higher the score the more food insecurity (access) is experienced by the household.

\[
\text{Total HFIAS (0-27)} = Q1 + Q2 + Q3 + Q4 + Q5 + Q6 + Q7 + Q8 + Q9
\]

Average HFIAS score for the study area was calculated as follows:

\[
\text{Average HFIAS Score} = \frac{\text{Total HFIAS Scores in the sample}}{\text{Sample size}}
\]

(iv) **Household food insecurity access prevalence (categories)**

Households were placed into a single unique category of food insecurity access prevalence: food secure, mildly food insecure, moderately food insecure and severely food insecure. In order to be able to assign households into these categories: first, frequency of occurrence to the corresponding questions were coded as 0 if the response was 'never'; 1 if the response was 'rarely'; 2 if the response was 'sometimes'; and 3 if the response was 'often' food insecure. A household was considered as more food insecure if it responded positively to questions which reflect more severe conditions and if it experienced such conditions more frequently. Second, a variable for household food insecurity access category was created sequentially and assigned values: 1 = Food Secure, 2 = Mildly Food Insecure Access, 3 = Moderately Food Insecure Access, and 4 = Severely Food Insecure Access. Table 13 is an illustration of how a household was placed into a single unique category of food insecurity prevalence depending on its set of responses to HFIAS generic questions.

<table>
<thead>
<tr>
<th>Food security status</th>
<th>Household responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food secure</td>
<td>Rarely anxious about food supply</td>
</tr>
<tr>
<td>Mildly food insecure</td>
<td>Frequently anxious about food supply, omission of preferred foods</td>
</tr>
<tr>
<td>Moderately food insecure</td>
<td>Eating disliked meals, eating smaller meals, eating fewer meals</td>
</tr>
<tr>
<td>Highly Food insecure</td>
<td>Little food in the house, sleeping hungry, eating just one meal a day</td>
</tr>
</tbody>
</table>

The percentage household food insecurity (access) prevalence at different categorical levels was calculated by the following formula:

\[
\text{HFIA Prevalence} = \frac{\text{Number of households with HFIA category}}{\text{Total number of households with a HFIA category}} \times 100
\]
3.6.6.2 Determination of Farm Household Food Security Status Based on Household Dietary Diversity Score

Information needed to calculate HDDS was collected by allowing the respondents to freely recall what food, drinks or snacks were taken by any household member at home over a 24 hours’ recall period. The questionnaire contained 17 food groups; the corresponding food as recalled by a respondent was underlined under the appropriate group by coding '1' if at least one food, drink or snack was mentioned, and '2' if no food, drink or snack was mentioned even after probing.

The HDDS variable for the two study areas was calculated by following the procedure suggested by Swindale and Bilinsky (2006). Some of the disaggregated food groups were combined as follows: all vitamin A rich vegetables and tubers, dark green leafy vegetables and other vegetables were combined to form one group of 'vegetables'; Vitamin A rich fruits and other fruits were combined to form one group of 'fruits'; organ meat and flesh meat were combined to form one group of 'meat'; oil and fats were combined with red palm products to form a group of 'oil and fats and red palm oil if applicable'; all other food groups retained their original status. The score for the combined food groups were coded as either '1' if one or more of the original food groups used to create the combined group were consumed, or '0' if none of the original food groups used to create the combined group was consumed. At last there were 12 food groups remaining and were included in the HDDS calculations. The food groups were: cereals; white roots and tubers; vegetables; fruits; meat; eggs; fish and other seafood; pulses, legumes and nuts; milk and milk products; oils/fats and red palm oil if was used; sweets; and spices, condiments and beverages.

During the analysis, values for each food group were re-coded as either “0” if none of food in the food group was consumed at home over a 24 hours’ recall period; or “1” if the food was consumed at home over a 24 hours’ recall period. A HDDS range from '0' to '12' where '0' means that the household is severely food insecure and '12' means that the household is food secure. It is total number of food groups consumed by members of the household. It was calculated as follows:
HDDS = Cereals + white roots and tubers + vegetables + fruits + meat + eggs + fish and other seafood + pulses + legumes and nuts + milk and milk products + oils and fats and red palm oil if applicable + sweets + and spices + condiments and beverages.

Average HDDS = \frac{\text{Sum (HDDS)}}{\text{Total Number of Households}}

### 3.7 Ethical Issues

Bessant and Watts (2007) have argued that research is a political activity, which involves the exercise of power by the researcher on one side and the participant on the other. They, therefore, emphasise the need for ensuring that the research processes or outcomes do not harm the participants by any means. In response to this argument, the study abided by the following ethical considerations. First, the study was guided by the University College Dublin ethical procedures whereby an exemption from ethical approval was obtained after the confirmation of the research approval by the Sokoine University of Agriculture (SUA) and the National Institute for Medical Research (NIMR) in Tanzania.

Second, the purpose of the study was made explicit to the village/hamlet leaders, key informants, FGDs participants and participating households to avoid any impediment to the research process. The research practice requires a researcher to obtain a written informed consent from the participants (Bessant and Watts, 2007; Mason, 2002). Assurance was made that participation was voluntary and that there would be no negative consequences if they decided not to participate in the survey. The initial approach was to ask each eligible household head to sign a written informed consent to participate. However, after discussion with the village leaders it was found that asking people to sign a written informed consent would complicate the process and may result in too many of the potential respondents refusing to participate. It was agreed that the hamlet leader would give the consent in writing on behalf of the participating households in his/her hamlet.
CHAPTER FOUR: DESCRIPTION OF THE STUDY AREA AND FARM HOUSEHOLDS

4.1. Overview

This chapter presents the key characteristics of the two contrasting study districts in pre- and post-harvest conditions. The second and third sections present information on farming conditions in Kishapu and Mvomero Districts, respectively. The fourth section presents and discusses the basic characteristics of the sampled farm households in the study area. The chapter ends with a discussion on farm household food security by comparing the two study areas in pre- and post-harvest conditions.

4.2 Farming in Kishapu District

Kishapu District has a total land area of 4,333 km$^2$ of which 37% is under settlements including farmed area, 44% has potential for agricultural activities but not fully utilised, 17% is suitable for grazing only, 2% is under forest and 1% is dry plains, arid land and rocks that are unproductive for agriculture and livestock keeping (Tanzanian Kishapu District Council, 2012). In 2012, the district’s population density was estimated at 63 people per square kilometre; whereas the average household size and population growth rate were 6.3 and 2.1%, respectively (Tanzanian NBS, 2013). The number of agricultural households in the District was 48,258 in 2008 which cultivated 498,653 acres and of these, 56% of households were involved in both crop and livestock farming and 44% in cropping only (Tanzanian NBS, 2008a).

Kishapu District is a semi-arid area which has two seasons in a year: the rainy season and dry season (see Table 5). The district’s land is characterized by flat and gently undulating plains covered with low and sparse vegetation (Tanzanian Kishapu District Council, 2012). On average, households in Kishapu cultivated about 10 acres and the main crops grown were maize, cotton, green gram, sorghum, pearl millet, sweet potatoes, sunflower, groundnuts, rice and cowpeas. The district has a high livestock population, including cattle, goats, sheep and chickens (Tanzanian NBS, 2008a).
Extension services provide technical backup and expert advice to farmers on improved agricultural practices and natural resources management (Tanzanian NBS, 2008b). In Kishapu, 92% of households received agricultural advice from extension workers, and the main extension messages were related to production of cash crops (mainly cotton), in particular: the use of proper crop spacing, the use of improved seeds and the use of inorganic fertiliser and other agrochemicals (Tanzanian NBS, 2008a). The major sources of agricultural credit in Kishapu are friends/relatives/neighbours (89% of households) and banks (11% of households) (Tanzanian NBS, 2008a). Only few households use improved farm inputs in Kishapu District, and the main farm implement, which is used by the majority of farm households is the hand hoe. The household use of farm equipment, implements and farm assets is as indicated in Appendix 10.

The major sources of water supply for human, cropping and livestock consumption in Kishapu Districts is as indicated in Appendix 11. In Kishapu District, the availability of natural water resources is low, almost no rivers or springs have surface discharges in most part of the dry season while the river basins cannot be exploited for irrigation purposes (Celestin, 2014). Kishapu District has approximately 80.78km$^2$ of natural forests that makes it impossible for lumbering activities (Tanzanian Kishapu District Council, 2012). However, households in Kishapu practise a traditional agro-forestry system commonly known as ngitili$^{12}$ (Kitalyi et al., 2013). Under the ngitili system household set aside a piece of land to supply pastures in the dry season. Ngitili also supplies wood and non wood-products, such as medicines and food for the households (Monela et al., 2005). Kishapu District has two official mines in operation; El Hilal Diamond mines, which employs about 200 people and Mwadui Diamond Mines, which employs about 1000 people (Society for International Development, 2009). There are also small scale informal gold mining activities carried out at Itilima and some other areas in Songwa Ward (Tanzanian Kishapu District Council, 2012).

Kishapu District has a low road density with a network of about 693 km categorized as trunk roads, regional roads, district roads, urban roads and feeder roads (See Appendix 12). Unlike the paved trunk road (Shinyanga - Mwanza highway), which passes through

$^{12}$ Ngitili is a traditional agro forestry system commonly practiced by some ethnic groups in the north of Tanzania, and in particular the Sukuma tribe in Shinyanga Region.
Kishapu, other categories of roads are unpaved and most of them are virtually impassable in the rainy season. The seasonal state of most roads and low road density in the district present constraints to smallholder farmers by putting them away from major roads, agricultural markets and other socio-economic service centres, thereby facing high transaction costs. The high transaction costs to farmers are associated with high transport costs, increased prices of inputs, impaired access to agricultural information and markets and ultimately reduced farm productivity, household income, increased food insecurity and poverty (Temu et al. 2013).

Kishapu District financing services are poor, and there is only one bank (the National Microfinance Bank) which was opened in 2015. The bank is located at Mhunze town (district’s headquarters), but it is uncertain whether it will be able to provide a broad range of financial products that are compatible with smallholder farming conditions. However, households can send and receive money through mobile money transfer services such as MPESA, Tigo Pesa, and Airtel Money. The district is connected to various communication infrastructures, including the Tanzania Telecommunications Company Limited (TTCL) and other mobile phone service providers, such as Vodacom Tanzania, Airtel and Tigo. However, accessibility to these networks is highly restricted to areas that are close to the district town and centre, and the services are unreliable in remote areas where most people live.

4.3 Farming in Mvomero District

As presented in Section 3.3, Mvomero District has a total land area of 7,325 km². The district is characterized as a high agricultural potential area with 75% of its land being suitable for agricultural activities and of which 45% is under cultivation and settlements (Tanzanian Mvomero District Council, 2013). Likewise, 11% of the district land is distributed over 20 forest reserves (Tanzanian MAFS & C, 2014), and the remaining proportion (14%) is used for grazing activities, mainly under Dakawa Ranch and individual landlords who have large pieces of land estimated to be over 1 km² each (SBT, 2016; Tanzanian MLFD, 2011). In 2012, the population density was estimated at 42 people per square kilometre, whereas the average household size and population growth rate were 4.3 and 2.4%, respectively (Tanzanian NBS, 2013). The number of
agricultural households in the District were 56,520 in 2008 which cultivated 213,867 acres (see Table 5), and the majority (82%) were engaged in crop production only, mainly maize farming (Tanzanian NBS, 2008b). Other crops grown in the district include paddy, pulses, cassava, groundnuts, simsim, coffee and horticultural crops such as spices and vegetables. The district is also famous for large-scale production of paddy rice and sugar cane. On average, a household in Mvomero cultivates around 5 acres. Livestock production, which includes cattle, goats, sheep, pigs and chicken, is also a significant contributor to the district’s economy.

Mvomero District has climatic conditions which are considered as adequate to support the production of most cereals, horticultural crops and pulse crops (see Table 5). The district has fertile agricultural valleys, consisting of alluvial and loamy soils suitable for agriculture. Some of these fertile farming valleys are Mvomero River valley in Mvomero Ward and Wami River valley which covers parts of Dakawa Ward (Tanzanian Mvomero District Council, 2013). Mvomero District has three agro-ecological zones. The Highland and Mountainous Zone occupies about a quarter of the district area extending to Nguu Mountain ranges to the North of the district and lies within an altitude of 1200-2,000m above sea level (a.s.l). This zone has very high potential for growing crops such as maize, paddy, sunflower, bananas, fruits, vegetables and spices. The Miombo Woodland Zone occupies about 20% of the district area with flat lowland physical features within the altitude of 600 - 1,200m a.s.l. The main farming activities in the zone are livestock grazing and production of crops such as maize, sorghum, pulses, millets, simsim and sunflower. The Savannah River Basin Zone extends along the great rivers of Mkata, Mgeta, Wami, Divue, Mlali, Diburuma, Mburumi and Mkindo. The zone has potential for irrigation, dry season cultivation, production of paddy, sugarcane, cotton, vegetables and small-scale fishing.

Generally, there is low productivity of various crops in Mvomero, which indicates that production could actually double without increasing the area under production (Tanzanian Mvomero District Council, 2013). However, the major challenge is inadequate extension services. In 2013, the district had 112 extension officers, which means that one extension officer was responsible for 2,343 farmers (Tanzanian Mvomero District Council, 2013). This, coupled with the hilly terrain of the district,
makes it difficult for many farmers to access extension services, and hence relying on traditional agricultural practices. The district has a research centre, Cholima Agro-Scientific Research Centre, which deals mainly with rice research, and a Farmers’ Training Centre at Mkindo, which trains farmers on irrigated paddy production, among others. These facilities cater for other areas outside the district as well. Just like Kishapu, the major sources of agricultural credit in Mvomero District are friends/relatives/neighbours and banks. In Mvomero, about 27% of households used improved seeds, and the use of other farm inputs as a percentage of district planted area was 5% (for inorganic fertilisers), 4% (for insecticides) and 3% (for fungicides) (Tanzanian NBS, 2008b). The main farm implement used by the majority of farm households is the hand hoe. The households’ use of farm equipment, implements and other farm assets in Mvomero is as indicated in Appendix 10.

Mvomero has better availability of natural water resources and high irrigation potential because of many rivers that dissect the district (Tanzanian Mvomero District Council, 2013) compared to Kishapu. The area that can be used for irrigation in Mvomero is more than 50,852 acres. However, the area which is being used for irrigation is only 25% (Tanzanian Mvomero District Council, 2013). Crops under irrigation are paddy rice, sugarcane and vegetables. Maize crop is cultivated in these areas during the dry season. Appendix 11 shows the water resources in Mvomero District. The forest sector plays an important role in the livelihoods of many communities in Mvomero. It provides energy, food, timber and non-timber forest products and is an important contributor to the economy of the district. The district has a total of 136 km$^2$ of forest reserve managed by the District Council and 576 km$^2$ under the Central Government, including 164 km$^2$ of the South Uluguru Nature Reserve (Tanzanian Mvomero District Council, 2013). The district has a large potential for beekeeping activities, and it is estimated that there are about 800 modern and improved beehives and 1,500 traditional beehives, which is far below the potential. The district’s major mining activities are associated with extraction of construction materials such as stone quarries, sand extraction and excavation of soil for production of bricks (Tanzanian Mvomero District Council, 2013).

Just like Kishapu, Mvomero District has low road density with a network of about 641 km (see Appendix 12). Of these, 296 km are managed by Mvomero District Council
whereas the remaining is managed by the central government which includes the Dar es Salaam-Dodoma highway as well as the Dar es Salaam-Iringa highway (Tanzanian Mvomero District Council, 2013). The district roads are those linking district headquarters with ward centres and trading centres within the district. Most of district roads are of gravel surface or earth and are in poor condition because of erratic or lack of maintenance. Due to the mountainous terrain, and the large rivers crossing the district, many villages are not reachable by road, and this curtails access to input/output markets and discourages farmers from increasing agricultural production due to lack of access to markets and other services. The central railway line from Dar es Salaam passes through the district, but it has no significant impact on the district’s economy as it does not have any major railway station.

The district has two banks in operation, the National Microfinance Bank (NMB) and Cooperative and Rural Development Bank (CRDB). Likewise, households in Mvomero have closer proximity to diverse financial institutions available in Morogoro town and can also send and receive money through mobile money transfer services such as MPESA, Tigo Pesa, and Airtel Money. The district is connected to various communication infrastructures including the Tanzania Telecommunications Company Limited (TTCL) and other mobile phone service providers such as Vodacom Tanzania, Airtel and Tigo. Unlike in Kishapu, in Mvomero District, the communication services can be accessed throughout the district.

4.4 Characteristics of Farm Households in Kishapu and Mvomero

This section presents and discusses the characteristics of the farm households surveyed in the study areas. The key household characteristics examined in this study are presented in Table 14
Table 14: Key Household Characteristics by Study Areas

<table>
<thead>
<tr>
<th>HOUSEHOLDS CHARACTERISTICS</th>
<th>Study Areas</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Kishapu</td>
<td>Mvomero</td>
<td>Both Study Areas</td>
</tr>
<tr>
<td></td>
<td>(n=255)</td>
<td>(n=251)</td>
<td>(n=506)</td>
</tr>
<tr>
<td>% Male headed households</td>
<td>76.9</td>
<td>81.7</td>
<td>79.2</td>
</tr>
<tr>
<td>% Female headed households</td>
<td>23.1</td>
<td>18.3</td>
<td>20.8</td>
</tr>
<tr>
<td>% Married household heads</td>
<td>78.4</td>
<td>80.5</td>
<td>79.4</td>
</tr>
<tr>
<td>% Single household heads</td>
<td>21.6</td>
<td>19.5</td>
<td>20.6</td>
</tr>
<tr>
<td>Household Size (number of people)</td>
<td>8</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>Age of the household head (years)</td>
<td>47</td>
<td>43</td>
<td>45</td>
</tr>
<tr>
<td>Education attainment of the household head (years)</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>% Household heads with zero years of formal education</td>
<td>25.9</td>
<td>22.7</td>
<td>18.7</td>
</tr>
<tr>
<td>Experience of household head in crop farming (years)</td>
<td>22</td>
<td>17</td>
<td>20</td>
</tr>
<tr>
<td>Land area cultivated by household (acres)</td>
<td>9.3</td>
<td>3.7</td>
<td>6.5</td>
</tr>
<tr>
<td>% Households which owned land</td>
<td>82.0</td>
<td>71.7</td>
<td>76.9</td>
</tr>
<tr>
<td>% Households which rented land</td>
<td>31.4</td>
<td>45.0</td>
<td>38.1</td>
</tr>
</tbody>
</table>


4.4.1 Sex of the Household Head

Table 14 indicates that almost 80% of the farm households were male-headed. The proportions of male-headed households were slightly higher in Mvomero than in Kishapu. The percentages of female-headed households in both study areas were slightly lower than the figures presented in the Tanzania 2012 Population and Housing Census where Shinyanga Region (where Kishapu is located) had 31% of households that were female-headed while Morogoro Region (home to Mvomero) had 30.51% female headed households (Tanzanian NBS, 2013). The figures generated through this study represented rural households only while the census figures represented the entire region regardless of disparities between rural and urban areas. Sex of household head has been associated with the choice of farming system that ultimately results in different forms of poverty, including food poverty in developing countries (Buvinic and Gupta, 1997; de Brauw, 2015; Jayamohan and Kitesa, 2014). For instance, a study in Mozambique showed that women preferred crops which required less complicated farming techniques, and they were less likely to grow their area’s main cash crops (de
Brauw, 2015). Likewise, women in most areas of work were lower income earners than men; had fewer assets and poorer access to other productive resources such as land; were less likely to migrate for income activities to other areas; and generally worked fewer hours in lower paid jobs which were more compatible with their domestic responsibilities (Buvinic and Gupta, 1997; Jayamohan and Kitesa, 2014).

### 4.4.2 Marital Status of the Household Heads

Most (79.4%) heads of the households in the study areas were married (Table 14). Kishapu had slightly fewer married household heads compared to Mvomero. Studies have shown that households with married household heads were more likely to be food secure than households in which the head was unmarried (Kaloi et al., 2005; Olayemi, 2012).

### 4.4.3 Household Size

The overall household size for both study areas was 7 persons (Table 14). The average household size in Kishapu was 8 persons and in Mvomero was 5 persons. Most households in Kishapu kept significant numbers of livestock in addition to crop production. A previous study in Kishapu by Malole (2013) reported that, among other factors, larger households in the area are associated with polygamous norms observed among men in the area. According to Boru et al. (2015), increased household size is also associated with cultivation of larger land areas because having more people in the household is an important asset that allows for working together in household production activities. Conversely, larger household size may be associated with high poverty levels if there are only few people producing to feed the entire household (Swai et al., 2012). Moreover, increasing household size in an area where household primarily depends on less productive land will result into an increased demand for food that cannot be matched with existing food supply. This may ultimately result into an increased household food insecurity (Bogale and Shimelis, 2009).
4.4.4 Age and Experience of the Household Head

The average age of the household heads in both study areas combined was 45 years (Table 14). The average age of the household head was higher in Kishapu than in Mvomero. The results in Table 14 indicate further that household heads in Kishapu had more farming experience (22 years) compared to Mvomero (17 years). There is a general proposition in literature that the age of the household head is negatively correlated with food insecurity, meaning that households headed by older people are less likely to be food insecure (Bogale and Shimelis, 2009) and this may be because such farm households have more experience in farming, have accumulated more wealth and use better planning. However, this relationship between age of the household head and household food security is not always linear. In almost all occupations (including farming), earnings increase for a time as the individual gains knowledge and experience and then start declining at an older age. According to the life cycle and income hypothesis, the younger the age of the household head the more income is accumulated, especially at the age of 45 years (Ibekwe, 2010).

4.4.5 Education of the Household Head

On average, the heads of household in both study areas had spent five years in school (Table 14). There was no statistical difference in the mean number of years a household head had gone to school between Kishapu and Mvomero (p > 0.05). However, the proportion of households with zero years of education was slightly higher in Kishapu District (25.9%) than that in Mvomero District (22.7%). The lower level of education attainment in Kishapu District can be associated with their farming nature, which relies extensively on household labour. Sending children to school may, therefore, present the cost to the household in terms of labour lost. It is unquestionable that education has a positive effect on the household adoption of agricultural innovations (Edwards-Jones, 2006; Rogers, 1995), which is one of the important factors for household food security.

4.4.6 Cultivated Land Area

On average, households in both study areas combined cultivated 6.5 acres (Table 14). Kishapu households cultivated 9.3 acres while Mvomero households cultivated 3.7
acres. Figure 9 highlights a more detailed contrast between households in Kishapu and Mvomero in terms of the amount of cultivated land area. A large proportion (44.6%) of households in Mvomero cultivated not more than 2 acres while 37.3% in Kishapu cultivated more than 10 acres.

![Distribution of Households by Cultivated Land Area by Districts](image)

**Figure 9: Distribution of Households by Cultivated Land Area by Districts**

*Source: Agridiet Study Household Survey: Pre-Harvest (2014).*

The contrast in size of cultivated land between Kishapu and Mvomero can be attributed to the following propositions: firstly, Kishapu District is located in a semi-arid area of Tanzania characterised by a unimodal rainfall pattern (see Section 4.2). Land productivity is generally low, and this could mean that households have to cultivate large land areas in order to meet household food demand. Secondly, the higher average household size in Kishapu could mean that there is enough household labour to allow cultivation of bigger land areas. Thirdly, the larger average household size in Kishapu could mean that there is an increased demand for food at the household level and, therefore, prompts cultivation of bigger land areas.

On the other hand, the smaller average cultivated land area in Mvomero may be associated with the following factors: firstly, as discussed in Section 4.3, Mvomero District has high agricultural potential, which is characterized by relatively better
climatic and soil conditions suitable for production of most crops. According to the informed elites and focus group discussions, these agro-ecological features made Mvomero more susceptible to land grabbing by elites from nearby towns in Morogoro and Dar es Salaam, which has ultimately resulted in land scarcity. Secondly, a significant portion of Mvomero land either is under estate cultivation, ranches or demarcated as forest reserve managed by either District Council or central government thereby accelerating the land scarcity problem (see Section 4.3).

4.4.7 Land Access

The majority of households (76.9%) in both study areas combined owned at least part of their cultivated land (Table 14). There were more households owning land in Kishapu (82%) as compared to Mvomero (71.6%). Even though the vast majority of households owned land, about 38.1% of household in both study areas combined rented at least part of their cultivated land area. The percentage of households renting land was higher in Mvomero (45.0%) as compared to Kishapu (31.4%), implying that access to land was more problematic in Mvomero than in Kishapu.

4.4.8 Crop Production

The major crops produced in both study areas were maize, rice, sorghum, sesame, green gram, pigeon peas, butter beans, other legumes, sunflower, sweet potatoes, cotton, tomatoes, onions, vegetables, groundnuts, pumpkins and millet. Figure 10 indicates that the cropping patterns varied between the two districts as follows: first, farm households in Kishapu District had more diversified cropping patterns, and the crops grown by more than half of surveyed farm households were maize (92.5%), cotton (85.1%), sweet potatoes (61.2%), groundnuts (60.4%) and green gram (54.5%). Other crops grown by, at least, 10% of farm households were sorghum, rice, other legumes and sunflower. In contrast, farm households in Mvomero had less diversified cropping pattern, with maize being the only crop grown by more than half of the surveyed farm households. Other crops grown by, at least, 10% of all farm households in Mvomero were rice, sunflower, butter beans and sorghum. Secondly, the main cash crops grown by farm households in Kishapu were cotton and green gram, while in Mvomero maize was considered as both
a cash and a food crop for many farm households. A study conducted by Benin et al. (2004) in Ethiopia indicated that households staying close to market centres were less likely to have a diversified cropping pattern because of their engagement in off-farm income generating activities. As discussed earlier in Section 4.2 and 4.3, Mvomero households had relatively better access to market centres compared to households in Kishapu.

![Bar chart showing distribution of households by main crops cultivated by district in 2013 farming season.](Image)

**Figure 10: Distribution of Households by Main Crops Cultivated by District in 2013 Farming Season**  
*Source: Agridiet Study Household Survey: Pre-Harvest (2014).*

The overall yields per acre for all major crops in both study areas were relatively low in 2013 as compared to 2014 farming season (Figure 11). In Kishapu, the yields for all major crops were relatively lower in 2013 than in 2014 (Figure 12), while in Mvomero the yields for most crops were relatively lower in 2013 than 2014 farming season (Figure 13). Besides other factors, the low yields in the 2013 farming season could be associated with unfavourable weather conditions which had adverse impact on farming
in all districts. Information received from FGDs participants in the study area also indicated that 2013 was characterised by drought and poor farm productivity and this can be seen in the following quotes:

... it’s only this year we have enough rains. It looks like it will be a good year. All crops had dried out because of drought during the month like this in the last year; we did not harvest (Mvomero - FGDs).

... for example last season of 2012/13, we did not get anything out of our farms. All crops dried because of drought, you could find a household having a yearly harvest of just a tin of maize (Kishapu - FGDs).

Appendix 13a and 13b indicate the rainfall patterns in Kishapu and Mvomero Districts, respectively.

![Figure 11: Annual Yield of Major Crops in 2013 and 2014 Farming Seasons in Both Areas](image)

*Figure 11: Annual Yield of Major Crops in 2013 and 2014 Farming Seasons in Both Areas*

*Source: Agridiet Study Household Survey: Pre- and Post-Harvest (2014).*
Figure 12: Annual Yield of Major Crops in 2013 and 2014 Farming Seasons in Kishapu District


Figure 13: Annual Yield of Major Crops in 2013 and 2014 Farming Seasons in Mvomero

The yields for most crops were generally lower in Kishapu than Mvomero in both 2013 and 2014 farming seasons (Appendix 14 and 15). The differences in yield of different crops between the two districts may be associated with the following reasons which have been discussed in detail under Section 4.2 and 4.3. Firstly, farm households in Kishapu District experience unpredictable rainfall patterns while in Mvomero District farm households experience a rainfall regime, which is regarded as adequate to support the production of most crops. In addition, Mvomero District has more fertile land suitable for agriculture compared to Kishapu. Secondly, unlike in Mvomero where there is high irrigation potential because of many rivers that dissect the district (Tanzanian Mvomero District Council, 2013), farm households in Kishapu District have poor access to natural water resources, such as rivers or springs that can be exploited for irrigation purposes during the dry season (Celestin, 2014). Thirdly, because of poor proximity to market places, town centres and main roads, farm households in Kishapu have relatively poor access to extension and credit services, and even when these services are available, they are linked to cash crop production, mainly cotton (Tanzanian NBS, 2008a). In Mvomero District, farm households have relatively better access to extension services because of proximity to market places, town centres and main roads. Likewise, Mvomero has better access to agricultural support institutions, such as agricultural research and training centres.

4.4.9 Livestock Production

The main livestock types kept by households in the study area were cattle, oxen, goats, sheep, chicken, duck and donkeys (Figure 14). A much higher proportion of households kept cattle (including oxen), goats and sheep in Kishapu relative to Mvomero. The proportions of households in Kishapu and Mvomero were similar in the case of poultry. The average number of animal units per household in both study areas was 7.3 TLUs and was much higher in Kishapu (10.5 TLUs) than in Mvomero (4.1TLUs). This difference may be associated with the contrasting natural environment in each area. Previous studies have indicated that households in semi-arid and dry lands tend to practise both crop and livestock farming as one way to secure livelihoods and cope with uncertainties (Blarel et al., 1992; Dixon et al., 2001; Ickowicz et al., 2012; Schiere et
al., 2006). According to Morris (2002), the economic importance of livestock to household income increases as the amount of rainfall declines.

Figure 14: Distribution of Households by Livestock type Owned by District in 2013

### 4.4.10 Household Income

The average annual household income in both study areas was TZS. 2.74 million for the 2013 farming season, and it was lower in Kishapu (TZS 2.45 million) and higher in Mvomero (TZS 3.03 million). Figure 15 shows that 80.7% of household income in Kishapu and 43.8% of household income in Mvomero was generated from farming. The remaining proportions of income for the two districts were generated from off-farm activities. The differences in the average household income and proportions of income generated from farm and off-farm sources between the two study areas could be associated with the fact that the study villages in Mvomero had closer proximity to Dar es Salaam-Morogoro-Dodoma main highway which is a major road artery in the country. In addition, Morogoro town with a population of over 300,000 people was likely to offer more off-farm work. In contrast, Kishapu is a relatively remote district of
Shinyanga Region, which offers fewer off-farm work opportunities. An analysis of rural livelihoods in Nigeria by Okoye et al. (2015) also found that an increase in accessibility to roads was positively associated with household income and proportion generated from off-farm activities.

![Figure 15: Percentage of Annual Household Income from Farm and Off-farm](source)

**Figure 15:** Percentage of Annual Household Income from Farm and Off-farm

*Source: Agridiet Study Household Survey: Pre-Harvest (2014).*

### 4.4.11 Summary

This section (Section 4.4) has indicated that farm households in the two study districts are diverse. In the remote and semi-arid district of Kishapu, where there is poor proximity to market places, town centres and main roads, farm households tend to have bigger family sizes, possibly because of polygamous family system in the area. Access to land is not very much restricted, and households cultivated on average 10.5 acres.
The cropping system was highly diversified, and households cultivated multiple food and cash crops in addition to livestock keeping. On average, farm households in Kishapu owned 10.5 animal units and generated the majority of household income from farming. In contrast, in Mvomero District where there is close proximity to market places, town centres and main roads, farm households had smaller family sizes and cultivated on average 4.1 acres. In this district, households grew one or relatively few crops which could be used as both food and cash crops. On average, farm households in Mvomero owned 4.1 animal units and generated the majority of their income from off-farm sources.

4.5 Household Food Security

This section discusses the households’ food security status in the two study areas as reflected by the Household Food Insecurity Access Scale (HFIAS) and the Household Dietary Diversity Score (HDDS).

4.5.1 Food Security Status Based on Household Food Insecurity Access Scale

This part discusses the household’s direct experience of food insecurity during the previous 30 days for both pre- and post-harvest seasons as measured by the use of HFIAS (see Section 3.6.6.1). The discussion is organised under four indicators which were computed to understand the characteristics of, as well as, changes in household food insecurity (access) in the study areas. The four indicators are 'Household Food Insecurity Access-related Conditions', 'Household Food Insecurity Access-related Domains', 'Household Food Insecurity Access Scale Score' and 'Household Food Insecurity Access Prevalence'.

