

**FOOD INSECURITY AND COPING STRATEGIES OF AGRO-PASTORAL
HOUSEHOLDS IN BABILE DISTRICT OF SOMALI REGIONAL STATE,
ETHIOPIA**

MSc Thesis

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**Food Insecurity and Coping Strategies of Agro-pastoral Households in Babile
District of Somali Regional State, Ethiopia**

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DEDICATION

*I dedicate this thesis manuscript to my mother **Anab Nouh** and father **Ahmed Hussein**, for nursing me with affection and love in the success of my life.*

STATEMENT OF AUTHOR

By my signature below, I declare and affirm that this thesis is my own work. I have followed all ethical and technical principles of scholarship in the preparation, data collection, data analysis and compilation of this thesis. Any scholarly matter that is included in the thesis has been given recognition through citation.

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BIOGRAPHICAL SKETCH

The author was born in March, 1986 in Awbare Village, Awbare District, Fafan zone of Somali Region. He attended his elementary and secondary education in Awbare Junior and Secondary School. He followed his preparatory education in Jigjiga Preparatory School. Upon his successful completion of his high school education, he joined Mekelle University in 2005/2006 and graduated with BSc degree in Natural Resource Economics and Management in 2008. Soon after his graduation, he was employed in the Bureau of Agriculture of Somali Region as a Natural Resource Management expert. He was then promoted as team leader in the Natural Resource Management Department of Agriculture Bureau in Somali Regional State and then Natural Resource Management Technical Assistance in the Food Security Department of Agricultural Bureau.

After three years of service in Agricultural Bureau, Somali Regional State, in July 2012, he joined Haramaya University to pursue his MSc degree in Agricultural Economics.

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LIST OF ABBREVIATIONS AND ACRONYMS

AE	Adult Equivalent
CAADP	Comprehensive African Agriculture Development Programme
CIDA	Canadian International Development Agency
CSA	Central Statistical Agency
DA	Development Agent
DFID	Department for International Development
DPPB	Disaster Prevention Preparedness Bureau
DPPC	Disaster Prevention and Preparedness Commission
EU	European Union
FAO	Food and Agriculture Organization
FSP	Food Security Program
FDRE	Federal Democratic Republic of Ethiopia
IFAD	International Fund for Agricultural Development
JZO	Jigjiga Zonal Office
LCRDB	Livestock, Crop and Rural Development Bureau
LPM	Linear Probability Model
MoFED	Ministry of Finance and Economic Development
NGO	Nongovernmental Organization
PSNP	Productive Safety Net Program
SD	Standard Deviation
SCUK	Save Children United Kingdom
SRS	Somali Regional State
TLU	Tropical Livestock Unit
USAID	United States Agency for International Development
WAO	Woreda Administration Office
WFP	World Food Program
VIF	Variance Inflation Factor

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FOOD INSECURITY AND COPING STRATEGIES OF AGRO-PASTORAL HOUSEHOLDS IN BABILE DISTRICT OF SOMALI REGIONAL STATE, ETHIOPIA

ABSTRACT

An understanding of the major causes of food insecurity is important for interventions aiming at reducing it. Therefore, this study was conducted to measure food insecurity status of agro-pastoral households, to identify determinants of food insecurity status of agro-pastoral households, and to identify agro-pastoral households coping strategies against food insecurity in study area. The analysis was based on household survey data gathered from 122 randomly selected households in four Kebeles based on probability proportional to size. Descriptive statistics, like mean, standard deviation, maximum, minimum and percentage distribution. Univariate analysis such as t-test and Chi-square (X²) test and binary Logit regression were used to achieve the stated objectives. The results from descriptive statistics show that of the total surveyed households, 56.5 percent were food insecure. The binary logit model outputs show that seven variables were significant determinants of household food insecurity. These were distance to nearest market centre, dependency ratio, cultivated land, livestock ownership, oxen ownership, remittance and off-farm income. Furthermore, results show that households also used different coping strategies against food insecurity and these include, borrowing food or cash from relatives or neighbour's, reduced number of meals, reduced meal size, sale of more livestock than usual and sale fire wood and charcoal. The results generally suggest the need to improve agricultural technologies enhancing land productivity and training of farmers on land management. Special attention should also be given to improving animal health services through provision of veterinary services and provision of training to livestock herders. Promoting off-farm activities and further enhancing use of technologies can be materialized through provision of rural financial services that can help agro-pastoralists in solving capital problem to buy farm oxen, farm input and use for trade.

Key words: Food insecurity, logit, agro-pastoral households, Babile.

1. INTRODUCTION

1.1. Background

Millions of dollars have been dispersed by governments, donors, international aid agencies, and multi-lateral development bodies in the developing countries including Ethiopia to address the problem of food insecurity and hunger. Despite the many programs and projects on food security, there are still millions of food insecure people around the world with many of them living in developing countries particularly in Africa (FAO, 2013)

Even though the problem of food insecurity has been the concern of developing countries for long time, now a days it is a world-wide issue. Estimates indicate that about 925 million people worldwide were chronically malnourished of which 906 million are in developing countries, in which two-thirds of these live in just seven countries (Bangladesh, China, Democratic Republic of Congo, Ethiopia, India, Indonesia and Pakistan) and the rest 19 million in the developed countries. Moreover, the proportion of undernourished people remains highest in sub-Saharan Africa, at 30 percent (that is, 239 million) in 2010 (FAO, 2010).

Ethiopia with an estimated population of over 90 million is the second populous nation in Africa. Out of the total population of the country 85 percent is found in rural areas (ECSA, 2011). The country is predominantly agrarian and agriculture plays an important role in the national economy (Di Falco *et al.*, 2011). It accounts for about 46 percent of the total GDP, employing and supporting about 84 percent of the total population and accounts for about 90 percent of the exports (Workneh, 2004; FDRE, 2008; CIA, 2011), but its productivity and performance in terms of feeding the country's population which is growing at 2.6 percent per annum is dismal (Habtom *et al.*, 2005; FDRE, 2008).

In Ethiopia, food insecurity is highly prevalent in moisture deficit highlands and in the lowland pastoral and agro-pastoral areas. Even in years of adequate rainfall and good harvest, the people, particularly in lowland agro-pastoral areas, remain food insecure and in need of food assistance.

Droughts have become frequent and more severe in recent years and are one of the most important triggers of malnutrition and food insecurity in the country (Dominguez, 2010).

Food insecurity in pastoralist areas can be viewed in terms of chronic and transitory food insecurity. Those vulnerable to chronic hunger are households that are either subjected to frequent or severe and regular food insecurity or households that have low resilience or both. In Contrast, households that suffer transitory food insecurity or hunger do so over a shorter but intense period, such as the life-threatening periods of drought (CAADP, 2009).

In Ethiopia, the dimensions, determinants and consequences of food security problems differ widely within the country. The Somali region of Ethiopia is one of the regions of the country which is mostly affected by recurrent drought and food security problems (USAID, 2011). Food insecurity in rural Somali region is subject to numerous shocks and stresses, including recurrent drought. Pastoralist and agro-pastoralist face higher risk than the urban household. Health and education service are very low in most rural communities, where immunization rate are little and illiteracy is over 90%.

The analysis of the GU (main rainy season) 2013 need assessment indicated that an estimated 691,790 people need assistance in the Somali region for three to four months-from July to October 2013 (DPPB, 2013) and Babile district was one of the districts which needed assistance in the region and most of the population of the district are agro-pastoralist from which about 70% of households' income is generated from crop-production and the remaining 30% comes from livestock rearing.

1.2. Statement of the Problem

Food insecurity is a reality for hundreds of millions of people around the world (Webb *et al.*,2006). About 17 million people in East Africa were highly or extremely food insecure and are in need of emergency humanitarian assistance (FEWS NET, 2010).

In Ethiopia, food insecurity is predominantly chronic in its nature; with the exception of particular crisis periods due to recurrent drought. Chronic food insecurity is a condition affecting the population that usually experiences food shortage even when weather and market conditions appear to be generally good. Chronically food insecure areas coincide with areas of low and unreliable rainfall, high population density and low resource endowments. Population pressure pushed farming out into marginal lands where it is not suited to the highland farming systems. The impact of recurrent drought has decreased the asset base further these repeatedly drought affected areas of the country, leading to destitution. The problem deepens when resource poor or people with no assets are further affected by extended droughts. A loss of assets in general makes it very difficult for households to get back to their normal life within a short time unless and otherwise there are appropriate responses.

The main causes of food insecurity are high population growth rate, high reliance on small-size and rain-fed agricultural holdings, lack of access to input, lack of access to credit, high susceptibility to drought, limited access to basic service, lack of access to market, land degradation and decreased productivity, lack of income generation opportunity and alternatives, lack of access to technology and lack of access to information on market, agricultural technology (FSP, 2003; WFP, 2006; EU, 2012).

Ethiopian government and international donors are implementing different types of responses to food insecurity to attain food self-sufficiency and reduced food aid dependency. Especially after implementation of Productive Safety Net Program (PSNP) in 2005, substantial resources were invested each year by the Government and its partners to reduce both chronic and transitory food insecurity problems. They in turn claim to address the ‘supply and demand side’ at national and household level, taking into account the diversity of the national economy. Three pillars of the strategy were implemented including increasing the availability of food (supply side responses) through domestic (own) production (i.e. increasing the level and stability of production, increasing food reserve, and influencing international food markets); ensuring access to food (demand based responses) for food-deficit households (i.e. improving income, productive assets available to vulnerable groups, and other market and non-market transfer); and strengthening emergency response capability WFP(2006).

Babile district is one of the chronically food insecurity district which government is taken as a pilot district for the implementation of PSNP starting from 2005 up to now due to the droughts which occur in the district and the total beneficiaries of the PSNP was 30,374 and Babile is one of the districts in Fafan zone of Somali regional state LCRDB (2009).

In the district, the problem of food insecurity among agro-pastoralists is believed to be caused mainly by low and erratic rainfall. According to LCRDB (2009), the problem of food insecurity is mostly related to climate change which results in variation of rain-fall and then this reduces moisture situation and when the rainfall distribution varies or rainy season delays or not totally received; it is likely to face food insecurity. Therefore, the main reasons that the researcher has taken this study which is food insecurity and coping strategies of agro-pastoral households of Babile district is that there was no studies of this type in the study area and also food security in the study area is deteriorating.

Food insecurity is the real and major problem in Babile district. Despite this, study on food insecurity and coping strategies of agro-pastoral households was not carried out in the area before.

1.3. Research Questions

This study attempted to address three research questions:

1. What is the food insecurity situation in the study area?
2. What are the factors that contribute to the food insecurity in the study area?
3. What are the coping strategies used by food insecure households in the study area?

1.4. Objectives of the Study

The general objective of the study was to assess the food insecurity situation and coping strategies of agro-pastoral households in Babile district of Somali Regional State.

The specific objectives are:

- To measure the food insecurity status of the agro-pastoral households in Babile district of Somali regional state;
- To identify the determinants of food insecurity status of agro-pastoral households in the study area.
- To identify agro-pastoral households coping strategies against food insecurity in the study area.