(i) Household Food Insecurity Access-related Conditions

This indicator was used to present the percentage of households which experienced any of the nine food insecurity access-related conditions reflected by HFIAS regardless of the frequency of occurrence over a 30 days’ recall period (see Section 3.6.6.1 (i)). Figure 16 presents the overall percentage of households in both the study areas, which responded affirmatively to each of the nine food insecurity conditions in pre- and post-
harvest seasons. It shows that the percentage of households that experienced each food insecurity access-related condition in both study areas was associated with seasonal nature of farming. The high percentage of households which experienced food insecurity access-related conditions at pre-harvest season can be explained by the combination of: low reserves of food stored at the household; low incomes from farming in the preceding year; and/or inadequate off-farm work that can enable households to access food through markets.

Figure 16: Distribution of Households by their Experienced Food Insecurity in Pre- and Post-harvest Seasons in Both Study Areas


Households’ experience of food insecurity access-related conditions was also associated with study areas. Figure 17 indicates that, in pre-harvest season, there were many households in Kishapu that experienced food insecurity access-related conditions as compared to Mvomero. The percentage of households, which experienced food insecurity access-related conditions decreased in post-harvest seasons in both districts
(Figure 18). There was a wider drop in the proportion of households responding affirmatively to each of the nine-food insecurity conditions in Kishapu than in Mvomero, indicating that seasonal nature of food supply effect was more a factor in Kishapu than in Mvomero.

Figure 17: Distribution of Households by their Experienced Food Insecurity in Pre-Harvest Season by Districts

The vast majority of households in both study areas experienced the three domains of HFIAS (anxiety and uncertainty about food supply; insufficient food quality; and insufficient food intake and its physical consequences) in pre-harvest than in post-harvest season (see Section 3.6.6.1 (ii)). Figure 19 indicates that 68.2% of households in both study areas experienced anxiety and uncertainty about food supply, which means that they were worried about fulfilling their food needs. The experience of anxiety and uncertainty about food supply was higher in Kishapu (80.4%) than in Mvomero (55.8%) in pre-harvest season. The percentage of households, which experienced anxiety and uncertainty about food supply, were significantly lower in post-harvest season (23.1%) in both study areas combined, 29% in Kishapu and 17.1% in Mvomero.
Figure 19: Distribution of Households by their Experienced Food Insecurity Access-related Domains by Districts

*Source: Agridiet Study Household Survey: Pre- and Post-Harvest (2014).*

Figure 19 indicates that 81.8% households in both study areas experienced insufficient food quality in the pre-harvest season, implying that these households either did not eat the kinds of food they preferred, ate fewer kinds of foods in a day or ate food they really did not want to eat because they lacked money to buy other types of foods. Almost all households (95.7%) in Kishapu and about half (47.1%) in Mvomero experienced food quality problems in the pre-harvest season. The overall percentage of households that experienced food quality problems in both study areas combined decreased by 35.4% in post-harvest season and the decrease was higher for Kishapu households (48.6%) and lower for Mvomero households (21.9%).

There were 60.5% households in both study areas that experienced insufficient food intake and its physical consequences in the pre-harvest season (Figure 19), implying that these households either ate smaller meals than they felt they needed; ate fewer meals in a day because there was not enough food; there was no food at all in the house because they had no resources to get food; went to sleep hungry because there was not enough food in the house; and spent a day and night without eating anything because
they had nothing to eat. There was a much higher proportion of households which experienced insufficient food intake in the pre-harvest season in Kishapu (83.5%) than in Mvomero (37.1%). On the other hand, fewer households (21.5%) in both study areas experienced insufficient food intake in post-harvest season. The change in percentage of households that experienced insufficient food intake and its physical consequences was higher in Kishapu (55.7%) than in Mvomero (22%).

(iii) Household Food Insecurity Access Scale Score

The HFIAS score was calculated to reflect the household experience of food access problems in the two districts in pre- and post-harvest seasons (see Section 3.6.6.1 (iii)). The score ranged from 0 to 27, with the larger numbers toward 27, reflecting an increase in food access problems and smaller numbers toward 0 reflecting decline in food access problems.

The mean HFIAS score was associated with the study area in both pre- and post-harvest seasons. Figure 20 indicates that the mean HFIAS score for both study areas combined was 8 in the pre-harvest season. The mean HFIAS score was 11.2 for Kishapu and 4.8 for Mvomero, implying that households in Kishapu had more food access problems than in Mvomero in pre-harvest season. The overall mean HFIAS score in both study areas combined dropped to 2.8 in the post-harvest season; the score in Kishapu dropped to 3.1 while the mean HFIAS score in Mvomero dropped to 2.5 in the post-harvest season. As argued earlier, the change in HFIAS score from pre-harvest to post-harvest seasons suggests that the farming season was more a factor in Kishapu than in Mvomero.
Figure 20: HFIAS Mean Score by Districts and Farming Seasons

*Source: Agridiet Study Household Survey: Pre- and Post-Harvest (2014).*

(iv) Household Food Insecurity Prevalence (categories)

Households were placed into single unique categories of food insecurity access prevalence: food secure, mildly food insecure, moderately food insecure and severely food insecure (see Section 3.6.6.1 (iv)). Household access to food in both study areas combined was associated with the seasonal nature of farming (Table 15). High prevalence of food insecurity in pre-harvest season can be explained by a combination of low reserves of harvested food, low incomes from farming in the preceding year and/or inadequate off-farm work that can enable households to access food through markets. The prevalence of food insecurity was higher in Kishapu than in Mvomero in pre- and post-harvest seasons. This can be explained by the fact that crop yields were generally lower in Kishapu than in Mvomero for both 2013 and 2014 farming seasons (see Appendix 14 and 15). In addition, households in Mvomero had close proximity to Dar es Salaam-Morogoro-Dodoma highway, giving them more access to off-farm work opportunities and income which was likely to be used to access food from market places.
Table 15: Distribution of Households by Food Insecurity Prevalence (categories) by Districts

<table>
<thead>
<tr>
<th>Prevalence categories</th>
<th>Farming season</th>
<th>Study areas</th>
<th>Both study areas</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Kishapu (n=255)</td>
<td>Mvomero (251)</td>
</tr>
<tr>
<td>Food Secure (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-harvest</td>
<td>3.5</td>
<td>30.3</td>
<td>16.8</td>
</tr>
<tr>
<td>Post-harvest</td>
<td>51.0</td>
<td>51.8</td>
<td>51.4</td>
</tr>
<tr>
<td>Mildly Food Insecure Access (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-harvest</td>
<td>6.7</td>
<td>23.1</td>
<td>14.8</td>
</tr>
<tr>
<td>Post-harvest</td>
<td>13.7</td>
<td>21.1</td>
<td>17.4</td>
</tr>
<tr>
<td>Moderately Food Insecure Access (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-harvest</td>
<td>39.2</td>
<td>27.5</td>
<td>33.4</td>
</tr>
<tr>
<td>Post-harvest</td>
<td>29.0</td>
<td>23.9</td>
<td>26.5</td>
</tr>
<tr>
<td>Severely Food Insecure Access (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-harvest</td>
<td>50.6</td>
<td>19.1</td>
<td>35.0</td>
</tr>
<tr>
<td>Post-harvest</td>
<td>6.3</td>
<td>3.2</td>
<td>4.7</td>
</tr>
</tbody>
</table>


4.5.2 Food Security Status Based on Household Dietary Diversity Score (HDDS)

The HDDS was calculated from information collected by allowing the respondents to freely recall what food, drink and/or snack was taken by any household member at home over a 24-hour recall period (See Section 3.6.6.2). Despite being statistically significant (p = 0.001), the actual overall difference in mean HDDS between the pre- and post-harvest seasons was relatively small (Figure 21). The mean HDDS was statistically significantly different between the pre- and post-harvest seasons in Kishapu (p = 0.001), and it was not statistically significantly different between pre- and post-harvest seasons in Mvomero (p = 0.203). This implies that the changes in dietary consumption patterns were more associated with the farming seasons in Kishapu than in Mvomero. The diversity of foods consumed in pre- and post-harvest seasons differed only slightly between the two study areas (Figure 21). The difference was statistically significant in the pre-harvest season (p = 0.001), and not significant in the post-harvest season (p = 0.266).
The five food groups consumed by, at least, 50% of households in both study areas and both pre- and post-harvest seasons were cereals, vegetables, fats/oils, spices/condiments/beverages and sweets (Figure 22). The proportion of households consuming these food groups did not seem to have varied much between pre- and post-harvest seasons. The only new food group consumed by, at least, 50% of the households in post-harvest season was that of legumes and nuts. Other food groups were consumed by less than 50% of the households in pre- and post-harvest seasons but with some variations. For instance, the proportion of households consuming fish, egg, meat and fruits increased while the proportion of households consuming white root tuber and milk decreased in the post-harvest season.

**Figure 21: Farm Household Dietary Diversity Score (HDDS) by Study Areas**

*Source: Agridiet Study Household Survey: Pre- and Post-Harvest (2014).*
Figure 22: Distribution of Households Consuming Each Food Group in Pre- and Post-harvest Seasons


The three main food groups consumed by, at least, half of the households in Kishapu in pre- and post-harvest seasons were cereals, vegetables and spices/condiments/beverages (Figure 23). The proportion of households consuming these food groups did not seem to have varied much between pre- and post-harvest seasons. The only new food group consumed by, at least, half of the households in the post-harvest season was legumes and nuts. Other food groups were consumed by less than half of the households in both pre- and post-harvest seasons but with notable variations. For instance, there was a notable increase in the proportion of households consuming oil and fats, sweets, fish and fruits. There was also a slight increase in the proportion of households consuming eggs and meat while the proportion of households consuming milk/milk products and white tuber and roots decreased in post-harvest season.
The six main food groups consumed by, at least, 50% of households in Mvomero in pre- and post-harvest seasons were cereals, vegetables, sweets, oil/fats, legume/nuts and spices/condiment/beverages (Figure 24). However, the proportions of households consuming vegetables, sweets and oil/fats in Mvomero were slightly lower in post-harvest season. All other food groups were consumed by less than 50% of the households in pre- and post-harvest seasons but with some variation. The proportions of household consuming fish, eggs, meat and fruits increased while there was little change in the proportion of households consuming milk/products and white tubers/roots in the post-harvest season.
**Figure 24: Distribution of Households in Mvomero Consuming Each Food Group in Pre- and Post-harvest Seasons**

*Source: Agridiet Study Household Survey: Pre- and Post-Harvest (2014).*

### 4.6 Summary

Kishapu households experienced greater food access problems than Mvomero households in the pre-harvest season. The probable reasons could be that: first, Kishapu households had bigger household size (8 persons) than Mvomero (5 persons) and, while bigger household size provided more labour, it is likely that it was inadequate to meet household food needs in the pre-harvest season. Secondly, there were far more livestock keeping households in Kishapu than in Mvomero (see Section 4.4.9), but the question remains as to why these households did not sell livestock to buy food. Part of the answer lies in the existing gender inequality in livestock asset ownership and in providing food for the household, in which women were found to be disadvantaged. While women were primarily responsible for selection and preparation of food consumed by the household, they had limited ownership, control and access to assets that could have been exchanged for food. Thirdly, unlike in Mvomero where there were more opportunities for off-farm work income because of close proximity to the Dar es Salaam-Dodoma highway and the town of Morogoro, Kishapu is a remote area and...
households had poor accessibility to off-farm work income which could have been used to purchase food in the pre-harvest season.

Household access to food improved in both study areas in the post-harvest season, and it was higher in Mvomero than in Kishapu. However, the findings of this study indicate a wider improvement in food access among households in Kishapu than in Mvomero, implying that farming season was more a factor in Kishapu than in Mvomero.

While the study areas and the two farming seasons were associated with household food access, they had little association with the range of foods consumed. Moreover, the fact that HDDS calculated did not account for food quantity, it is likely that the differences seen between the two study areas and between pre- and post-harvest seasons occurred for amounts of foods consumed, while the food types in general remained the same.
CHAPTER FIVE: FARMING SYSTEMS AND HOUSEHOLD FOOD SECURITY

5.1 Overview

In Tanzania, almost 90% of all agricultural related employees are smallholder farmers living in rural areas (Tanzanian NBS, 2012). Therefore, growth in the agricultural sector has potential to address the problem of food insecurity and overall poverty reduction among smallholder farmers (Byerlee, Diao, and Jackson 2005; OECD 2006). As argued by Dixon et al. (2001), farming system forms a focal point for targeting interventions through improved farming practices, which ultimately result in increased farm production, farm productivity and profitability. This, in turn, may influence the amount and types of food available to farm households (Dorp et al., 2012). This chapter examines the link between farming systems and household food security in two districts, Kishapu and Mvomero, of Tanzania. Specifically, the chapter discusses the findings from the analysis of the main farming systems of the study area and household food security status under each identified farming system in pre- and post-harvest seasons. The next section discusses the main farming systems in the study areas, followed by discussion of the farm household characteristics, agricultural activities, household income and, finally, food security status.

5.2 Main Farming Systems in the Study Areas

The 506 farm households which formed the study sample for both pre- and post-harvest seasons were categorised into the four main farming systems outlined in Section 3.6.4, namely Single Food Crop (SFC) (25% of households), Mixed Food Crops (MFC) (31% of households), Cash Crop(s) (CC) (22% of households) and Mixed Crop-Livestock (MCL) (22% of households). The distribution of households across the four farming systems showed a contrast between Kishapu and Mvomero Districts. Unsurprisingly, the majority (88%) of MCL households were found in the more arid Kishapu District, while a similar majority (88%) of the SFC households were in Mvomero.

The farming systems in the two districts are clearly associated with their natural environment and proximity to market places. The natural environment of the farm
household influences the production capacity of a particular area as well as the agricultural management practices (Dixon et al., 2001). A study by Handa and Mlay (2006) in Mozambique revealed that households residing close to main roads had an increased access to markets and alternative sources of income. Kishapu is a remote semi-arid area with features that are more suited to mixed farming activities as a way to mitigate risk that may be associated with the semi-arid nature of the environment. Mvomero had relatively higher average rainfall, a feature which makes it more suited to crop cultivation. The large proportion of households in Mvomero that grew only one crop (88%) may be associated with the fact that one in every four grew paddy rice, which, by its nature, is mono-cropped. Households in Mvomero had closer proximity to market places, main road to Dodoma and Morogoro town centre (main market); so they were more likely to supplement their farm income with income generated from off-farm work.

5.3 Household Characteristics by Farming Systems

On average, households in the study area comprised seven members, which was higher than the national average of five persons. Tisdell (2002) pointed out that the low cost of raising children through relying on extended household support, and the demand for labour in agriculture that depended on household members was associated with large household sizes in rural areas. The average household size (Table 16) was different among the farming systems (p < 0.001). The MCL households had significantly larger household sizes than households practising the other three farming systems (p < 0.001). The SFC households had the smallest household sizes of 5 persons. Large households are important for provision of labour as most of the household members take part in production activities (Swai et al., 2012). Increased household size is associated with cultivation of larger land area (Boru et al., 2015).
Table 16: Household Characteristics by Farming Systems

<table>
<thead>
<tr>
<th>Households Characteristics</th>
<th>Farming Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total (n=506)</td>
</tr>
<tr>
<td>Average household size (number of members)</td>
<td>6.7</td>
</tr>
<tr>
<td>Average land area cultivated by household</td>
<td>6.5</td>
</tr>
<tr>
<td>(acres)</td>
<td>20.8</td>
</tr>
<tr>
<td>Female headed households (%)</td>
<td>31.6</td>
</tr>
<tr>
<td>Household renting (not own) land (%)</td>
<td></td>
</tr>
</tbody>
</table>


Farm households in the study areas cultivated an average of 6.5 acres (Table 16). This is somehow larger than the national average of five acres (Tanzanian NBS, 2012), and can be explained by the fact that some of the sampled households practised mixed crop-livestock farming, a livelihood strategy which requires a relatively bigger land area. The cultivated land area was different between the farming systems (p < 0.001). The MCL households cultivated a significantly larger land area than households practising the other three farming systems (p < 0.001), thereby reflecting the more extensive nature of farming in Kishapu. These findings are in line with findings of a study by Mnenwa and Maliti (2010) who found that some of the households practising sorghum/millet/livestock farming system in Shinyanga Region tended to have larger farm holdings. The SFC households cultivated, on average, smaller land areas than MFC households (p < 0.001) and CC households (p = 0.008). A study on the association between farm sizes and farming systems in Africa by Hassan and Nhachena (2008) found that larger farm sizes were associated with multiple cropping patterns and/or mixed crop livestock-keeping activities..

Male headed most households (79.2%) in the study area and female headed only few (20.8%) (Table 16). Although the relationship between sex of heads of the household and farming system practiced was not statistically significant different (p = 0.983), there was slightly more female-headed households practicing either SFC or MFC farming system than those practicing CC and MCL, implying that female-headed households
were more likely to cultivate crops, which could provide household food. About 31.6% of household in the study area depended entirely on rented land for farming (Table 16).

About 31.6% of all households studied (n = 506), depended entirely on rented land. Of these households, 35% practiced SFC farming system and 34.4% practiced MFC farming system, implying that the rented land was primarily used to cultivate crops, which could provide household food. The remaining percentage of households practiced either CC (24.4%) or MCL (6.3%). An analysis of land renting practices within each farming group shows a statistically significant association between ownership of land and the system applied by farm household (p < 0.001). Table 16 indicates that the percentage of household that depended entirely on rented land was highest (45.5%) for SFC households and lowest (8.8%) for MCL, implying that access to land was more problematic for SFC households.

5.4 Agricultural Activities by Farming Systems

The six major crops grown in the study area were maize, sorghum, green gram, sweet potatoes, cotton and groundnuts. Other crops were rice, sesame, pigeon peas, butter bean, other legumes, sunflower, tomatoes, onions, vegetables, pumpkins and millet. The cropping patterns varied across the four farming systems with maize being the major crop cultivated by almost all households (over 90% of households) in all systems (Table 17). The SFC households had less diversified cropping than households practising the other three farming systems, with maize being the major food and cash crop grown by almost all households (94%). On average, SFC households owned the smallest farm sizes (about 2 acres), a factor that was likely associated with production of single or fewer crop(s). Similar results have been reported by Ellis and Mdoe (2003) and Hassan and Nhema (2008), which indicated that maize was a dominant food and cash crop in Morogoro farming systems. The MFC, CC and MCL households had more diversified cropping with crops, such as cotton and green gram, mostly being grown for cash (Table 17). Blarel et al. (1992) asserted that diversified cropping patterns made farmers more efficient in overcoming risks associated with natural calamities, such as floods, droughts and other perils.
Table 17: Distribution of Households by Major Crops Grown by Farming System (2013)

<table>
<thead>
<tr>
<th>Crop</th>
<th>SFC (n=123) %</th>
<th>MFC (n=158) %</th>
<th>CC (n=112) %</th>
<th>MCL (n=113) %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maize</td>
<td>94.3</td>
<td>92.4</td>
<td>99.1</td>
<td>98.2</td>
</tr>
<tr>
<td>Sorghum</td>
<td>8.9</td>
<td>33.5</td>
<td>17.0</td>
<td>61.1</td>
</tr>
<tr>
<td>Green gram</td>
<td>4.1</td>
<td>24.7</td>
<td>33.0</td>
<td>62.8</td>
</tr>
<tr>
<td>Sweet potatoes</td>
<td>3.3</td>
<td>40.5</td>
<td>21.4</td>
<td>59.3</td>
</tr>
<tr>
<td>Cotton</td>
<td>3.3</td>
<td>44.9</td>
<td>42.9</td>
<td>84.1</td>
</tr>
<tr>
<td>Groundnuts</td>
<td>3.3</td>
<td>28.5</td>
<td>22.3</td>
<td>76.1</td>
</tr>
</tbody>
</table>


The yield per acre for major crops in the study area was relatively low in 2013 as compared to 2014 farming season (Table 18). Besides other factors, the low yield during the 2013 farming season was most likely associated with drought which occurred during that year (see Appendix 13a and 13b). The yield per acre for major crops varied across the four farming systems, and for most crops, it was higher in 2014 compared to 2013 (Table 18). The SFC households had the highest yields of maize per acre in both 2013 and 2014.

Table 18: Average Yield of Major Crops by Farming Systems in 2013 and 2014 (kgs/acre)

<table>
<thead>
<tr>
<th>Crop</th>
<th>SFC (n=123) 2013</th>
<th>MFC (n=158) 2013</th>
<th>CC (n=112) 2013</th>
<th>MCL (n=113) 2013</th>
<th>SFC (n=123) 2014</th>
<th>MFC (n=158) 2014</th>
<th>CC (n=112) 2014</th>
<th>MCL (n=113) 2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maize</td>
<td>413</td>
<td>236</td>
<td>396</td>
<td>131</td>
<td>602</td>
<td>236</td>
<td>535</td>
<td>309</td>
</tr>
<tr>
<td>Sorghum</td>
<td>242</td>
<td>148</td>
<td>290</td>
<td>122</td>
<td>264</td>
<td>228</td>
<td>239</td>
<td>282</td>
</tr>
<tr>
<td>Green gram</td>
<td>3</td>
<td>47</td>
<td>43</td>
<td>70</td>
<td>66</td>
<td>93</td>
<td>74</td>
<td>98</td>
</tr>
<tr>
<td>Sweet potatoes</td>
<td>255</td>
<td>231</td>
<td>443</td>
<td>349</td>
<td>389</td>
<td>47</td>
<td>572</td>
<td>586</td>
</tr>
<tr>
<td>Cotton</td>
<td>97</td>
<td>178</td>
<td>160</td>
<td>149</td>
<td>127</td>
<td>160</td>
<td>144</td>
<td>188</td>
</tr>
<tr>
<td>Groundnuts</td>
<td>270</td>
<td>182</td>
<td>201</td>
<td>133</td>
<td>143</td>
<td>182</td>
<td>144</td>
<td>195</td>
</tr>
</tbody>
</table>


The main types of livestock kept in the study area were cattle (25% of households), oxen (22%), goats (29%), sheep (20%), and chickens (61%). Other livestock types, such as donkeys and ducks, were also found in the study area but were kept in very few
households. The percentage of households keeping each of the livestock types was highest for MCL households and varied by farming systems (Figure 25).

![Distribution of Households Keeping Livestock by Farming Systems](image)

**Figure 25: Distribution of Households Keeping Livestock by Farming Systems (2013)**

*Source: Agridiet Study Household Survey: Pre-Harvest (2014).*

The number of livestock kept by each household was expressed as livestock units measured in TLUs (see Section 3.6.4) and varied between the four farming systems. As indicated under Section 3.6.4, households with more than 7.3 TLUs in addition to crop production were categorised under the MCL. As a result, SFC households had the fewest number of livestock units (0.4TLUs) followed by CC (0.9TLUs), MFC (1.2TLUs) and, as would be expected, MCL had the highest number of livestock units (30TLUs).

### 5.5 Household Income by Farming Systems

Household income comprised the annual net farm income and annual off-farm income generated from the 2013 farming season data. The annual net farm income comprised the cash receipts from sales of farm products and non-cash farm income, less the total cost of farming. The off-farm income was obtained by summing up the income.
generated from: self employment; salaries and/or wages; small scale mining; sales of charcoal and/or firewood; remittances received from within and outside Tanzania; pension payments; income received through leasing land and/or other farm items; and income received as interest.

The average annual household income in the study areas was TZS 2.74 million\textsuperscript{13} for the 2013-farming season. However, this varied across all the four farming systems with MCL households having the highest (TZS 4.85 million) average annual income, followed by CC (TZS 3.16 million), MFC (TZS 1.91 million) and SFC (TZS 1.49 million). The percentage of income generated from farm and off-farm sources varied across the four farming systems with MCL households having the highest dependence on farming income (88\% of total income) and the majority of these households were found in Kishapu, a relatively remote district of Shinyanga Region, which had few off-farm income opportunities. The SFC households had the lowest dependency on farm income (36\% of total income). The majority of SFC households were found in Mvomero, a district located close to main roads and the major town of Morogoro and this implies that they were more likely to generate most of its income from off-farm sources. The MFC and CC households had 48\% and 42\% dependence on farm income, respectively. The balance of the household income for the four farming groups was generated from off-farm work.

Mishra et al. (2002) found that farm households located near main roads and urban areas would be expected to have more income generated from off-farm sources. Fan and Chan-Kang (2005) found that the share of household off-farm income in five Asian countries was inversely related to cultivated farm size. Other studies in sub-Saharan Africa have shown that households with less reliance on farming income tend to be better-off than those specializing in farming activities (Davis et al., 2014; Ellis and Mdoe, 2003).

\textsuperscript{13} 1 Euro was equivalent to TZS 2,223 as of 28\textsuperscript{th} February 2014 (Bank of Tanzania, 2014)
5.6 Household Food Security Status

Household food security status was reflected through two indicators, namely HFIAS and HDDS. This section presents the findings related to household food insecurity prevalence during the previous 30 days for both pre- and post-harvest seasons in 2014 as well as household diet diversity over a 24-hour recall period for both pre- and post-harvest seasons in 2014.

5.6.1 Prevalence of Food Insecurity

Prevalence of food insecurity was explored in two ways: first, by exploring the relations between farming systems applied by farm households and food security status; and second, by comparing characteristics of farm households under different categories of food insecurity prevalence conditions.

5.6.1.1 Households by Food Security Status by Farming Systems

The Household Food Insecurity Access Prevalence (HFIAP) results reflect the seasonal nature of farming as households in all four farming systems had better food access in the post-harvest season than in the pre-harvest season (Table 19). Characteristics of the pre-harvest season, such as low food reserves, high prices of food, low-income reserves (savings) and/or inadequate off-farm income, were factors contributing to limited household food access. Table 19 indicates further that the food insecurity prevalence levels in both pre- and post-harvest seasons varied by farming systems. Household food insecurity prevalence levels were lowest for SFC households and highest for MCL households in the pre-harvest season.
Table 19: Distribution of Households by Food Security Status by Farming Systems in 2014

<table>
<thead>
<tr>
<th>HFIAP status</th>
<th>Farming season</th>
<th>Farming systems</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>SFC (n=123)</td>
<td>MFC (n=159)</td>
<td>CC (n=111)</td>
<td>MCL (n=113)</td>
<td></td>
</tr>
<tr>
<td>Food Secure (%)</td>
<td>Pre-harvest</td>
<td>19.5</td>
<td>18.2</td>
<td>18.9</td>
<td>9.7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Post-harvest</td>
<td>39.8</td>
<td>49.7</td>
<td>54.1</td>
<td>63.7</td>
<td></td>
</tr>
<tr>
<td>Mildly Food Insecure Access (%)</td>
<td>Pre-harvest</td>
<td>20.3</td>
<td>14.5</td>
<td>18.9</td>
<td>5.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Post-harvest</td>
<td>27.6</td>
<td>14.5</td>
<td>13.5</td>
<td>14.2</td>
<td></td>
</tr>
<tr>
<td>Moderately Food Insecure Access (%)</td>
<td>Pre-harvest</td>
<td>32.5</td>
<td>27.7</td>
<td>28.8</td>
<td>46.9</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Post-harvest</td>
<td>27.6</td>
<td>28.9</td>
<td>27.9</td>
<td>20.4</td>
<td></td>
</tr>
<tr>
<td>Severely Food Insecure Access (%)</td>
<td>Pre-harvest</td>
<td>27.6</td>
<td>39.6</td>
<td>33.3</td>
<td>38.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Post-harvest</td>
<td>4.9</td>
<td>6.9</td>
<td>4.5</td>
<td>1.8</td>
<td></td>
</tr>
</tbody>
</table>


The change in the proportions of households, which reported being either food secure or severely food insecure in the post-harvest season, was smallest for the SFC households and largest for the MCL households. The proportion of food secure households increased by 20% for SFC households, 32% for MFC households, 35% for CC households and 54% for MCL households in the post-harvest season. Likewise, the proportion of severely food insecure households decreased by 23% for SFC households, 33% for MFC households, 29% for CC households and by 36% for MCL households in the post-harvest season.

The integration of both crop cultivation and livestock keeping contributes to both farm income and household nutrition through consumption of milk and meat (Ajeigbe et al., 2010; Mayanja et al., 2015). The question that arises, therefore, is: Why is it that MCL households, which had the highest incomes of all the four farming systems, experienced the highest prevalence of food insecurity in the pre-harvest season? There are several factors contributing to this situation: firstly, MCL households tend to farm on the more fragile and low productive land, resulting in lower yields per unit area. As the 2013 farming season was characterised by low yield, MCL households were likely more affected than others. Secondly, MCL households had the lowest levels of off-farm income (12%) and, therefore, household food security was more dependent on seasonal farm incomes. The fact that MCL households experienced the highest levels of food
insecurity in the pre-harvest season and the lowest levels in the post-harvest season suggests poor access to cash and reserves for these households in the pre-harvest/hungry season. However, one concern could be why MCL households did not save the income generated from farming and use it in the lean season (pre-harvest) to buffer the effects of hunger. Part of the answer could be that MCL households had the largest household sizes, while a large household size in MCL was important for providing labour for both livestock keeping and cropping activities, it could be associated with high food insecurity levels if there were only a few people farming to feed the entire household. Thus, although MCL households had the highest overall income, such income was seasonal and it is possible that it was depleted in just a few months after the harvest period.

Another concern is why MCL households did not sell livestock rather than enduring hunger. Part of the answer could be attributed to the existing gender inequality in various aspects of livelihoods in rural areas, including the asymmetries in ownership, control and access to assets, such as livestock. Previous research in Tanzania has shown that while women are primarily responsible for ensuring the availability of food for the household, they are disadvantaged in terms of asset ownership. Njuki et al. (2011) found that women were more likely to own small ruminants and poultry than cattle and their market participation was limited to the sale of milk, chicken and eggs, whereas the sale of sheep, goats and cattle was dominated by men. Likewise, animals such as cattle have cultural value (mainly considered as expression of wealth and status) among many traditional livestock keepers and are less likely to be sold under many circumstances (Mlekwa, 1996).

Households with less diversified cropping patterns which include cash crop(s) and/or food crop(s) have been found to generate smaller income and are more vulnerable to food insecurity (Ali, 2010). The question that arises is: Why were SFC households, which generated the lowest overall income, the least vulnerable to food insecurity during the lean season (pre-harvest) and experienced the smallest change in food security status in the post-harvest season? Some of the answers to this question lie in the role of household size and off-farm income. Firstly, the SFC households had the smallest household size (5 persons) of all the four farming systems and, therefore, it was
likely that household food production closely matched household food demands. Secondly, the SFC households had the highest dependency on off-farm income (64% of total income) and, therefore, were less likely to be affected by seasonal availability of farm income. Fan and Chan-Kang (2005) assert that expanding to off-farm employment is considered an important aspect of poverty alleviation. Thirdly, the majority (88%) of the SFC households were found in Mvomero, a district likely to offer more off-farm income opportunities all the year round because of its proximity to the main roads and the major town of Morogoro. Thus, although SFC households had the lowest overall income of all the four farming systems, access to such income was likely distributed all the year round; therefore, these households did not feel the same pressure in the pre-harvest season as others, which generated most of their income from seasonal farm sources.