1.5. Significance of the Study

A study about food insecurity and coping strategies of agro-pastoral households is crucial as it provides information on the effective measures to be taken to implement appropriate strategies and enhance food security. Besides, the output of this research will greatly help to development practitioners and policy makers to acquire better knowledge to carry out development interventions at the right time and place to decrease vulnerability to food insecurity. This study will also help to identify the different coping strategies in order to make interventions appropriate to the area.

This study will also be important to all concerned sectors that are going to implement projects which are related to food security in the area which may include the government, nongovernmental organization and private investors. In general, the beneficiary of this study will be government, nongovernmental organizations, private sectors and the community at large. The results of the study can also be made ready and documented at district level so that it will serve as source material for further research development strategies.

1.6. Scope and Limitations of the Study

This study focused on measuring food insecurity status of agro-pastoral households in Babile district and the study also identifies determinants of food insecurity in the study area and also the coping strategies used by agro-pastoral households against food insecurity.

The study was conducted in Babile district of Ethio-Somali regional state; the study covered only four out of the 13 kebeles of the district from which a total of 122 households was selected randomly. Therefore, the study was limited due to limited resources in terms of time and budget. Moreover, there were limitations in use of cross section data and lack of well-documented records.

1.7. Organization of the Thesis

This thesis research is organized into five chapters. Chapter one deals with the background information, statement of the problem, objectives, significance and scope and limitations of the study. Chapter two presents review of literature which focuses on the basic concepts and definitions, food security indicators and measurement, coping strategies against food insecurity, empirical studies on determinants of food insecurity and conceptual framework of the study. Description of the study area, data type, source and methods of data collection, sampling technique and sample size, method of data analysis and definition of variables and hypothesis are presented in the third chapter. Chapter four deals with the results and discussion of the research outcomes and finally chapter five presents summary, conclusions and recommendations of the study.

2. LITERATURE REVIEW

In this chapter, different literature were reviewed in order to exploit the information required for this study like basic definitions of food insecurity, food shortage, malnutrition and undernourished, food security indicators and measurement, coping strategies against food insecurity, empirical studies on food insecurity and conceptual frameworks of the study are presented.

2.1. Basic Concepts and Definitions

The term food security originated in international development literatures in the 1960s and 1970s. Public interest in global and domestic food security grew rapidly following the world oil crisis and related food crisis of 1972-74 and the African famine of 1984-85. Over time a large number of different definitions have been proposed. There are approximately 200 definitions and 450 indicators of food security (Hoddinott, 1999). Maxwell and Frankenbergers (1992) report lists 194 different studies on the concept and definition of food security and 172 studies on indicators.

World Food Summit in 1974 defined food security 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.” Later, World Bank (1986) defined food security as “access by all people at all times to sufficient food for an active and healthy life”.

The USAID (1992) defined food security as a situation achieved when all people at all times have both physical and economic access to sufficient food to meet their dietary needs for a productive and healthy life. In contrast, food insecurity is the lack of access to sufficient food that leads to poor health, reduced energy and other physical and physiological deterioration *i.e.*, failure of livelihoods to guarantee access and entitlement to sufficient food at the household and individual levels.

FAO (2001) on its part defines food security as ‘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’. Food, here, is defined as any substance that people eat and drink to maintain life and growth. As a result, safe and clean water is an essential part of food commodities.

Food security is defined, in its most basic form, as access by all people at all times to the food required for a healthy life. Access to the needed food is necessary, but not a sufficient condition for a healthy life. A number of other factors, such as the health and sanitation environment and household and public capacity to care for vulnerable members of society, also come in to play Von Broun *et al.* (1992).

Food security has three major components: availability, access and utilization (Haddad, 1997; Kifle and Yoseph, 1999). They are presented as follows:

Food availability: The availability of sufficient quantities of food of appropriate quality, supplied through domestic production or imports (including food aid).

Food access: Access by individuals to adequate resources (entitlements) for acquiring appropriate foods for a nutritious diet. Entitlements are defined as the set of all commodity bundles over which a person can establish command given the legal, political, economic and social arrangements of the community in which they live (including traditional rights such as access to common resources).

Utilization: Utilization of food through adequate diet, clean water, sanitation and health care to reach a state of nutritional well-being where all physiological needs are met. This brings out the importance of non-food inputs in food security.

According to FAO (2000), food insecurity is a situation that exists when people lack secure access to sufficient amounts of safe and nutritious food for normal growth and development and an active and healthy life. It may be chronic, seasonal or transitory. At times when an individual,

household, or community is unable to avail and access food for the above mentioned reasons then the situation could be described as a state of food insecurity.

Food insecurity is also an underlying cause of malnutrition and in extreme cases results in mortality. A high degree of food insecurity when compounded with other undesirable factors can threaten livelihoods. High risks of food insecurity and livelihoods can be expressed in terms of malnutrition, morbidity, and in extreme cases mortality (Beruk, 2003). ‘Chronic’ and ‘transitory’ refer to temporal dimensions of food insecurity, where the former is long-term or persistent, while the latter is short-term and temporary. Some common definitions of chronic food insecurity include: ‘the inability of a household or an individual to meet the minimum daily food requirements for a long period of time’ (IFAD, 1997); persistent inability on the part of the household to provide itself adequately with food’ (FAO, 2005) and ‘when households are unable in normal times to meet food needs because they lack sufficient income, land or productive assets, or experience high dependency ratios, chronic sickness or social barriers’ (WFP, 2004).

Transitory food insecurity, on the other hand, is usually defined as: ‘a sudden (and often precipitous) drop in the ability to purchase or grow enough food to meet physiological requirements for good health and activity’ (Barrett *et al.*, 2001), the sudden reduction of a household’s access to food to below the nutritionally adequate level’ (IFAD, 1997); and ‘When there is a temporary inability to meet food needs, usually associated with a specific shock or stress such as drought, floods or civil unrests’ (DFID, 2002). Evidenced by these definitions, chronic food insecurity tends to be associated with structural deficiencies or vulnerability, while transitory food insecurity is generally a result of temporary shocks and fluctuations, but there are obvious linkages between the two.

Transitory food insecurity can be further divided into cyclical and temporary food insecurity (CIDA, 1989, cited in Maxwell and Frankenberger, 1992). Temporary food insecurity occurs for a limited time because of unforeseen and unpredictable circumstances; cyclical or seasonal food insecurity when there is a regular pattern in the periodicity of inadequate access to food. This may be due to logistical difficulties or prohibitive costs in storing food or borrowing.

Food shortage: is defined as when there is not enough food available for people to eat, Food shortage occurs when food supplies within a bounded region do not provide the energy and nutrients needed by that region's population. Food shortage is most easily conceptualized as a production problem - not enough food is grown to meet regional needs - but constraints on importation as well as storage can also cause or contribute to food shortage. Food shortage is also created where food is exported from areas where production is adequate or even abundant. Historically, the great hunger of Ireland (1845-1847) and the famine of Bengal (1944) have been attributed more to British political decisions to export locally produced grain supplies without compensating imports than to production shortfalls per se (Woodham-Smith 1962; Sen 1981). Even when production shortfall is the primary cause of insufficient supply, the ecological and political reasons for production problems vary widely. They range from natural disasters such as drought, flood, or fungus, to political disasters such as civil conflict, to misguided economic policies such as price controls- all of which discourage production of essential foods.

In all situations of food shortage, many within the region's population are hungry; but in every food-short region, others still enjoy adequate access to food. Equally, although many are food secure in areas of adequate food production, some still go hungry. These variable patterns of hunger result not only from skewed food distribution within regions based on differential political and economic resources, but also from selective marketing, and from non-market political policies of food extraction or assistance.

Malnutrition: can be defined as the physical and mental weakness and disability that results when the body doesn't get the nutrients it needs to function and grow (Peace Corps, 1989). It is generally caused by lack of nutrients resulting from inadequate food intake or ill health. As defined by UNICEF, *malnutrition* is a direct result of inadequate dietary intake and disease, which, in turn, are the results of insufficient household food security, inadequate maternal and child care, insufficient health services, and an unhealthy environment (Gillespie *et al.*, 1996). This framework suggests the convergence between food security and nutrition, that is, without

food security, good nutrition cannot be achieved; and without good nutrition, individuals have more difficulty being economically productive.

Undernourished: is defined as not getting enough food or not getting enough health food for good health and growth. Undernourished basically means that people are not getting sufficient nutrition to meet their requirements. People that fall into this category often go without meals and are hungry for much of time, they may live in a country where there has been a drought or other natural disaster or be refugees and actually have no home or family or support network to help.

Undernourishment exists when caloric intake is below the minimum dietary energy requirement. The minimum dietary energy requirement is the amount of energy needed for light activity and a minimum acceptable weight for attained height, and it varies by country and from year to year depending on the gender and age structure of the population. Throughout this report, the words “hunger” and “undernourishment” are used interchangeably.

2.2. Food Security Indicators and Measurement

2.2.1. Food Security Indicators

Food security as defined above by FAO (1996) is determined by a triad of concepts: food availability, food access, food utilization and stability. Furthermore, these components of food security are broad and complex concept that is determined by interrelated agro-physical, socioeconomic, and biological factors (von Braun *et al.*, 1992). Consequently, its assessment requires multi-dimensional consideration since there is no universally established indicators which serve as a measuring tool.

Along with the development of the concept of food security many indicators were identified and classified into different groups by different researchers. For instance, Frankenberger (1992) classified the different types of indicators into two main categories: ‘process indicators’ which

reflect both food supply and food access and ‘outcome indicators’ which serve as proxy for food consumption. Food supply indicators provide information on the likelihood of shock or disaster that will adversely affect household food security. But, the importance of indicators that measure food access become apparent when it is realized that household food insecurity were occurring despite the availability of food. These indicators provide information on the capacity of the population affected by shock or disaster to withstand the effect. But, according to Frankenberger (1992) their use as indicator is location specific.

Household food security outcome indicators include all direct and indirect indicators. Direct indicators of food consumption include those indicators which are closest to actual food consumption rather than to marketing channel information or medical status. Indirect indicators are proxy indicators for food consumption like using food in storage during a critical time of the year to assess the household food security status but people may be reluctant to discuss food in storage due to culture). Many of the indicators that are appropriate for one area may not be appropriate for another. So that aggregation of the information at the regional or national level is difficult (Hoddinot, 2001a; Frankenberger, 1992).

Coping strategy which is practiced by the household to ensure their future income generating capacity in addition to maintaining their level of consumption is another indicator of household food security. These includes change in cropping and planting pattern, migration to towns in search of urban employment, increased petty of commodity production, sale of possession, sale of productive asset, sale of firewood and charcoal. But, that, these strategy will also vary by region, community, household, sex and age. Furthermore, the type of strategies employed also will vary depending up on the severity and duration of potentially disruptive condition (Haddad *et al.*, 1991).

Chung *et al.* (1997) proposed two types of indicators. First, generic indicators are those that can be collected in a number of different settings and are derived from well-defined conceptual framework of food security. Household dependency ratio is an example of generic indicators. Second, field work may also reveal a set of location specific indicators. This indicator typically carries meaning only within a particular study area because of cultures or socio economic

factors. Location specific indicators can be identified only from detailed understanding of local condition. This understanding of location specific indicators is best obtained by using qualitative data collection.

Given that food security is multi-faceted concept, no one indicator encompasses all dimensions of availability, access, utilization and stability (Chung *et al.*, 1997). Consequently, FAO (2003) classified indicators of food security depending on the component of food security as defined by FAO (1996). They include: food stability and availability indicators, food access indicators and food utilization indicators (FAO, 2003). Popular indicators of food security tend to provide information on only one of these dimensions at a time (Hoddinot *et al.*, 2009).

Similarly, Hoddinot *et al.* (2009) divided indicators into primary and proxy indicators corresponding to each aspects of food security according to the definition of food security given by FAO (1996). The most commonly used primary indicators include; dietary energy intake, calorie availability and perception of dietary adequacy and acceptability. In addition proxy indicators commonly used are: Food frequency, dietary diversity, meal frequency, coping strategies and food security scales. Most of these indicators are difficult to quantify, highly context sensitive and require great care in interpretation (Hoddinot *et al.*, 2009).

To sum up since food security is a multi-faceted concept there is no universally agreed rule as to which specific indicator to use for assessing household food security. Indicators should be defined in ways that are appropriate to the local food security conditions and purpose of analysis (USAID, 1999). Furthermore in choosing which indicator to use several considerations should be made like: resource availability, relevance and accuracy and timeliness (Frankenberger, 1992). Thus, in this study direct survey of calorie intake per adult equivalent per day will be used to compute proxy indicators of household food security.

2.2.2. Measuring Food Security

Measuring the required food for an active and healthy life and the degree of food security attained is a question to be addressed in a food security study. According to Von Braun *et al.*

(1992), given the multiple dimensions (chronic, transitory, short term and long term) of food insecurity, there can be no single indicator for measuring it. Different indicators are needed to capture the various dimension of food insecurity at the country, household and individual levels:

Country level: Food security at the country level can to some extent be measured in terms of demand (requirement) and supply i.e. the quantities of available food and needs. According to Hoddinot (1999), the supply of food may be from current production and stocks and from previous production whereas the need has to be determined on the basis of biological or nutritional requirement of a given society for a certain period of time usually a year or a day. However, national-level measures inherently lend themselves only to addressing national-scale food availability shortfalls, not intra national access and utilization concerns.

Household level: Food security at the house hold level is best measured by direct survey of dietary intake (in comparison with appropriate adequacy norms). However, they measure the existing situation and not the downside risks that may occur. The level of, and changes in socio economic and demographic variables such as real wage, employment, price ratio and migration properly analysed can serve as proxies to indicate the status of, and change in food security. Indicators and their risk pattern needs to be continually measured and interpreted to monitor food security at the household level.

Individual level: Anthropometrics information can be a useful complement because the measurements are taken at the individual level. Yet such information is the outcome of changes of health and sanitation environment and other factors. Most importantly, this information indicates food security after the fact.

In the work by Frankenberger (1992), a distinction is made between "process indicators"—those that describe food supply and food access—and "outcome indicators" that describe food consumption. However, process indicators are insufficient to characterize food security outcomes. Chung *et al.* (1997) found that there is little correlation between a very large set of process indicators and measures of food security outcomes. Outcome indicators shows good estimate of house hold consumption than process indicators.

According to Weibe and Maxwell (1998), the most frequent used measures include consumption and expenditure, nutritional status and coping strategies and resource related correlates. Anthropometric measures of nutritional status are sometimes used as food security indicators. However, food security is not the only determinant of nutritional status. As a result, its usage needs data collection on other determinants of nutritional status like health, intra house hold distribution, maternal care and time allocation.

Income and consumption has been traditionally used as a measure of food security. But measurement method based on income has three further limitations: 1) they cannot be used for determining the location of food insecurity, 2) it has limited use for understanding the cause of food insecurity, 3) it focuses only on the diet quantity to the exclusion of other important aspect of food security such as diet quality and vulnerability (Smith *et al.*, 2006). Thus, consumption is a better measure of longer-term household welfare as it is subject to less temporal variation than income. In addition, households are likely to under report their income level more than they do with their consumption (MoFED, 2008).

Consequently, most analyses rely on measuring food consumption. Hoddinot (2001a) made comparison of different outcome measures of household food insecurity namely, individual intake, household calorie acquisition, dietary diversity and indices of household coping strategies in terms of time requirement, cost, skill and susceptibility to misreporting. Household calorie acquisition is found to be better measurement. Hoddinot (2001a) briefly discussed them as follows:

Individual food intake data: This is a measure of the amount of calories, or nutrients, consumed by an individual in a given time period, usually 24 hours. To generate these data, there are two basic approaches used. The first is observational. An enumerator resides in the household throughout the entire day, measuring the amount of food served to each person, and the amount of food prepared but not consumed ("plate waste") is also measured. In addition, the enumerator notes the type and quantity of food eaten as snacks between meals as well as food consumed outside the household. The second method is recall. The enumerator interviews each household member regarding the food they consumed in the previous 24-hour period. This covers the type

of food consumed, the amount consumed, food eaten as snacks and meals outside the household. Data collected on quantities of food are expressed in terms of their caloric content, using factors that convert quantities of edible portions into calories. These intake data are compared with minimum calorie requirement. Despite its advantages in terms of accuracy, it is unlikely to be an indicator that can be feasibly collected as part of many development projects.

Household caloric acquisition: This is the number of calories, or nutrients, available for consumption by household members over a defined period of time. The principal person responsible for preparing meals is asked how much food she prepared over a period of time. After accounting for processing, this is turned into a measure of the calories available for consumption by the household. To generate these data, a set of questions regarding food prepared for meals over a specified period of time, usually either 7 or 14 days, is asked to the person in the household most knowledgeable about this activity. This measure produces a crude estimate of the number of calories available for consumption in the household. Because the questions are retrospective, rather than prospective, the possibility that individuals will change their behaviour as a consequence of being observed is lessened. The level of skill required by enumerators is less than that needed to obtain information on individual intakes. On average, it took around 30 minutes per household to obtain these data, an amount of time considerably less than that required to obtain information on individual intakes.

Dietary diversity: This is the sum of the number of different foods consumed by an individual over a specified time period. To generate these data, one or more persons within the household are asked about different items that they have consumed in a specified period. These questions can be asked to different household members where it is suspected that there may be differences in food consumption among household members. Even though it is simple to use, the simple form of this measure does not record quantities. If it is not possible to ask about frequency of consumption of particular quantities, it is not possible to estimate the extent to which diets are inadequate in terms of caloric availability.

Indices of household coping strategies: This is an index based on how households adapt to the presence or threat of food shortages. The person within the household who has primary

responsibility for preparing and serving meals is asked a series of questions regarding how households are responding to food shortages. After these data are collected, the number of different coping strategies used by the household will be counted and categorized as number of strategies that the household used often, from time to time, or rarely. The higher the sum, the more food-insecure the household will be. As it is subjective comparison among household would be difficult. In addition, it is highly susceptible to misreporting of the household's circumstances.

To sum up, among the four types of food security measurement discussed above, the last two indicators could not capture consumption of particular quantities and as a result it is not possible to calculate kilocalories consumption per household. In household caloric acquisition method, conversion of gross household food consumption into calories, and dividing the calorie figure by the number of adult equivalent in household and the number of days of the recall period results in a concise figure for average calories consumed per adult equivalent per day which is then compared with the minimum calorie requirement. In this study, since focus of analysis is household, household calorie acquisition was utilized.

2.3. Coping Strategies against Food Insecurity

In describing the concept of coping strategy/mechanism common terms or phrases like coping technique and survival methods are often used interchangeably by writers and researchers. In this context, coping strategy means coping mechanism or coping technique is implying mainly at a household and individual levels. Coping strategy could be defined as a mechanism by which households or community members meet their relief and recovery needs, and adjust to future disaster-related risks by themselves without outside support (Dagne, 1993; as cited in Tesfaye, 2005).

Dagne (1993) defined coping strategies as “mechanisms by which households or community members meet their relief and recovery needs, and adjust to future disaster-related risks by themselves without outside support”.

In any stage of food insecurity (initial or severe), agro-pastoral households practice different coping strategies but with low frequency. The less frequently practiced coping strategies were: becoming temporary traders, by making mortar from trees and selling in main towns inside the country or outside as well, by working as daily labour in nearby towns or areas, by participating in the food for work programme and by eating wild foods were found (Gulled,2006).

Coping mechanism used by agro-pastoral households in Ethiopia include; livestock sales, agriculture employment, certain type of off-farm employment and migration to other area, requesting grain loans, sales of wood or charcoal, small scale trading, selling dung and crop residues, rising of food consumption of wild plants, reliance on relief assistance, relying on remittances from relatives, selling of clothes, and dismantling of parts of their houses for sale (Yared, 2001). Inability to cope, or vulnerability, is conventionally related to assets, particularly physical assets such as land, labour and capital (Elizabeth, 2004).

Households use different means to cope when a food crisis hits them. Their coping mechanisms are adapted depending on how bad the crisis are and what is available to help them manage their situation. Some sale their assets, look for part time work, turn to their social network, venture into income generating activities, engage in food for work activities and others get food relief from NGOs and the government (Chlembo, 2004).

Another study by Eshetu (2000) further revealed that the most common coping practice that are sequentially used during food crisis consisted of reducing number and size of meals, sale of small ruminants and draft oxen, consuming wild food, and borrowing of cash and/or food from better-off neighbours and/or relatives. Another less frequently used strategies were: postponing wedding and other ceremonies, sale of fire wood, with drawing children from school and eating toxic taboo foods.

2.4. Empirical Studies on Food Insecurity

Getachew (1993) in his study in Kembata and Hadiya districts has tested the significance of the relationship between household resources and food security. For the test he included six

variables such as: farming systems, land size, production output, livestock, household size and fertilizer. Using logistic regression model (logit for short), he showed that there is statistically significant relationship between food insecurity and each of the above determinants except farming system. Moreover, in this study all the variables were negatively related with food insecurity except household size.

Degnew (2000) has also summarized the major factors that contributed to the current food insecurity in Ethiopia. Degnew indicated that the widening gap between food production and population growth, dominance of crop farming which exclusively depends on rain fed cultivation characterized by erratic and unreliable rainfall, a limited access to and unaffordable cost of agricultural technology and inputs, degradation of natural resource base (productive resource decline) caused by many factors, lack of an appropriate development policy environment such as land tenure and absence of proper land use policy, and natural disasters as the main determinants of food insecurity. The same study further indicated that inequitable access to resources by women, relatively high percentage of pre-and post-harvest losses and inadequate knowledge of food processing and preservation techniques and limited training programs that are aimed at reducing these losses, lack of access to formal credit and banking services, poor transportation network and distribution facilities, the negative impact of inappropriate use and untargeted free distribution of food aid are other contributing factors for the current food insecurity in Ethiopia.