5.6.1.2 Households Characteristics by Food Insecurity Prevalence Categories

It is useful to explore the characteristics of households under different HFIAP categories to have better understanding of the variation in food security status across different farming systems. Table 20 shows that female-headed households were more likely to be severely food insecure in the pre-harvest season compared to male-headed households. Of all 105 female-headed households, only 11.4% were food secure, 12.4% were mildly food insecure while the majority were either moderately food insecure (31.4%) or severely food insecure (44.8%). Other studies have shown that women in most areas of work are lower income earners, have fewer assets and limited access to other productive resources (e.g. land and livestock) and have limited access to off-farm paid jobs that are more compatible with their domestic responsibilities (Buvinic and Gupta, 1997; Gebru and Beyene, 2012; Jayamohan and Kitesa, 2014).
Table 20: Household Characteristics by Household Food Insecurity Access Prevalence Status (Pre-Harvest Season)

<table>
<thead>
<tr>
<th>Household Characteristics</th>
<th>Food Secure</th>
<th>Mildly Food Insecure Access</th>
<th>Moderately Food Insecure Access</th>
<th>Severely Food Insecure Access</th>
</tr>
</thead>
<tbody>
<tr>
<td>A: Percentage distribution of households for different variables</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% of female headed households (n=105)</td>
<td>11.4</td>
<td>12.4</td>
<td>31.4</td>
<td>44.8</td>
</tr>
<tr>
<td>% of male headed households (n=401)</td>
<td>18.2</td>
<td>15.5</td>
<td>33.9</td>
<td>32.4</td>
</tr>
<tr>
<td>% of households renting entire land (n=160)</td>
<td>18.1</td>
<td>16.3</td>
<td>30.0</td>
<td>35.6</td>
</tr>
<tr>
<td>% of households owning land (n=346)</td>
<td>16.2</td>
<td>14.2</td>
<td>35.0</td>
<td>34.7</td>
</tr>
<tr>
<td>B: Means for different variables</td>
<td>n=85</td>
<td>n=75</td>
<td>n=169</td>
<td>n=177</td>
</tr>
<tr>
<td>Age of the household head</td>
<td>43.0</td>
<td>42.4</td>
<td>46.0</td>
<td>46.4</td>
</tr>
<tr>
<td>Dependence ratio</td>
<td>116.7</td>
<td>133.5</td>
<td>128.7</td>
<td>150.3</td>
</tr>
<tr>
<td>Household Size (number of members)</td>
<td>5.4</td>
<td>5.8</td>
<td>7.1</td>
<td>7.2</td>
</tr>
<tr>
<td>Education level of the household head (years in school)</td>
<td>5.5</td>
<td>5.4</td>
<td>5.0</td>
<td>4.6</td>
</tr>
<tr>
<td>Total land holding per household (acres)</td>
<td>29.5</td>
<td>24.7</td>
<td>15.0</td>
<td>12.1</td>
</tr>
<tr>
<td>Distance to nearest market (minutes)</td>
<td>26.1</td>
<td>44.3</td>
<td>40.3</td>
<td>54.6</td>
</tr>
<tr>
<td>Household income (millions)</td>
<td>4.6</td>
<td>4.0</td>
<td>2.5</td>
<td>1.5</td>
</tr>
<tr>
<td>Proportion of household income generated from farm sources</td>
<td>49.3</td>
<td>50.4</td>
<td>73.8</td>
<td>80.9</td>
</tr>
<tr>
<td>Proportion of household income generated from off-farm sources</td>
<td>50.7</td>
<td>49.6</td>
<td>26.2</td>
<td>19.1</td>
</tr>
</tbody>
</table>


The average age of the heads of the household in food secure category and mildly food insecure categories were 43.0 years and 42.4 years, respectively (Table 20). The average age of the heads of the household in moderately food insecure and severely food insecure categories were 46.0 and 46.4 years, respectively. This implies that a young and energetic head of the household was more likely to be food secure because he/she was able to cultivate land intensively and produce more food compared to an older head of the household. Likewise, it is likely that younger heads of the households were more likely to engage with off-farm jobs and generate income, which could be used to access food from different sources. According to Babatunde et al. (2007), the age of the household head has impact on his or her labour supply for food production.

Table 20 shows that the most food secure categories, had the smallest (116.7) age dependence ratio while the least food secure households had highest (150.3), implying that, an increase in the number of dependants in the household: increases the burden to
economically active members of the household; increases the food requirement of households; and reduces the probability of household staying food secure. These findings are consistent with other studies which revealed that high dependency ratio is positively associated with an increase in both household poverty and food insecurity (Etim and Solomon, 2010; Ojogho, 2010; Orewa and Iyangbe, 2010). Table 20 indicates further that, food secure category had the smallest household size while the severely food insecure category had the biggest. It is possible that bigger household size, together with higher age dependency ratio resulted to an increased demand for food that could not be matched with existing food supply during the pre-harvest season. The relationship between bigger household size and food insecurity was also highlighted during the FGDs in Kishapu:

Poor households have very big families, they cannot work to earn enough and feed their families; they don't have good house made up of corrugated iron sheets. A rich person can sell up to five cattle and manage to buy corrugated iron sheets

The number of years of schooling of the heads of household under the food secure category was largest (5.5), and it decreased as you move to categories with severely food insecure conditions (Table 20). This implies that, the more household head is educated, the more he/she stands a better chance of keeping his/her household food secure. Other studies have indicated that an increase in number of years of schooling is associated with an individual’s chance to: make informed decisions on the use of improved farming practices, which can lead to an increase in income; participate in off-farm income generating activities, which in some areas are considered more profitable than farming; benefit from social networks within and outside their community; access productive resources; and ultimately, improve livelihood and food security status (Edwards-Jones, 2006; Gebru and Beyene, 2012; Rogers, 1995).

Households under the food secure category had the largest total land holding while those in severely food insecure category had the smallest (Table 20); implying that incident of food insecurity tends to be more severe in households with relatively small farm holdings. Table 20 indicates further that households in the study areas were either renting or owning their farmed land. However, regardless of the nature of land ownership (owned or rented), majority of households were either moderately or severely
food insecure. Likewise, the difference in percentages between households renting land and those farming their own land in each category of food insecurity prevalence was less noticeable. It is important to note that land holding stands for a host of factors, including wealth, capacity to bear risk, access to credit and source of income. Asmelash (2014) argues that larger farms are associated with greater wealth and income and, therefore, increased availability of capital, which in turn, increases the probability that a household will invest in purchases of farm inputs and agricultural extension services, and ultimately, an increase in food production and food security status.

Households under the food secure category were more likely to be closer to the markets than for severely food insecure households (Table 20). It is possible that accessibility to market infrastructure was likely to lower transaction cost associated with: farm production, generating off-farm income, accessing food available at the market, and therefore, boosting household security status. This finding is consistent with those of other scholars who noted that a household, which is better integrated into the market system, is more likely to avoid the impact of food shocks, in particular, in the lean seasons (Gebru and Beyene, 2012; Sichoongwe et al., 2014).

As would be expected, household under the food secure category had the largest income (4.6 milion), and it decreased as you move to categories with severely food insecure conditions (Table 20). Moreover, households under the more food secure categories (food secure and mildly food insecure) generated almost half of their income from off-farm sources while those under more food insecure categories (moderately food insecure and severely food insecure) generated majority of their income from farm sources (Table 20). This implies that households with high dependence on off-farm income were less likely to be affected by seasonal availability of farm income. As discussed earlier in Section 5.6.1.1, less reliance on farming income tend to make household better-off than those specializing in farming activities (Davis et al., 2014; Ellis and Mdoe, 2003).
5.6.2 Household Dietary Diversity Score

While statistically significant (p < 0.001), the overall difference in mean household dietary diversity scores (HDDS) between the farming seasons was relatively small. The diversity of foodstuffs consumed in pre- and post-harvest seasons differed only slightly among the four farming systems (Figure 26). The difference between farming systems was statistically significant in the pre-harvest season mainly associated with SFC and MFC households (p = 0.027). The difference was also significant in the post-harvest season mainly associated with SFC and MFC households (p = 0.031), and MFC and MCL households (p = 0.045). The change in diversity of food consumed in pre- and post-harvest seasons was significant for CC households (p = 0.048) and MCL households (p = 0.001). Several authors suggest a positive relationship between household income and dietary diversity, meaning that an increase in household income is likely to improve the household dietary diversity (Pollack, 2001; Rashid et al., 2011; Ruel, 2002).

In this study it was found that, while MCL households had the highest overall incomes, they had lower dietary diversity compared to SFC and CC households. In addition, from the perspective that food security (dietary diversity) is achieved when ‘growing everything you eat and eating everything you grow’ (Boonleaing et al., 2014; Taruvinga et al., 2013), it was expected that MCL and MFC households would have the highest dietary diversity, but this was not the case. The question arises is; Why is it that MCL and MFC households did not have the highest dietary diversity? Part of the answer to this question could be associated with three possible explanations, namely, people’s cultural behaviour as it relates to foodstuffs consumed; and the role of both production diversity and market access on household dietary diversity. These factors discussed as follows.

Firstly, the relatively small change in dietary diversity between farming systems and across farming seasons suggests that the types of foods consumed were likely to be associated with the food culture/dietary habits of people in the study area, rather than with food availability. According to Gittelsohn and Vastine (2003), every cultural setting has its own conception of what is considered as food, and this influences
decision-making about selection, preparation, serving and consumption of food. This conception is considered as something normative that can be passed from one generation to another and plays a part in influencing both individual and household eating behaviours. Keding et al. (2012) and Lyana and Manimbulu (2014) also highlighted this relationship between farming and food culture. Likewise, Kishapu and Mvomero are culturally diverse Districts. Mvomero District (where the majority of SFC households were located) has relatively diverse ethnic groups, including the Luguru, Kaguru, Nguu and Zigua, while Kishapu (where most of the MCL and MFC were found) is less multicultural and the major ethnic group is Sukuma. The cultural difference between the two districts coupled with proximity to main roads and major urban centres was likely to offer more incentives for diverse diet amongst the households in Mvomero District.

Secondly, it is important to explore the role of production diversity on household dietary diversity. A study by Sibhatu et al. (2015), have indicated that farm production diversity is positively associated with dietary diversity, but in the current study, this relationship appears not to be holding. Households practicing the least diverse farming system, such as SFC, had a relatively greater dietary diversity. As indicated earlier in Section 5.2, 88% of SFC households were found in Mvomero, a district with close proximity to main roads and urban centres and, therefore, greater accessibility to market and off-farm income. It is possible that, SFC households complemented their farm income with off-farm income when there was a decline in income generated from farming. As a result, cash earnings from off-farm activities increased the households’ ability to buy diverse foods from the market. According to Sibhatu et al. (2015), this effect is much larger than the effect from increasing farm production diversity. Although accessibility to markets and, therefore, off farm income was likely to be associated with increased dietary diversity, the pending question would be, why was the difference in diet diversity very small when compared to other farming groups? Part of the answer could be associated with the type of food outlets available in Mvomero. It is possible that SFC households were buying foods, which were associated with unhealthy dietary diversification, for instance, through increased consumption of fats, sweets, or sugary beverages. The lesson learned here is that, lower production diversity, as it is the case
for SFC households, is not necessarily associated with lower household dietary diversity, if household can access diverse types of foods from the market.

**Figure 26: Household Dietary Diversity Scores by Farming Systems in Pre-harvest and Post-harvest seasons**  
*Source: AgriDiet Study Household Survey: Pre- and Post-Harvest (2014).*

Household diets across the farming systems in both farming seasons were mainly based on five food groups, namely cereals, vegetables, oils/fats, sweets (which includes sugar, honey, sweetened soda or sugary foods), and legumes/nuts/seeds (Table 21). There was an increase in consumption of legumes, fruits and fish across all four farming systems in the post-harvest season. The average prices for a kilogram of beans (TZS 1,440), a mango (TZS 490) and a piece of banana (TZS 130) in the pre-harvest season increased to about TZS 1,630, TZS 540 and TZS 170, respectively, in the post-harvest season. The increase in prices of the legumes and fruits in the post-harvest season implies that the increase in consumption of these foods is likely to be associated with the combined effects of improved household incomes, market prices that enabled access and seasonal

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availability of foods. The average price of sardine, a common fish type consumed in the area was TZS 6,000 a kilogram in the pre-harvest season and decreased to TZS 3,500 in the post-harvest season. The high price of sardine in the pre-harvest season could be associated with low availability. The key informant from the Tanzania Fisheries Department in Lake Victoria Zone, the main source of sardine for most parts of Tanzania indicated that there was low availability, and hence, high price of sardines during the rainy season, which is normally between October and April. It is also possible that high price of sardines during the pre-harvest season was associated with high demand which could not be met with available market stock. The findings of this study are supported by other studies in Mozambique and Uganda, which revealed that the consumption of legumes and animal source foods was higher in the harvest season, which is closely related to post-harvest in terms of food availability/affordability, than in the planting season which is closely related to the pre-harvest in terms of food availability/affordability (Handa and Mlay, 2006; M. Mayanja et al., 2015).

Table 21: Distribution of Farm Households by Food Groups Consumed by Farming System in Pre- and Post-harvest seasons

<table>
<thead>
<tr>
<th>Food groups</th>
<th>SFC (n=123)</th>
<th>MFC (n=158)</th>
<th>CC (n=112)</th>
<th>MCL (n=113)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre-harvest (%)</td>
<td>Post-harvest</td>
<td>Pre-harvest (%)</td>
<td>Post-harvest</td>
</tr>
<tr>
<td>Vegetable</td>
<td>94</td>
<td>93</td>
<td>96</td>
<td>95</td>
</tr>
<tr>
<td>Fruits</td>
<td>6</td>
<td>17</td>
<td>3</td>
<td>16</td>
</tr>
<tr>
<td>Meat</td>
<td>6</td>
<td>8</td>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td>Oils and fats</td>
<td>83</td>
<td>74</td>
<td>58</td>
<td>56</td>
</tr>
<tr>
<td>Cereals</td>
<td>100</td>
<td>100</td>
<td>99</td>
<td>99</td>
</tr>
<tr>
<td>White tubers and roots</td>
<td>7</td>
<td>9</td>
<td>14</td>
<td>5</td>
</tr>
<tr>
<td>Eggs</td>
<td>0</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Fish</td>
<td>18</td>
<td>29</td>
<td>16</td>
<td>19</td>
</tr>
<tr>
<td>Legumes nuts and seeds</td>
<td>48</td>
<td>61</td>
<td>45</td>
<td>67</td>
</tr>
<tr>
<td>Milk and Milk products</td>
<td>7</td>
<td>5</td>
<td>11</td>
<td>5</td>
</tr>
<tr>
<td>Sweets</td>
<td>77</td>
<td>69</td>
<td>54</td>
<td>52</td>
</tr>
</tbody>
</table>


Table 21 indicates further that there was a decline in consumption of milk and milk products and roots/tubers in the post-harvest season. Greater consumption of milk and milk products during the pre-harvest season was attributed to households having poor access to food at the time. Therefore, milk was retained for home consumption. An improvement in availability and access to other foods during the post-harvest season
meant that households were more likely to release milk and milk products to the market and/or leave it to calves. Likewise, a decline in consumption of roots and tubers during the post-harvest season was most likely because these foods were mainly stored for use during the lean (pre-harvest) season. This is in line with research by Handa and Mlay (2006) on food consumption patterns, seasonality and market access in Mozambique, which revealed increased consumption of root and tuber crop products during the lean season.

Table 2 indicates further that there was very low consumption of eggs across all farming groups and in all seasons. Information from focus group discussion indicates that, people did not want to consume eggs because they perceived it as destroying the breeding stock (chicks). One FGD participant argued ‘...I cannot eat eggs, these are just chicks’. Just like eggs, the proportion of households consuming meat in all farming systems and in all farming seasons were very small, implying that poor consumption of meat left many households at possible risk of inadequate iron and other nutrients. One would expect to have many MCL households reporting meat consumption, but just like households in other farming systems, they hardly consume meat. The poor consumption of meat among MCL households could be associated to the tendency of livestock keeping households to view livestock as having value in the realms of wealth status, savings, social integration and buffer/insurance, rather than consumption (Mayanja et al., 2015). However, a personal communication with key informants in Kishapu revealed that livestock keeping households tended to slaughter small stock for home consumption on irregular basis and during the special occasions meat consumption is common, a situation which may not have been captured during the 24 hour dietary recalls. This information was also revealed during the focus group discussions:

...goat is an animal slaughtered whenever there is a guest. Chicken is used as food for the household.

...sheep and goats can help to prepare for cultivation, maybe, you have large farm, you can call some people and they help with farming...

...you can slaughter one goat to feed Ukombakomba during the farming season.
The consumption of sweets has long been in scrutiny for its association with chronic diseases worldwide (Drewnowski et al., 2012). Despite this fact, over 50% of households across each farming system reported to have consumed sweets over 24-hour recall period and there was little seasonal variation. The high consumption of sweets in this study can be accounted by the frequency of tea or porridge consumption, which usually contain sugar and was frequently consumed by many households in the study area. This finding is consistence with FAO (2004) study in Somalia, which also found a very high sugar consumption as people usually added sugar in their meals.

5.7. Summary

This chapter highlighted the value in understanding the farming systems that exist in rural areas in order to better understand household food security status. A classification of farming systems as offered by Mnenwa and Maliti (2010) in Tanzania is a useful and a broad starting point. However, it does not account for the strategies, which increasingly define rural livelihoods. The nature of the farming system evolves depending on: which crop(s) is/ are grown; the degree of dependence and market orientation a household has for particular crop(s); the livestock units owned; and extent of engagement with off-farm work, These are all examples of factors to be considered by an evolving classification scheme. This chapter has indicated that an understanding of the characteristics of the main farming systems employed can facilitate addressing the problems of food insecurity in Tanzania.
CHAPTER SIX: FACTORS ASSOCIATED WITH FARM HOUSEHOLD
CHOICE OF FARMING SYSTEMS

6.1 Overview

As farming decisions and actions made by a farm household are closely associated with its food security status (Ellis, 2000), understanding how farm households make decisions facilitates the matching of agricultural extension services to the needs of the farm households. However, the diverse farming environment means that the outcome of household farming decisions are diverse and are associated with a variety of factors which may range from farm/natural environment characteristics, farmer/household characteristics and institutional/farming context characteristics (see Section 2.9). In turn, these factors are associated with farm household production and resource allocation decisions; in particular, the choice of farming system. This chapter, therefore, sets out to further the understanding of factors associated with farm household decision-making processes with regard to the choice of farming systems. In this chapter, the Expected Utility Theory and the Theory of Planned Behaviour (discussed in Section 2.8) are combined to examine farm household decision-making processes. The study used both quantitative and qualitative approaches. The first part of this chapter discusses the main characteristics of households followed by discussion of the main findings on the factors associated with farm household decisions about farming systems in the two study districts.

6.2 Farm Households by Study Areas

Table 22 presents the main household characteristics in the two districts. Unsurprisingly, a high proportion of households (39%) in the relatively remote semi-arid Kishapu District practised a Mixed Crop and Livestock farming system in contrast to the higher rainfall and less remote area of Mvomero District where relatively many households (43%) practised a Single Food Crop farming system. The distribution of households across the farming systems in the two districts can be associated with their natural environment and geographic location. The average household size in Kishapu was larger than Mvomero. Larger households in Kishapu were considered essential for
provision of needed farm labour for both cropping and livestock herding. Kishapu had higher mean age of household heads (47 years) than Mvomero (43 years). The age of the household head is positively associated with farming experience (Bogale and Shimelis, 2009) and, as a farm household acquires more and more experience in farming, it can accumulate more wealth, use better planning, and ultimately improve success in farming. There was a slight difference in education level of household heads between Kishapu and Mvomero.

Table 22: Descriptive Statistics for Variables Included in the MNL Model

<table>
<thead>
<tr>
<th>Variables</th>
<th>Kishapu (n=255)</th>
<th>Mvomero (n=251)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependent variable</td>
<td>Percentage/mean</td>
<td>Percentage/mean</td>
</tr>
<tr>
<td>Farming system of the household (%)</td>
<td>SFC 5.9</td>
<td>43.0</td>
</tr>
<tr>
<td></td>
<td>MFC 35.7</td>
<td>26.7</td>
</tr>
<tr>
<td></td>
<td>CC 19.2</td>
<td>25.1</td>
</tr>
<tr>
<td></td>
<td>MCL 39.2</td>
<td>5.2</td>
</tr>
<tr>
<td>Predictor variables</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average household size (adult equivalent units)</td>
<td>4.6</td>
<td>3.4</td>
</tr>
<tr>
<td>Average age of the household head</td>
<td>47.0</td>
<td>43.1</td>
</tr>
<tr>
<td>Average years of education of the household head (years)</td>
<td>4.9</td>
<td>5.1</td>
</tr>
<tr>
<td>Average farm size per household (acres)</td>
<td>30.3</td>
<td>5.3</td>
</tr>
<tr>
<td>Households with access to off-farm work income (%)</td>
<td>52.5</td>
<td>83.3</td>
</tr>
<tr>
<td>Female headed households (%)</td>
<td>23.1</td>
<td>18.3</td>
</tr>
<tr>
<td>Households with access to credit/input (%)</td>
<td>29.4</td>
<td>43.0</td>
</tr>
<tr>
<td>Households with access to extension services (%)</td>
<td>42.4</td>
<td>52.2</td>
</tr>
<tr>
<td>Households with membership to organisation (%)</td>
<td>19.6</td>
<td>23.9</td>
</tr>
<tr>
<td>Households who owned land (%)</td>
<td>72.9</td>
<td>63.7</td>
</tr>
</tbody>
</table>


In Kishapu, households owned larger farmland than in Mvomero. The bigger household size in Kishapu may be associated with household labour availability and an increased demand for food, therefore prompting cultivation of larger land areas. Likewise, larger farms in Kishapu may be associated with the need for pasture for livestock. On the other hand, the smaller average cultivated land area in Mvomero might be associated with its high agricultural potential, which is characterized by bimodal rains and fertile
agricultural land, thereby making it more susceptible to land grabbing by rich people from major towns of Morogoro and Dar es Salaam, which ultimately resulted in land scarcity. Table 22 indicates further that more households in Mvomero had access to off-farm work income compared to Kishapu. Mvomero is located closer to main roads and major urban centres like Morogoro, which were likely to offer more off-farm income opportunities. Kishapu is a relatively remote and was likely to offer fewer off-farm income opportunities, which could supplement income generated from farm sources. The close proximity to major towns and main road made Mvomero households have better access to credit/input services, extension services, and access to local organisations compared to households in Kishapu. The percentages of female-headed households in all areas were slightly lower than the Tanzania national average (Tanzanian NBS, 2013). A larger percentage of households in Kishapu owned the land they farmed compared to households in Mvomero.

6.3 Factors Associated with Household Farming Choices

The MNL results for both Kishapu and Mvomero showed that the Pearson and Deviance statistics were not statistically significant (p > 0.05), meaning that predicted values were not significantly different from the observed values, and thus the model was a good fit of the data. Table 23 indicates that the variables which had an overall statistically significant contribution (at 5% level) to household choice of farming system in Kishapu were household size, farm size and access to credit and input services, while in Mvomero the variables were farm size, access to off-farm income and household membership in an organisation.
Table 23: Likelihood Ratio Statistics Showing the Overall Contribution of Each Predictor Variable to the Model

<table>
<thead>
<tr>
<th>Effect</th>
<th>Kishapu (n=255)</th>
<th>Mvomero (n=251)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-2 Log Likelihood of Reduced Model</td>
<td>Chi-Square</td>
</tr>
<tr>
<td>Intercept</td>
<td>473.706*</td>
<td>0.000</td>
</tr>
<tr>
<td>Household size (Adult equivalent units)</td>
<td>497.087</td>
<td>23.381***</td>
</tr>
<tr>
<td>Age of the household head</td>
<td>476.499</td>
<td>2.792</td>
</tr>
<tr>
<td>Education of the head</td>
<td>476.024</td>
<td>2.317</td>
</tr>
<tr>
<td>Farm size</td>
<td>509.780</td>
<td>36.074***</td>
</tr>
<tr>
<td>Off-farm income (no access)</td>
<td>474.890</td>
<td>1.184</td>
</tr>
<tr>
<td>Sex of the head (female)</td>
<td>474.698</td>
<td>.992</td>
</tr>
<tr>
<td>Credit and input services (no access)</td>
<td>482.655</td>
<td>8.949***</td>
</tr>
<tr>
<td>Extension services (no access)</td>
<td>476.845</td>
<td>3.138</td>
</tr>
<tr>
<td>Membership in organisation (not a member)</td>
<td>474.620</td>
<td>.914</td>
</tr>
<tr>
<td>Land tenure system (not own land/renting the entire farmland)</td>
<td>476.862</td>
<td>3.155</td>
</tr>
</tbody>
</table>

Note: **significant level = 5%, ***significant level = 1%


6.3.1 Factors Associated with Household Farming Choice in Kishapu

Table 24 shows the parameter estimates for predictor variables on the three categories of farming systems in Kishapu relative to the MCL farming system category. The coefficients of household size and farm size were negatively and statistically significant for SFC, MFC and CC households, which suggests that the odds of choosing any of the three farming systems other than the MCL system increase for those households with smaller household sizes and smaller farm sizes. The results also show that not owning land (relying entirely on rented land) positively and significantly increases the likelihood that a household will choose SFC relative to MCL while this is not the case for MFC and CC systems. The overall implication of these findings is that resource-constrained households, particularly in relation to farm size and land ownership as well as household size were less likely to adopt an MCL farming system. There are two propositions for this: firstly, MCL farming system requires a relatively larger land area
to support both livestock keeping and crop production. The relationship between MCL farming system and larger land area requirement was emphasised during the FGDs and interviews with key informants as indicated in the following quotes:

...we don't have enough pasture for our cattle; that's why we have people migrating to other regions... (Kishapu-FGDs).

Livestock keeping is the main challenge here ... it needs a larger land area for one to be a good livestock keeper (Kishapu - Interview).

These findings are consistent with those of a study on the association between farm sizes and farming systems in Africa by Hassan and Nhachema (2008), which found that larger farm sizes were associated with multiple cropping patterns and/or mixed crop-livestock-keeping activities.

Secondly, MCL farming system is labour demanding; therefore, bigger household size was likely to supply needed labour for both livestock keeping and cropping activities. The association between labour and farming practices was also raised during the FGDs in Kishapu as quoted below.

... we have big families here, sometimes more than 10 members per household. If you do not have enough land to cultivate then you will not be able to feed your household and for that reason, you are poor (Kishapu - FGDs).

Hassan and Nhachema (2008) found that large farming households were likely to engage in diversified farming practices, such as multiple cropping and livestock keeping, whereas smaller households tend to practise only mono-cropping. Similarly, other studies have shown that households with greater number of members are likely to farm larger land areas and conduct critical farming operations at the right time than those with fewer (Boru et al., 2015: Swai et al., 2012).

Except for the SFC farming system category which was practised by just 5.9% of households in Kishapu, access to credit and to input services were statistically and negatively associated with the odds of choosing either MFC or CC over MCL. This implies that households which had no access to credit and input services were more likely to practise MCL farming systems compared to MFC and CC households. MCL households tended to live in relatively remote areas to ensure access to sufficient land
for both pasture and crop production and, consequently, had a harder time accessing the mainly urban-based credit institutions. According to Temu et al. (2013), financial institutions that provide a broad range of financial services, such as credit and savings, are heavily urban biased. The difficulties experienced by farmers in Kishapu in accessing credit and input services were captured in the discussion with key informants as indicated in the following quote:

...if you need money, you have to borrow from shopkeepers in Mhunze town, then you will pay back twice the amount you borrowed... I am poor and cannot seek a bank loan.....there are savings groups here but this is only for members ....agricultural extension officers own their agro-vet shops at Mhunze town; ...and the input prices are very high in those shops; where can you get that money for buying fertilisers or pesticides while there is no food at home? (Kishapu - Interview).

The analysis of FGD transcripts showed that, apart from household size, farm size, land ownership, and access to credit and input services, the psychological constructs were also associated with a household’s choice of farming system. Table 25 indicates that there were 87 statements/quotes associated with the household choice of farming system in Kishapu. These statements were categorised under 12 key themes and further linked to the three key aspects of the Theory of Planned Behaviour discussed in Section 2.8.2 namely attitudes, subjective norms and perceptions. These are discussed in turn.

**Attitudes:** Positive or negative attitudes towards certain crops and/ or livestock types were likely to be associated with the household’s choice of farming system in Kishapu (Table 25). The FGD participants statements nominated food/cash income (n=16) and farming operations (n=10) as the top most important themes, which were repeatedly stated to reflect positive attitudes on certain crops or livestock. Other themes such as buffer against hunger, social values and saving/security also were commonly recognised as positively associated with the choice of farming system in Kishapu. For the identified negative attitudes, the most salient theme was soil/weather (n=6).

**Subjective norms:** The selection of what crops to grow or livestock to keep was likely to be associated with social pressure, which was build around the prevailing subjective norms in Kishapu (Table 25). The farmers considered quotes related to wealth status theme (n=8) as the most salient referents supportive of their choice of certain types of
crops and livestock. Another supportive referent was traditional practice (n=4). Likewise, FGD participants identified some statements related to culture (n=2) and traditional practice (n=2) as unsupportive of their choice of certain farming system in the study area. For instance, while livestock types like cattle and goats were seen as an expression of wealth, poultry (chicken) were considered less valuable and viewed as ‘just like other birds’.

**Perceive behavioural control:** Perceptions around farming practices in Kishapu were mostly associated with both ease of managing the livestock and easy access to good market and better price for the produce (Table 25). The frequently reported theme associated with household choice of crop or livestock to grow was profitable/marketable (n=5). For instance, farmers were replacing cotton with green gram because they considered the latter as more marketable and profitable than the former. Likewise, economic return (n=9) was recognised in various statements as barriers to performing certain forms of farming. For example, the FGD participants reported that young people in Kishapu did not want to engage themselves in agriculture simply because they considered farming as both difficult and unprofitable.
Table 24: MNL Estimates for Factors Associated with Household Farming Choices in Kishapu District

<table>
<thead>
<tr>
<th>Variables</th>
<th>SFC</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Std.</td>
<td>Std.</td>
<td>Std.</td>
<td>Std.</td>
<td>Std.</td>
<td>Std.</td>
<td>Std.</td>
<td>Std.</td>
<td>Std.</td>
<td>Std.</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>Error</td>
<td>Wald</td>
<td>Exp (B)</td>
<td>B</td>
<td>Error</td>
<td>Wald</td>
<td>Exp (B)</td>
<td>B</td>
<td>Error</td>
</tr>
<tr>
<td>Household size (Adult equivalent units)</td>
<td>-.587**</td>
<td>.235</td>
<td>6.231</td>
<td>.556</td>
<td>-.550***</td>
<td>.134</td>
<td>16.881</td>
<td>.577</td>
<td>-.546***</td>
<td>.161</td>
</tr>
<tr>
<td>Age of the household head</td>
<td>.008</td>
<td>.026</td>
<td>.103</td>
<td>1.008</td>
<td>.024</td>
<td>.016</td>
<td>2.303</td>
<td>1.024</td>
<td>.008</td>
<td>.018</td>
</tr>
<tr>
<td>Education of the head</td>
<td>-.147</td>
<td>.109</td>
<td>1.834</td>
<td>.863</td>
<td>-.005</td>
<td>.069</td>
<td>.005</td>
<td>.995</td>
<td>-.007</td>
<td>.079</td>
</tr>
<tr>
<td>Farm size</td>
<td>-.201**</td>
<td>.098</td>
<td>4.177</td>
<td>.818</td>
<td>-.061***</td>
<td>.018</td>
<td>11.607</td>
<td>.941</td>
<td>-.088***</td>
<td>.031</td>
</tr>
<tr>
<td>Off-farm work income (no access)</td>
<td>-.296</td>
<td>.738</td>
<td>.161</td>
<td>.744</td>
<td>-.413</td>
<td>.381</td>
<td>1.175</td>
<td>.662</td>
<td>-.243</td>
<td>.450</td>
</tr>
<tr>
<td>Sex of the head (female)</td>
<td>.392</td>
<td>.746</td>
<td>.276</td>
<td>1.480</td>
<td>-.251</td>
<td>.471</td>
<td>.284</td>
<td>.778</td>
<td>-.148</td>
<td>.548</td>
</tr>
<tr>
<td>Credit and input services (no access)</td>
<td>.450</td>
<td>.904</td>
<td>.247</td>
<td>1.568</td>
<td>-.886**</td>
<td>.437</td>
<td>4.113</td>
<td>.412</td>
<td>-1.094**</td>
<td>.486</td>
</tr>
<tr>
<td>Extension services (no access)</td>
<td>-.107</td>
<td>.669</td>
<td>.026</td>
<td>.899</td>
<td>.571</td>
<td>.378</td>
<td>2.277</td>
<td>1.770</td>
<td>.192</td>
<td>.437</td>
</tr>
<tr>
<td>Membership in organisation (not a member)</td>
<td>.031</td>
<td>.809</td>
<td>.001</td>
<td>1.031</td>
<td>.321</td>
<td>.475</td>
<td>.458</td>
<td>1.379</td>
<td>.483</td>
<td>.570</td>
</tr>
<tr>
<td>Land tenure system (not owning land/ renting the entire farmland)</td>
<td>1.330**</td>
<td>.767</td>
<td>3.004</td>
<td>3.780</td>
<td>.474</td>
<td>.492</td>
<td>.930</td>
<td>1.607</td>
<td>.452</td>
<td>.539</td>
</tr>
</tbody>
</table>

Note: The base category is MCL, **significant level = 5%, ***significant level = 1%

Table 25: Selection of Statements/Quotes from FGDs Indicating Farmers’ Beliefs Regarding Household Choices of Farming System in Kishapu

<table>
<thead>
<tr>
<th>TPB Concept</th>
<th>Themes (frequency)</th>
<th>Example of statements/quotations</th>
</tr>
</thead>
</table>
| **Attitudes**        | Positive          | Food and cash income (n=16) "...chicken is mainly used for domestic consumption’; ‘...most households will start consuming sorghum when there is food shortage’. ‘Many people here grow green gram ...it pays more than cotton’. ‘So the milking cows will help, ...in raising income as some of it is sold and supply milk for children to drink at our homes’. Farming operations (n=10) ‘Oxen is used for farming, if you don’t have one ... you will suffer food shortage because you cannot cultivate big area’. ‘You can slaughter one goat to feed ‘Ukombakomba” during the farming season’. Social values (n=4) ‘If you don’t have cattle you can’t pay the bride price, especially if you have male children’. ‘...a goat is slaughtered to honour an important guest’. Soil/weather (n=10) ‘...Sorghum, it endures drought more than maize’. ‘Sorghum is very resistant to drought, had it not been because of bird attack, we would have harvested much’. Buffer against hunger (n=5) ‘We grow sorghum as a buffer against hunger. Most household will start consuming sorghum during the period of food shortage like December, January and February’. Savings/security (n=4) ‘That’s why, when you visit different places, people have cattle, because that is where u save your money, when you are faced with a problem, that is where you get help’. ‘You can sell cattle and have some cash to solve your problems’. Negative Soil and weather (n=6) ‘We don’t grow beans here...They don’t grow well because of the soil type.....they are attacked by pests’. ‘You can’t grow sorghum in a land suitable for cotton or maize. The type of land determines what you grow’. Medicinal value (n=2) ‘There are other people keeping some animals for performing witchcrafts’. Subjective norm Supportive Traditional practice (n=4) ‘...it is our custom in Sukuma tribe to keep livestock’. ‘Farming is our custom in Sukuma...’. Wealth status (n=8) ‘The first thing you see when you visit a rich household is cattle and goat’. ‘Well, you will see this family has a poor life ... because they don’t own any property like animals, has no business also has no land to support their farming activities’. Unsupportive Traditional practice (n=2) ‘...you can’t keep pigs while your parents have not done so’. Culture (n=2) ‘Chicken is just a bird and not a livestock in our culture; you see, women can slaughter chicken and cook it without getting permission from husband’. Perceptions Easiness Profitable/marketable (n=5) ‘For long time we have depended on cotton as our cash crop but now, nearly each household grow green gram. You get more than TZS1000 if you sell one kg of green gram and only TZS 650 for one kg of cotton’. Hardness Economic Return (n=9) ‘Young men are obsessed with doing business rather than being farmers. So they are really struggling’. ‘When they evaluate the type of agriculture they are involved in, they see no fruitful returns’. ‘They have been farming for a long time but cannot see the benefits’. ‘...and they see no profits out of it. Sometimes rains are not enough to foster good harvest’. ‘... Youths do not want to engage themselves in agriculture. For them it is much better to be in business since there is no gain from agriculture. For instance one can make only eighty thousand in a year from cotton growing’. Note: ‘n’ = number of statements/quotes related to the theme; ‘TPB’ = Theory of Planned Behavior.
6.3.2 Factors Associated with Household Farming Choices in Mvomero

Table 26 shows the parameter estimates for predictor variables on the three categories of farming systems in Mvomero relative to SFC farming category. The MNL results for Mvomero suggest that household choice of farming system was associated with the availability of resources such as land, off-farm income, and social capital (expressed as ‘membership in organisations’). The coefficient of farm size was positively and statistically significant (P < 0.05) for all three farming systems (MFC, CC and MCL), implying that the odd of choosing any of the three farming systems relative to SFC rises for those households with bigger farm size. This finding suggests that smaller farm sizes were likely to be the reason why most households in Mvomero practised SFC farming system (Table 22).

The role of farm size in household decision-making was highlighted repeatedly during the FGDs and interviews with key informants in Mvomero. There were strong perceptions among the participants that the available land does not meet the village population farming demands, and it was expected to remain so in the future. This is reflected in the following quotes:

...the land which is available today does not meet our current population demands. Our young people need land; they want to be self-reliant but we don't have that land (Mvomero-Key informant).

...land will be scarce in the coming few years because most areas in this village are already occupied (Mvomero-FGDs).

However, there were perceptions that shortage of farming land in Mvomero was associated with either misconduct of some of the village officials, failure to follow land use plans, and/or giving land ownership rights to only few individuals while neglecting the village majority. These perceptions are illustrated by the quotes below:

...we don't have land shortage in this village. What exists here is corruption. You find very few people with up to 100 acres and others owning even more (Mvomero-FGDs).

...we have village land use plan which set aside areas for crop production and livestock keeping activities. Nevertheless, people do not follow this plan ... I want
The discussion conducted with the key informants suggests that as time goes, household and clan lands are being fragmented into small pieces to accommodate the newly born individuals in each generation. As a result, the sizes of land owned by households have been decreasing with an increase in population size. One of the key informants maintained that ‘as number of people per household or clan increases, the size of land also decreases’. According to another key informant in Mvomero, the continued shrinking of the household land size has lead to over-exploitation of fields and, as a result, there is consistent rotation of cultivation on the same fields, erosion of soil nutrients, reduced crop productivity and reduced household food availability. This finding agrees with a study by Lyatuu (2013) on the effect of land access on livelihood strategies in Mvomero Ward, which showed that repeated fragmentation and land market, soil erosion and overexploitation have reduced the size and value of land available at household level. As indicated earlier in Section 2.5, an increase in population escalates the competition for land and other resources between different user groups such as wealthy urban based elites, smallholder rural communities, state/national governments that have varying interests on rural land and, foreign companies attracted to land in rural areas (Jayne et al., 2014).

The difficulties experienced by farm households in Mvomero in accessing agricultural land have made them prefer certain farming practices. The findings from FGDs indicated that farm households were less likely to go for farming systems that require large amounts of land, such as mixed crop-livestock farming system. Even farmers who tended to integrate livestock with crop production in their farming tended to go for livestock types, such as poultry, which are more manageable within a small piece of land. The perceptions of farmers regarding the choice of livestock type that can be integrated with crop production are illustrated in the following quotes:

Livestock keeping is the main challenge here since it needs a larger land area for one to be a good livestock keeper (Mvomero-FGDs).

Unlike goats and cattle, it is cheaper to keep chicken and ducks. Goats and cattle require big grazing areas (Mvomero-FGDs).
The coefficient of households with no access to off-farm income was positive and statistically significant for MCL system (which was only practised by just 5.2% of households) but not for MFC and CC households, implying that households which had no access to off-farm work, when compared to those with such access, were more likely to choose MCL farming systems over SFC. There are two propositions for this: first, MCL households tended to have bigger farm sizes, implying that households participated in off-farm activities for ‘push reasons’ such as shortage of farmland to support their livelihoods. Second, it is possible that the combination of both livestock keeping and cropping activities increased the labour efficiency of the households, thereby resulting in no surplus labour for off-farm work. Thus, while cropping is characterized by peak labour demands, the steady work needed for livestock management activities can spread labour requirements more evenly during the year. The coefficient of no membership in organisations was negatively and statistically associated with MCL farming system, implying that households without any membership in local organisations were more likely to choose SFC over MCL farming system when compared to those who belong to such organisations. The MCL households tend to rely on its social network, commonly known as ‘ukombakomba’\(^\text{14}\), to support the major farming operations, such as weeding and harvesting, because of the relatively bigger farmland.

Besides the findings from the household survey, the analysis of FGDs transcript for Mvomero showed that there were 68 statements associated with household choice of farming systems (Table 27). These statements were categorised into 12 themes and further organised under the three key aspects of the Theory of Planned Behaviour (TPB) namely: attitudes towards the behaviour; subjective norms; and perceptions. The findings related to the three aspects of TPB are outlined in turn and details are presented in Table 27.

**Attitudes**: Positive or negative attitudes towards certain crops and/ or livestock types were likely to be associated with the household’s choice of farming system in

\(^{14}\) ‘Ukombakomba’ is local name for labour sharing groups as commonly practiced by households in the study area.
Mvomero (Table 27). The most frequently identified theme with statements representing positive attitudes towards the choice of crop or livestocks in Mvomero was food/cash income (n= 15). The remaining positives statements were organised into three themes namely social values, savings/security, and medicinal value. Soil/weather was discussed and has both a positive (n=6) and negative (n=4) qualities in influencing household choice of crops or livestock types. Other negative statements associated with household choice of farming systems were organised under two themes namely profitable/marketable (n=4) and agricultural advices (n=3).

**Subjective norms:** The selection of what crops to grow or livestock to keep was likely to be affected by social pressure, which was built around the prevailing norms in Mvomero (Table 27). The participants considered traditional practice (n=7) as the most salient referents supportive of their performing certain form of farming. Another supportive referent was wealth status (n=3). For instance, the households keeping cattle were considered as being wealthier than those who did not keep. Likewise, FGD participants mentioned the statements which indicated that culture (n=8) was unsupportive of their performing certain forms of farming. For instance, participants across all FGDs in Mvomero had strong beliefs that cultivation of bambara nuts will make dangerous animals like lions to invade their villages. Likewise, farmers who did not own cattle believed that cattle belonged to Maasai people, therefore, any attempt to raise such animals was like declaring war on the Maasai people.

**Perceptions:** Perceptions around farming practices in Mvomero were mostly associated with both ease of managing the livestock or crop type and easy access to market for the produce (Table 27). The most frequently reported theme which represents the easiness of performing certain form of farming was profitable/marketable (n=5). For instance, it was highlighted that farmers in Mvomero grew crops such as sunflower, maize and rice because they perceived them as having good market demand. The most frequently nominated theme indicating the hardness of performing some certain form of farming in Mvomero was economic return (n=4).
**Table 26: MNL Estimates for Factors Associated with Farming Choices in Mvomero District**

<table>
<thead>
<tr>
<th>Variable</th>
<th>MFC B</th>
<th>Std. Error</th>
<th>Wald</th>
<th>Exp(B)</th>
<th>MCL B</th>
<th>Std. Error</th>
<th>Wald</th>
<th>Exp(B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Household size (Adult equivalent units)</td>
<td>.008</td>
<td>.155</td>
<td>.003</td>
<td>1.008</td>
<td>.014</td>
<td>.159</td>
<td>.008</td>
<td>.986</td>
</tr>
<tr>
<td>Age of the household head</td>
<td>.020</td>
<td>.013</td>
<td>2.335</td>
<td>1.020</td>
<td>.013</td>
<td>.014</td>
<td>.870</td>
<td>.987</td>
</tr>
<tr>
<td>Education of the head</td>
<td>.049</td>
<td>.054</td>
<td>.817</td>
<td>1.050</td>
<td>.008</td>
<td>.054</td>
<td>.020</td>
<td>.992</td>
</tr>
<tr>
<td>Farm size</td>
<td>.358***</td>
<td>.095</td>
<td>14.123</td>
<td>1.431</td>
<td>.303***</td>
<td>.096</td>
<td>10.001</td>
<td>1.354</td>
</tr>
<tr>
<td>Off-farm work income (no access)</td>
<td>-.678</td>
<td>.486</td>
<td>1.945</td>
<td>.507</td>
<td>-.628</td>
<td>.523</td>
<td>1.442</td>
<td>.534</td>
</tr>
<tr>
<td>Sex of the head (female)</td>
<td>.263</td>
<td>.433</td>
<td>.368</td>
<td>1.300</td>
<td>-.019</td>
<td>.448</td>
<td>.002</td>
<td>.981</td>
</tr>
<tr>
<td>Credit and input services (no access)</td>
<td>-.080</td>
<td>.352</td>
<td>.051</td>
<td>.923</td>
<td>.035</td>
<td>.353</td>
<td>.010</td>
<td>1.036</td>
</tr>
<tr>
<td>Extension services (no access)</td>
<td>.029</td>
<td>.336</td>
<td>.007</td>
<td>1.029</td>
<td>.444</td>
<td>.341</td>
<td>1.694</td>
<td>1.559</td>
</tr>
<tr>
<td>Membership in organisation (not a member)</td>
<td>.690</td>
<td>.479</td>
<td>2.075</td>
<td>1.993</td>
<td>-.690</td>
<td>.412</td>
<td>2.804</td>
<td>.502</td>
</tr>
<tr>
<td>Land tenure system (not own land/ renting the entire farmland)</td>
<td>.805</td>
<td>.421</td>
<td>3.667</td>
<td>2.238</td>
<td>-.006</td>
<td>.413</td>
<td>.000</td>
<td>.994</td>
</tr>
</tbody>
</table>

Note: The base category is SFC, **significant level = 5%, ***significant level = 1%

*Source: Agridiet Study Household Survey: Pre-Harvest (2014).*
<table>
<thead>
<tr>
<th>TPB Concept</th>
<th>Themes (frequency)</th>
<th>Example of statements/quotations</th>
</tr>
</thead>
</table>
| Attitudes         | Positive Food/cash income (n=15) | ‘Frankly speaking, ugali [maize meal] does not cost our income; we depend on what we farm. ’
|                   |                         | ‘Today, local brew is made from maize and many people like this…’. ’
|                   |                         | ‘Rice, sesame and sunflower are mainly grown for cash’. ’
|                   |                         | ‘Most of us here have chicken … we keep them as food and sometimes can be sold to solve some family problems’. ’
|                   |                         | ‘If you are struggling with life, you will be given a herd of cattle to look after it. You are then allowed to take all the milk for your own home consumption and cash earning’. ’
|                   | Social values (n=2)     | ‘…we use it to pay the bride price, if you don’t have livestock it will be difficult for your son to get married’. ’
|                   |                         | ‘…goat is an animal slaughtered whenever there is a guest. Chicken is used as food for the household’. ’
|                   | Soil/weather (n=6)      | ‘…we changed the types of crops and went for those which withstand drought…’. ’
|                   |                         | ‘…weather is one of those factors which determine the types of crops grown here’. ’
|                   | Savings/security (n=2)  | ‘If your child is sick … sell cattle and send him/her to hospital, if your food reserve is depleted … sell cattle and buy food’. ’
|                   | Medicinal value (n=2)   | ‘If your child is sick, you can take one chicken … send it to the witch doctor and your child will be healed’. ’
| Negative          | Agricultural advices (n=2) | ‘… advices are based on certain crops which are not part of food crops grown in this village … he visited me twice or thrice, he brought me Situka maize seeds. He also … supplied me with cashew nut seeds’ ’
|                   | Profitable/marketable (n=3) | ‘…sorghum farming lost popularity because not so many people are using local brew made from it’. ’
|                   | soil / weather (n=4)    | ‘… because our location here allowed us to grow rice’. ’
|                   |                         | ‘Beans is not very productive in this area, very few people grew this type of crop’. ’
| Subjective norms  | Supportive Traditional practice (n=7) | ‘…we inherit all these livestock from our forefathers, keeping livestock is like tradition to us’. ’
|                   | Wealth status (n=3)     | ‘…we keep large animals like cattle … the more animals the wealthier you are’. ’
|                   |                         | ‘Rich household have three to four herds of cattle’. ’
| Unsupportive      | Culture (n=8)           | ‘…we are not allowed to grow bambara nuts in this village. We believe that when we grow such crop dangerous animals like lions will invade the village’. ’
|                   |                         | ‘…we also believe that keeping goats and cattle is like declaring war on the Maasai’. ’
|                   |                         | ‘We don’t eat chicken in the community. Its meat is very small … our women do not know how to cook chicken’. ’
| Perceptions       | Easiness Profitable/marketable (n=5) | ‘… it is easier to get customers if you grow maize, rice, sunflower and sesame… we are the ones who decide the price’. ’
|                   |                         | ‘I grew sunflower and sesame because there is market for it. There are customers and you can sell it at any price’. ’
|                   |                         | ‘We don’t have formal market here and that why we are now shifting to sesame farming’. ’
|                   |                         | ‘…we used to grow cotton but we had nowhere to sell it’. ’
|                   | Affordable (n=2)        | ‘Most people here keep chicken because it is affordable’. ’
|                   |                         | ‘There are no disturbances if you choose to keep chicken and ducks… chicken is easier to keep in whatever way you like’. ’
|                   | Hardness Affordable (n=3) | ‘Goats and cattle require big grazing areas; it is likely to enter into conflict with your neighbors if you will keep these animals’. ’
|                   |                         | ‘…it is also expensive to keep cattle and therefore we end up keeping chicken and ducks only’. ’
|                   | Economic return (n=4)   | ‘Farming was a good business, but not today’. ’
|                   |                         | ‘Cotton was grown as cash crop, but it was abandoned because of marketing problems. We have focused our attentions to sesame and sunflower production because it has good market’. ’

Note: ‘n’ = number statements/quotes related to the theme; ‘TPB’ = Theory of Planned Behavior
6.4 Summary

In this Chapter both Expected Utility Theory (EUT) and the Theory of Planned Behaviour (TPB) were combined to analyse factors associated with households’ choice of farming systems in two districts of Tanzania. The application of EUT allowed the study of the relationship between the expected utility/benefit of farm household and choosing a particular farming system by examining the role of observed predictor variables. The TPB helped to understand the role of psychological constructs in shaping the household choice of farming system. The chapter has indicated the following:

Firstly, in the semi-arid and remote areas like Kishapu, larger households were more likely to choose a Mixed Crop and Livestock farming system indicating that bigger family size ensured the supply of needed labour for both livestock keeping and cropping activities. In the area with greater proximity to main roads and major urban centres like Mvomero, households endowed with low levels of productive capital in the form of land and livestock were compelled to seek out off-farm work. In these same areas, households with high levels of productive capital (i.e. larger farms and more livestock) tended to join local groups such as *ukombakomba*, to enable access to labour at times of peak labour requirements such as sowing and harvesting of crops.

Secondly, in remote area like Kishapu, households were less likely to use agricultural credit and input services, implying that such households tended to practice a more extensive farming system in the face of lack of institutional support services. Third, in remote and semi-arid areas like Kishapu, households with larger farms were more likely to adopt extensive farming system such as the MCL. In these areas, households that relied heavily on land rental were more likely to choose SFC farming systems, implying that lack of tenure security made farmers concentrate on intensive food crop production. Areas of higher average rainfall, higher irrigation potential and greater proximity to markets like Mvomero had trouble in access to farmland and households tended to adopt a farming system that required relatively smaller land areas such as SFC. Lastly, this Chapter has shown further that that utility maximisation, as a guide to decision-making neither adequately nor accurately explained farmers’ behaviour in terms of farming system undertaken. As a counter-balance, it is important to understand
attitudes, subjective norms and perceptions about certain crops and livestock types to provide better insight into the choice of farming systems and, therefore, the TPB was used to fill this gap.
CHAPTER 7: INTEGRATED DISCUSSION

7.1 Overview

Answers to questions regarding characteristics of the farming systems of an area and factors influencing household choice of farming system are important to food security analysis as well as identifying policy options and specific strategies for food insecurity and overall poverty reduction among smallholder farm households. Information gaps in the linkages between farming systems and the socio-economic status of farm households limits the extent to which agricultural policies can address the specific needs of farmers who apply different farming systems. It is, therefore, important to understand the factors influencing farm household decision-making processes about the choice of farming systems and their relationship with household food security status.

Chapters Four, Five, and Six of this thesis have discussed the characteristics of the study area, the farming systems and established the households’ food security status. This chapter presents an integrated discussion of the issues arising in the aforementioned chapters and is structured under broad headings related to the study objectives.

7.2 Characteristics of the Main Farming Systems in the Study Area

The analysis of the findings indicated that a single farming system does not apply in the either of the study districts, since different farm households apply different livelihood strategies depending on their assets endowment (Ellis, 2000). Accordingly, households in the two districts were engaged in four types of farming systems, namely Single Food Crop (SFC), Mixed Food Crops (MFC), Cash Crops (CC), and Mixed Crop and Livestock (MCL) described in Section 3.6.4. Features that characterised each of the four farming systems were: natural environment characteristics, mainly agro-ecological parameters, such as soil topography and climatic characteristics; access to services as well as input and output markets; household size; cultivated farm area; main agricultural activities; and income generated from different sources. Based on these features, there were clear distinctions among the households using SFC and MCL farming systems. The key characteristics of each of the farming systems are discussed in turn.
7.2.1 Single Food Crop (SFC) Farming System

Farm households applying a Single Food Crop (SFC) farming system allocated at least 70% of total cultivated land area to a single food crop only, and more than half of the yield from that crop was consumed at home (see Section 3.6.4). Most of these households were found in Mvomero District, had relatively the smallest households, cultivated relatively small farms, kept few livestock, and generated most of their income from off-farm sources. It should be noted that households in Mvomero District were close to the main roads and major town centres of Morogoro and Dar es Salaam, and this was likely to offer more opportunities for off-farm income generating activities. Likewise, because of close proximity to main roads and major town centres, SFC households were subjected to land pressures, prompted by high land values and, as a result of high prices land was difficult to access. Therefore, farm households were likely to cultivate small farm areas and grow crops (mainly maize and rice) which produced higher quantities of food for domestic consumption. Similar findings have been revealed by Benin et al. (2004) in Ethiopia where it was found that households staying close to market centres were less likely to have diversified cropping patterns because of their engagement in off-farm income generating activities.

7.2.2 Mixed Crop-Livestock (MCL) Farming System

Most of the MCL households were found in the remote and semi-arid Kishapu District, which had relatively the largest households, cultivated relatively bigger farms and generated most of their income from farming. It is possible that availability of extra labour coupled with ownership of livestock, such as cattle (including oxen) which were likely to provide draught power, allowed undertaking of intensive ploughing practices and, therefore, cultivation of bigger farm areas. Likewise, the remote location of farm households in Kishapu District implies that they had poor access to farm input and output markets and opportunities for off-farm income generating activities. Therefore, farm households were likely to have an on-farm diversified farming system to overcome risks associated with poor access to markets and farming in semi-arid areas.
These findings agree with those of previous studies which indicated that households in semi-arid and dry lands tend to practise both crop and livestock farming as one way to secure livelihoods and cope with uncertainties (Blarel et al., 1992; Dixon et al., 2001; Ickowicz et al., 2012; Schiere et al., 2006). Morris (2002) added that the economic importance of livestock to the household income increases as rainfall declines. Ibrahim et al. (2009) argue that combination of crop(s) and livestock in the same farm enables farmers to reduce the unit cost of producing each agricultural commodity in the sense that livestock can feed on the field crops remains after harvest, thereby reducing the cost of feed; while livestock can be a source of manure for the crops.

7.2.3 Cash Crop (CC) Farming System

Although each district had a significant number of CC households, there was a relatively higher percentage in Mvomero than in Kishapu, implying that farm households in Mvomero were more likely to market their crop harvests because of close proximity to markets. In addition, the CC households had relatively larger household sizes than SFC households, cultivated relatively bigger farm areas than SFC households, possessed fewer animal units (less than 7.3TLUs) and generated 58% of their household income from off-farm sources (see Section 5.5). One of the major distinctions between CC farming system in the two districts was that, in Kishapu, CC households cultivated mainly non-food cash crops, such as cotton and green gram, implying that the availability of land in Kishapu could allow households to set aside part of the land for non-food cash crop production. On the contrary, Mvomero CC households grew mainly food cash crops, such as maize and rice, implying that land access difficulties in Mvomero could not allow fragmentation of land between non-food cash crop(s) and other crops, and for this reason households were compelled to grow few crops such as maize and/or rice, which could save for own food and cash earning. A study in Kenya by Omamo (1998) found that improved access to road networks and markets promoted specialization in crops that raised farm cash incomes. Likewise, a study in Zimbabwe by Govereh and Jayne (1999) indicated that, under relatively land-abundant conditions and where livestock (including draught animals) are kept, households are more likely to use animal traction and put more land under cultivation, and part of this land may be allocated for non-food cash crop production.
7.2.4 Mixed Food Crops (MFC) Farming System

Although each district had a significant number of the MFC households, there was a relatively higher percentage in Kishapu than in Mvomero, implying that farm households in Kishapu were more likely to diversify for food to overcome risks associated with poor access to markets and farming in semi-arid areas. Just like for CC households, the MFC households had relatively larger household sizes than SFC households, cultivated relatively bigger farm areas than SFC households, possessed fewer animal units (less than 7.3TLUs) and generated roughly half of their households’ income from off-farm sources (see Section 5.5). These findings agree with those by Sichoongwe et al. (2014) and Ibrahim et al. (2009) who reported that households located far from the nearest market diversified for food security, mainly because of high transaction costs associated with access to the market.

7.3 Household Food Security Status

Ickowicz et al. (2012) argue that the combination of livestock with a cropping system is likely to contribute effectively to livelihood and food security as it can provide not only part of the food needed by the family but also manure and draught power that might be useful for boosting crop productivity. They added that livestock can also provide income to the household, buffering the household against risks and uncertainty when used as a form of saving and also expression of wealth. Therefore, one would expect that households in Kishapu, which had more on-farm diversified farming system and cultivated largest farm areas, to be more food secure than households in Mvomero which had less on-farm diversified systems and cultivated smallest farm areas.

However, this was not the case as households in Kishapu experienced much more food problems than their counterparts in Mvomero (see Section 4.5). The probable reasons for the high level food insecurity in Kishapu could be that: firstly, Kishapu households had bigger household sizes (average of 8 persons/household) than Mvomero (5 persons/household) and, while bigger household size was important in the provision of farm labour; it is likely that it did not match with food availability in the pre-harvest season. Secondly, there were far more livestock keeping households in Kishapu than in
Mvomero (see Section 4.2 and 4.3), but the question remains, why did the households not sell livestock to buy food? Part of the answer would seem to be due to the existing gender inequality in ownership of livestock, whereby women tend to be more disadvantaged (Njuki et al., 2011; Seebens, 2011). While women were primarily responsible for selection and preparation of food consumed by the household members, they had limited ownership, control and access to assets that could have been exchanged for food. Thirdly, unlike in Mvomero where there are more opportunities for off-farm work income because of close proximity to Morogoro town and the main road, Kishapu is a remote area, hence households have poor access to off-farm income which could have been used to purchase food in the pre-harvest season. Household access to food improved in both study areas in the post-harvest season, and it was higher in Mvomero than in Kishapu. However, the findings of this study indicate a wider improvement in food access among households in Kishapu than in Mvomero, implying that farming season was more a factor in Kishapu than in Mvomero.

7.4 Farming Systems and Farm Household Food Security

This study has shown that the farming systems applied by farm households were associated with household food security in two ways: increased farm production and increased income generated from the sale of agricultural commodities; and increased income generated through off-farm work, which was used to access food from the market place. In this study, the findings with regard to the relationship between farming systems and farm household food security status can be stated and discussed under the following two key statements.

(i) Households that had the highest overall household income and the highest proportion of income generated from farming (like the case of MCL households) experienced greatest food access problems during the lean (pre-harvest) periods.

One would have expected that households, which diversified farming in terms of crop-livestock mix and/or diversified their cropping patterns to be more food secure in the lean (pre-harvest) periods. However, this was not the case as households applying MCL
farming system was the most food insecure in the lean (pre-harvest) period. These findings are inconsistent with an argument by Dorp et al. (2012) that food security is directly associated with the amount and types of foods that farm households produce and, in particular, within subsistence agriculture. These findings also contradict other studies which argued that the integration of both crop cultivation and livestock keeping contributes to both farm income and household food security through consumption of milk and meat (Ajeigbe et al., 2010; Kalinda and Langyintuo, 2014; Mayanja et al., 2015).

There are two possible explanations for high food insecurity amongst MCL households in the pre-harvest period. Firstly, MCL households generated most of their income from off-farm sources (see Section 5.5) and, therefore, household food security was more dependent on seasonal farm incomes. The fact that MCL households experienced the highest levels of food insecurity in the pre-harvest season and the lowest levels in the post-harvest season suggests poor access to cash and reserves for these households in the pre-harvest/hungry season. However, one concern could be why MCL households did not save the income generated from farming and use it in the lean season (pre-harvest) to buffer the effects of hunger. Part of the answer could be that MCL households had the largest household sizes, while a large household size in MCL was important for providing labour for both livestock keeping and cropping activities, it could be associated with high food insecurity levels if there were only a few people farming to feed the entire household. Thus, although MCL households had the highest overall income, such income was seasonal and it is possible that it was depleted in just a few months after the harvest period.

These findings are supported by an analysis presented in Section 5.6.1.2, which indicates that households under the severely food insecure category generated most of their income from farm sources, had the biggest households and the highest age dependent ratio. Therefore, it is possible that bigger household size, together with higher age dependency ratio resulted to an increased demand for food that could not be matched with existing food supply during the pre-harvest season. It is also possible that larger number of members in the households, of which many were likely to dependants had increased the burden to economically active members of the household; had
increased the food requirement of households; and had reduced the probability of household staying food secure. These findings are consistent with other studies which revealed that high dependency ratio is positively associated with an increase in both household poverty and food insecurity (Etim and Solomon, 2010; Ojogho, 2010; Orewa and Iyangbe, 2010)

Secondly, high food insecurity amongst MCL households in the pre-harvest season could be associated with gender inequality in livestock ownership and control and in providing food for the family. It should be noted that, while women were primarily responsible for selection and preparation of food consumed by the household members, they had limited ownership, control and access to assets, which could have been exchanged for food. These findings are supported by analysis presented in section 5.6.1.2, which show that even the female-headed households were more likely to be severely food insecure in the pre-harvest season compared to male-headed households. Other studies have shown that women in most areas of work are lower income earners, have fewer assets and limited access to other productive resources (e.g. land and livestock) and have limited access to off-farm paid jobs that are more compatible with their domestic responsibilities (Buvinic and Gupta, 1997; Gebru and Beyene, 2012; Jayamohan and Kitesa, 2014).

(ii) Households that had the lowest overall household income and the highest proportion of income generated from off-farm sources (like the case of SFC households) were more likely to have better food access in the lean (pre-harvest) periods.

There are two possible explanations for low food insecurity amongst SFC households in the pre-harvest season. Firstly, as indicated in Section 5.6.1.1, almost all (88%) SFC households were found in Mvomero, a district likely to offer more off-farm income opportunities all the year round because of its proximity to the main roads and the major town of Morogoro. Thus, although SFC households had the lowest overall income of all the four farming systems, access to such income was likely distributed all the year round; therefore, these households did not feel the same pressure in the pre-harvest season as others, which generated most of their income from seasonal farm sources.
This finding is supported by an analysis in Section 5.6.1.2 which also indicates that households which were more food secure (like the case of SFC households) generated almost half of their income from off-farm sources, implying that households with high dependence on off-farm income were less likely to be affected by seasonal availability of farm income. As discussed earlier in Section 5.6.1.1, less reliance on farming income tend to make household better-off than those specializing in farming activities (Davis et al., 2014; Ellis and Mdoe, 2003). According to Fan and Chan-Kang (2005), expanding farm labour to off-farm employment is considered an important aspect of poverty alleviation. While on-farm diversification of production, such as integration of multiple food crops, cash crops or mixed crop-livestock systems is likely to mitigate risk (Ellis, 2000). This study found that households with the least on-farm diversified farming system, i.e. the SFC group, were the least vulnerable to seasonal food insecurity. This was largely due to the contribution of off-farm income as the main source of household income. Ellis (2000) argues that farming alone may fail to provide an adequate means of survival if the household does not engage in diverse sources of income (farm and off-farm activities).

Secondly, the closer proximity to main roads and major town centres like Morogoro among the SFC households increased their accessibility market for both agricultural inputs and foods. This finding is also confirmed by an analysis presented in Section 5.6.1.2 which indicated that households under the food secure category were more likely to be closer to the markets than for severely food insecure households. Improved access to market was likely to be associated with improved farming practices, which ultimately resulted in increased farm production, farm productivity and/or profitability. This, in turn, could influence the amount and diversity of food available to farm households from their own production. Likewise, it is also possible that increased access to market was associated with improved household food security status through an increased income generated from the sale of agricultural commodities and greater farm productivity. This finding is consistent with those of other scholars who noted that a household, which is better integrated into the market system, is more likely to avoid the impact of food shocks, in particular, in the lean seasons (Gebru and Beyene, 2012; Sichoongwe et al., 2014).
7.5 Farm Household Decision-Making Processes about the Choice of Farming System

Household geographical location (district) acted as a proxy for the natural environmental factors, such as soil, topography and climatic conditions (rainfall, temperature and humidity). As discussed in Section 2.9.3, the natural environmental factors define the feasibility of particular crops and livestock types that can be raised in a particular area (Dixon et al., 2001; Morris, 2002; Reardon et al., 1994). Kishapu experiences relatively low and erratic rainfall, while Mvomero had fertile soils and a rainfall regime, which is considered adequate to support the production of most cereal, horticultural and pulse crops. Likewise, household geographical location acted as proxy for accessibility to agricultural support services as well as markets. In Kishapu, households had poor access to agricultural support services and input and output markets were difficult to access compared to those of Mvomero.