Ramakrishna *et al.* (2000) took an empirical study in the Amhara regional state of Ethiopia, in the case of North Wollo. The data analysis based on food balance sheet and aggregate food security index reveal that the north wello zone is highly food insecure area and the majority of the sampled household depends on famine relief assistance. In addition they tried to find the cause of food insecurity using logit model and found that cereal production, education, fertilizer consumption, livestock, land size, reduce the probability that household food insecure while, family size increase the probability of insecurity.

Abebaw (2003) made an assessment of Dimension and Determinants of Food Insecurity among rural households in rural Dire Dawa Area, Eastern Ethiopia, The logistic regression model results make known that annual household income, amount of credit received, irrigation use, age of the

household head, educational status of the household head, cultivated land size and total livestock owned have negatively affect food insecurity status of the households. While family size and number of oxen owned affect food insecurity status of the household positively. The likely explanation is that in an area where households depend on less productive agricultural land, increasing household size results in increased demand for food. But this demand will not be matched with the existing food supply so ultimately end up with food insecurity and there may be households in the study area cultivate their farmland using hand tools. Moreover, some farm households even if they are using oxen for farm operation it could not be possible to see the effect because their farm size is small. However, oxen could serve as a store of wealth and disposed during time of severe food shortage. But this is not practiced in the area, because farmers think that regaining such asset is by far difficult.

IKPI *et al.* (2004) in their study in Nigeria using Tobit model found that sex of head, educational level, dependency ratio, network, farm size, input usage, commercialization extent, being a member of cooperative, food expenditure, remittance have negative influence on food insecurity, whereas age of head, household size, positively influences on the food insecurity and all the variables are significant.

Yusuf (2007) made an assessment of “Determinants of Food Security in Pastoral and Sedentary Livelihoods: The Case of Erer District Shinille Zone, Somali Regional State” using binary logit model. According to his result annual income and livestock holding affect household food insecurity negatively whereas family size, age of the household head, spread of livestock diseases are identified to influence household food insecurity positively. The possible explanation is as family size increases, the amount of food for consumption in one’s household increases thereby that additional household member shares the limited food resources in the household. In addition the more the household head is older, the less labour force the household has to carry out both livestock and crop production and reason for the positive correlation between spread of livestock disease and food insecurity is that in areas where livestock production is predominantly very essential, the spread of livestock disease can directly or indirectly affect household access to food. It makes a livestock infectious, sick or lead to mortality while livestock is one of the major sources of cash income for the households in the

study area. Hence in a situation where spread of livestock disease is severe, the probability of a household to loss his livestock is very high and so can easily be vulnerable to food insecurity.

According to Ferehewet (2007) the number of family size and female headed household have positively relationship with food insecurity that means if the number of female headed household increase the food insecurity of that household will increase comparing to the male headed household and agricultural income, nonfarm activity, income gain from remittance and gift have negatively relationship with food insecurity which means if the household get money somewhere else the food insecurity of that household will reduce.

Alem (2007) Indicate his study by holding other variables constant a shift to participation on off-farm activities decreases the probability of household food insecurity by 66%. A shift to smaller family size (smaller than the sample mean family size) decreases the probability of food insecurity by 63%. A shift to high yield (larger than the sample mean) and large farm size (larger than the mean farm land size) decrease the probability of household food insecurity by 39% and 42%, a shift from dependency altitude to self-reliance decreases the probability of food insecurity by 25%. A shift to good wealth status (larger than the sample mean TLU) and an improvement in land tenure security decrease the probability of household food insecurity by 38% and 31%, respectively.

Babatunde *et al.* (2008) conducted a gender-based analysis of vulnerability to food insecurity in Nigeria. They found that female headed households were more vulnerable to food insecurity than male headed households. They also found that increase in farm size and crop output reduces vulnerability to food insecurity in male headed households.

Tefera (2009) carried out a study on the determinants of household food security and coping strategies the case of Farta district, south Gondar zone using logit model found that sex of household head, total livestock holding (TLU), total cultivated land, non-farm activities, improved seed use and soil fertility status were found to have positive influence on food security status.

Basher (2010) made analysis of food security status and coping strategies of kabribayah district of Jigjiga zone of Somali regional state he found that the education, livestock owned, farm income, availability of off-farm and non- farm income, farming experience all these explanatory variables have positive relationship with food security whereas large family size and age of the household have negative relationship with food security.

Lewin and Fisher (2010) using logistic regression model examined the socio-economic characteristics of the farm households, agronomic factors, and government policies that affect food insecurity in rural Malawi. They found that the probability of the household to be food insecure is significantly influenced by land size holding, access to market, availability of irrigation, extension visit, education level of the household head, and farm input price. They also found that households in south Malawi had lower probability of being food insecure for they had access to the Malawi Social Action Fund, a social program which finances self-help community projects and transfers cash through safety-net activities.

The empirical study undertaken in the southern regional state of Ethiopia in wolayita, showed that majority of the rural households (74.2%) are food insecure. A binary logistic model was used to determine the factors, which influence households' food security status. The results obtained from the analysis indicated those households with large family sizes, large dependents, and young heads were food insecure. Livestock ownerships, farm inputs, employment in off farm sectors have positive impact on the household food security status (Adugna and Wogayehu, 2011).

Sisay (2012) indicated in his study entitled on Food insecurity and coping strategies: a perspective from Kersa district, East Hararghe Ethiopia using binary logit model found that out of eleven significant variable six significant variables were thought to influence the food security status. Those variables that showed significance in the model were: age of the household head, sex of the household head, household size in Adult Equivalent, total cropping land in ha, oxen owned and remittances in Birr. From this household size in adult equivalent and age of the household head affect food security negatively.

Indris (2012) carried out study on assessment of food insecurity, its determinants and coping mechanism among pastoral household of afar national regional state the case of zone one, chifra district. Logistic regression model results make known that among explanatory variable large family size, dependency ratio, age of the household head affect food insecurity positively where non-farm income affect household food security negatively.

Zerihun and Getachew (2012) studies on Levels of household food insecurity in rural areas of Guraghe zone, Southern Ethiopia and take a sample of 150 out of the total sampled household heads female comprises 14 percent, and out of the female and male heads about 67 and 59 percent are food insecure respectively this indicates that female headed household are more vulnerable to food insecurity than male headed household.

Amsalu and Beyene (2012) in their study entitled on Empirical analysis of the determinants of rural households food security in Southern Ethiopia in Shashemene District has shown that the major factors affecting food security of rural households were family size, total cultivated land size of household head, annual farm income, total cultivated land size, total off-farm income and livestock holding. Study also indicates that annual farm income; off farm income have a significant and positive influence on the state of household food security while family size and food security were negatively related.

2.5. Conceptual Framework of the Study

Based on the empirical study reviewed determinants of food insecurity status can be affected by demographic, human capital, economic and institutional factors which will fall in any of the three dimension of food availability, access, and utilization (Figure, 1).

The demographic factors including age of the household head, sex of the household head, family size and dependency ratio whereas age, family size and dependency ratio affected the household food insecurity status positively while sex of the household head affected the household food insecurity status negatively. That is, households with large family size are more prone to food insecurity than others. In addition, households with high dependency ratio have high risk of food

insecurity. Furthermore, age of household head and food insecurity has positive relationship which means as the age of the household head increase that household is unable to work hard for survival for his family members. However, households headed by female are more food insecure than households headed by male.

Variables like size of cultivated land, livestock ownership, number of oxen owned, remittance and income earned from off/non-farm activities were the important economic factors affecting the food insecurity status of households. That is households with large cultivated land, large number of livestock, oxen, remittance from their relatives and large income from off/non-farm income have more probability to be food secure than others.

Variables like fertilizer use and access to credit use were the important institutional factors affecting the food insecurity status of the households negatively. However, distance to nearest market affects food insecurity status of households positively.

Variable Educational level of the household head is important human capital affecting food insecurity negatively which means as the education level of the household head increase the food insecurity status of that household decrease

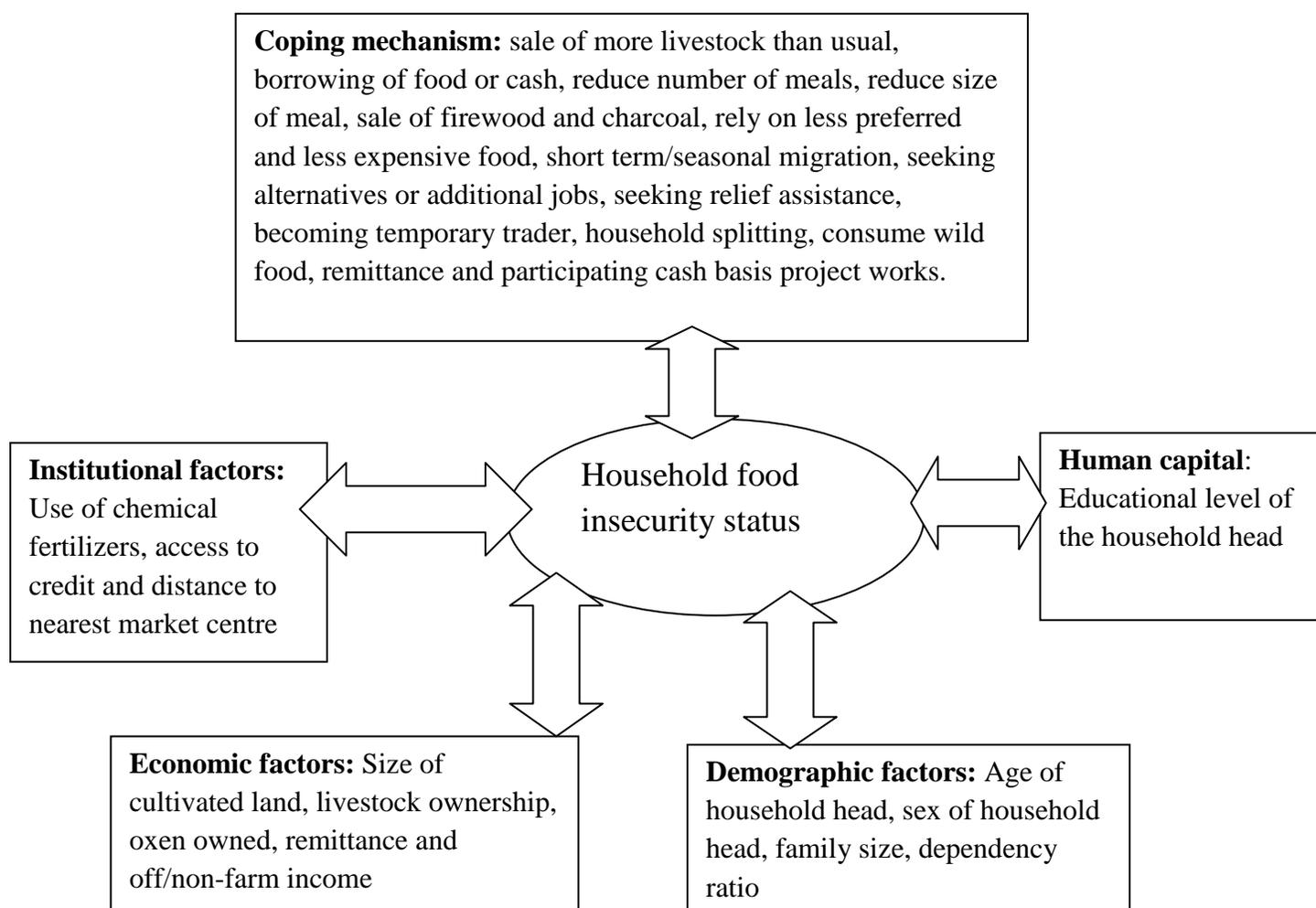


Figure 1: Conceptual framework of the study

Source: Own source based on literature review

3. RESEARCH METHODOLOGY

In this chapter, brief description of the study area, data type, source and method of data collection, sampling technique and sample size, methods of data analysis and definition of variables and hypothesis are presented.