The factors influencing the choice of farming system discussed here are: household size, age of the household head, education level of the household head; cultivated area of the farm, access to off-farm income, sex of the household head, access to credit and input services, access to extension services, household membership of organisation, land tenure system and psychological factors (see Section 2.9).

7.5.1 Household Size

Size of household was one of influential factors for choice of farming system in both study areas. While bigger household size was associated with the practice of MCL farming systems, smaller households were associated with the SFC farming system. It has been argued that larger household size is one of the important assets for working together to reduce poverty but this will only be attained if most of the family members take part in family production activities (Swai et al., 2012). Moreover, increased household size is associated with cultivation of bigger land area (Boru et al., 2015). Conversely, larger household size may be associated with high poverty levels if there are only a few people working to feed the entire family. Increasing household size in an area where households primarily depend on less productive land will result in an
increased demand for food that cannot be matched with existing food supply. This may, ultimately, result in increased household food insecurity (Bogale and Shimelis, 2009).

7.5.2 Age of the Household Head

The head of the household was used as a basis for describing household experience in farming. Although not statistically significant, this study indicated that households with older heads of households were more likely to choose MCL farming system, while those with younger heads of households were more likely to choose SFC farming system. A previous study by Gebru and Beyene (2012) showed that an increase in the age of the head of household decreased the likelihood that he or she will participate in off-farm income generating activities implying that younger heads of household were more flexible with time to use on different off-farm income generating activities than older heads of household.

7.4.3 Education of the Household Head

Based on the literature, one would expect that the educational level of the household head would have had a significant association with the household’s choice of farming system. As argued earlier in Section 2.9.2, education contributes to transmission of specific information, development of generic skills or proficiencies and influences individuals’ beliefs, attitudes and habits towards farming (Weir, 1999). Likewise, better education influences the decision-making process, particularly in adopting improved farming practices (Edwards-Jones, 2006; Rogers, 1995). It was, therefore, expected that an increase in educational level of the household head would lead to improved livelihoods by diversifying income generating activities through off-farm income generating activities which were considered more profitable than farming. Also educated heads of household were more likely to have better access to extension services being influenced by their ability to read and write, benefit from social networks within and outside their community and have better access to productive resources (Gebru and Beyene, 2012). However, in this study the level of education did not have a significant association with the households’ choice of farming systems, possibly because there was no variation in the mean number of years the heads of household had
attended school across the four farming systems. In both study districts, there were no structural resources, such as vocational training schools and tertiary education institutions which could provide post-secondary education (Tanzanian Kishapu District Council, 2012; Tanzanian Mvomero District Council, 2013). Most of the secondary schools in the two districts were only constructed in the last few years, meaning that majority of the heads of household did not have the opportunity to go beyond seven years of primary education.

7.5.4 Farm Size

The average area cultivated by farm households was among the factors which were significantly associated with households’ choice of farming systems in both study areas. The MCL households cultivated the largest land area of all the four farming systems, while SFC households cultivated the smallest area. The possible reasons why MCL households cultivated the largest land area were: firstly, as discussed in Section 7.2.2, availability of extra labour coupled with ownership of livestock, such as cattle (including oxen) were likely to provide draught power and, therefore, undertaking of intensive ploughing practices and cultivation of bigger farm areas. Secondly, the larger average household size for MCL households could mean that there was an increased demand for food at the household and, therefore, prompted cultivation of bigger land area. Thirdly, most of the MCL households were found in Kishapu, a district with poor agro-ecological conditions and overall low land productivity, implying that households had to cultivate bigger farm area to meet family food requirement. These findings agree with both Hassan and Nhemachena (2008) and Sichoongwe et al. (2014) who noted that farm households in the semi-arid areas cultivated large farms and tended to mix crop production with livestock keeping activities as a way of averting risks and achieving self-sufficiency in food production. Moreover, a study conducted by Boru et al. (2015) in Ethiopia showed that household size was positively associated with cultivated farm area, meaning that labour availability was related to the amount of land cultivated.

On the other hand, the smaller farm areas for the SFC households might be associated with high agricultural potential in terms of land quality, rainfall and access to agricultural support services. These factors combine to cause an increased interest in
land acquisition by rich people from nearby major towns, resulting in rising costs of land rentals and purchase. As a result, households in these areas experienced difficulties in accessing farmland and tended to adopt a farming system that required a relatively smaller land area, such as SFC. Likewise, the fact that households in Mvomero had better access to main roads and town centres which were likely to offer off-farm income generating activities implied that labour available for farming activities was reduced, and it is likely that this prompted cultivation of small farms in the area. A previous study by Gebru and Beyene (2012) has also showed that households with smaller farm sizes were more likely to participate in off-farm income generation activities than those households with large farms.

7.5.5 Access to Off-farm Income

Households in the study area generated their income either through crop production, livestock production, off–farm sources or a combination of these sources. This study indicated that households which had no access to off-farm work income were more likely to choose MCL farming system and less likely to choose SFC. The MCL households had the highest dependence on farming income (88% of total income). It should be noted that, although MCL households did not diversify their income through off-farm works, they had the most diversified on-farm income which was generated through combinations of crop production and livestock keeping. These findings concur with previous studies in Zambia and Ethiopia which indicated that the farther a farmer is from a market place, the more likely he or she will diversify his/her farming system (Sichoongwe et al., 2014; Gebru and Beyene, 2012). This is because, households which are farther away from market places experience high transaction costs, which make it expensive for them to get crop products to the market places. As a result, they are forced to grow crops which meet their home consumption demands (Gebru and Beyene, 2012; Ibrahim et al., 2009).

The SFC households had the lowest dependency on farm income (36% of total income from farming). It is likely that, as this area was in close proximity to towns and main roads, it stimulated the households’ participation in off-farm income generating activities. Likewise, the close proximity to market places for households in Mvomero
implied that they were more likely to get higher returns from the sale of crop products and, therefore, encouraging specialisation in few crops. Ibrahim et al. (2009) argued that high profit generated from a particular crop is likely to promote households’ desire to specialise in the production of that crop while less profitable crops may induce farmers to diversify. Okoye et al. (2015) in an analysis of rural livelihoods in Nigeria, also found that an increase in road accessibility was positively associated with engagement in off-farm activities.

7.5.6 Sex of the Household Head

It was expected that the sex of the head of the household would be significantly associated with the households’ choice of the farming system in the study area. This is because the sex of household head has been associated with the choice of farming system that ultimately results in different forms of poverty, including food poverty in developing countries (Buvinic and Gupta, 1997; de Brauw, 2015; Jayamohan and Kitesa, 2014).

Although the sex of the household head was not significantly associated with the households’ choice of the farming systems in the study area, the findings indicated that female headed households were more likely to be associated with the choice of either SFC or MFC, while male headed household were more likely to choose either CC or MCL. Previous studies pointed out that, in many areas of developing countries, food crops are normally regarded as women’s crops while cash crops are frequently regarded as men’s crops (Carr, 2008; de Brauw, 2015; Njuki et al., 2011). This is because women are responsible for feeding their household members and, thus, prefer to cultivate subsistence crops which are likely to provide household food, whereas men are responsible for providing household’ cash income and, thus, raise cash crops (Carr, 2008). Other studies have also shown that women in most areas of work were: lower income earners than men; had fewer assets and poorer access to other productive resources such as land and livestock; were less likely to migrate for income activities to other areas; and they generally worked fewer hours in lower paid jobs which were more compatible with their domestic responsibilities (Buvinic and Gupta, 1997; Gebru and Beyene, 2012; Jayamohan and Kitesa, 2014).
7.5.7 Access to Credit and Input Services

Access to credit facilities allows a household to hire labour and cover the input costs (Byerlee et al., 1982). In this study, access to credit and input services had a statistically significant association with the farm households’ choice of farming system in Kishapu only. Except for the SFC farming system category, which was practised by just 5.9% of households in Kishapu, households which had no access to credit and input services were more likely to practise MCL farming systems compared to MFC and CC households. The MCL households tended to live in relatively remote areas to ensure access to sufficient land for both pasture and crop production and, consequently, had a harder time accessing the mainly urban-based credit institutions. According to Temu et al. (2013), financial institutions that provide a broad range of financial services, such as credit and savings, are heavily urban biased. As argued in Section 2.9.1, markets and roads promote production of higher valued crops, increase prices of local agricultural products, and promote more intensive use of agricultural inputs (Pender and Gebremedhin, 2007; Reardon et al. 1994; Titus and Adefisayo, 2012). Likewise, better access to roads and markets is associated with off-farm work opportunities, something that may reduce the intensity with which households participate in farming activities (Pender and Gebremedhin, 2007).

7.5.8 Extension Services

Although access to extension services was not statistically significantly associated with the choice of the farming systems in both the study areas, the findings indicated that farm households which had access to extension services were more likely to apply the SFC farming system. Due to the fact that the majority of of SFC households were found in Mvomero District, it is possible that this location offered more accessibility to agricultural support services because of close proximity to town centres. Previous studies have indicated that lack of adequate extension services is one of the constraining factors for adoption of particular farming practices (Titus and Adefisayo, 2012). Access to information about farming is likely to promote increased use of external inputs, such as fertiliser and improved seeds (Pender and Gebremedhin, 2007). Likewise, extension
services bring to farmers useful messages about new technologies, including improved farming practices (Rogers, 1995).

7.4.9 Membership to Organisations

A farm household participating in social relationships, such as participation in local organisations, is likely to have better access to information about farming practices, increasing household awareness and access to improved agricultural technologies and inputs, obtain more yields, and earn higher returns from improved market accessibility (Pender and Gebremedhin, 2007). In this study, households which did not have membership in local organisations, such as groups and cooperatives, were less likely to choose MCL and more likely to choose SFC farming system. The MCL households in the study area tended to rely on a social network commonly known as *ukombakomba* to support major farming operations, such as weeding and harvesting, because of the relatively bigger farm size. Membership to organizations among the MCL households in the study area was, therefore, considered as a means of building strong social network that helped farm households pool their labour together for farm work as well as sharing farm equipment, such as hand hoe and ox-plough.

7.5.10 Land Tenure System

Households with better access to land and other forms of assets are more likely to purchase different forms of external inputs and boost farm production (Pender and Gebremedhin, 2007). This study revealed that households which did not own the land they farmed or those that relied entirely on rented land were less likely to choose the MCL farming system and more likely to choose the SFC farming system. Similar findings were obtained in Zambia by Sichoongwe et al. (2014) who indicated that households which owned the land they farmed had higher probability that they would engage in farm diversification. This means that, by owning land, households were more in control of how many crops to grow and or livestock to keep.
7.5.11 Psychological Factors (farmer’s attitudes, subjective norms and perceptions)

The discussion of the findings as presented in Section 7.5.1 to 7.5.10 showed that the expected utility of farm household choosing a particular farming system was a function of observed variables, such as those related to farmer/household characteristics, institutional/farming context characteristics and natural/farm characteristics. However, as discussed earlier in Section 2.8, farm households’ choice of farming system is not only dictated by utility maximising behaviour, but other factors related to psychological constructs such as attitudes, subjective norms and perceptions were also responsible (Borges et al., 2015a). This study confirmed that utility maximisation, as a guide to decision-making, neither adequately nor accurately explained farmers’ behaviour in terms of farming system undertaken. As a counter-balance, it is important to understand farmers’ attitudes, subjective norms and perceptions about certain crops and livestock types to provide better insight into the choice of farming systems. Several authors have indicated that psycho-social characteristics affect household preferences on food and consumption patterns and, therefore, also influence the types of crops or livestock that a farm household is willing to raise (Chambers, 1983; FAO, 2000; UNICEF, 1991). In addition, psycho-social factors influence the attitudes of farm household towards risk factors and other farming practices (Holloway and Ilbery, 1996; Theocharopoulos et al., 2012; Willock et al., 1999).

7.6 Farm Household Decision-making, Farming Systems and Food Security

Farming decisions and actions made by farm households are closely associated with household food availability, social and wealth status (Ellis, 2000). However, the diverse farming environment meant that the outcomes of household farming decisions were diverse and were associated with a variety of factors which ranged from farm/natural environment characteristics and farmer/household characteristics to institutional/farming context characteristics (see Section 2.9). In turn, these factors were associated with farm households’ production and resource allocation decisions, in particular, the choice of farming system. Because of the differences in farming conditions in the two districts, there was a clear distinction with regard to households’ choice of farming system practised in the each. For instance, while almost all SFC
households were found in Mvomero, a similar proportion of the MCL households was found in Kishapu. The difference in proportions of households which applied MFC or CC farming system between the districts was less pronounced.

The study has indicated that the farming systems applied by farm households in the study areas had a close association with food security status in the following ways: first, through consumption of home produced food or use of income generated from the sales of harvests and greater farm productivity. As argued by Dixon et al. (2001), a farming system forms a focal point for targeting interventions through improved farming practices, which ultimately may result in: increased farm production, farm productivity and/or profitability. This, in turn, may influence the amount and types of food available to farm households (Dorp et al., 2012). In this study, households which generated most of their income from farming, like MCL households, experienced the greatest seasonal variability in food security status. Secondly, farm household food security was also associated with income generated from off-farm sources which can be used to access food from the market. Devereux (2001) argued that food productivity is necessary but not the only solution to the problems of food insecurity. Thus, people may cope with food shortage by using their diversified endowments, which range from own production to tangible assets, intangible assets and markets, just to mention some (Chambers, 1983, Chambers, 1995b; DFID, 1999; Sen, 1981). In this study, households which had close proximity to main roads and town centres, like the case of SFC households, diversified their income through off-farm works and were more resilient to seasonal change of food security status.
CHAPTER 8: CONCLUSIONS AND RECOMMENDATIONS

8.1 Overview

The overall objective of this study was to determine factors that influence farm households’ choices of farming systems and how these factors influence their food security. The study was conducted in two distinctly different agro-ecological zones of Tanzania, namely Kishapu and Mvomero Districts. Data were collected during both pre- and post-harvest seasons in 2014 from 506 farm households through face-to-face interviews, which were supplemented with market price survey, key informant interviews and focus group discussions. Farming systems, as practised by households in the two districts, were identified based on crops grown, degree of dependence and market orientation for particular crops, and livestock ownership. Household food security status was determined by use of the Household Food Insecurity Access Scale (HFIAS) and the Household Dietary Diversity Score (HDDS). This chapter discusses theoretical and practical implications of the study and reflects on the methodologies used. It also presents the study conclusions and the recommendations arising.

8.2 Theoretical Implications

Farm household livelihoods in Tanzania are normally diverse and complex, making it difficult to capture the dynamics of their food security in one conceptual framework. In order to determine the contribution of farming systems to the household food security in Tanzania, this study developed an analytical model (Figure 8) from theories discussed in the literature reviewed in Sections 2.2 to 2.9, which see poverty and, in particular, food insecurity as an outcome of diverse, complex, and dynamic forces. A review of different theories provided an understanding of both the strengths and the limitations of each in understanding the problem of food insecurity. The use of these different theories has, therefore, helped in counteracting the limitations of each and allowed for consideration of various factors and processes that act to either constrain or enhance farm households’ ability to attain food security status.

The study combined Expected Utility Theory (EUT) and the Theory of Planned Behaviour (TPB) to analyse the factors associated with households’ choice of farming
system in the study area and this helped to overcome some of the limitations associated with each theory when taken separately. In particular, the findings indicated that farm households’ choice of farming system in the study areas is not only associated with utility maximising behaviour but also psychological constructs, such as attitudes, subjective norms and perceptions. Thus, while the application of EUT was useful to study the utility aspect of decision-making, the TPB helped to appreciate the role of psychological constructs such as farming attitudes, subjective norms and perceptions on farm household decision-making processes about the choice of a farming system.

It is important to recognise that this study highlighted what is already known that farm household decision-making process depends on an array of factors. Researchers should acknowledge that farm households do not only engage in economically optimal decision-making, but also try to optimise attitudes, subjective norms and perceptions when deciding what farming system they apply. A combination of two theories can provide a broad and comprehensive view of the farm household decision-making process and their choice of farming systems and allow researchers to better formulate their research on this topic.

8.3 Practical Implications

Understanding of farm household decision-making processes facilitates matching of agricultural extension strategies to needs of farm households. The findings of this study have helped to understand how farm households in rural areas similar to the one studied, arrive at particular farming system. Moreover, how their choice of farming system is associated with household food security outcomes. Policy makers may consider the use of these findings and improve their understanding of the smallholder farming environment to create appropriate policy and institutional frameworks that will help farmers make informed decisions towards sustainable use of natural resources, agricultural growth and addressing the problem of food insecurity in settings similar to the one studied. The findings from this study add value to the already existing debates in scholarly and policy literature on farming systems and food security. Indeed, the findings contribute to the resource base available for training the next generation of scholars on farming systems and food security. In addition, the findings help policy
makers think critically about local and national policies related to agriculture, food and nutrition sectors.

8.4 Methodological Aspects

The application of pragmatism research approach in which qualitative and quantitative data were generated allowed a comprehensive analysis of farming systems and household food security status in pre- and post-harvest conditions in the study area. As discussed in Section 3.2, the qualitative study through the use of focus group discussions preceded and generated information relevant to the topic, and which together with pre-test survey helped to shape the development and validation of the household survey questionnaire. The focus group discussions were followed by two rounds of questionnaire-based household surveys of the same respondents in pre-and post-harvest periods. In addition to household surveys, local market price surveys were conducted on a monthly basis for various commodities consumed by farm households in 2014. Finally, qualitative data collection was done through the use of focus group discussions and key informant interviews and generated additional information relevant to the topic under investigation and which was used to comment on the data generated through questionnaire-based household surveys in pre- and post-harvest conditions and local markets price surveys.

Quantitative methods generated measurable information such as: demographic characteristics; institutional characteristics associated with farming; farming practices and productivity; and household economy including asset ownership. On the other hand, qualitative methods generated information which could not be accounted for in numeric terms and included the range of behavioural (psychological) characteristics such as attitudes, subjective norms and perceptions. This study has indicated that, if data are carefully generated through relevant and appropriate methods, such data are likely to complement and generate answers to the research questions posed. However, the application of pragmatism research approach was not without limitations. As is the case with many surveys, one of the challenges was to balance time, cost, logistics constraints, and the burden imposed on both participants and researchers in order to generate adequate information for each research question.
8.5 Conclusions

Based on the findings and discussion presented in Chapter 4, 5, 6 and 7, this study makes a number of conclusions. These are organised under headings associated with each of the four specific objectives of the study.

8.5.1 Characteristics of the Main Farming Systems in the Study Area

The farming systems in the two study areas were clearly associated with their natural environment and proximity to market. Farm households residing close to the main roads and town centres, like those of Mvomero District, had increased access to markets and alternative sources of income. Such households were likely to have smaller farms and practice the SFC farming system. Due to their closer proximity to the main roads and town centres, these households were more likely to supplement their farm income by income generated from off-farm work which, in turn, limited the households’ level of engagement with more labour intensive farming activities and their drive to cultivate larger land areas. Due to their proximity to markets, the SFC households in the area were subjected to high land pressure and high land values. Consequently, households were compelled to grow crops, such as maize and rice, which by their nature produce higher biomass demanded for home consumption and for accessible markets in the nearby town centres.

Farm households that were located in a remote and semi-arid area, like in Kishapu District, had poor access to markets and alternative sources of income. Such households were likely to cultivate bigger farms and practice the MCL farming system as a way to mitigate risks associated with the semi-arid environment and poor access to off-farm work income. Households in Kishapu, which had poor access to markets, promoted more on-farm crop diversity in order to produce biomass, which is thought to provide their own food and feeds for livestock. Likewise, owning many livestock such as cattle (including oxen) was likely to provide draught power for land cultivation and crop maintenance.

A slightly higher percentage of Cash Cropping (CC) households was found in Mvomero District, implying that improved access to road networks and markets in nearby towns
centres promoted specialization to crops that raise farm cash incomes. In areas where land availability is not a limitation, like in Kishapu, households were likely to set aside pieces of land for growing cash crops, such as cotton. However, in areas where land access was limited, like in Mvomero, households were less likely to set aside land for cash crop production and, for this reason, households were compelled to grow crops, such as maize and/or rice, which had the dual benefit of being food for household consumption and a cash crop.

A slightly higher percentage of MFC households were found in Kishapu, implying that households located far from the nearest market diversified for food security mainly because of high transaction costs associated with access to the market. Likewise, poor access to off-farm work income, which could have been used to access food from the market, was likely to be associated with cultivation of multiple food crops.

**8.5.2 Food Security Status of the Study area in Pre- and Post-harvest Seasons**

Kishapu households experienced greater food access problems than Mvomero households in the pre-harvest season and this may be related to household size, opportunities for off-farm income and women’s ownership of assets (livestock). The low food reserves, high prices of food, low income reserves (savings) and/or inadequate off-farm income, which are typical characteristics of the pre-harvest season, implied that larger household sizes, like the case of Kishapu District, were likely not associated with adequate food availability. Households with poor access to off-farm income, as in the case of Kishapu, were more reliant on farming income and so were more likely to be affected by food insecurity in the pre-harvest season. Likewise, women have a primary role in selecting and preparing food but had limited ownership of assets, such as livestock, that could have been exchanged for food during the lean season.

Household access to food improved in both study areas in the post-harvest season and was greater for households in Mvomero than in Kishapu. However, was a wider improvement in food access among households in Kishapu than in Mvomero. The greater reliance on farming income among households in Kishapu implied that they were more likely to be affected by seasonal variability of food supply. In contrast,
households in Mvomero had more access to off-farm income and were more likely to access food from the market throughout the year.

While the study areas and the two farming seasons were associated with household food access, they had little association with the range of foods consumed. Moreover, the fact that the HDDS does not measure food quantity, it is likely that the differences seen between the two study areas and between pre- and post-harvest seasons occurred for amounts of foods consumed, while the food types in general remained the same.

A limited change in the range of foods consumed by households in the pre- and post-harvest seasons in the two study areas suggests that the types of foods consumed were associated more with the dietary habits of people than with food availability and affordability.

8.5.3 Farming Systems and Food Security Status

Households that diversified their income through off-farm activities (like the case of many SFC households) were more likely to have better food access in the lean (pre-harvest) periods. Despite the fact that MCL households had the highest overall household income and derived the highest proportion of this from farming, they experienced greatest food access problems relative to the other three farming systems during the pre-harvest season, implying that other factors beyond income were responsible. For instance, MCL households had largest household size coupled with gender inequality in livestock assets acquisition and in providing food for the family, reflecting that women are disadvantaged.

While farming systems and seasons influenced household food access, they had little influence on the range of foods consumed. The fact that even those households with more diversified farming systems (such as MFC and MCL households) displayed a very small change in dietary diversity across farming seasons, suggests that the types of foods consumed were associated more with the dietary habits of people rather than with food availability and affordability. Moreover, the fact that HDDS does not account for food quantity, it is likely that the differences seen occurred for amounts of foods consumed, while the food types in general remained the same.
While on-farm diversification of production, such as integration of multiple food crops, cash crops or mixed crop-livestock systems, is likely to mitigate risk (Ellis, 2000), this study found that households with the least diversified farming system, i.e. the Single Food Crop group were the least vulnerable to seasonal food insecurity. This was largely due to the contribution of off-farm income as the main source of household income.

8.5.4 Factors Influencing Choices of Farming Systems

The study has shown that households in similar agro-ecological zones/districts apply different farming systems that have evolved in response to a set of interacting factors that determine the course of action by the household, in order to satisfy household needs. In other words, a farming system evolves in response to a specific context (place and time), therefore, households’ application of particular farming system depends on three sets of interacting contextual factors: the household/farmer characteristics, representing those factors of which households have more control; the institutional/farming context, representing those factors outside the farm for which households have little or no control; and the natural/farm level characteristics, representing factors such as soil type, topography and climatic conditions.

The household/farmer level characteristics, such as household size, engagement with off-farm income generating activities, household membership in an organisation and psychological constructs related to farmer’s attitudes, subjective norms and perceptions, were associated with the application of particular farming systems. In the semi-arid and remote areas of Kishapu, larger households were more likely to choose a Mixed Crop and Livestock farming system, indicating that larger family size ensured the supply of needed labour for both livestock keeping and cropping activities. In the area with greater proximity to main roads and major urban centres like the case of Mvomero, households endowed with low levels of productive capital in the form of land and livestock were compelled to seek out off-farm work. In these same areas, households with high levels of productive capital (i.e. larger farms and more livestock) tended to join local groups such as ukombakomba, to enable access to labour at times of peak labour requirements such as sowing and harvesting of crops. In both areas, the choice of farming systems was associated with households’ economic and social objectives such
as: adequate food and cash earnings; meeting medical costs; security against hunger and uncertainties; continuing farming and cultural tradition. This finding implies that utility maximisation, as a guide to decision-making neither adequately nor accurately explained farmers’ behaviour in terms of farming system undertaken. As a counterbalance, it is important to understand farmers’ attitudes, subjective norms and perceptions about certain crops and livestock types to provide better insight into the choice of farming systems.

The institutional support, such as access to credit and input services had a role in household decision-making about the choice of farming systems. This study has indicated that households in a remote area, like the case of MCL households in Kishapu, were less likely to use agricultural credit and input services, implying that such households tended to practice a more extensive farming system in the face of lack of support services. The MCL households tended to live in relatively remote areas to ensure access to sufficient land for both pasture and crop production and, consequently, were more likely to experience a harder time accessing the mainly urban-based credit institutions.

The natural and farm characteristics, such as farm size and the nature of ownership of the land farmed, were significantly associated with households’ choice of farming system. In remote and semi-arid areas like Kishapu, households with larger farms were more likely to adopt extensive farming system, such as the MCL. In these areas, households which relied heavily on land rental were more likely to choose SFC farming systems, implying that lack of tenure security made farmers concentrate on intensive food crop production. Areas of higher average rainfall, higher irrigation potential and greater proximity to markets, like Mvomero, experienced increased interest in land acquisition by rich people from nearby major towns, resulting in rising costs of land rentals and purchase. As a result, households in these areas had trouble in access to farmland and tended to adopt a farming system that required relatively smaller land areas such as SFC.
8.6 Recommendations

The study makes a number of recommendations, which aim to contribute to improving the livelihoods of small-scale farm households through better targeting of extension and other services. To facilitate their consideration, the recommendations are separated into different levels, namely: policy level; district level; household level and recommendations for future studies.

8.6.1 Policy Level Recommendations

i. In a remote semi-arid area like Kishapu, where households have few off-farm income opportunities and where land is not scarce but is less productive, the government and other stakeholders should devise strategies to improve land productivity by facilitating: access to credit and input services; adoption of more drought-tolerant crops; and access to information on good agricultural practices, which are compatible with farming in semi-arid conditions.

ii. In a high agricultural potential area like Mvomero, where households have more off-farm income opportunities and where land is scarce, the government and other stakeholders should support farmers to meet their household needs through: development of irrigation infrastructure, creating accessible credit schemes to facilitate the establishment of businesses which can add value to agricultural production, and provision of transport and communications infrastructure which can help farmers reduce transaction costs associated with farming and enable greater access to off-farm work.

iii. Policies aimed at improving the smallholder farming conditions should take into consideration farmers’ attitudes, subjective norms and perceptions about certain crops and livestock types as these were found to be associated with the choice of farming systems and ultimately household food security status.

iv. In this study, the majority (76.2) of the female headed households were either severely or moderately food insecure in the pre-harvest season. Likewise, about half these households did not own land they farmed and were likely to cultivate either single food crop or multiple food crops. It is necessary therefore, for the national policy to address the following: first, because of the women crucial role
in providing household food, there is a need to support crops (e.g. maize, legumes, horticultural crops and others grown for home consumption) and livestock types (eg. chicken) which are considered more as women’s assets. This can be done by improving women’s access to affordable technologies, such as improved seeds and breeding stock as well as access to advisory services. Second, there is a need to promote women’s control of productive resources, such as land and livestock. This could be done by establishing and promoting local grassroots organizations which links them to the formal sector, and hence enable better access to resources. Third, there is a need to conduct and promote gender equality awareness campaigns which aim to eliminate socio-cultural constraints to women’s control of productive resources, such as land and livestock.

8.6.2 District (Study Area) Level Recommendations

i. In each district, there is need for accessible microfinance services for farmers, which are compatible with their farming needs so that they can build up capital to cover costs of farm activities.

ii. There is need to facilitate the formation of farmers’ organisations to make it easier for them to access agricultural extension services, make informed farming decisions and improve household food security status.

iii. Local government authorities in each district should support households to diversify their labour into off-farm work in areas with access to off-farm employment opportunities, such as in local towns in order to reduce farm household vulnerability to seasonal food insecurity. This might be done through the provision of accessible vocational/skills training that can qualify people for off-farm work opportunities available in the study areas.

8.6.3 Household Level Recommendations

i. Behavioural change communication strategies are needed to address attitudes, norms and perceptions, which guide household choices of certain crops and
livestock types, which have the potential to impact positively on livelihoods and household food security status.

ii. As dietary diversity varied only slightly between the four farming systems and across the farming seasons, strategies to improve food security should promote behavioural change on what is culturally accepted as food. There is a need for appropriate culture-based gender awareness campaign for both males and females, in order to change their eating habits towards more diverse, balanced and nutritious diets. This is because meeting the nutritional requirements of individuals requires appropriate dietary practices which is affected by the range of foods consumed, which are themselves strongly influenced by nutritional knowledge, cultural biases, and the competing demands for the time of women (the main household caretaker).

8.6.4 Recommendation for Future Research

On the basis of the fact that even households with more diversified farming systems such as MFC and MCL displayed a small change in dietary diversity across farming seasons, future researchers may need to seek answers with regard to how local cultural practices influence household eating behaviour. Moreover, research should be conducted to determine whether the cultural practices of an area influence food security even when a diverse set of foods is available.
REFERENCES


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Insecurity and Vulnerability Information and Mapping Systems (FIVIMS) Secretariat, UK.


APPENDICES

Appendix 1: Map of Kishapu District Showing the Locations of Study Villages
Appendix 2: Map of Mvomero District Showing the Locations of Study Villages
Appendix 3: Pre-harvest Household Survey Questionaire

QUESTIONNAIRE
TANZANIA AGRIDIET PROJECT
AGRICULTURE-NUTRITION HOUSEHOLD SURVEY (2014)
PRE-HARVEST (ROUND ONE)

Enumerators Name:………………………………
Signature: …………………………………

FIRST APPOINTMENT
Date enumerated: ………………………………..
Start Time: ……………………………………..
End Time: ……………………………………..

Present at the household  |  Male  |  Female  |  If absent, reason for absence………..

SECOND APPOINTMENT
Date enumerated: ………………………………..
Start Time: ……………………………………..
End Time: ……………………………………..

Checked by (Name): ……………………………..
Signature: …………………………………..
Date: ……………………………………..

Interview Results (circle the right number)

1. Completely Filled
2. Partially Filled
3. Refused
4. Building Ruined / Removed
5. Empty Building
6. Other (Specify) ………
OVERVIEW OF THE AGRIDIET PROJECT

We are conducting research with Sokoine University of Agriculture and St. Augustine’s University under the Irish Aid funded AgriDiet project to examine the link between agriculture and nutrition. We want to explore ways in which your farming and food management practices impact on nutrition, particularly of women and children in rural household.

STRUCTURE OF THE QUESTIONNAIRE

Title Page
Identification Details
Module One: Household Characteristics
Module Two: Household Economy
Module Three: Food and Care Practice
Module Four: Health Status
Module Five: Social Capital
**IDENTIFICATION DETAILS**

<table>
<thead>
<tr>
<th>S/N</th>
<th>Location</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID1</td>
<td>Region</td>
<td>________________________________</td>
</tr>
<tr>
<td>ID2</td>
<td>District</td>
<td>________________________________</td>
</tr>
<tr>
<td>ID3</td>
<td>Division</td>
<td>________________________________</td>
</tr>
<tr>
<td>ID4</td>
<td>Ward</td>
<td>________________________________</td>
</tr>
<tr>
<td>ID5</td>
<td>Village</td>
<td>________________________________</td>
</tr>
</tbody>
</table>

**Details of the respondent and household head**

<table>
<thead>
<tr>
<th>Codes</th>
<th>ID6</th>
<th>Name &amp; Number of household head</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID7</td>
<td></td>
<td>Sex of household head (Male = 1, Female = 2)</td>
</tr>
<tr>
<td>ID8</td>
<td></td>
<td>Name of First respondent…………………</td>
</tr>
<tr>
<td>ID8a</td>
<td></td>
<td>Relationship of Respondent to Household Head (use code ID9)</td>
</tr>
<tr>
<td>ID9</td>
<td></td>
<td>Name of Second Respondent ………………..</td>
</tr>
<tr>
<td>ID9a</td>
<td></td>
<td>Relationship of Second Respondent to Household Head (use code ID9)</td>
</tr>
<tr>
<td>ID10</td>
<td></td>
<td>Name of Translator ……………………..</td>
</tr>
<tr>
<td>ID10a</td>
<td></td>
<td>Relationship of translator to Household Head (use code ID9)</td>
</tr>
</tbody>
</table>

**Code ID9a&10a: Relationship of Respondent to Household Head Codes**

| 1 = Self               | 5 = Grandchild | 9 = Father/Mother-in-law | 13 = Uncle/Aunt |
| 2 = Wife/Husband/Partner | 6 = Father/Mother | 10 = Sister/Brother-in-law | 14 = Other relative |
| 3 = Son/Daughter       | 7 = Brother/Sister | 11 = Daughter/son-in-law | 15 = Helper/Servant |
| 4 = Step son/daughter  | 8 = Niece/Nephew | 12 = Grandparent | 16 = Not Related |
MODULE ONE: INFORMATION ON HOUSEHOLD CHARACTERISTICS (HC)

We would like information regarding all members of this household (children and adults). This includes those who are members of the household who are away today but who normally live here. Could you please answer the following questions, starting with household head/yourself and then moving from the oldest to the youngest household member?

<table>
<thead>
<tr>
<th>ID</th>
<th>Name (start with the HH head)</th>
<th>Sex</th>
<th>Age (Years)</th>
<th>Marital Status</th>
<th>Relationship with HH Head (Code 1a)</th>
<th>Number of Years in School</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Code 1a: Relationship with HH head**

1 = Self  
2 = Wife/Husband/Partner  
3 = Son/Daughter  
4 = Step son/daughter  
5 = Grandchild  
6 = Father/Mother  
7 = Brother/Sister  
8 = Niece/Nephew  
9 = Father/Mother-in-Law  
10 = Sister/Brother-in-law  
11 = Daughter/son-in-law  
12 = Grandparent  
13 = Uncle/Aunt  
14 = Other relative to head/Spouse  
15 = Helper/Servant  
16 = Not Related
### Module One: Information on Household Characteristics (HC) (Continue)

<table>
<thead>
<tr>
<th>ID</th>
<th>Name</th>
<th>Major occupation (Code 1c)</th>
<th>Member living outside the household</th>
<th>If Yes, give reason for living outside h/hold (Code 1d)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 = Yes 2 = No</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Code 1c: Major occupation**

1 = Farming
2 = Small scale entrepreneur
3 = Labourer/Skilled-unskilled
4 = Natural resource extraction (stone, sand…)
5 = Civil servant
6 = Private sector/NGO employee
7 = Paid Cooperative official
8 = Police/Armed forces member
9 = Pensioner (receiving pension)
10 = Other activity (Specify)
11 = Currently unemployed
12 = Student/Underage

**Code 1d: Reason for living outside the household**

1 = Education (High school/College)
2 = Search for job
3 = To stay with other relatives
4 = Others (Specify…)

---

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MODULE TWO: HOUSEHOLD ECONOMY (HE)
Module 2.1: Household Asset Ownership/Possession
2.1.1. Housing and Facilities (HF)
HF1. Please, kindly provide some details of your homestead buildings

<table>
<thead>
<tr>
<th>No.</th>
<th>Type of Building structure</th>
<th>Tick</th>
<th>Is it rented/owned? (1=rented, 2=Owned, 3=Not rented &amp; Not owned)</th>
<th>No. of rooms</th>
<th>*Condition (1=Poor, 2=Moderate, 3=Good)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Human dwelling</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Kitchen</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Shower/bathroom</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Other (specify)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note:
1. **Poor**: walls made of poles or mud, thatched roof, poorly ventilated windows and stubble doors.
2. **Moderate**: mud brick walls, corrugated iron sheet roofing, earth floor, non-grilled windows and wooden/iron sheet doors.
3. **Good**: brick walls, corrugated iron sheets for roofing, cemented floor, grilled windows and wooden/iron sheet doors.

HF2. If rented, what is the monthly rent? ………………………TZS

HF3. What is the main source of energy used for lighting?
1. Electricity
2. Solar
3. Gas
4. Kerosene (lantern/chimney)
5. Kerosene (Wick lamps)
6. Candles
7. Firewood
8. Others (Specify)

HF4. What is the main source of energy used for cooking?
1. Electricity
2. Solar
3. Gas (industrial)
4. Gas (biogas)
5. Kerosene
6. Charcoal
7. Firewood
8. Animal residuals
9. Others (specify)
2.1.2. Asset Ownership (2013 agriculture year) (AO)

AO1. Household Items during the 2013 agriculture year

Please provide information on the following household items during the past 12 months

<table>
<thead>
<tr>
<th>Item</th>
<th>Does your household own the following asset? (1 = Yes, 2 = No)</th>
<th>If yes, specify the quantity?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Radio</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Mobile phone</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Bicycle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Motor vehicle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 Motorcycle (any type)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 Television</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 Beds</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 Cupboards</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 Normal chairs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 Furniture suit (cushen chairs)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 Iron (electric/charcoal)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 Cooker (electric or gas)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13 Refrigerator/Freezer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14 Other (specify)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

AO2. Agricultural production equipment during the 2013 agriculture year

Please provide information on ownership of agricultural equipment during the past 12 months

<table>
<thead>
<tr>
<th>Name/Type of equipment/ asset equipment</th>
<th>Does your household own the following asset? (1=Yes, 2=No)</th>
<th>If yes, specify the quantity?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Hand hoe</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Ox-plough (set)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Water pump (Motorised/mechanical)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Milling machine (motorised/hand)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 Machette</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 Others (specify)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2.1.3. Land holding during the 2013 cropping year (LH)

LH1. Did your household own/access any agricultural land during the past 12 months?
1 = Yes, Then continue 2 = No, Then go to LH3

<table>
<thead>
<tr>
<th>LH2. Land Category</th>
<th>Total Area (acre)</th>
<th>Crops</th>
<th>Livestock</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>LH2.1. Owned</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LH2.2. Rented-in/Borrowed</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LH2.3. Rented-out land</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

LH3. Did you have access to communal grazing land? (1=Yes, 2=No)

LH4. If your response to LH3 is ‘yes’, is the area of land available for your livestock
(1) Adequate? (2) Inadequate?
LH5. *(Enumerator ask this question if LH2.1 was answered)* who owns the land?
(1) Male Head of Household   (2) Female Spouse/Head of Household   (3) Both

2.2: Non/off Farm Sources of Income (SI)

**SI1:** Please provide the average annual income from the following sources during the past 12 Months.

<table>
<thead>
<tr>
<th>SN</th>
<th>Income source</th>
<th>Did you/your household receive income from…? (1=Yes, 2=No)</th>
<th>Amount (TZS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Non/off-farm employment</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Self-employment: petty trading (hairdresser, carpenter, sale of beverages, handicrafts, etc.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Salaries/labour wages of resident household member</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Small scale mining</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Charcoal/ fuel wood sales</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Migrant remittances/transfer from other households</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>From elsewhere in Tanzania (friends, relatives, neighbours, etc.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>From another country (friends, relatives, etc.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Pension payments</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Renting out/leasing of house, land, equipment, etc.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Other income sources (Specify)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Total estimated annual income</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**SI2.** Which months of the year do you not have any income to the household?

……………………
2.3. Credit and Savings (CS)

CS1. Did you receive any farm input vouchers from the government during the past 12 months?  
1=Yes  2=No

CS2. If Yes, what type(s) of farm input voucher?  
(a) Mineral fertilizer (list the fertilizer types)..................
(b) Improved crop seed varieties (list the crops)..................  
c) Other (specify)........................................

CS3. In which month(s) of the year was the voucher received? ........................

CS4. In which month(s) of the year was the voucher needed? ........................

CS5. Does any member of this household operate a saving or current account?  
1=Yes  2=No

<table>
<thead>
<tr>
<th>Member number</th>
<th>CS6a. Amount saved in past 12 months (TZS).</th>
</tr>
</thead>
<tbody>
<tr>
<td>First member</td>
<td></td>
</tr>
<tr>
<td>Second member</td>
<td></td>
</tr>
<tr>
<td>Third member</td>
<td></td>
</tr>
</tbody>
</table>

CS6. What were the other ways you saved during the past 12 months?  
1. .........................2. ......................... 3. .........................

CS7. If Yes to either CS5 or CS6, What was the main reason for saving?  
..............................

CS8. Has any member of the household taken a bank loan during the last 12 Months?  
1=Yes  2=No

<table>
<thead>
<tr>
<th>Member number</th>
<th>CS8a. Amount saved in past 12 months (TZS).</th>
</tr>
</thead>
<tbody>
<tr>
<td>First member</td>
<td></td>
</tr>
<tr>
<td>Second member</td>
<td></td>
</tr>
<tr>
<td>Third member</td>
<td></td>
</tr>
</tbody>
</table>

CS9. If Yes to CS8, what was the loan for? ..............................

CS10. If ‘No’ to CS8, explain the reasons why the household did not take loan for any purpose during the last 12 months? ..............................
2.4. Crop Production and Disposal (CP)

CP1. How long have you been cultivating crops? _____________ Years or Months

**Crop production (2013 production year)**

Kindly provide the following detailed information on crops grown, output obtained and their disposal

<table>
<thead>
<tr>
<th>S/N</th>
<th>Crop(s) grown</th>
<th>Area allocated for each crop (acres)</th>
<th>Area Under Irrigation agric (acres)</th>
<th>Intercropped with (CP2)</th>
<th>Quantity produced (kgs)</th>
<th>Quantity consumed at home (kgs)</th>
<th>Quantity Sold (kgs)</th>
<th>Quantity retained for seed (kgs)</th>
<th>Processed harvest (kgs)</th>
<th>Post-harvest loss? (kgs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Maize</td>
<td>CP2</td>
<td>CP3</td>
<td>CP4</td>
<td>CP5</td>
<td>CP6</td>
<td>CP7</td>
<td>CP8</td>
<td>CP9</td>
<td>CP10</td>
</tr>
<tr>
<td>2</td>
<td>Rice</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Sorghum</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Sesame</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Green Grams</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Other Legumes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Sun flower</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Sweet Potatoes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Cotton</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Tomatoes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Onions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Vegetables</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td><strong>Other Crops</strong></td>
<td>**</td>
<td>**</td>
<td>**</td>
<td>**</td>
<td>**</td>
<td>**</td>
<td>**</td>
<td>**</td>
<td>**</td>
</tr>
</tbody>
</table>
CP10. Why did your household grow the type(s) of crop(s) you mentioned during the past 12 months? ………………………………………………………………………………………………………..

CP11. What fruit tree(s) does your household have?

<table>
<thead>
<tr>
<th>No</th>
<th>Type</th>
<th>Tick</th>
<th>No. of fruit trees</th>
<th>*No. of bags harvested</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>No Fruit tree</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Orange</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Mango</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Pawpaw</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Guava</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Other (specify)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

CP12. Please indicate how many days of... [Labour category] were spent in... [Major crop production activity] during the past 12 months?

<table>
<thead>
<tr>
<th>Labour category</th>
<th>Major crop production activities</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Land preparation</td>
</tr>
<tr>
<td></td>
<td>Man Days</td>
</tr>
<tr>
<td>Household labour</td>
<td></td>
</tr>
<tr>
<td>Hired labour</td>
<td></td>
</tr>
</tbody>
</table>

CP13. How did you address pests on your field crops during the past 12 months?
1) Did not take any measure
2) Selection of pest resistant plant species/varieties
3) Pesticides (enumerator: list all that are ever used on your farm) ………
4) Mixed/ inter cropping
5) Other (Specify)

CP14. How did you address crop diseases on your farm during the past 12 months? (Enumerator: circle all that apply)
1) Did not take any measure species/varieties
2) Plant spacing
3) Fungicides (enumerator: list all that are ever used on your farm) ………
4) Selection of resistant plant
5) Other (specify)
CP15. How did you address weeds on your farm during the past 12 months? (Multiple answers possible).
1) Did not take any measure
2) Hand weeding
3) Herbicides (enumerator: list all that are ever used on your farm) ……….
4) Use of fast emerging crop varieties
5) Other (specify)

CP16. During the past 12 months, did you grow different crops from the previous year?
1. Yes 2. No =>CP18

CP17. If Yes to CP16, What is the main reason you changed the crops you grow?
………………………………………………………………………………………………

CP18. How did you make the decision when to harvest the crop during the past 12 months?
1) Maturity  (3) Danger from theft
2) Market price  (4) Other (specify) ………………..

CP19. Does your household have access to any storage facility?
1) Yes  (2) No

CP20. If YES to CP19: Which are they (a) On Farm  (b) In House  (c) Public

CP21. If YES to CP19 how did you store the crops during the past 12 months? (Enumerator: circle all that apply)
1) In locally made traditional structure  (2) In modern store
3) In Sacks/open drum  (4) In airtight drum
5) Other (specify) ______

CP22. How did you protect your stored crops during the past 12 months? (Enumerator: circle all that apply)
1) Did not take any measure
2) Ashes
3) Pesticides/insecticides (enumerator: list all that are ever used on your farm) ……
4) Tree leaves and other herbs
5) Others (specify)
6) Cow dung

CP23. If you experienced any losses, what are the main reasons for the loss?
1. …………………
2. …………………
3. …………………
CP24. Where did you sell your harvests during the past 12 months? (Enumerator: circle all that apply)
(1) In the village market
(2) In the neighbouring village market
(3) Sell to traders who visit the village
(4) On the roadside
(5) To the Neighbour
(6) Other (specify)

CP25. What difficulties did you face when trying to sell your crops?
(1) Poor Transport Infrastructures
(2) No formal market
(3) Low prices
(4) Low demand
(5) Others (Specify). ……..
(6) Others (Specify). ……..

CP26. How did you address these difficulties? …………………………………………………..

CP27. What is the distance of your homestead to your most commonly used output market place? (Give one way estimate in mins) ________

CP28. What are the three main problems you experienced when growing crops in 2013?
1. ________________ 2. ________________ 3. ________________

CP29. If the rains are very poor or fail do you:
(1) Plant same crops anyway
(2) Do not plant any crop
(3) Plant different crops - (Please mention the crops)………..
(4) Make prayers/Rituals to gods
(5) Planting of short term varieties
(6) Migrate
(7) Other (Specify)
2.5. Livestock Production and Disposal (2013 agricultural year) (LP)

LP1. How long have you been keeping livestock? _______________ Years or Months

Provide details for livestock production activities of your household during the past 12 months

<table>
<thead>
<tr>
<th>S/N</th>
<th>Livestock and livestock product type</th>
<th>How many ..... Do you keep?</th>
<th>Quantity sold (No)</th>
<th>Quantity consumed at home (No)</th>
</tr>
</thead>
</table>

I: Livestock type

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Calves</td>
<td>LP2</td>
<td>LP3</td>
</tr>
<tr>
<td>2</td>
<td>Heifers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Milking cows</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Dry cows</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Bulls</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Oxen</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Goats</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Sheep</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Donkey</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Chicken</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Others (Specify)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

II: Livestock products:

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Milk</td>
<td>Kgs</td>
<td>Lts</td>
</tr>
<tr>
<td>2</td>
<td>Butter</td>
<td>Kgs</td>
<td>Lts</td>
</tr>
<tr>
<td>3</td>
<td>Yoghurt</td>
<td>Kgs</td>
<td>Lts</td>
</tr>
<tr>
<td>4</td>
<td>Cheese</td>
<td>Kgs</td>
<td>Lts</td>
</tr>
<tr>
<td>5</td>
<td>Hide (No)</td>
<td>Kgs</td>
<td>Lts</td>
</tr>
<tr>
<td>6</td>
<td>Skin (No)</td>
<td>Kgs</td>
<td>Lts</td>
</tr>
<tr>
<td>7</td>
<td>Animal manure (Bags)</td>
<td>Kgs</td>
<td>Lts</td>
</tr>
<tr>
<td>9</td>
<td>Others (Specify)</td>
<td>Kgs</td>
<td>Lts</td>
</tr>
</tbody>
</table>

LP6. Why did your household keep the type(s) of livestock you mentioned during the past 12 months? ..............................................................................................................................
LP7. We will now ask you information regarding labour distribution by gender in the major livestock production activities. Please indicate a typical number of hours/days of... [Labour category] spent in...[Major livestock activity] during the past 12 months?

<table>
<thead>
<tr>
<th>Labour category</th>
<th>Major livestock production activities</th>
<th>Pasture/fodder establishment and management (Days)</th>
<th>Animal grazing (Outdoor) (hrs/day)</th>
<th>Animal feeding (Indoor) (hrs/day)</th>
<th>Manure handling/cleaning (hrs/day)</th>
<th>Milking (hrs/day)</th>
<th>Housing (Days)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Man</td>
<td>Woman</td>
<td>Child</td>
<td>Man</td>
<td>Woman</td>
<td>Child</td>
</tr>
<tr>
<td>Household labour</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hired labour</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

LP8. Where did you sell your livestock/products during the past 12 months?
(1) In the village market    (3) Sell to traders who visit the village   (5) Neighbour
(2) In the neighbouring village market (4) On the roadside   (6) Other (specify)

LP9. How did you address animal diseases during the past 12 months?
(1) Did not take any measure    (4) Seek advice from friends/neighbours/relatives
(2) Seek advice from veterinarian (5) Seek advice from agriculture input shops
(3) Use traditional medicine    (6) Selection of disease resistant livestock species
(7) Other, (specify)
LP10. What are the three main problems that you experienced in livestock production in the past 12 months? Start with the most important problem facing your household.
1. .................................. 2. .................................. 3. ..................................

LP11. What difficulties did you face when trying to sell your livestock/livestock products?
  a. Poor Transport Infrastructures  
  b. No formal market  
  c. Low prices  
  d. Low demand  
  e. Others (Specify)....

LP12. How do you address these difficulties? ..................................................

2.6 Agricultural Inputs and Uses (AIU)
AIU1. Please provide information on the uses & sources of agriculture input during the past 12 months

<table>
<thead>
<tr>
<th>Type of input</th>
<th>Did you use...?</th>
<th>If Yes, give source?</th>
<th>Estimated annual expenditure 2013 (TZS)</th>
<th>If No, give reason for not using...</th>
<th>Assessment of availability of...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Code 1 Code 2 Code 3 Code 4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Mineral fertilizers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Animal manure</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Pesticides</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Herbicides</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 Improved Seeds/Seedlings</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 Chicks/breeding stock</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 Veterinary medicines</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 Animal feeds/Concentrates</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 Mechanization services</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Code 1 Code 2 Code 3 Code 4                   |                |                      |                                        |                                   |                                  |
| 1=Yes                                         |                |                      |                                        |                                   |                                  |
| 2=No                                          |                |                      |                                        |                                   |                                  |
| 1=Government institutions                     |                |                      |                                        |                                   |                                  |
| 2=Buy from shops                              |                |                      |                                        |                                   |                                  |
| 3=Own farm                                    |                |                      |                                        |                                   |                                  |
| 4=Other (specify)                             |                |                      |                                        |                                   |                                  |

AIU2 What is the distance of your homestead to your most commonly used input market centre? (Give one way estimate in minutes) ...............

227
2.7. Household Decision-Making (HDM)

<table>
<thead>
<tr>
<th>No</th>
<th>Who decides on the following?</th>
<th>Male spouse</th>
<th>Female spouse</th>
<th>Both</th>
</tr>
</thead>
<tbody>
<tr>
<td>HDM1</td>
<td>Purchase of farm equipment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HDM2</td>
<td>Crops to cultivate in the farm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HDM3</td>
<td>Sale of crops</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HDM4</td>
<td>How to spend cash from sale of crops</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HDM5</td>
<td>Foods to feed the household</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HDM6</td>
<td>Livestock species to raise</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HDM7</td>
<td>Sale of livestock</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HDM8</td>
<td>How to spend cash from sale of livestock</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HDM10</td>
<td>Attend farm training</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HDM11</td>
<td>Other (specify)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
2.8. Agricultural Information and Extension Services (AIE)

AIE1. During the past 12 months...

<table>
<thead>
<tr>
<th>Sources of advice/ information</th>
<th>AIE1a. Did you receive advice/information for your agricultural/livestock activities from ... [sources]?</th>
<th>AIE1b. Was the information about...?</th>
<th>AIE1c. How many times did someone from... [Source] visit your farm in the past 12 months?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Government extension</td>
<td>1=Yes</td>
<td>1=Yes</td>
<td>1=Yes</td>
</tr>
<tr>
<td>2 Non Governmental Organisation</td>
<td>2=No → NEXT ROW</td>
<td>2=No</td>
<td>2=No</td>
</tr>
<tr>
<td>3 Cooperative/Farmer's association</td>
<td></td>
<td>2=No</td>
<td>2=No</td>
</tr>
<tr>
<td>5 Radio/Television</td>
<td></td>
<td>2=No</td>
<td>2=No</td>
</tr>
<tr>
<td>6 Publication</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 Neighbour/Relatives/Friends</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 Other (specify)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

AIE2. If yes to any of the items in AIE1a, Please provide information about how useful and accessible to you/your household were each source of agricultural advice/information during the past 12 months.

<table>
<thead>
<tr>
<th>Source of advice/ information</th>
<th>AIE2a. How useful was ... [Source] as a source of advice/information? (1=Not useful, 2=Somehow Useful 3=Very useful)</th>
<th>AIE2b. How accessible was ... [Source] as a source of advice/information? (1=Not accessible, 2=Somehow accessible 3=Very accessible)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Government extension</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Non Governmental Organization</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Cooperative/Farmer's association</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 Radio/Television</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 Publication</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 Neighbour/Relatives/Friends</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 Other (specify)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
AIE3: If yes to any of the items in AIE1b, how important to you/your household were each type of agricultural advice/information during the past 12 months?

<table>
<thead>
<tr>
<th>Type of advice/ information</th>
<th>AIE3a. How important was… [type] advice/information (1=Not important, 2= Somehow important, 3=Very important)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1  Crop production</td>
<td></td>
</tr>
<tr>
<td>2  Livestock production</td>
<td></td>
</tr>
<tr>
<td>3  Agro-processing</td>
<td></td>
</tr>
<tr>
<td>4  Agricultural prices and marketing</td>
<td></td>
</tr>
<tr>
<td>5  Other (specify)</td>
<td></td>
</tr>
</tbody>
</table>

AIE4. Please indicate the best preferred method should agricultural information be made available to you/your household in the future.

………………………………………………………………………………………………………….

AIE5. What are the 3 major challenges in accessing extension service delivery in your area?
(1) ........................................ (2) ........................................... (3) ...........................................

AIE6. If you have livestock:
   (a) Where do you get them treated or vaccinated? ..........................................................
   (b) What is the distance from your homestead.................................kms.
### MODULE THREE: FOOD AND CARE PRACTICES (FCP)

#### Module 3.1: Household Expenditure and Consumption

Now we will ask you questions related to your household expenditure and consumption of major food and non-food items during the last 30 days.

#### 3.1.1. Regular household food expenditure and consumption during the last 30 days

<table>
<thead>
<tr>
<th>Item</th>
<th>1. Total quantity of ... consumed in the last 30 days</th>
<th>2. Amount of ... consumed in the last 30 days from different sources</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Own produce</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HEC1</td>
</tr>
<tr>
<td>1</td>
<td>Maize/Maize Flour (kg)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Rice (kg)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Wheat flour (kg)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Sorghum (kg)</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Bread (loaves)</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Local donuts/Vitumbua/Chapati (No)</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Sweet Potatoes (kg)</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Irish Potatoes (kg)</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Cassava (kg)</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Beans &amp; other legumes (kg)</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Groundnuts (kg)</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Cooking Oil (lt)</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Ginger &amp; other Condiments (kg)</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Tomato (kg)</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Onion (kg)</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Carrots (kg)</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Cabbage (No)</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Lettuce/other vegetables(bundles)</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Mango, Papaya &amp; other fruits (number)</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Tea/Coffee (packets)</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Sugar (kg)</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Salt (kg)</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Beef, Goat, Mutton (kg)</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Fish (Number)</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>Chicken (Number)</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>Eggs (Number)</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>Milk (lt)</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>Honey (lt)</td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>Others (Specify…)</td>
<td></td>
</tr>
</tbody>
</table>
### 3.1.2. Purchase of Durable Items and Other Services (PDI)

<table>
<thead>
<tr>
<th>S/N</th>
<th>What was your household expenditure on the following items during the last 30 days?</th>
<th>In-cash expenditure (TZS)</th>
<th>In-kind expenditure/gift given away (TZS)</th>
<th>Total expenditure (TZS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PDI1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Cooking materials (charcoal, kerosine, etc.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Laundry (soap, detergents, etc.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Payment of household utilities (electricity, airtime vouchers &amp; water bills, etc.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Kitchen utensils</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>School fees &amp; related</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Medical expenditure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Special occasions (funerals, weddings, parties, rituals, charity, etc.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Personal care (body lotion, hair oil, etc)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Clothing and footwear (tailored clothes, ready-made clothes, rain clothes, underwear, baby clothes, diapers, hats, shoes, boots, etc.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Personal effects (costume/gold jewellery, handbags, wallets, wristwatch, clocks, umbrellas)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Household furniture</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Transport (bought or paid fare)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Building materials (renovation/construction)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Hiring Farm Equipment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Recreation (entertainment services, recreational goods and supplies)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Money transfers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Servant Salary</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Other (specify)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## MODULE 3.2: FOOD SECURITY/INSECURITY ISSUES AND COPING MECHANISMS

### 3.2.1. HOUSEHOLD FOOD INSECURITY ACCESS SCALE (HFIAS)

For each of the following questions, consider whether they have happened in the past 30 days. If the answer is ‘Yes’ to a question, please indicate how often this happened.

<table>
<thead>
<tr>
<th>No.</th>
<th>Question</th>
<th>How often did this happen?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>(0) Never = it did not happen in the past 30 days</td>
</tr>
<tr>
<td>AF1</td>
<td>In the past (30 days), did you worry that your household would not have enough food?</td>
<td>(1) Rarely = once or twice in the past 30 days</td>
</tr>
<tr>
<td>AF2</td>
<td>In the past [30 days], did it happen that you or any household member were not able to eat the kinds of foods you would have preferred to eat because of lack of resources?</td>
<td>(2) Sometimes = three to ten times in the past 30 days</td>
</tr>
<tr>
<td>AF3</td>
<td>In the past [30 days], did it happen that you or any household member had to eat a limited variety of foods because of lack of resources?</td>
<td>(3) Often = more than ten times in the past 30 days</td>
</tr>
<tr>
<td>AF4</td>
<td>In the past [30 days] did it happen that you or any household member had to eat some foods that you really did not want to eat because of lack of resources?</td>
<td></td>
</tr>
<tr>
<td>AF5</td>
<td>In the past [30 days] did it happen that you or any household member had to eat a smaller meal than you felt you needed because there was not enough food?</td>
<td></td>
</tr>
<tr>
<td>AF6</td>
<td>In the past [30 days] did it happen that you or any household member had to eat fewer meals in a day because there was not enough food?</td>
<td></td>
</tr>
<tr>
<td>AF7</td>
<td>In the past [30 days] did it happen that there was no food to eat of any kind in your house, because of lack of resources to get food?</td>
<td></td>
</tr>
<tr>
<td>AF8</td>
<td>In the past [30 days] did it happen that you or any household member went to sleep at night hungry because there was not enough food?</td>
<td>If yes, ask respondent to describe</td>
</tr>
<tr>
<td>AF9</td>
<td>“In the past [30 days] did it happen that you or any household member went a whole day and night without eating anything at all because there was not enough food?”</td>
<td>If yes, ask respondent to describe</td>
</tr>
</tbody>
</table>
3.2.2 HOUSEHOLD DIETARY DIVERSITY SCORE (HDDS)

Please describe the foods (meals and snacks) that you (or your household members) ate yesterday during the day and night. Start with the first food eaten in the morning.

<table>
<thead>
<tr>
<th>Breakfast</th>
<th>Snack</th>
<th>Lunch</th>
<th>Snack</th>
<th>Dinner</th>
<th>Snack</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SN</th>
<th>FOOD GROUP</th>
<th>EXAMPLES</th>
</tr>
</thead>
<tbody>
<tr>
<td>HDD1</td>
<td>CEREALS</td>
<td>Maize, rice, wheat, sorghum, or any other grains or foods made from these (e.g. bread, ugali, porridge etc.)</td>
</tr>
<tr>
<td>HDD2</td>
<td>VITAMIN A RICH VEGETABLES AND TUBERS</td>
<td>pumpkin, carrots, or sweet potatoes that are orange inside + other locally available vitamin-A rich vegetables</td>
</tr>
<tr>
<td>HDD3</td>
<td>WHITE TUBERS AND ROOTS</td>
<td>white potatoes, white yams, white cassava, or other foods made from roots</td>
</tr>
<tr>
<td>HDD4</td>
<td>DARK GREEN LEAFY VEGETABLES</td>
<td>Any dark, green, leafy vegetables such as cassava leaves, bean leaves, spinach, amaranth, spinach, i.e. wild veges etc.</td>
</tr>
<tr>
<td>HDD5</td>
<td>OTHER VEGETABLES</td>
<td>Other vegetables (e.g. tomato, onion, eggplant), including wild vegetables</td>
</tr>
<tr>
<td>HDD6</td>
<td>VITAMIN A RICH FRUITS</td>
<td>ripe mangoes, ripe papaya + other locally available vitamin A-rich fruits</td>
</tr>
<tr>
<td>HDD7</td>
<td>OTHER FRUITS</td>
<td>other fruits, including wild fruits</td>
</tr>
<tr>
<td>HDD8</td>
<td>ORGAN MEAT (IRON-RICH)</td>
<td>liver, kidney, heart or other organ meats or blood-based foods</td>
</tr>
<tr>
<td>HDD9</td>
<td>FLESH MEATS</td>
<td>beef, pork, lamb, goat, rabbit, wild game, chicken, duck, or other birds</td>
</tr>
<tr>
<td>HDD10</td>
<td>EGGS</td>
<td>chicken, duck, guinea hen or any other egg</td>
</tr>
<tr>
<td>HDD11</td>
<td>FISH</td>
<td>fresh or dried fish or shellfish</td>
</tr>
<tr>
<td>HDD12</td>
<td>LEGUMES, NUTS AND SEEDS</td>
<td>beans, peas, lentils, nuts, seeds or foods made from these</td>
</tr>
<tr>
<td>HDD13</td>
<td>MILK AND MILK PRODUCTS</td>
<td>milk, cheese, yogurt or other milk products</td>
</tr>
<tr>
<td>HDD14</td>
<td>OILS AND FATS</td>
<td>oil, fats or butter added to food or used for cooking</td>
</tr>
<tr>
<td>HDD15</td>
<td>RED PALM PRODUCTS</td>
<td>Red palm oil, palm nut or palm nut pulp sauce</td>
</tr>
<tr>
<td>HDD16</td>
<td>SWEETS</td>
<td>sugar, honey, sweetened soda or sugary foods such as chocolates, candies, cookies and cakes</td>
</tr>
<tr>
<td>HDD17</td>
<td>SPICES, CONDIMENTS, BEVERAGES</td>
<td>spices (black pepper, salt), condiments (soy sauce, hot sauce), coffee, tea, alcoholic beverages or local examples</td>
</tr>
</tbody>
</table>

HDD18. Did you or anyone in your household eat anything (meal or snack) OUTSIDE of the home yesterday?
1 = Yes  2 = No
**DIETARY DIVERSITY GUIDING QUESTIONS FOR THE HOUSEHOLD SURVEY**

<table>
<thead>
<tr>
<th></th>
<th>Question</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Who was the first person in the household to wake up yesterday?</td>
<td>1. me/spouse</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. my daughter</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Others Specify</td>
</tr>
<tr>
<td>2</td>
<td>After you woke up, what was the first thing prepared or consumed in the</td>
<td></td>
</tr>
<tr>
<td></td>
<td>household?</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Did you make coffee /tea or porridge yesterday? (breakfast)</td>
<td>1 = Yes, 2 = No</td>
</tr>
<tr>
<td>4</td>
<td>At what time?</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Did you consume the tea or coffee with something else or only had the</td>
<td>1 = Yes, 2 = No</td>
</tr>
<tr>
<td></td>
<td>coffee?</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>What were the ingredients in the coffee/tea/porridge?</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Do you sweeten all the tea/ coffee/ porridge at once, or does each person</td>
<td>sweeten all at once</td>
</tr>
<tr>
<td></td>
<td>sweeten their own cup?</td>
<td>no sweeten at all</td>
</tr>
<tr>
<td></td>
<td></td>
<td>sweeten individually</td>
</tr>
<tr>
<td>8</td>
<td>What was the next thing prepared or consumed after the tea/ coffee/</td>
<td></td>
</tr>
<tr>
<td></td>
<td>porridge?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(Asks for and writes down all the ingredients of each foods consumed at</td>
<td></td>
</tr>
<tr>
<td></td>
<td>breakfast).</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Is there any beverage with breakfast?</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>What was the next thing prepared or consumed after breakfast?</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Did anyone in the household eat anything between breakfast and lunch? For</td>
<td></td>
</tr>
<tr>
<td></td>
<td>example, fruits, nuts or milk for the baby?</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>(After requesting information on the ingredients of each meal after lunch).</td>
<td></td>
</tr>
<tr>
<td></td>
<td>What was the next thing prepared after lunch?</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>(Notes all the ingredients of each dish consumed at dinner) Was any</td>
<td></td>
</tr>
<tr>
<td></td>
<td>beverage served with dinner?</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Did anyone in the household eat or drink anything after dinner? For</td>
<td>1 = Yes if yes specify</td>
</tr>
<tr>
<td></td>
<td>example, a cup of tea/ coffee or a piece of fruit or milk for the baby?</td>
<td>2 = No</td>
</tr>
<tr>
<td>15</td>
<td>Did you all go to bed at the same time, or did some household members</td>
<td></td>
</tr>
<tr>
<td></td>
<td>stay up later than others?</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Did you eat or drink any last thing before going to bed?</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>If something is eaten describe it</td>
<td></td>
</tr>
</tbody>
</table>
3.3. Household Coping Strategies/Mechanisms and Related (HCS)

Please ask these questions to the mother. Ask questions HCS5 to HCS10 to the household head (husband) in case of male-headed households as well.