3.1. Description of the Study Area

3.1.1. Overview of Babile District

3.1.1.1. Location

Babile District is one of the sixty eight District of Somali regional state it has border in the west by the Oromia Region, on the north by Gursum District, on the east by Jigjiga District and on the east and south by Nogob Zone. The attitude is estimated to be 800M-1500M above sea level.

3.1.1.2. Climate

The District receives an annual rainfall that varies from 400mm- 800mm. the mean temperature ranges from 28-34 degree centigrade. Unlike the other part of the region, the rainy season (*Gu*) in the District has three sub seasons: *Dira* (April- May), *Hagaa* (june- july) and *karan* (August- Septeber) all of which are equally important for cultivation of crop, availability of water and pasture for livestock. Furthermore, the dry season, *Jilaal* (October - March) is divided in to two sub seasons, *Deyr* (October - November) and *Kalil* (December - March).

3.1.1.3. Population

According to the estimates of CSA (2008), the total population of the Babile District was about 77,304 people (35,686 (46%) of the total population were female, and 41,618 (54%) of the total population were male) while the rural and urban population were 76,032 (from this 66,532 were

agro-pastoral and 9,500 are pastoral) and 1,272 respectively. The average family size for rural and urban areas is 7.2 and 6.1 persons respectively (WAO, 2012).

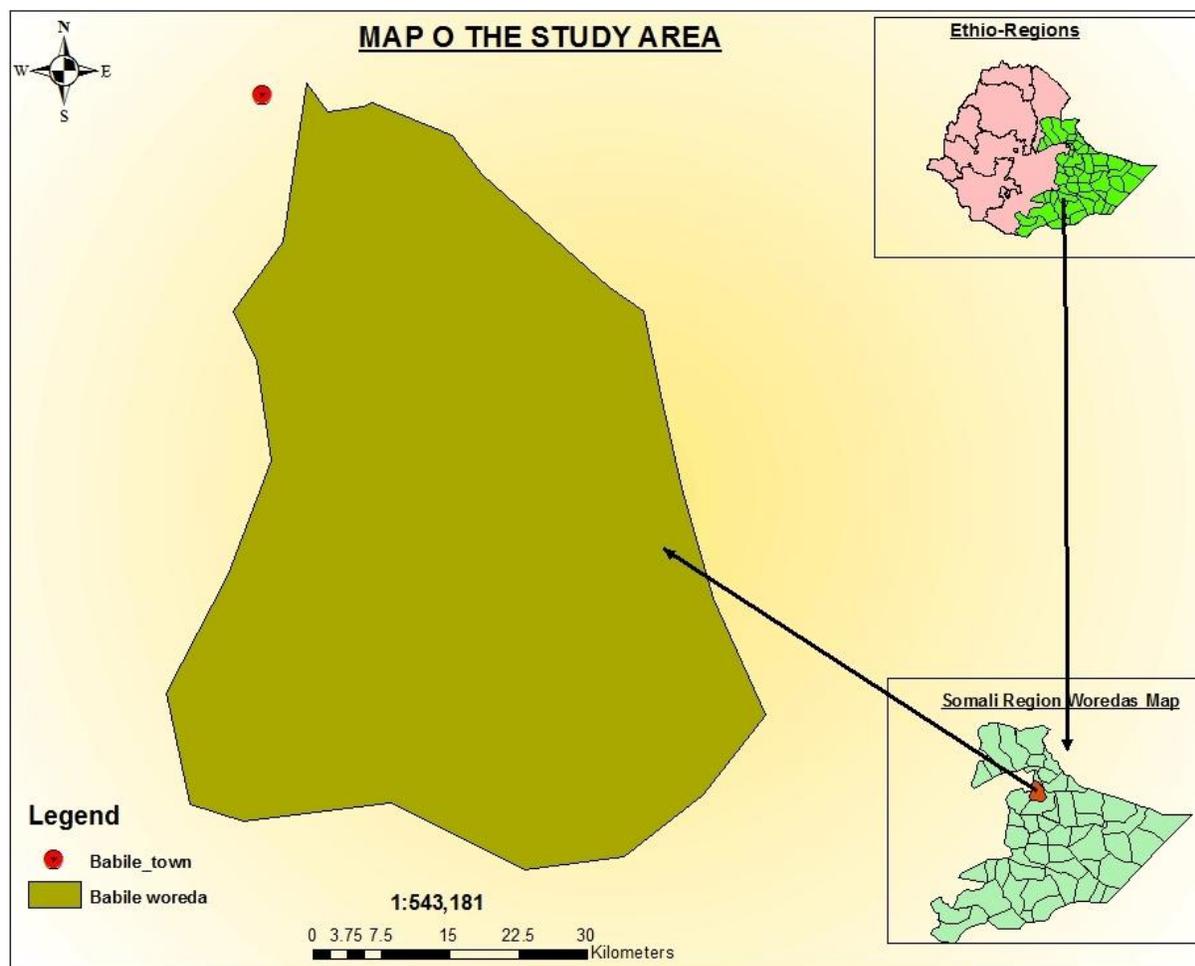


Figure 2:Map of the study area

3.2. Data Types, Sources and Methods of Data Collection

The data used in this study pertain from both primary and secondary sources. This study primarily relied on primary data which were collected by using a semi-structured interview questionnaire, key informant interview and focus group discussions. Before embarking on the collection of primary data, enumerators were trained on the content of the questionnaire. To check similar understanding by all enumerators a pilot test was conducted after which some minor adjustments were made before full data collection process was started.

Furthermore, relevant secondary data were collected from regional bureaus like Somali Regional Disaster Prevention and Preparedness Bureau, Regional Livestock Crop and Rural Development Bureau and other Regional Bureaus and also from the zone administration and district offices and nongovernmental organization that implement different projects. Also secondary data were collected from published documents, official websites and unpublished documents and also related literature were deeply reviewed.

3.3.Sampling Technique and Sample Size

An important decision that has to be taken while selecting a sampling technique is about the size of the sample. Appropriate sample size depends on various factors relating to the subject under investigation like the time aspect, the cost aspect, the degree of accuracy desired (Gupta, 2002). If sample size is too small, we may fail to achieve the objectives of our analysis. But if it is too large, we waste resources. So that appropriate sample size has to be selected in order to get good representative data.

In order to determine the sample size there are several formulas developed. But the simplified formula to calculate the sample size was provided by Yamane (1967) which is given by:

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

Where

n is the sample size

N is the number of households

e is the level of precision.

In the process of selecting the sample, two-stage random sampling procedure was employed. Babile district contains 13 agro-pastoral kebeles from which four agro-pastoral kebeles were selected randomly. Following this, a total of 122 households were selected randomly by employing probability proportional to size.

According to CSA (2008), the total population of the Babile district was about 77,304 people (35,686 (46%) of the total population were female and 42,618 (54%) of the total population were male) while the rural and urban population are 76,032(from this 66,532 are agro-pastoral and 9,500 are pastoral) and 1,272 respectively. The average family size for rural and urban areas is 7.2 and 6.1 persons respectively. Ninety one percent confidence level and $e = 0.09$ are inserted into above Equation 1.

$$n = \frac{9241}{1 + 924(0.09)^2} = 122$$

Then according to the Yamane (1967) formula the sample size of 122 agro-pastoral households were selected randomly from the selected four agro-pastoral kebeles. After having the total number of households in each of the four agro-pastoral households, probability proportional to size was sampling technique employed to select the sample households from the four agro-pastoral kebeles.

Table 1: Total number of households by Kebele and their respective sample size

Kebele	Total number of households	Sampled households
Biqa	696	40
Qoloji	470	27
Dhawrato	575	33
Elbahay	383	22
Total	2124	122

Source: Own computation (2014)

3.4. Methods of Data Analysis

3.4.1. Descriptive statistics

Descriptive statistics like percentages, mean and standard deviation, minimum, maximum and others were used to describe the determinants of food insecurity status in the study area based on the socio-economic, institutional, human capital and demographic situations. Statistical tests like t-test and chi-square test were also used to compare food insecure and food secure households in the study area based on different demographic, socio-economic and institutional factors

3.4.2. Measuring food security status of the household

The household food insecurity status was measured by direct survey of household consumption. The person responsible for preparing meals was asked how much food was prepared for consumption from purchase, stock and/or gift/loan/wage over a period of seven days. In this study, a seven-day recall method was used since such a measure gives more reliable information than the household expenditure method (Bouis, 1993). According to Guller (2006), these seven days recall period was selected due to the fact that it is appropriate for exact recall of the food items served for the household within that week. If the time exceeds a week, for instance 14 days, the respondent may not recall properly what she has been served before two weeks.

Therefore, the consumption data collected on the basis of seven days recall method was converted into kilocalorie using the food composition table adopted from Ethiopian Health and Nutrition Research Institute (EHNRI, 1997). Then, in order to calculate the household's daily food consumption, the total household's caloric food consumption for seven days was divided by seven. The household's daily caloric food consumption per adult equivalent was calculated by dividing the household's daily food consumption by the family size after adjusting for adult equivalent using the consumption factor for age-sex categories.

Then the result was compared with the minimum subsistence requirement per AE per day of 2,200 Kcal which is set by the Ethiopian Government (MoFED, 2008). Accordingly, this value of minimum subsistence requirement was used as a cut-off point between food secure and

insecure households in which case the household is said to be food secure if it meets this minimum and insecure otherwise.

3.4.3. Coping strategies

The coping mechanisms used by agro-pastoral households were identified and analyzed using descriptive statistics tools and the local coping strategy practiced by the agro-pastoralists in the study area were different since food insecurity conditions vary spatially and temporally.

3.4.4. Econometric method

In order to identify the determinants of the food insecurity situation of the households a Logit model was used.

In this study, the dependent variable Y (household food insecurity) is dichotomous variable taking value 1 if the household is food insecure and 0 otherwise. In the case where the dependent variable is dichotomous, probability regression models are the most fitting to study the relationship between dependent and independent variables. In the case where the response variable is qualitative, it is the probability of the dependent variable given independent variable that is determined. One the most common qualitative regression model is logit model (Gujarati, 2004).

Linear probability model like a typical linear regression model, determine the conditional expectation of the dependent variable given independent variable. Beside this, the model is encountered with many problems like non-normality and heteroscedastic variances of the disturbance U_i and the probability fails to fall in between 0 and 1 values. For this reason, linear probability model is not attractive model and it is fallen out of use in many practical applications. These problems could be easily solved by using probit and logit models. In these two models the probability will fall in between 0 and 1. In most applications these two models are quite similar. The main difference being the logistic distribution has slightly fatter tails, that is to say, the conditional probability P_i approaches zero or one at a slower rate in logit than in probit.

Therefore, there is no compelling reason to choose one over the other. In practice many researchers choose the logit model because of its comparative mathematical simplicity (Gujarati, 2004).

Therefore, in this study logit model was chosen for its simplicity and less complexity of its interpretation.

Then, following Gujarati (2004) logit model is specified as follows:

$$P_i = E(Y = 1 / X_i) = \frac{1}{1 + e^{-(\beta_0 + \beta_i X_i)}} \quad (2)$$

For ease of exposition, the probability that a given household is food insecure is expressed as:

$$P_i = \frac{1}{1 + e^{-z_i}} \quad (3)$$

Probability of being food secure is $1 - P_i$:

$$1 - P_i = \frac{1}{1 + e^{z_i}} \quad (4)$$

Thus,

$$\frac{P_i}{1 - P_i} = \frac{1 + e^{z_i}}{1 + e^{-z_i}} = e^{z_i} \quad (5)$$

This is the ratio of the probability that a household is food insecure to the probability of that it is food secure. It is the odds ratio in favour of food insecurity.

Taking the natural log of the above equation:

$$L_i = \ln\left(\frac{P_i}{1-P_i}\right) = Z_i \quad (6)$$

Where, P_i is the probability that the household is food insecure ranges from 0 to 1 and Z_i is a function of n explanatory variable and is expressed as:

$$Z_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n \quad (7)$$

Where, β_0 is an intercept and $\beta_1, \beta_2, \dots, \beta_n$ are the slopes of the equation and L_i is logs of odds ratio in favour of food insecurity which is not only linear in parameters but also linear in terms of explanatory variables. If the disturbance term U_i is introduced, the logit model will become:

$$Z_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n + U_i \quad (8)$$

3.5. Definition of Variables and Hypothesis

3.5.1. Dependent variable

Household food insecurity status (HFINS): It is a dichotomous dependent variable in the model taking a value 1 if the household is food insecure and 0 otherwise. Households' food insecurity status was determined by comparing total kilocalories consumed in household per adult equivalent per day with the daily minimum requirement of 2200kcal/AE/day. Households getting 2200kcal/AE/day and above were considered as food secure and otherwise food insecure.

3.5.2. Independent variables

Independent variables that are hypothesized to affect the food insecurity status are presented below.

Sex of the household head (SEXHH): It is dummy variable taking a value of 1 if the household head is female and 0 otherwise. According to Tefra (2009), sex of the household head positively

influenced on the food security status. Therefore, it is expected that female headed households have more chance to be food insecure and positive relationship with food insecurity.

Family size (FMSZAE): This variable refers to the size of household members who live together under the same roof converted to AE. The expectation is that as the family size increases the probability of the household to have disguised unemployment increases which would in turn affect the well-being of the household (Hilina, 2005). Therefore, it is hypothesized that large family size has positive relationship with food insecurity.

Age of the household head (AGEHH): Age is a continuous explanatory variable referring to the age of the household head in years. As the age of household head increases, the probability that the household is becoming food insecure increases, since aged agro-pastoralists are unable to work hard for the survival of his family members. In light of this, age of the household head and food insecurity is positively correlated. Indris (2012) indicated in his study that the age of the household head affect food insecurity positively. Therefore, it is hypothesized that age of the household head has positive relationship with food insecurity.

Size of cultivated land (LANDCULT): This is measured in hectares and refers to size of the cultivated land. So that households with large cultivated land size is expected to produce more and those with small cultivated land is expected to produce less. Thus, Lewin and Fisher (2010) indicated in their study that size of cultivated land and food insecurity has negative relationship. Therefore, it is hypothesized that size of cultivated land and food insecurity has negative relationship.

Dependency ratio (DEPRATIO): This indicates the number of children under age 15 and old age of above 64 expressed in terms of adult equivalent expressed as a ratio of active family labour members (i.e. age15-64). As the number of dependents increases the active labour force (i.e. age15-64) beside themselves are obliged to support these dependents. Thus this leads to the share of resources and income obtained by the active labour force and hence a decline to the well-being of the household in average terms. Abebaw (2003) have come up that dependency ratio and food insecurity have positive relationship. Thus, the hypothesis is that a household with large

economically non- active family members tend to be food insecure than those with less burden of dependents.

Education level of the household head (EDUCLEVEL): it is dummy variable taking the value of 1 if the household head is illiterate and 0 if the household head can read and write, The better the educational level of the household head, the higher the probability of that family became food secure. According to the study of Frehiwot (2007) there is negative relationship between education level of the household head and household food insecurity. So that it is hypothesized that education level of the household head has negative relationship with food insecurity.

Livestock owned (TLU): Livestock are main source of livelihood of agro-pastoralist community in Somali region. Households who possess large number of livestock are expected to be less vulnerable to food insecurity than the one who have few livestock. Since households with larger number of livestock produce more milk, milk products and meat for direct consumption and owners could be more food secured. Besides, the contribution of livestock to food security includes the manure and income from sales of livestock and livestock products, which are often used for purchase of food grains during times of food shortage. Livestock sale is also used as the major coping strategy during famine and seasonal food shortage. Hence, the higher the value of TLU, the higher will be the probability of being food secure. Adugna and Wogayehu (2011) in their study in Wolayita found that households with more number of livestock have more probability to be food secure than households with less number of livestock. Therefore it is hypothesized that large number of livestock and food insecurity has negative relationship.

Distance to nearest market centre (DISTMRKT): It refers to the distance between the farmers' home and the nearest market that the household usually made transaction which is measured in kilometres. It was expected that households nearer to market center have better chance to improve household food security status than those who do not have a proximity to market centers. It is therefore hypothesized, in this study that the nearer the household to the market centre, the less would be the probability of being food insecure. The same result was also obtained by Lewin and Fisher (2010). Therefore, in this study it is hypothesized that distance to nearest market centre has positively relationship with food insecurity.

Number of oxen owned by the household (NUMBOXEN):This refers to the number of ox a household owns for the purpose of traction power. As a household have ox for the traction power farmer could easily cover the ploughing and able to manage other farm practices. Therefore, well ploughed farm could produce better; by pass the family secured food production. Thus owing ox is hypothesized to be negatively related with the likelihood of being food insecure.

Income from off/non-farm activities (NONAOFRM):It is continuous variable and was measured in birr. Off-farm income represents the amount of income the farmers earn in the year out of on-farm activity in the farm. Non-farm income is the amount of income generated from activities other than crop and livestock production like labour in non-agricultural activities (small scale industrial activities, cottage industries, commercial and others). Basher (2010) indicated in his study that the availability of off/non-farm income and food security has positive relationship. It is hypothesized that households who managed to earn higher off/non-farm income are less likely to be food insecure .i.e., off/non- farm income is expected to have a negative impact on food insecurity.

Remittance (REMITA):This is a variable where most households in the study area are benefiting from supporting each other deeds of the Somali culture. Gulled (2006) in his study indicated that remittance and food insecurity were negative relationship. It is hypothesized that relative economic support from abroad and within the country has negatively related to the food insecurity status of the household.

Use of chemical fertilizers (FERTILIZER): The use of chemical fertilizer is taken as important yield improving per unit area. Soil fertility reduction is believed to be among the major factors for low food production that hinders food security (Tesfaye, 2005). The households that use fertilizer are expected to have better yield than non-users. It is represented as a dummy variable taking value 1 if the farmers not use chemical fertilizer, 0 if the household use chemical fertilizer. Therefore, it is hypothesized that relationship between the food insecurity and use of chemical fertilizers has negative relationship.

Access to credit (CREDITU): It is a dummy variable taking a value of 1 if household not access credit and 0 otherwise. It refers to the amount of money borrowed from different sources. According to Abebaw (2003), credit is used for different purpose like purchase of chemical fertilizers, etc to reduce risk of food insecurity of the households. Consequently, households who are not able to access the amount of credit they required, were expected to have more probability of being food insecure than others. Therefore it is hypothesized that the relationship between the food insecurity and access to credit has negatively related.

Table 2: Summary of variables definition, measurement and hypothesis

Variable	Variable type	Variable definition and measurement	Hypothesis
Food insecurity status	Dummy	1 if the household is food insecure; 0 otherwise	
Sex	Dummy	1 if the household is female; 0 otherwise	-
Family size in AE	Continuous	Family size in adult equivalent	+
Age	Continuous	Age of the household head in years	+
Land size	Continuous	Land cultivated in hectares	-
Dependency ratio	Continuous	Ratio of dependents to active members	+
Education	Dummy	1 if the household is illiterate, 0 otherwise	-
Livestock	Continuous	Livestock owned in TLU	-
Distance to nearest market	Continuous	Distance to market centres in KM	+
Oxen	Continuous	Number of oxen owned	-
Fertilizer	Dummy	1 if the household not use fertilizer, 0 otherwise	-
Off/non-farm income	Continuous	Income from off/non-farm activities in Birr	-
Remittance	Continuous	Income from relatives in Birr	-
Credit	Dummy	1 if the household not access credit 0 otherwise	-

Source: Own definition (2014)

4. RESULTS AND DISCUSSION

This chapter presents the results of the study pertaining to various objectives. Descriptive results are discussed in section 4.1. Section 4.2 presents and discusses the econometric model results. While the final section 4.3 deals with the households coping mechanisms.

4.1. Descriptive Results

4.1.1. Food security status of the sample households

The households' food insecurity status can be measured by direct survey of income, expenditure and consumption. In this study, households' food or calorie acquisition/consumption per adult per day is used to identify the food secure and food insecure households. The calorie consumed by the household is compared with the minimum recommended calorie of 2200 kcal per adult per day. If the consumption/acquisition is less than the recommended amount then, the household is categorized as food insecure and if greater than, as food secure.

The households' food security status was measured by direct survey of consumption. Data on the available food for consumption, from home production, purchase and /or gift/loan/wage in kind for the previous seven days before the survey day by the household was collected. Then the data were converted to kilocalorie and then divided to household size measured in AE. Following this, the amount of energy in kilocalorie available for the household is compared with the minimum subsistence requirement per adult per day (i.e. 2200 kcal). As a result, from all respondent households, 69(56.5%) households were found to be food insecure and 53(43.5%) of them food secure.

Results presented in Table 3 shows that the mean per capita calorie intake of the sample household was 2187.73 kcal, which is lower than the minimum calorie requirement of 2200kcal. The average and maximum calorie intake of food insecure households were below the minimum energy required for an individual to live a healthy life. There was statistically significant mean

difference between food secure and food insecure households at one percent probability level. Thus, the study area could be classified as food insecure given the fact that majority (56.5%) of the surveyed households were not getting the minimum daily energy requirement for an individual to live healthy life.