HCS2. Did your household face food shortages during the last 12 months?  
1=Yes, 2=No

HCS3. If ‘Yes’ to HC2, in which month(s) of the year were the food shortage serious in the household? List the months ……………, ……………, …………………

HCS4. If again 'Yes', to HC2 what are the most important causes of food shortage in the household? Please list in the order of their importance (1=Most important)

1. ………………………………………………………………………………
2. ………………………………………………………………………………
3. ………………………………………………………………………………

HCS5. What measures did you take when your household faced serious food shortage?  
1) ………………  2) ……………………  3) …………………

HCS6. Where do you get food you do not produce?  
(a) Buy from neighbours  (c) Seek from the forest  
(b) Buy from the local shops/market (d) Others (specify)……

HCS7. What difficulties do you face when trying to buy foodstuff

a) Poor Transport Infrastructure  d) Lack of alternatives  
b) High prices  e) No formal market  
c) Low supply  f) Others (Specify)

HCS8. How do you address these difficulties? 1) ………  2) …………  3) …………

HCS9. What are the major traditional/socio-cultural activities that consumed a significant amount of your food produce in the past 12 months?  
(a) Weddings  (c) Traditional dances  (e) Others (specify)  
(b) Religious offering/Rituals  (d) Funerals

HCS10. Apart from funerals, what month do most of the major traditional social-cultural activities (e.g. weddings, traditional dances, etc.) take place in your area? ………………….
MODULE FOUR: HEALTH STATUS

4.1 Illness and disability (ILD)
ILD1. Was there any member of the household who suffered any kind of illness and/or disability during the past 12 months? (1) Yes (2) No
(If Yes, list the household member ID: ………………………………………………………………)
ILD2. Where do you normally seek help when a member of your household is sick?
Multiple answers possible
(1) District Hospital (4) Traditional healer (7) Other (specify)
(2) Village Health Centre (5) Chemist / pharmacy
(3) Private Clinic (6) Do not consult
ILD3. If 'no' (Option 6) in (ILD2) above, please give reasons:
(1) Could not afford expenses (3) The service is too far
(2) The illness was not serious (4) Others (Specify) ………………………………………
ILD4. Who takes care of the sick and/or disabled in the household? …………………
ILD6. What is the average time spent in taking care of the sick and/disabled? ………………… Hours per day

4.2 Water and Sanitation (WS)
WS1. What is the main source of drinking water for members of your household?
1 = Piped water 4 = Unprotected well 7 = Unprotected spring/River
2 = Public tap/standpipe 5 = Rainwater collection 8 = Bottled water
3 = Protected well 6= Protected spring 9 = other (specify)
WS2. How long does it take to fetch water and come back in most of the times? In minutes
WS3. Who is responsible to fetch water in the household?
(1) Adult women (3) Female child (5) Other (specify)
(2) Adult men (4) Male child
WS4. What do you usually do to the water to make it safer for drinking?
(1) Boil (4) Use water filter (ceramic, sand, composite, etc.),
(2) Add Bleach/Chlorine (5) No treatment
(3) Strain it through a cloth (6) other (specify)
WS5. What type of toilet facility does your household use?
1 = No toilet/bush 4 = Improved pit latrine – household owned
2 = Flush toilet 5 = Other type (specify)
3 = Pit latrine – traditional
WS6. Do you share toilet facility with other households? 1=Yes, 2=No
WS7. If yes to WS6 above, with how many households do you share the facility?
WS8. When do members of your household normally wash their hands? …………………
WS9. How does your household primarily dispose of household waste?
   (1) Dumped in street/open space,   (3) Rubbish pit    (5) Burned
   (2) Disposed in the compound/Farm (4) Dumped into river  (6) Other (specify)

MODULE FIVE: SOCIAL CAPITAL (SC)
Now we would like to ask you some questions about how you feel about this village, and how you take part in the community activities
SC1 Are you/someone in your household a member of any groups/organizations?
   1 = Yes   2 = No
SC2. If 'Yes' to SC1, list up to three in order of importance

<table>
<thead>
<tr>
<th>Group</th>
<th>Type of group (Write the option and name of group)</th>
<th>Participation</th>
</tr>
</thead>
</table>
| Group A | 1 = Religious group  
         | 4 = Youth Group  
         | 2 = Farmers’ Association  
         | 5 = Women’s group  
         | 3 = Development Committee  
         | 6 = Other (specify) | 1= An active member with position (e.g. Chairperson, Secretary, Treasurer)  
         | 2= Active member but no formal position  
         | 3= Not an active member |
| Group B | | |
| Group C | | |

SC3. What is the value of these groups (listed in SC1) to your household wellbeing?
…………………………………………………………………………………………….
SC4. Are there any services where you or members of your household are occasionally denied or have only limited opportunity to use?  
   1 = Yes   2 = No
If Yes:  
   (1) Education/schools  
   (2) Health services/clinics  
   (3) Job training/employment  
   (4) Credit/finance  
   (5) Water distribution/Sanitation Services  
   (6) Agricultural extension  
   (7) Justice/conflict resolution  
   (8) Other (specify)
SC5. Are there any other members of this community excluded from some services?  
   1 = Yes  2 = No
SC6. If 'Yes' to SC5 what services are they excluded from?:
   (1) Education/schools  
   (2) Health services/clinics  
   (3) Job training/employment  
   (4) Credit/finance  
   (5) Water distribution/Sanitation Services  
   (6) Agricultural extension  
   (7) Justice/conflict resolution  
   (8) Other (specify)
SC7. If 'Yes' again to SC5, What are the reasons why some people are excluded from these services? (Enumerator more than one option is possible)

1. Income level/Wealth/Social Status
2. Disability
3. Age
4. Gender
5. Race/ethnicity
6. Religious beliefs
7. Lack of education
8. Political affiliation
9. Other, Specify……

SC8. What procedure is used to make the decision related to major development projects needed in this village? ……………………………

SC9. Suppose someone in the village had something unfortunate happen to them, e.g. bereavement. Who do you think they could turn to for help in this situation? ……………………………

SC10. Please tell me whether in general you agree or disagree with the following statements: Use the code

1 = strongly agree 2 = Agree 3 = Disagree 4 = strongly disagree

SC16a. Most people in this village are willing to help if you need it

SC16b. I feel accepted as a member of this village

SC16c. The relationships in this village are harmonious

SC11. Who primarily resolves disputes in this village?

1. People work it out between themselves [ ]
2. Household members [ ]
3. Neighbours [ ]
4. Community leaders [ ]
5. Religious leaders [ ]
6. Judicial leaders [ ]
7. Other (specify) [ ]

INTERVIEWER: You have now come to the end of the interview. Make sure to do the following:

i. Thank the respondent for the cooperation shown by the members of the household during the interview

ii. Take enough time to examine all the entries/boxes on all pages. Make sure that no empty boxes are left, for which an entry is required. In particular work out, with the help of the main informant, how information (missing) relating to members of the household who happen to be absent at the time of the interview can be obtained.
Appendix 4: Post-harvest Household Survey Questionnaire

QUESTIONNAIRE
TANZANIA AGRIDIET PROJECT
AGRICULTURE-NUTRITION HOUSEHOLD SURVEY (2014)
POST-HARVEST (ROUND TWO)

Enumerators Name:………………………………
Signature: ………………………………………

FIRST APPOINTMENT
Date enumerated: ………………………………..
Start Time: ………………………………………
End Time: ………………………………………

Present at the household | Male | Female | If absent, reason for absence………
Who was interviewed at this household during the last survey? | Same Male | Same Female | Other (Specify)……

SECOND APPOINTMENT
Date enumerated: ………………………………..
Start Time: ………………………………………
End Time: ………………………………………

Checked by (Name): …………………………….
Signature: ………………………………………
Date: ………………………………………

Interview Results (circle the right number)

1. Completely Filled
2. Partially Filled
3. Refused
4. Building Ruined / Removed
5. Empty Building
6. Other (Specify) ……

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OVERVIEW OF THE AGRIDIET PROJECT

We are conducting research with Sokoine University of Agriculture and St. Augustine’s University under the Irish Aid funded AgriDiet project to examine the link between agriculture and nutrition. We want to explore ways in which your farming and food management practices impact on nutrition, particularly of women and children in rural household.

STRUCTURE OF THE QUESTIONNAIRE
Title Page
Identification Details
Module One: Household Characteristics
Module Two: Household Economy
Module Three: Food and Care Practice
Module Four: Social Capital
IDENTIFICATION DETAILS

Location of the respondent

<table>
<thead>
<tr>
<th>S/N</th>
<th>Location</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID1</td>
<td>Region</td>
<td>………………………………………………………………………</td>
</tr>
<tr>
<td>ID2</td>
<td>District</td>
<td>………………………………………………………………………</td>
</tr>
<tr>
<td>ID3</td>
<td>Division</td>
<td>………………………………………………………………………</td>
</tr>
<tr>
<td>ID4</td>
<td>Ward</td>
<td>………………………………………………………………………</td>
</tr>
<tr>
<td>ID5</td>
<td>Village</td>
<td>………………………………………………………………………</td>
</tr>
<tr>
<td>ID5a</td>
<td>Hamlet</td>
<td>………………………………………………………………………</td>
</tr>
</tbody>
</table>

Details of the respondent and household head

| ID6 | Name of household head | ………………………………………… |
| ID7 | Sex of household head (Male = 1, Female = 2) |
| ID8 | Name of First respondent | ………………………………………… |
| ID8a| Relationship of Respondent to Household Head (use code ID9) |
| ID9 | Name of Second Respondent | ………………………………………… |
| ID9a| Relationship of Second Respondent to Household Head (use code ID9) |
| ID10| Name of Translator | ………………………………………… |
| ID10a| Relationship of translator to Household Head (use code ID9) |

Code ID9&10: Relationship of Respondent to Household Head Codes

1 = Self  
2 = Wife/Husband/Partner  
3 = Son/Daughter  
4 = Step son/daughter  
5 = Grandchild  
6 = Father/Mother  
7 = Brother/Sister  
8 = Niece/Nephew  
9 = Father/Mother-in-Law  
10 = Sister/Brother-in-law  
11 = Daughter/son-in-law  
12 = Grandparent  
13 = Uncle/Aunt  
14 = Other relative  
15 = Helper/Servant  
16 = Not related
MODULE ONE: INFORMATION ON HOUSEHOLD CHARACTERISTICS (HC)

HC10. How many people are living in this household? ………………

HC11. Is there any household member who has moved to this household since our last visit? 1=Yes 2=No

HC12. Is there any household member who has moved from this household since our last visit? 1=Yes 2=No

HC9. If yes HC12, give reason for leaving outside the household
1) Education (High school/College)  (3) To stay with other relatives  (5) Moved temporarily for farming activities
2) Search for job  (4) Went to the market/business trip

If yes again to HC12, Provide details of the new member(s)

<table>
<thead>
<tr>
<th>ID</th>
<th>HC1</th>
<th>HC2</th>
<th>HC3</th>
<th>HC4</th>
<th>HC5</th>
<th>HC6</th>
<th>HC7</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Name (start with the HH head)</td>
<td>Sex</td>
<td>Age (Years)</td>
<td>Marital Status</td>
<td>Relationship with HH Head (Code 1a)</td>
<td>Number of Years in School</td>
<td>Major occupation (Code 1c)</td>
</tr>
<tr>
<td></td>
<td>Male=1</td>
<td>(months only for children &lt;2yrs)</td>
<td>1=Single 2=Married 3=Widowed 4=Divorced</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Female=2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
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<tr>
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<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>
**Code 1a: Relationship with HH head**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Self</td>
</tr>
<tr>
<td>2</td>
<td>Wife/Husband/Partner</td>
</tr>
<tr>
<td>3</td>
<td>Son/Daughter</td>
</tr>
<tr>
<td>4</td>
<td>Step son/daughter</td>
</tr>
<tr>
<td>5</td>
<td>Grandchild</td>
</tr>
<tr>
<td>6</td>
<td>Father/Mother</td>
</tr>
<tr>
<td>7</td>
<td>Brother/Sister</td>
</tr>
<tr>
<td>8</td>
<td>Niece/Nephew</td>
</tr>
<tr>
<td>9</td>
<td>Father/Mother-in-Law</td>
</tr>
<tr>
<td>10</td>
<td>Sister/Brother-in-law</td>
</tr>
<tr>
<td>11</td>
<td>Daughter/son-in-law</td>
</tr>
<tr>
<td>12</td>
<td>Grandparent</td>
</tr>
<tr>
<td>13</td>
<td>Uncle/Aunt</td>
</tr>
<tr>
<td>14</td>
<td>Other relative to head/Spouse</td>
</tr>
<tr>
<td>15</td>
<td>Helper/Servant</td>
</tr>
<tr>
<td>16</td>
<td>Not related</td>
</tr>
</tbody>
</table>

**Code 1c: Major occupation**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Farming</td>
</tr>
<tr>
<td>2</td>
<td>Small scale entrepreneur</td>
</tr>
<tr>
<td>3</td>
<td>Labourer/Skilled-unskilled</td>
</tr>
<tr>
<td>4</td>
<td>Natural resource extraction</td>
</tr>
<tr>
<td>5</td>
<td>Civil servant</td>
</tr>
<tr>
<td>6</td>
<td>Private sector/NGO employee</td>
</tr>
<tr>
<td>7</td>
<td>Paid Cooperative official</td>
</tr>
<tr>
<td>8</td>
<td>Police/Armed forces member</td>
</tr>
<tr>
<td>9</td>
<td>Pensioner (receiving pension)</td>
</tr>
<tr>
<td>10</td>
<td>Other activity (Specify)</td>
</tr>
<tr>
<td>11</td>
<td>Currently unemployed</td>
</tr>
<tr>
<td>12</td>
<td>Student/Underage</td>
</tr>
</tbody>
</table>

**4.1 Illness and disability (ILD)**

ILD1. Was there any member of the household who suffered any kind of long term illness and/or disability during the 2014 production year?  
1=Yes  
2=No  

If Yes, List the Household Member Names  
1. ................................  
2. ................................  
3. ................................
MODULE TWO: HOUSEHOLD ECONOMY

2.1.2. Asset Ownership (2014 production year (AO))

AO1. Household Items during the 2014 production year

Did your household add to or reduce any of the following items since last survey?

<table>
<thead>
<tr>
<th>Item</th>
<th>Did you add/reduce...?</th>
<th>Quantity added of... since last survey</th>
<th>Quantity reduced of... since last survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Radio</td>
<td>1=Yes, 2=No</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Mobile Phone</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Bicycle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Motor vehicle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Motorcycle (Any type)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Television</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Beds</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Cupboards</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Normal chairs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Furniture Suit (Cushen chairs)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Iron (Electric/Charcoal)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Cooker (Electric or Gas)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Refrigerator/Freezer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Tables</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Other (specify)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

AO2. Agricultural production equipment during the 2014 production year

Did your household add to or reduce any of the following since last survey?

<table>
<thead>
<tr>
<th>Name/Type of equipment/asset equipment</th>
<th>Did you add/reduce...?</th>
<th>Quantity added of... since last survey</th>
<th>Quantity reduced of... since last survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Hand Hoe</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Ox-plough (Set)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Water Pump (Motorised/Mechanical)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Milling Machine (Motorised/Hand)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 Machette/knives</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 Axe</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 Shovel</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 Wheel barrow</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 Other (specify)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

CS11. What farm inputs were most needed by you in this season? (Circle all that apply)

(1) Mineral fertiliser  (4) Improved breeds of livestock
(2) Improved crop seed variety  (5) Veterinary medicine
(3) Agrichemicals  (6) Others (specify)

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CS1. Did you receive any farm input vouchers from the government during the 2014 production season?
   1=Yes            2=No

CS2. If yes, What type(s) of farm input voucher?
   (a) Mineral Fertilizer (List the fertilizer types)…………………
   (b) Improved crop seed varieties (List the crops)…………………
   (c) Other (specify)………………………………..

CS3. If Yes in CS1, in which month(s) of the year was the voucher received? …………..

CS4. In which month(s) of the year was the voucher needed? …………..

CS12. How did you finance your farm input costs during the 2014 production season?
   1) Did not buy inputs            (4) Money lenders
   2) Own finances                  (5) Interested in finance but no access
   3) Loans from banks              (6) Other sources (specify)

CS8. Has any member of the household taken a loan since last visit?
   1=Yes            2=No

If Yes, Then respond to CS9 and CS13     If No, Then respond to CS10

<table>
<thead>
<tr>
<th>member number</th>
<th>CS8a. Amount taken (TZS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>First member</td>
<td></td>
</tr>
<tr>
<td>Second member</td>
<td></td>
</tr>
<tr>
<td>Third member</td>
<td></td>
</tr>
</tbody>
</table>

CS9. If Yes again to CS8, what was the loan for? ……………………………

CS13. If Yes again to CS8, what was the source(s) of the loan?
   1) …………………………..    2) …………………………..    3) …………………………..

CS10. If ‘No’ to CS8, explain the reasons why the household did not take loan for any purpose since last visit?………………………………………………………………………………
### 2.4. Crop Production and Disposal (CP)

**Crop production (2014 production year)**

Kindly provide the following detailed information on crops grown, output obtained and their disposal

<table>
<thead>
<tr>
<th>S/N</th>
<th>Crop(s) grown</th>
<th>Area allocated for each crop (acres)</th>
<th>Area Under Irrigation agric (acres)</th>
<th>Intercropped with ... (CP2)</th>
<th>Quantity produced (kgs)</th>
<th>Quantity consumed at home (kgs)</th>
<th>Quantity retained for seed (kgs)</th>
<th>Processed harvest (kgs)</th>
<th>Post-harvest loss? (kgs)</th>
<th>Reason for growing...</th>
<th>Importance of ... to livelihood? (1=Not important, 2=Somehow important, 3=Very important)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CP2</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>1</td>
<td>Maize</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Rice</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>3</td>
<td>Sorghum</td>
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</tr>
<tr>
<td>4</td>
<td>Sesame</td>
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<tr>
<td>5</td>
<td>Green Grams</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>6</td>
<td>Butter Beans</td>
<td></td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>7</td>
<td>Pigeon Peas</td>
<td></td>
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<tr>
<td>8</td>
<td>Other Legumes</td>
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<td>9</td>
<td>Sun flower</td>
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<tr>
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<td>Sweet Potatoes</td>
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<tr>
<td>11</td>
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<td></td>
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</tr>
<tr>
<td>12</td>
<td>Tomatoes</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13.i</td>
<td>Groundnuts</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13ii</td>
<td>Pumpkins</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13iii</td>
<td>Millet</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
P13. What amount of fruits did you harvest since last visit?

<table>
<thead>
<tr>
<th>No</th>
<th>Type</th>
<th>Tick</th>
<th>No. of bags harvested</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>No Fruit tree</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Orange</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Mango</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Pawpaw</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Guava</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Coconut</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Other (specify)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

CP14. Please indicate how many days of... [Labour category] were spent in... [Major crop production activity] during the 2014 production year?

<table>
<thead>
<tr>
<th>Labour category</th>
<th>Major crop production activities - 2014 season</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Land preparation</td>
</tr>
<tr>
<td></td>
<td>Man Days</td>
</tr>
<tr>
<td>Household labour</td>
<td></td>
</tr>
<tr>
<td>Hired labour</td>
<td></td>
</tr>
</tbody>
</table>

CP15. How did you address pests on your field crops during the 2014 production year?
1) Did not take any measure
2) Selection of pest resistant plant species/varieties
3) Pesticides (enumerator: list all that are ever used on your farm) _______
4) Mixed/ inter cropping
5) Other (Specify)

CP16. How did you address crop diseases on your farm during the 2014 production year?
1) Did not take any measure
2) Plant spacing
3) Fungicides (enumerator: list all that are ever used on your farm)
4) Selection of resistant plant species/varieties
5) Other (specify)

CP17. How did you address weeds on your farm during the 2014 production year?(multiple answers possible).
1) Did not take any measure
2) Hand weeding/hoeing
3) Herbicides (enumerator: list all that are ever used on your farm)
4) Use of fast emerging crop varieties
5) Other (specify)

CP18. During the 2014 production year, did you grow different crops from the previous year?
1. Yes
2. No => CP18

CP19. If Yes to CP18, What is the main reason you changed the crops you grow?

……………………………………
CP20. What influenced your decision on when to harvest the crop during the 2014 production year?
1) Maturity 
2) Market price 
3) Danger from theft 
4) Other (specify) _____________________________

CP21. Does your household have access to any storage facility?
1) Yes 
2) No 

CP22a. If YES to CP21: Which are they (a) On Farm (b) In House (c) Public 

CP22b. If YES to CP21 how are you storing the crops in this 2014 production year?
1) In locally made traditional structure 
2) In modern store 
3) In Sacks/open drum 
4) In airtight drum 
5) Other (specify) ………….. 

CP23. How are you protecting your stored crops in this 2014 production year? (Enumerator: circle all that apply)
1) Did not take any measure 
2) Ashes 
3) Pesticides/insecticides (enumerator: list all that are ever used on your farm) 
4) Tree leaves and other herbs 
5) Others (specify) 

CP24 If you experienced any post-harvest losses in this 2014 production year, what are the main reasons for the loss?
1. ______________ 
2. ______________ 
3. ______________ 

CP25. Where did you sell your harvests during the 2014 production year?
1) In the village market 
2) In the neighbouring village market 
3) Sell to traders who visit the village 
4) On the roadside 
5) To the Neighbour 
6) Other (specify) 

CP26. What difficulties did you face when trying to sell your crops?
1) Poor Transport Infrastructures 
2) No formal market 
3) Low prices 
4) Low demand 
5) Others (Specify). … 

CP27. How did you address these difficulties? ………………………………………………… 

CP28. What is the distance of your homestead to your most commonly used output market place? (Give one way estimate in mins) …………….. 

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CP29. What are the three main problems you experienced when growing crops in 2014 production year?
1. ................
2. ................
3. ................

CP33. What are the specific weather risks that crop production faced in this area? (Circle all that apply)
1) Drought  (3) Temperature  (5) Other (specify)
2) Excess rain/flood  (4) Humidity

CP34. If you ever experienced any of the weather risks outlined above, how did you manage it? ..................................................

CP35. In which of the last ten years do you recall having most favourable weather for crop production? Mention the year(s) .................................

CP36. In which of the last ten years do you recall having the worst weather for crop production? Mention the year(s) .................................
### 2.5. Livestock Production and Disposal (2014 production year) (LP)

Provide details for livestock production activities of your household during the 2014 production year.

<table>
<thead>
<tr>
<th>S/N</th>
<th>Livestock and livestock product type</th>
<th>How many ..... Do you keep?</th>
<th>Quantity sold (No)</th>
<th>Quantity consumed at home (No)</th>
<th>Reason(s) for keeping</th>
<th>Importance of … to livelihood? (1=Not important, 2=Somehow important, 3=Very important)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>I: Livestock type</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Calves</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Heifers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Milking cows</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Dry cows</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Bulls</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Oxen</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Goats</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Sheep</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Donkey</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Chicken</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>Others (Specify)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>II: Livestock products:</strong></td>
<td>Kg/LtS</td>
<td>Kg/LtS</td>
<td>Kg/LtS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Milk</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Yoghurt</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Hide (No)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Skin (No)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Animal manure (Bags)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Eggs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Others (Specify)</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
LP7. We will now ask you information regarding labour distribution by gender in the major livestock production activities. Please indicate a typical number of hours/days of... [Labour category] spent in...[Major livestock activity] during the 2014 production year?

<table>
<thead>
<tr>
<th>Labour category</th>
<th>Major livestock production activities-2014 production season</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pasture/fodder establishment and management (Days)</td>
</tr>
<tr>
<td></td>
<td>Animal grazing (Outdoor) (hrs/day)</td>
</tr>
<tr>
<td></td>
<td>Animal feeding (Indoor) (hrs/day)</td>
</tr>
<tr>
<td></td>
<td>Manure handling/cleaning (hrs/day)</td>
</tr>
<tr>
<td></td>
<td>Milking (hrs/day)</td>
</tr>
<tr>
<td></td>
<td>Housing (Days)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Man</th>
<th>Woman</th>
<th>Child</th>
<th>Man</th>
<th>Woman</th>
<th>Child</th>
<th>Man</th>
<th>Woman</th>
<th>Child</th>
<th>Man</th>
<th>Woman</th>
<th>Child</th>
<th>Man</th>
<th>Woman</th>
<th>Child</th>
</tr>
</thead>
<tbody>
<tr>
<td>Household labour</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hired labour</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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</tr>
</tbody>
</table>

LP8. Where did you sell your livestock/products during the 2014 production year?
1) In the village market 4) On the roadside
2) In the neighbouring village market 5) Neighbour
3) Sell to traders who visit the village 6) Other (specify)

LP9. How did you address animal diseases during the 2014 production year?
1) Did not take any measure 4) Seek advice from friends/neighbours/relatives
2) Seek advice from veterinarian 5) Seek advice from agriculture input shops
3) Use traditional medicine 6) Selection of disease resistant livestock species
7) Other (specify)
LP10. What are the three main problems that you experienced in livestock production in the 2014 production year? Start with the most important problem facing your household.
1…………………… 2…………………… 3. ………………………

LP11. What difficulties did you face when trying to sell your livestock/livestock products?
1. Poor Transport Infrastructures 3. Low prices 5. Others (Specify)..
2. No formal market 4. Low demand

LP12. How do you address these difficulties?

...............................................................

2.6 Agricultural Inputs and Uses (AIU)
AIU1. Please provide information on the uses & sources of agriculture input during the 2014 production year.

<table>
<thead>
<tr>
<th>Type of input</th>
<th>Did you use…?</th>
<th>If Yes, give source?</th>
<th>Estimated expenditure 2014 (TZS)</th>
<th>If No, give reason for not using…</th>
<th>Assessment of availability of …</th>
</tr>
</thead>
<tbody>
<tr>
<td>Code 1</td>
<td>Code 2</td>
<td>Code 3</td>
<td>Code 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Mineral fertilizers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Animal manure</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Pesticides</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Herbicides</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 Improved Seeds/Seedlings</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 Chicks/breeding stock</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 Veterinary medicines</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 Animal feeds/Concentrates</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 Mechanization services</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Code 1</th>
<th>Code 2</th>
<th>Code 3</th>
<th>Code 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1=Yes</td>
<td>1=Government institutions</td>
<td>1=Very expensive</td>
<td>1=Easily obtained</td>
</tr>
<tr>
<td>2=No</td>
<td>2=Buy from shops</td>
<td>2=Not available</td>
<td>2=Obtained/with difficulty</td>
</tr>
<tr>
<td>3=Own farm</td>
<td>3=Not needed</td>
<td>3=Not available</td>
<td>3=Not available</td>
</tr>
<tr>
<td>4=Other (specify)</td>
<td>4=Laborious work to apply and use</td>
<td>5=Don’t know how to use</td>
<td></td>
</tr>
</tbody>
</table>
### 2.8. Agricultural Information and Extension Services (AIE)

**AIE1.** During the 2014 production year...

| Source of advice/ information | AIE1a. Did you receive advice/ information for your agricultural/ livestock activities from ... [sources]?
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Crop production</td>
</tr>
<tr>
<td>1=Yes</td>
<td>1=Yes</td>
</tr>
<tr>
<td>2=No → NEXT ROW</td>
<td>2=No</td>
</tr>
</tbody>
</table>

1. Government extension
2. Non Governmental Organisation
3. Cooperative/Farmer's association
4. Radio/Television
5. Publication
6. Neighbour/Relatives/Friends
7. Other (specify)

**AIE2.** If yes to any of the items in AIE1a, Please provide information about how useful and accessible to you/your household were each source of agricultural advice/information during the 2014 production year.

<table>
<thead>
<tr>
<th>Source of advice/ information</th>
<th>AIE2a. How useful was … [Source] as a source of advice/information? (1=Not useful, 3=Very useful)</th>
<th>AIE2b. How accessible was … [Source] as a source of advice/information? (1=Not accessible, 2 = Somehow accessible 3=Very accessible)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
AIE3: If yes to any of the items in AIE1b, how important to you/your household were each type of agricultural advice/information during the 2014 production year?

<table>
<thead>
<tr>
<th>Type of advice/ information</th>
<th>AIE3a. How important was... [type] advice/information (1=Not important, 2=Somehow important, 3=Very important)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Crop production</td>
<td></td>
</tr>
<tr>
<td>2 Livestock production</td>
<td></td>
</tr>
<tr>
<td>3 Agro-processing</td>
<td></td>
</tr>
<tr>
<td>4 Agricultural prices and marketing</td>
<td></td>
</tr>
<tr>
<td>5 Other (specify)</td>
<td></td>
</tr>
</tbody>
</table>
## MODULE THREE: FOOD AND CARE PRACTICES (FCP)

### Module 3.1: Household Expenditure and Consumption

Now we will ask you questions related to your household expenditure and consumption of major food and non-food items during the last 30 days.