Table 3:Households food insecurity status

Energy Available per AE in (Kcal)	Food secure (N=53)	Food insecure (N=69)	Total	t-value
Maximum	3151.52	2164.26	3151.52	
Minimum	2210.5	1524.366	1524.366	-1.65***
Mean	2572.714	1892.013	2187.727	
St. Deviation	283.3918	162.3463	405.1079	

Note: *** Significant at 1 percent probability level of significance

Source: Own Survey(2014)

4.1.2. Household demographic characteristics

The following sub section discusses the demographic characteristics of the respondent households. The household characteristics are compared to see the difference among food insecure and food secure groups. The variables discussed here are those which do have influential relationship to the food insecurity status of a household in the study area. Different characteristics of a household like the age of household head's, sex of the household head, dependency ratio and family size in AE were given due consideration.

Table 4: Mean and proportion difference test of variables between demographic characteristics, food insecure and food secure households

Variable	Mean/proportion			t-/ χ^2 -value
	FI (N = 69)	FS (N= 53)	Total (N= 122)	
Sex	0.75	0.87	0.80	2.47
Age	39.04	48.96	43.35	4.75***
Family size	6.03	5.51	5.81	-1.61***
Dependency ratio	1.98	0.62	1.39	-10.42***

Note: ***significant at 1 percent probability level of significance

Source: Own survey (2014)

Age is an important demographic characteristics of the household assumed to bring food insecurity difference among the agro-pastoral households. The average age of the sampled household heads was 43.35 years (SD=12.09) with minimum and maximum of 24 and 80 years respectively. The average age of food insecure household heads was 39.04 years (SD=9.82) whereas it was 48.96 years (SD=12.54) for food secure household heads. There was statistically significant difference in the mean age of household heads between food insecure and food secure households at less than one percent probability level.

The mean of family size in AE for the sampled households was 5.81 (SD=1.83) with the minimum of 2.35 and maximum of 12.3. The mean of family size in AE was 6.03(SD=2.01) and 5.51 (SD=1.53) for food insecure and food secure households respectively. The mean family size in adult equivalent exhibits statistically significant difference between food insecure and food secure households at one percent probability level. Therefore, all other things remaining constant, the result shows that the food requirement of the food insecure households would be greater than those of the food secure households because when the dependency ratio of the family size increase the food insecurity of that household also increase.

Therefore, households which have more family size and less productive members are more food insecure than households which have less number and more productive members.

Dependency ratio was hypothesized as having positive relationship with the households food insecurity status in that households with the larger dependency ratio is more food insecure than households with less dependency ratio. The average mean dependency ratio of the sampled households was 1.39 (SD=1.01) with the minimum of 0.00 and maximum of 4.32. The mean dependency ratio was 1.98(SD=0.90) for food insecure households and 0.62(SD=0.53) for food secure households. There was statistically significant mean difference of dependency ratio between food insecure and food secure households at less than one percent probability level. Thus, the result shows that food insecure households had high dependency burden than food secure which may increase vulnerability of households to be food insecurity.

4.1.3. Economic factors/Resource ownership

This subsection presents the economic factors affecting the food insecurity status of the households which include the size of cultivated land, livestock owned in TLU, number of oxen owned, remittance and off/non-farm income activities.

Table 5: Mean and proportion difference test of variables between resource ownership, food insecure and food secure households

Variable	Mean/proportion			t-/ χ^2 -value
	FI (N = 69)	FS (N= 53)	Total (N= 122)	
Cultivated land	1.54	2.77	2.07	6.48***
Livestock owned in TLU	1.33	1.90	1.57	3.83***
Number of oxen owned	0.48	1.58	0.96	8.74***
Remittance	41.89	183.60	103.45	3.21***
Off/non-farm income	225.87	882.22	493.64	3.14***

Note: ***significant at 1 percent probability level of significance

Source: Own survey (2014)

It was hypothesized that the size of cultivated land by the household negatively affects the food insecurity status of the households. That is, households with large cultivated land in hectares have more probability of escaping the problem of food insecurity than household with small cultivated land in hectares.

Cultivated land per household for the sampled households varies from a minimum of 0.24ha to a maximum of 7 ha. Average cultivated land of the sampled households was 2.07ha with a standard deviation of 1.14. The average cultivated land was 1.54ha (SD=0.64ha) and 2.77ha (SD=1.26ha) for food insecure and food secure households respectively. There is statistically significant difference between food insecure and food secure households in their mean cultivated land at less than one percent probability level. The result shows that food insecure households were relying on very small pieces of land than the food secure households to meet their food requirement.

Livestock production is the important part of crop production in the rural areas in that it enables households to earn better income with which they can purchase food when they are in short of their stock and invest in purchase of inputs that increase their production. And this in turn enables households to ensure food security at household's level (Adunga and Wogayehu, 2011). It was hypothesized that livestock holding in TLU is negatively related with the problems of food insecurity in that households with large number of livestock in TLU have better chance of becoming food secure than otherwise.

The mean livestock holding of the sampled households was 1.57 TLU (SD=0.81) with minimum of 0.12 TLU and maximum of 4.16 TLU. The mean livestock holding was 1.33 TLU (SD=0.54) and 1.90 TLU (SD=0.97) for food insecure and food secure households respectively. The t-test for the equality of the means in livestock holding between food insecure and food secure households shows that there was statistically significant mean difference at less than one percent probability level.

In the study area oxen is the most important traction power for the production of crops. As a result, it was hypothesized that the number of oxen owned is negatively related with the food

insecurity status of households in the study area. That is, the more the number of oxen owned the less the probability of the household to become food insecure.

The number of oxen owned by the sampled households varies from the minimum of zero to a maximum of three. The average number of oxen owned by the sampled households was 0.96 with a standard deviation of 0.86. The average number of oxen owned was 0.48 (SD=0.53) and 1.58 (SD=0.80) for food insecure and food secure households respectively. The average number of oxen owned was appeared to be greater for food secure compared to food insecure households and this difference was statistically significant at less than one percent probability level.

According to remittance sources, it was payments that come from family members of households either living abroad or locally engaged jobs (bread winners), family members always give a help hand to their decent families when they go oversees countries or locally accessed some sort of job opportunity. It was hypothesized that having relative economic support from abroad or within the country was negatively related to the food insecurity status of the household.

The average remittance of the sampled household heads was 103.45birr (SD=232.38) with minimum and maximum of 0 and 880 birr respectively. The average remittance of food insecure household heads was 41.89 birr (SD=139.29) whereas it was 183.60birr (SD=297.84) for food secure household heads. There was statistically significant mean difference between food insecure and food secure households at less than one percent probability level.

Off/non-farm income is very important for the wellbeing of the households in that it help the households to access food when income from agriculture is inadequate to enable households to access food throughout the year. Consequently, it was hypothesized to affect the food insecurity status of the households negatively in which households who are managed to earn more income from such activities are more food secure than others.

The sampled households who have engaged in off/non-farm activities have generated an average income of Birr 493.64 with its standard deviation of 1049.40. Food insecure households have generated very low average income of about Birr 225.87 (SD=748.94) while their counterparts

generated an average of Birr 882.22 (SD= 1268.86) in the study period. The t-test for the equality of the mean of income generated shows that there was statistically significant difference between food insecure and food secure households at less than one percent probability level.

4.1.4. Human capital

The results of the human capital hypothesized to differentiate between food insecure and food secure households are presented and discussed under this subsection as follows:

Table 6: Mean and proportion difference test of variables between human capital, food insecure and food secure households

Variable	Mean/proportion			t-/ χ^2 -value
	FI (N = 69)	FS (N= 53)	Total (N= 122)	
Education of the household head	0.17	0.47	0.30	12.57***

Note: ***significant at 1 percent probability level of significance

Source: Own survey (2014)

The educational level of the household head is an important human capital which is expected to affect food insecurity status of households negatively. That is, the more the educational level of the household head, the more the possibility of household to diversify their livelihood so that the less possibility the household to become food insecure.

Out of the total sampled households 69.7 percent were illiterate whereas 30.3 percent's were read and write. So that the education level of the household heads shows significant difference between food secure and food insecure households at less one percent probability level.

4.1.5. Institutional factors

The results of the institutional factors hypothesized to differentiate between food insecure and food secure households are presented and discussed under this subsection as follows:

Table 7: Mean and proportion difference test of variables between institutional factor, food insecure and food secure households

Variable	Mean/proportion			t-/ χ^2 -value
	FI (N = 69)	FS (N= 53)	Total (N= 122)	
Fertilizer	0.11	0.37	0.23	11.58***
Proximity to market centre	9.39	7.66	8.64	-3.24***
Credit use	0.17	0.35	0.25	5.4**

Note: *** and **at 1 and 5 percent probability level of significance respectively

Source: Own survey (2014)

Appropriate application of modern farm inputs such as chemical fertilizers increases crop yield and productivity and this bring food insecure households to become food secure. Because of this fact, farmers have been encouraged to adopt utilization of modern farm inputs to improve land productivity and to boost overall production (Degefa, 2002 cited in Tesfaye, 2005). Therefore, in the study area utilization of use of chemical fertilizers are expected to affect food insecurity status of the households' negatively.

From the total sampled households, users of chemical fertilizers accounted for 23 percent while non-users of chemical fertilizers accounted for 77 percent. The proportion of chemical fertilizer users was 11.6 percent of total sampled food insecure households. In addition to this; chemical fertilizer users accounted for about 37.7 percent of the total food secure households. Whereas, the proportion of non-users of chemical fertilizers out of total sampled food secure and food insecure households were 62.3 and 88.4 percent respectively. There was statistically significant proportion difference between food secure and food insecure households in terms of use of chemical fertilizers.

Good infrastructure is essential for food security by ensuring low food price and efficient market that can respond to changes in demand. It also reduces the cost of transporting produce and inputs (such as fertilizers) and food shortage. It allows information transfer between producers and traders, and gives farmers access to new technologies (FAO, 2009). As a result it was hypothesized that the distance of the household's residence from the nearest market centre is negatively related with food insecurity status and households nearest to the market centre have less probability of becoming food insecure.

The mean distance of food insecure households to the nearest market was 9.39 Km whereas the food security was 7.66 Km. Even though it seems that food insecure households were travelling more distance than food secure households, statistical test for the equality of mean distance shows there was significant difference between the food insecure and food secure households in the market centre at 1% probability level.

Credit decreases the probability of the households to become food insecure because credit is used for many purposes like consumption or purchase of agricultural input such as chemical fertilizers and improved seeds, etc. As a result, it was hypothesized that households who are getting the amount of credit they required have less probability of becoming food insecure than others.

From the total sampled households, households which were access to credit use accounted for 25.4 percent while households which were not access to credit use accounted for 74.6 percent. The proportion of access to credit household heads was 17.4 percent of total sampled food insecure households. In addition to this; access to credit headed households accounted for about 35.8 percent of the total food secure households. Whereas, the proportion of non-access to credit users household heads out of total sampled food secure households and food insecure female headed households were 64.2 percent and 82.6 percent respectively. There was statistically significant proportion difference between food secure and food insecure households in terms of credit at less than five percent probability level. Thus, the result shows that households which were access to credit use are more food secure than households which are not access to credit use.

4.2. Econometric Model Results

As specified in the methodology part of this study, the analysis was made using binary logistic regression model. In this section, this model was used to see the relative influence of household's demographic, socio-economic, human capital and institutional variables on food insecurity status. Identification of the descriptive statistics is not enough to stimulate policy actions unless the relative influence of each factor is known for priority based intervention.