#### 3.1.1. Regular household food expenditure and consumption during the last 30 days

<table>
<thead>
<tr>
<th>Item</th>
<th>1. Total quantity of ... consumed in the last 30 days</th>
<th>2. Amount of ... consumed in the last 30 days from different sources</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Own produce</td>
<td>Purchase d</td>
</tr>
<tr>
<td>HEC1</td>
<td>HEC2a</td>
<td>HEC2b</td>
</tr>
<tr>
<td>Maize/Maize Flour (kg)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rice (kg)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wheat flour (kg)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sorghum (kg)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bread (loaves)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Local donuts/Vitumbua/Chapati (No)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sweet Potatoes (kg)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Irish Potatoes (kg)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cassava (kg)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beans &amp; other legumes (kg)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Groundnuts (kg)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cooking Oil (lt)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ginger &amp; other Condiments (kg)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tomato (kg)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Onion (kg)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carrots (kg)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cabbage (No)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lettuce &amp; other vegetables(bundles)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mango, Papaya &amp; other fruits (No)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tea/Coffee (packets)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sugar (kg)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salt (kg)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beef, Goat, Mutton (kg)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fish (Number)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chicken (Number)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eggs (Number)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Milk (lt)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Honey (lt)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coconut (No)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sardine (Kg)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### 3.1.2. Purchase of Durable Items and Other Services (PDI)

<table>
<thead>
<tr>
<th>S/N</th>
<th>What was your household expenditure on the following items during the last 30 days?</th>
<th>In-cash expenditure (TZS)</th>
<th>In-kind expenditure/gift given away (TZS)</th>
<th>Total expenditure (TZS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PD1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Cooking materials (charcoal, kerosene, etc.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Laundry (soap, detergents, etc.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Payment of household utilities (electricity, airtime vouchers &amp; water bills, etc.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Kitchen utensils</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>School fees &amp; related</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Medical expenditure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Special occasions (funerals, weddings, parties, rituals, charity, etc.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Personal care (body lotion, hair oil, etc)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Clothing and footwear (tailored clothes, ready-made clothes, rain clothes, underwear, baby clothes, diapers, hats, shoes, boots, etc.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Personal effects (costume/gold jewellery, handbags, wallets, wristwatch, clocks, umbrellas)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Household furniture</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Transport (bought or paid fare)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Building materials (renovation/construction)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Hiring Farm Equipment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Recreation (entertainment services, recreational goods and supplies)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Money transfers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Servant Salary</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Other (specify)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### MODULE 3.2: FOOD SECURITY/INSECURITY ISSUES AND COPING MECHANISMS

#### 3.2.1. HOUSEHOLD FOOD INSECURITY ACCESS SCALE (HFIAS)

For each of the following questions, consider whether they have happened in the past 30 days. If the answer is ‘Yes’ to a question, please indicate how often this happened.

<table>
<thead>
<tr>
<th>No.</th>
<th>Question</th>
<th>How often did this happen?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>(0) Never= it did not happen in the past 30 days</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(1) Rarely= once or twice in the past 30 days</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(2) Sometimes = three to ten times in the past 30 days</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(3) Often = more than ten times in the past 30 days</td>
</tr>
<tr>
<td>AF1</td>
<td>In the past (30 days), did you worry that your household would not have enough food?</td>
<td></td>
</tr>
<tr>
<td>AF2</td>
<td>In the past [30 days], did it happen that you or any household member were not able to eat the kinds of foods you would have preferred to eat because of lack of resources?</td>
<td></td>
</tr>
<tr>
<td>AF3</td>
<td>In the past [30 days], did it happen that you or any household member had to eat a limited variety of foods because of lack of resources?</td>
<td></td>
</tr>
<tr>
<td>AF4</td>
<td>In the past [30 days] did it happen that you or any household member had to eat some foods that you really did not want to eat because of lack of resources?</td>
<td></td>
</tr>
<tr>
<td>AF5</td>
<td>In the past [30 days] did it happen that you or any household member had to eat a smaller meal than you felt you needed because there was not enough food?</td>
<td></td>
</tr>
<tr>
<td>AF6</td>
<td>In the past [30 days] did it happen that you or any household member had to eat fewer meals in a day because there was not enough food?</td>
<td></td>
</tr>
<tr>
<td>AF7</td>
<td>In the past [30 days] did it happen that there was no food to eat of any kind in your house, because of lack of resources to get food?</td>
<td></td>
</tr>
<tr>
<td>AF8</td>
<td>In the past [30 days] did it happen that you or any household member went to sleep at night hungry because there was not enough food?</td>
<td>If yes, ask respondent to describe</td>
</tr>
<tr>
<td>AF9</td>
<td>“In the past [30 days] did it happen that you or any household member went a whole day and night without eating anything at all because there was not enough food?”</td>
<td>If yes, ask respondent to describe</td>
</tr>
</tbody>
</table>
3.2.2 HOUSEHOLD DIETARY DIVERSITY SCORE (HDDS)
Please describe the foods (meals and snacks) that you (or your household members) ate yesterday during the day and night. Start with the first food eaten in the morning.

<table>
<thead>
<tr>
<th>SN</th>
<th>FOOD GROUP</th>
<th>EXAMPLES</th>
<th>1 = YES</th>
<th>2 = NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>HDD1</td>
<td>CEREALS</td>
<td>Maize, rice, wheat, sorghum, or any other grains or foods made from these (e.g. bread, ugali, porridge etc.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HDD2</td>
<td>VITAMIN A RICH VEGETABLES AND TUBERS</td>
<td>pumpkin, carrots, or sweet potatoes that are orange inside + other locally available vitamin-A rich vegetables</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HDD3</td>
<td>WHITE TUBERS AND ROOTS</td>
<td>white potatoes, white yams, white cassava, or other foods made from roots</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HDD4</td>
<td>DARK GREEN LEAFY VEGETABLES</td>
<td>Any dark, green, leafy vegetables such as cassava leaves, bean leaves, spinach, amaranth, spinach, incl. wild veges etc.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HDD5</td>
<td>OTHER VEGETABLES</td>
<td>other vegetables (e.g. tomato, onion, eggplant) , including wild vegetables</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HDD6</td>
<td>VITAMIN A RICH FRUITS</td>
<td>ripe mangoes, ripe papaya + other locally available vitamin A-rich fruits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HDD7</td>
<td>OTHER FRUITS</td>
<td>other fruits, including wild fruits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HDD8</td>
<td>ORGAN MEAT (IRON-RICH)</td>
<td>liver, kidney, heart or other organ meats or blood-based foods</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HDD9</td>
<td>FLESH MEATS</td>
<td>beef, pork, lamb, goat, rabbit, wild game, chicken, duck, or other birds</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HDD10</td>
<td>EGGS</td>
<td>chicken, duck, guinea hen or any other egg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HDD11</td>
<td>FISH</td>
<td>fresh or dried fish or shellfish</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HDD12</td>
<td>LEGUMES, NUTS AND SEEDS</td>
<td>beans, peas, lentils, nuts, seeds or foods made from these</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HDD13</td>
<td>MILK AND MILK PRODUCTS</td>
<td>milk, cheese, yogurt or other milk products</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HDD14</td>
<td>OILS AND FATS</td>
<td>oil, fats or butter added to food or used for cooking</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HDD15</td>
<td>RED PALM PRODUCTS</td>
<td>Red palm oil, palm nut or palm nut pulp sauce</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HDD16</td>
<td>SWEETS</td>
<td>sugar, honey, sweetened soda or sugary foods such as chocolates, candies, cookies and cakes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HDD17</td>
<td>SPICES, CONDIMENTS, BEVERAGES</td>
<td>spices(black pepper, salt), condiments (soy sauce, hot sauce), coffee, tea, alcoholic beverages or local examples</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
HDD18. Did you or anyone in your household eat anything (meal or snack) OUTSIDE of the home yesterday?
1 = Yes  2 = No

**DIETARY DIVERSITY GUIDING QUESTIONS FOR THE HOUSEHOLD SURVEY**

<table>
<thead>
<tr>
<th></th>
<th>Question</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Who was the first person in the household to wake up yesterday?</td>
<td>1. me/spouse</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. my daughter</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Others Specify</td>
</tr>
<tr>
<td>2</td>
<td>After you woke up, what was the first thing prepared or consumed in the household?</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Did you make coffee/tea or porridge yesterday? (breakfast)</td>
<td>1 = Yes, 2 = No</td>
</tr>
<tr>
<td>4</td>
<td>At what time?</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Did you consume the tea or coffee with something else or only had the coffee?</td>
<td>1 = Yes, 2 = No</td>
</tr>
<tr>
<td>6</td>
<td>What were the ingredients in the coffee/tea/porridge?</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Do you sweeten all the tea/coffee/porridge at once, or does each person sweeten their own cup?</td>
<td>sweeten all at once</td>
</tr>
<tr>
<td></td>
<td></td>
<td>no sweeten at all</td>
</tr>
<tr>
<td></td>
<td></td>
<td>sweeten individually</td>
</tr>
<tr>
<td>8</td>
<td>What was the next thing prepared or consumed after the tea/coffee/porridge?</td>
<td></td>
</tr>
</tbody>
</table>

(Asks for and writes down all the ingredients of each foods consumed at breakfast).

<table>
<thead>
<tr>
<th></th>
<th>Question</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>Is there any beverage with breakfast?</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>What was the next thing prepared or consumed after breakfast?</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Did anyone in the household eat anything between breakfast and lunch? For example, fruits, nuts or milk for the baby?</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>(After requesting information on the ingredients of each meal after lunch). What was the next thing prepared after lunch?</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>(Notes all the ingredients of each dish consumed at dinner) Was any beverage served with dinner?</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Did anyone in the household eat or drink anything after dinner? For example, a cup of tea/coffee or a piece of fruit or milk for the baby?</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Did you all go to bed at the same time, or did some household members stay up later than others?</td>
<td>1 = Yes if yes specify</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 = No</td>
</tr>
<tr>
<td>16</td>
<td>Did you eat or drink any last thing before going to bed?</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>If something is eaten describe it</td>
<td></td>
</tr>
</tbody>
</table>
3.3. Household Coping Strategies/Mechanisms and Related (HCS)

Please ask these questions to the mother. Ask questions HCS2 to HCS9 to the household head (husband) in case of male-headed households as well.

| HCS1. Number of servings per day [First tick the composition of household members] |
|:-----------------:|-----------------:|-----------------:|
|    1             | Household member* | Tick             |
|    2             | Children under 5 | Number/Frequency of meals |
|    3             | Girls (6-18 years) |                     |
|    4             | Boys (6-18 years) |                     |
|    5             | Lactating mother |                     |
|    6             | Pregnant mother |                     |
|    7             | Non-lactating/Non-pregnant woman |       |
|    8             | Husband & other adult men living in the household |       |

HCS2. Did your household face food shortages since last survey? 1= Yes 2= No

HCS3. If ‘Yes’ to HC2, in which month(s) were the food shortage serious in the household? List the months ……………………

HCS4. If again ‘Yes’, to HC2; What were the most important causes of food shortage in the household? Please list in the order of their importance (1=Most important)
  1) ……………………
  2) ……………………
  3) ……………………

HCS5. If YES to HCS2; What measures did you take if your household faced serious food since last survey?
  1) ……………………
  2) ……………………
  3) ……………………

HCS6. Where did you get food you do not produce?
  (a) Buy from neighbours
  (b) Buy from the local shops/market
  (c) Seek from the forest
  (d) Others (specify) ……………………

HCS7. What difficulties did you face when trying to buy foodstuff?
  a) Poor Transport Infrastructure
  b) High prices
  c) Low supply
  d) Lack of alternatives
  e) No formal market
  f) Others (Specify) ……………………

HCS8. How did you address these difficulties?
  1) ……………………
  2) ……………………
  3) ……………………

HCS9. What (if any) were the major traditional/socio-cultural activities that consumed a significant amount of your food produce in the 2014 production year?
  (a) Weddings
  (b) Religious offering/Ritual
  (c) Traditional dances
  (d) Funerals
  (e) Others (specify) ……………………
HCS10. What kinds of food do you usually buy from neighbours?
1) ……………………….
2) ……………………….
3) ……………………

HCS11. What kinds of food do you usually buy from local shops?
1) ……………………….
2) ……………………….
3) ……………………

HCS12. What kinds of food do you usually buy from the district market?
1) ……………………….
2) ……………………….
3) ……………………

HCS13. At what time of the year do you usually find it difficult to buy food because of high prices?
1) ……………………….
2) ……………………….
3) ……………………

HCS14. What do you do in that situation? (HCS 13 above)
1) ……………………….
2) ……………………….
3) ……………………

HCS15. What kinds of food do you seek from the forest?
1) ……………………….
2) ……………………….
3) ……………………

HCS16. When do you usually consume such food? (Time in a year) (HCS 15 Above)
1) ……………………….
2) ……………………….
3) ……………………

HCS17. Whose duty is it to pick such food from the forest?
1) ……………………….
2) ……………………….
3) ……………………

HCS18. Are there any difficulties in finding forest foods?  1 = Yes  2 = No
1) ……………………….
2) ……………………….
3) ……………………

HCS19. What are they? (HCS 18 Above)
1) ……………………….
2) ……………………….
3) ……………………

HCS20. How do you face these difficulties? (HCS 19 Above)
1) ……………………….
2) ……………………….
3) ……………………
MODULE FIVE: SOCIAL CAPITAL
Now we would like to ask you some questions about how you feel about this village, and how you take part in the community activities

SC1 Have you/someone in your household joined any groups/organizations in 2014?
1 = Yes  2 = No

SC2. If 'Yes' to SC1, list up to three in order of importance

<table>
<thead>
<tr>
<th>Group</th>
<th>Type of group (Write the option and name of group)</th>
<th>Participation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 = Religious group</td>
<td>1= An active member with position (e.g. Chairperson, Secretary, Treasurer)</td>
</tr>
<tr>
<td></td>
<td>4 = Youth Group</td>
<td>2= Active member but no formal position</td>
</tr>
<tr>
<td></td>
<td>2 = Farmers’ Association</td>
<td>3= Not an active member</td>
</tr>
<tr>
<td></td>
<td>5 = Women’s group</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3 = Development Committee</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6 = Other (specify)</td>
<td></td>
</tr>
</tbody>
</table>

Group A
Group B
Group C

SC3. What is the value of these groups (listed in SC1) to your household wellbeing?

INTERVIEWER: You have now come to the end of the interview. Make sure to do the following:

i. Thank the respondent for the cooperation shown by the members of the household during the interview

ii. Take enough time to examine all the entries/boxes on all pages. Make sure that no empty boxes are left, for which an entry is required. In particular work out, with the help of the main informant, how information (missing) relating to members of the household who happen to be absent at the time of the interview can be obtained.
Appendix 5: Checklist for Focus Group Discussion in the Pre-harvest Season

GUIDE TO FOCUS GROUP DISCUSSIONS (FGDs)

PRE-HARVEST

Introduction:

Thanks for agreeing to be part of this discussion. We appreciate your willingness to participate.

We are........................................................................................................................................

Coming from..................................................................................................................................

We are conducting research with Sokoine University of Agriculture and St. Augustine’s University under the Irish Aid funded AgriDiet project to examine the link between agriculture and nutrition. We want to explore ways in which your farming and food management practices impact on nutrition, particularly of women and children in rural households.

Your involvement in this discussion is crucial. Since the study is about agriculture nutrition linkage, the findings of the research can benefit the entire rural households. Your opinions will help us to identify policies and interventions that can make a positive impact on agriculture and nutritional status.

This is not a test, and there are no right or wrong answers to the focus group questions. The most important thing is that you should feel comfortable and contribute as much as you can. We want to hear many different viewpoints and would like to hear from everyone. We hope you can be honest even when your responses may not be in agreement with the rest of the group. In respect for each other, we ask that only one individual speak at a time in the group and that responses made by all participants be kept confidential.
We assure you that all the information that you provide to us will be used exclusively for our research. We want to capture everything, therefore will record the session but all responses will appear anonymously in our report.

1. Profile of the Focus Group
   i. Number of people: Men__________, Women__________
   ii. Characteristic of Group:_____________________________
   iii. Location of meeting:_____________________________
   iv. Date:__________ Start time: _____ Finish time:_____

2. General welfare information
   i. Relative to other communities in the district, how do you regard the standard of living in your village?
   ii. How has the standard of living changed over the last 20 years?
   iii. What development projects are currently implemented in this village? What are the main needs/priorities being addressed?
   iv. What are the characteristics of a poor household and a rich household in this village?
   v. What are the characteristics of a good, moderate and poor housing condition in this village? Ask for details

3. Resources
   i. How do people get access to land and water resources?
   ii. How are disputes settled over access to land and water in this village?
   iii. Is there enough land available in this village for your children’s generation?

4. Farming practices and sources of food
   i. What are the main changes that have taken place in the way people make a living over the past 20 years?
   ii. Why do households in this village raise the type(s) of crop/livestock you mentioned?
   iii. What are the main problems that are associated with crop/livestock production in this village?
   iv. Where is the main market for buying food and selling produce for people in this village?
5. Agricultural information
   Where do people in this village receive advice and information on farming practices?

6. Food Insecurity and coping mechanisms
   i. Are food shortages common in your village?
   ii. How do people cope with food shortage when they happen?
   iii. How easy is it for people to get food from the market? Which foodstuffs are obtainable from the market?

7. Health and sanitation
   i. What are the major health problems in this village?
   ii. What could be done to improve the health situation?
   iii. When would people normally wash their hands?

8. Community strengths and challenges
   i. What are the greatest strengths of this community as a whole?
   ii. What are the major challenges to the wellbeing of people in this community?
   iii. What are the modalities for supporting each other in times of need in this community?
Appendix 6: Checklist for Focus Group Discussion in the Post-harvest

GUIDE TO FOCUS GROUP DISCUSSIONS (FGDs)

POST-HARVEST

Introduction:

Thanks for agreeing to be part of this discussion. We appreciate your willingness to participate.

We are .......................................................... Coming from ..........................................................

We are conducting research with Sokoine University of Agriculture and St. Augustine University of Tanzania under the Irish Aid funded AGRIDIET project to examine the link between agriculture and nutrition. We want to explore ways in which your farming and food management practices impact on nutrition, particularly of women and children in rural households. This is the second round of discussions; the first round was in January/February 2014. We want to seek more information and clarification to issues, which we did not address during the first round of discussions.

Your involvement in this discussion is crucial. Since the study is about agriculture nutrition linkage, the findings of the research can benefit the entire rural households. Your opinions will help us to identify policies and interventions that can make a positive impact on agriculture and nutritional status.

This is not a test, and there are no right or wrong answers to the focus group questions. The most important thing is that you should feel comfortable and contribute as much as you can. We want to hear many different viewpoints and would like to hear from everyone. We hope you can be honest even when your responses may not be in agreement with the rest of the group. In respect for each other, we ask that only one individual speak at a time in the group and that responses made by all participants be kept confidential.
We assure you that all the information that you provide to us will be used exclusively for our research. We want to capture everything, therefore will record the session but all responses will appear anonymously in our report.

1. Profile of the Focus Group
   v. Number of people: Men__________, Women__________
   vi. Nature of the Group (i.e. men only, female only, mixed): _________________
   vii. Location of meeting:______________________________
   viii. Date:___________ Start time: _____ Finish time:_____

2. General welfare information
   vi. Relative to past production year, what went well and what did not go well in this area during the 2014 production year in terms of crop and livestock production?

3. Farming practices
   v. What were the main factors (besides food for consumption and cash earning) that determined which crops you cultivated in this area in 2014?
   vi. What were the main factors (besides food for consumption and cash earning) that determined which livestock species you kept in this area during the 2014 production year?
   vii. Where did you sell/ are you selling the agricultural outputs from 2014 production season? What were/are the challenges when selling the agricultural outputs?
   viii. What have been the major agricultural production risks that you experienced in this area during the past 10 years? How did people manage the risk if it occurred in this area?
4. Agricultural information, inputs and credit services

i. What were the main challenges in accessing advice and information on farming in 2014? How did you deal with these challenges?

ii. What were the main challenges in accessing farm inputs in 2014? How did you deal with these challenges?

iii. What were the main challenges in accessing credit services in 2014? How did you deal with these challenges?

5. Food Insecurity and coping mechanisms

i. What were the factors that determined what food people ate in this area in 2014? [Please probe on how the social surroundings like friends, neighbours and community influence the type of food people ate in this area]

ii. How do people normally get food (besides own production) for home consumption in this area? What were the main difficulties to get food for home consumption in 2014?

iii. Where is the closest market for food in this area? What food is available at the market?

iv. During the year 2014, was access to food affected seasonally? If yes, how and why? What were the ‘lean’ months?

v. What was the average price (per kg/local unit of measurement) of the major staple foods at the market in 2014? During year 2014, was the price of the major staple foods affected seasonally? If yes, how, when and why?
Appendix 7: Checklist for Key Informant Interviews

KEY INFORMANT INTERVIEW GUIDES

INTRODUCTION

Thanks for agreeing to be part of this discussion. I appreciate your willingness to participate.

I am........................................................................................................................................
Coming from.................................................................................................................................

I am conducting research with Sokoine University of Agriculture and St. Augustine University of Tanzania under the Irish Aid funded AGRIDIET project to examine the link between agriculture and nutrition. We want to explore ways in which farming and food management practices impact on nutrition, particularly of women and children in rural household.

Your involvement in this discussion is crucial. Since the study is about agriculture-nutrition linkage, the findings of the research can benefit the entire rural households. Your opinions will help us to identify policies and interventions that can make a positive impact on agriculture and nutritional status.

This is not a test, and there are no right or wrong answers to any of the questions. The most important thing is that you should feel comfortable and provide your honest opinion as much as you can. I assure you that all your responses are confidential and will be used exclusively for our research purpose. I want to capture everything, therefore will record the session but all your responses will appear anonymously in our report.
PROFILE OF THE KEY INFORMANT  
ix. Category:__________________________________________  
x. Position (if representing any organisation)_____________  
xii. Location of the meeting:______________________________  
   xii. Date:___________ Start time: _____ Finish time:_____  

KEY INFORMANT DISCUSSIONS GUIDING QUESTIONS  

Category A: Village/Ward agricultural extension officers  
i. Where did farmers obtain the main farm inputs in 2014? What were the challenges facing farmers in accessing these farm inputs? How did your office help farmers to address these challenges?  
ii. Where did farmers obtain credit services? In your experience, what percentage of farmers in this area used credit services in 2014? What were the challenges facing farmers in accessing credit services in this area? How did your office help farmers to address these challenges?  
iii. What were the main problems that were associated with crop production in this area in 2014? How did your office help farmers to address such problems?  
iv. What were the main problems that were associated with livestock production in this area in 2014? How did your office help farmers to address such constraints?  
v. What were the major challenges in delivering agriculture extension services in this area in 2014?  

Category B: Village elders  
i. What main changes have taken place in the way people make a living over the past 30 years?  
x. How do people in this area obtain land for crop cultivation/livestock keeping activities? What are the challenges?  
xi. What are the social-cultural practices that affect the type and amount of food available to the household in this area?  
xii. What are the main causes of food shortages in this area?  
xiii. What do people normally do when there is a shortage of food?  
xiv. What do people normally do if rains are poor or fail?
xv. How do people in this community make savings?

Category C: Village executive officers (VEO)

i. What procedures are used to make decisions on major development projects needed in this village?

ii. What are the main causes of conflicts between villagers in this community? How do people resolve them?

iii. How do people get access to land resources?

iv. What were the main sources from which farmers in this village received agricultural information and advice in 2014?

v. Where did people obtain credit services in this village in 2014?

Category D: Village health centre representatives

i. What were the main health problems facing this community in 2014?

ii. What actions were in place to address the kinds of health problems you mentioned in 2014?

iii. What were the constraints in addressing health problems in 2014?

iv. What could be done to improve the health situation in this community?

Category E: Farm input suppliers (agro-dealers)

i. What types of farm inputs did you supply to farmers in this area in 2014?

   (i)________________________________________________

   (ii)_______________________________________________

   (iii)_______________________________________________

   (iv)_______________________________________________
If fertiliser is mentioned in Category E, please provide the following information:

<table>
<thead>
<tr>
<th>No</th>
<th>Type of fertiliser</th>
<th>Price/kg in TZS (2013)</th>
<th>Price/kg in TZS (2014)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*If there is a price difference* Why has there been a price change?..........................

If crop seed is mentioned in Category E, please provide information on the most common variety per each species supplied:

<table>
<thead>
<tr>
<th>No</th>
<th>Type of crop seed (most common variety in the area)</th>
<th>Price/50kg pack in TZS (2013)</th>
<th>Price/50kg pack in TZS (2014)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*If there is a price difference* Why has there been a price change?..........................

If pesticide/insecticide is mentioned in Category E, please provide information on the most commonly used in this area:

<table>
<thead>
<tr>
<th>No</th>
<th>Type of pesticide/insecticide in its standard unit of measurement</th>
<th>Price in TZS (2013)</th>
<th>Price in TZS (2014)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*If there is a price difference* Why has there been a price change?....................

If veterinary medicine is mentioned in Category E, please provide information on the most commonly used in the area.

<table>
<thead>
<tr>
<th>No</th>
<th>Type of vet-medicine in its standard unit of measurement</th>
<th>Price in TZS (2013)</th>
<th>Price in TZS (2014)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*If there is a price difference* Why has there been a price change?....................

ii. What challenges did you face in supplying farm inputs to this area in 2014?

How did you deal with the challenges? How did you address them?
# Appendix 8: Market Price Survey Questionnaire

**TANZANIA AGRIDIET PROJECT**

**MONTHLY LOCAL MARKETS PRICE SURVEY SHEET (2014)**

<table>
<thead>
<tr>
<th>No.</th>
<th>Food Items</th>
<th>Seller 1</th>
<th>Seller 2</th>
<th>Seller 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Maize (20Kg Bin)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Rice (Kg)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Sorghum (Kg)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Wheat Flour (Kg)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Cassava (Pile)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Beans (Kg)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Sugar (Kg)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Bread</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Sweet Potatoes (20Kg Bin)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Irish Potatoes (Pile)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Local Salt (Kg)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Salt (Packet - 100g)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Beef (Kg)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Goat meat (Kg)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Chicken</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Mutton (Kg)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Bar of Soap</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Tea Leaves (Packet) - 200g</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Groundnuts (Kg)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Cooking Oil (Litre)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Cabbage, Lettuce &amp; other vegetables (bundle)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Tomatoes (Pile)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Onions (Pile)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>Mango</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>Banana</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>Eggs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>Fresh Milk (Lt)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>No.</th>
<th>Essential Non-Food Items</th>
<th>Seller 1</th>
<th>Seller 2</th>
<th>Seller 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Charcoal (Bag)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Firewood (Bundle)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Bar of soap</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Body Jelly (300ml can)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Washing Powder (1kg)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Water Contribution (Monthly)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Officer:** ________________________________  
**Signature:** ________________________________  
**Date:** ________________________________
## Appendix 9: Local Market Prices in Mhunze, Makuyu and Dakawa Markets

<table>
<thead>
<tr>
<th>Crop/ livestock/ product</th>
<th>Kishapu (Mhunze)</th>
<th>Mvomero (Makuyu)</th>
<th>Mvomero (Dakawa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maize</td>
<td>440.59</td>
<td>555.56</td>
<td>444.44</td>
</tr>
<tr>
<td>Rice</td>
<td>1,126.39</td>
<td>1,083.33</td>
<td>1,066.62</td>
</tr>
<tr>
<td>Sorghum</td>
<td>206.02</td>
<td>520.00</td>
<td>5,008.30</td>
</tr>
<tr>
<td>Cotton</td>
<td>750.00</td>
<td>800.00</td>
<td>800.00</td>
</tr>
<tr>
<td>Sweet potatoes</td>
<td>332.41</td>
<td>500.00</td>
<td>500.00</td>
</tr>
<tr>
<td>Groundnuts</td>
<td>1,761.11</td>
<td>2,233.33</td>
<td>2,000.00</td>
</tr>
<tr>
<td>Tomatoes</td>
<td>961.11</td>
<td>1,000.00</td>
<td>733.33</td>
</tr>
<tr>
<td>Onions</td>
<td>1,500.00</td>
<td>1,500.00</td>
<td>1,100.00</td>
</tr>
<tr>
<td>Sesame</td>
<td>2,000.00</td>
<td>2,100.00</td>
<td>2,100.00</td>
</tr>
<tr>
<td>Green grams</td>
<td>1,800.00</td>
<td>1,850.00</td>
<td>1,900.00</td>
</tr>
<tr>
<td>pigeon peas</td>
<td>1,300.00</td>
<td>1,400.00</td>
<td>1,250.00</td>
</tr>
<tr>
<td>butter beans</td>
<td>1,300.00</td>
<td>1,400.00</td>
<td>1,388.89</td>
</tr>
<tr>
<td>Other legumes</td>
<td>950.00</td>
<td>888.88</td>
<td>950.00</td>
</tr>
<tr>
<td>Sunflower</td>
<td>1,043.00</td>
<td>1,120.00</td>
<td>1,200.00</td>
</tr>
<tr>
<td>VegeTable 5s</td>
<td>500.00</td>
<td>200.00</td>
<td>500.00</td>
</tr>
<tr>
<td>Pumpkins</td>
<td>1,200.00</td>
<td>1,200.00</td>
<td>1,200.00</td>
</tr>
<tr>
<td>Millet</td>
<td>385.00</td>
<td>420.00</td>
<td>415.00</td>
</tr>
<tr>
<td>Eggs</td>
<td>308.33</td>
<td>300.00</td>
<td>233.33</td>
</tr>
<tr>
<td>Milk</td>
<td>849.28</td>
<td>900.00</td>
<td>550.00</td>
</tr>
<tr>
<td>Large cattle</td>
<td>708,333.33</td>
<td>866,388.89</td>
<td>833,888.89</td>
</tr>
<tr>
<td>Medium cattle</td>
<td>373,888.89</td>
<td>529,722.22</td>
<td>558,333.33</td>
</tr>
<tr>
<td>Calves</td>
<td>215,555.56</td>
<td>282,916.67</td>
<td>254,583.33</td>
</tr>
<tr>
<td>Goats</td>
<td>47,120.37</td>
<td>62,222.22</td>
<td>56,458.33</td>
</tr>
<tr>
<td>Sheep</td>
<td>50,694.44</td>
<td>51,666.67</td>
<td>52,097.22</td>
</tr>
<tr>
<td>Chicken/ducks</td>
<td>11,194.44</td>
<td>9,583.33</td>
<td>7,250.00</td>
</tr>
</tbody>
</table>

*Source: Agridiet Study monthly market price surveys in 2014*

1 Euro was equivalent to TZS 2,223 (Bank of Tanzania, 2014)
### Appendix 10: Households use Farm Equipment/Implement/Asset by districts

<table>
<thead>
<tr>
<th>Agricultural equipment/implement/asset</th>
<th>Kishapu (%)</th>
<th>Mvomero (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hand hoe</td>
<td>99</td>
<td>99</td>
</tr>
<tr>
<td>Ox cart</td>
<td>18</td>
<td>1</td>
</tr>
<tr>
<td>Ox plough</td>
<td>47</td>
<td>1</td>
</tr>
<tr>
<td>Oxen</td>
<td>61</td>
<td>1</td>
</tr>
<tr>
<td>Tractor</td>
<td>0.5</td>
<td>3.5</td>
</tr>
<tr>
<td>Power tiller</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

*Source: Tanzanian NBS (2008a) and Tanzanian NBS (2008b)*

### Appendix 11: Number of Water resources by Districts

<table>
<thead>
<tr>
<th>Water resource</th>
<th>Kishapu (Count)</th>
<th>Mvomero (Count)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chaco dams</td>
<td>20</td>
<td>6</td>
</tr>
<tr>
<td>Shallow well</td>
<td>223</td>
<td>274</td>
</tr>
<tr>
<td>Rain water harvest</td>
<td>91</td>
<td>2</td>
</tr>
<tr>
<td>Bore holes</td>
<td>2</td>
<td>17</td>
</tr>
<tr>
<td>River water/ gravity</td>
<td>14</td>
<td>22</td>
</tr>
<tr>
<td>Piped schemes/ pumps</td>
<td>10</td>
<td>7</td>
</tr>
</tbody>
</table>

*Source: Tanzanian Kishapu District Council (2012) and Tanzanian Mvomero District Council (2013)*

### Appendix 12: Road Infrastructure by District

<table>
<thead>
<tr>
<th>Road category</th>
<th>Kishapu (Count)</th>
<th>Mvomero (Count)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trunk road</td>
<td>96</td>
<td>112</td>
</tr>
<tr>
<td>Regional road</td>
<td>192</td>
<td>233</td>
</tr>
<tr>
<td>District road</td>
<td>261</td>
<td>64</td>
</tr>
<tr>
<td>Urban</td>
<td>20</td>
<td>17</td>
</tr>
<tr>
<td>Feeder</td>
<td>124</td>
<td>215</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>693</strong></td>
<td><strong>641</strong></td>
</tr>
</tbody>
</table>

*Source: Tanzanian Shinyanga Regional Commissioner’s Office (2013) and Tanzanian Mvomero District Council (2013).*
Appendix 13a: Rainfall Pattern (Anomaly) in Kishapu District

Source: Global Weather Data for SWAT (2016)

Appendix 13b: Rainfall Pattern (Anomaly) in Mvomero District

Source: Global Weather Data for SWAT (2016)
Appendix 14: Annual Yield of Major Crops by District in 2013 farming season (kg/acre).

Appendix 15: Annual Yield of Major Crops by District in 2014 Farming Season (kg/acre).