4.2.1. Determinants of agro-pastoral household food insecurity

This section presents and discusses empirical findings of econometric model result. Estimates of the parameters of the variables expected to determine the agro-pastoral food insecurity are displayed in Table 18. The goodness-of-fit was tested by the Log likelihood ratio (LR) test. The result shows the chi-square of 134.21 with 13 df and p-value of zero. This means that χ^2 is statistically significant and the model displays a good fit. The Pseudo R^2 of the model is also 80.35%. This verifies that the model has a good fit to the data and explained significant non-zero variations in factors influencing food insecurity.

Among the total of thirteen explanatory variables included in the model, seven variables were found to be statistically significant in influencing the food insecurity status while the remaining six explanatory variables were statistically insignificant. Among factors which had significant influence on food insecurity are livestock owned in TLU and number of oxen holding were statistically significant at 5% probability level; Remittance, dependency ratio, off/non-farm income, land cultivated and distance to nearest market centre were significant at 10% probability level.

Table 8: Maximum likelihood estimates of binary logistic model

Variable	Coefficient	Z- value	Standard Error	P>Z	Marginal effect
Sex	2.320	1.370	1.695	0.172	0.113
Age	-0.018	-0.440	0.041	0.659	-0.004
Family size	-0.300	-0.990	.304	0.324	-0.015
Dependency ratio	2.193	1.900	1.157	0.058	0.120*
Education level	1.635	1.000	1.637	0.318	0.142
Land cultivated	-1.062	-1.710	0.623	0.088	-0.046*
Livestock owned	-1.883	-2.040	0.924	0.042	-0.114**
Oxen holding	-1.904	-1.980	0.961	0.048	-0.197**
Fertilizer	0.818	0.670	1.213	0.500	0.074
Credit	1.216	0.900	1.344	0.366	0.134
Remittance	-0.008	-1.710	0.004	0.088	-0.0003*
Off/Non-farm	-0.001	-1.850	0.001	0.064	-0.00004*
Income					
Distance to nearest market centre	0.431	1.690	0.255	0.091	0.019*
Constant	1.920	0.560	3.426	0.575	-
LR chi2 (14)					134.21
Log likelihood					-16.41
Pseudo R ²					0.80

Source: Econometric regression model output (2014)

Note: ** and * significant at 5% and 10%, probability level of significance respectively.

Dependency ratio: Dependency is burden to every households, it was also a catalyst for food insecurity. It was found that dependence ratio and food insecurity have positive relationship and significant at less than 10 percent probability level. The positive sign shows that the probability of becoming food insecure is high for households where productive members are less than unproductive members. Other variables remaining constant, as the dependent age group (<15 and >65) increases by a unit, the probability that the household is food insecure increases

by 12 percent. This result is also in line with the result of Dereje (2008), Indris (2012) and Saadiq (2012).

Livestock holding excluding Oxen per AE: It was found that the relationship between livestock holding and food insecurity has negative and significant at less than five percent probability level. Other variables remaining constant, increase in the number of livestock holding in TLU by a unit, decreases the probability that the household is food insecure by 11.4 percent. A household which has large number of livestock in tropical livestock unit has more opportunity like meat, milk and so on. In addition to this one other possible alternative was that livestock is used as store of value which can be discharged to market at time of shocks by the agro-pastoral households; especially small ruminants was observed from the study area. This result is supported by Mulegeta (2002), Saadiq (2012) and Indris (2012).

Oxen owned: It was found that this variable has significant and negative relationship with food insecurity status. It significantly affects the food insecurity status of the households at less than five percent probability level. Other variables remaining constant, increase in the number of oxen owned by one, decreases the probability that the household become food insecure by 19.7 percent. The explanation is that household who has enough oxen they produce enough food, oxen are used as draft power for the cultivation of crops whose value provide a given household enough food harvest to sustain livelihood. This result is also in line with the result of Tesfaye (2005), Guled (2006) and Zerihun (2009).

Off/Non-Farm Income per AE: It was found that this variable has negative relationship with food insecurity and statistically significant at less than ten percent probability level. The negative relationship shows that those households with non/off-farm activities may earn more income to improve their living condition. Other variables remaining constant, as the income of Non/Off farm activities increases by one Birr of money per AE the probability of the household to become food insecurity decreases by 0.004 percent. The explanation is that agro pastoralists who have access to non/off-farm income opportunities are less likely to become food insecure than those households who had no or little access as the additional money could play an important role in times of critical situation. This result is supported by Zegeye (2009) and indiris (2009).

Land cultivated (Land size): It was found that food insecurity and size of cultivated land has significant (at less than ten percent probability level) and negative relationship with the household food insecurity status. The negative sign shows that the probability that the household is food insecure decreases as cultivated land increases. Other variables remaining constant, increase in cultivated land by one hectare, decreases the probability that the household is food insecure by 4.6 percent. The possible explanation is that, when cultivated land increases the household would be able to produce more which in turn helps to reduce food insecurity problem of his family during the hard time. This result is supported by Zerihun (2009).

Distance to Nearest Market in KM: It was found that distance to nearest market and food insecurity have positive relationship and significant at less than ten percent probability level. The positive sign shows that the probability of becoming food insecure is high for those households that are far to the market comparing to those that are near to market because those who near the market they have the access to sale their product and buy products they need but those that are far they don't have such facilities and even they sale their products with low price. Other variables remaining constant, as the distance to nearest market increases by one kilo meter, the probability that household become food insecure increases by 19 percent. This result is supported by Lewin and Fisher (2010).

Remittance per AE: Remittance is an economic support in terms of money send from inside and outside of the country. It was found that food insecurity and remittance has significant (at less than ten percent probability level) and negative relationship with the household food insecurity status. The negative sign shows that the probability that the household is food insecure decreases as remittance increases. Other variables remaining constant, if the remittance increases by one Birr in AE decreases the probability that household becomes food insecure by 0.03 percent. This result is also in line with the result of Gulled (2009).

4.3. Household Coping Mechanisms

Households adopt and develop diversified coping strategies and sequential responses through which people used at times of decline in food availability.

As illustrated in the Table 19 agro-pastoralists in the study area use alternative coping mechanisms such as: sale of more livestock than usual, borrowing of food, reduce number of meal, reduce size of meal, sale firewood and charcoal, seasonal migration, seeking alternative or additional job, rely on less preferred and less expensive food, seeking relief assistance, becoming temporary trade, household splitting, consume wild food, remittance, participating in cash basis project works.

Table 9: Most commonly used coping mechanisms

Household coping mechanisms	Food insecure (56.5%) N= 69	Food secure (43.5%) N = 53	Total (100%) N = 122
	%	%	%
Sale of more livestock than usual	72.5	39.6	58.2
Borrowing of food or cash	97.1	54.7	78.7
Reduce number of meals	65.2	43.4	55.7
Reduce size of meal	62.3	35.8	50.8
Sale fire wood and charcoal	50.7	20.8	37.7
Rely on less preferred and less expensive food	33.3	22.6	28.9
Short term/seasonal migration	5.8	15.1	9.8
Seek alternative or additional jobs	30.4	3.8	18.9
Seeking relief Assistance	27.5	13.2	21.3
Becoming temporary trader	14.5	47.2	28.7
Household splitting	7.2	0	4.1
Consume wild food	24.6	9.4	18.03
Remittance	18.8	24.5	21.3
Participating in cash basis project works	14.5	3.7	9.8

Source: Field survey, 2014

N = sample size

The first most important coping mechanism used by the large number of surveyed households is borrowing of food or cash which was about 97.1 and 54.7 percent of food insecure and food secure households respectively which has significant difference between food insecure and food secured households; this strategy was the most common strategy practiced in the study area.

The second, third and fourth most important coping strategies used by large number of agro-pastoral households were sale of more livestock than usual, reduce number of meals and reduce size of meal which was about 69.6, 59.4 and 53.4 percent of food insecure respectively and 35.8, 39.6 and 28.3 percent of food secure households respectively.

To 50.7, 33.3, 30.4, 27.5 and 24.6 percent of sale fire wood and charcoal, rely on less preferred and less expensive food, seek alternative or additional jobs, seeking relief assistance and consume wild food respectively were also among the important coping strategies used in the study area.

Remittances, participating in cash basis project works, becoming temporary trader, household splitting, short term/seasonal migration were also among the coping mechanisms used in the study area.

5. SUMMARY, CONCLUSIONS AND RECOMENDATIONS

This chapter contains a brief narration of the objectives, research methodology, findings of the study and the coping strategies that are practiced by the agro-pastoralists. Finally, from the findings of the study, conclusions were drawn and recommendations have been made.

5.1. Summary

This study was undertaken in Babile district of Fafan zone of Somali Region with the specific objectives of to measure the food insecurity status of the agro-pastoral households, identifying the determinants of food insecurity in the agro-pastoral households, identifying agro-pastoral household coping strategies used by households in the study area. To achieve these objectives the study relied more on primary data which were collected by conducting household survey from 122 randomly selected households in four randomly selected kebeles of the district. Households' demographic, socio-economic, human capital and institutional data which were deemed to be relevant were collected, organized, analysed and interpreted to come up with the results.

Data were analysed using both descriptive statistics and econometric method. The descriptive statistics were used to study the demographic, socio-economic, human capital and institutional factors in relation to food insecurity status of households. The econometric method in which logit model was specified and estimated was used to analyse the determinants of food insecurity in the study area.

The sampled households were classified into food secure and food insecure groups based on kilo-calories (kcal) actually consumed by the households during the previous seven days of survey data either through purchase, gift or other means. Total amount of food commodity consumed by each household during the seven days were converted into equivalent daily kilo calories (kcal) per adult equivalent (AE) and then compared with recommended daily kcal per adult equivalent. Total daily food energy per adult equivalent of less than 2200 kcal was considered as food insecure and 2200 kcal above food secure. Accordingly, 56.5 percent of

sampled households were living on total daily food energy level per adult equivalent of less than the minimum recommended requirement.

Binary logit model was employed to study the relations between the probability of households being food insecure and household's socio-economic characteristic. The model result revealed seven significant variables out of the hypothesized variables. Among the significant variables distance to nearest market centre and dependency ratio were positively related with food insecurity. While the remaining significant variables such as total livestock owned, number of oxen, non/off farm income, remittance and land cultivated were negatively related with food insecurity status of the households in the study area.

In addition to this, the coping strategies practices by most of the agro-pastoral households in the study area were borrowing cash or food from relatives or neighbours (78.7), sale of more livestock than usual (58.2), reduce number of meals (55.7), reduce size of meals (50.8), sale of charcoal and fire wood (37.7) and so on.

5.2. Conclusions and Recommendations

The result of this study shows that 56.5 percent of the surveyed households were unable to get the minimum daily energy requirement. In order to improve households' food security situation in the district, the following may be the major recommendable areas of intervention.

The high dependency ratio from the study result calls for policy makers to focus on projects like family planning. Large family size is as aside problem for the household if the non-productive members are high. Awareness creation should be the first task to tackle this problem. Therefore organizations working on the health stream need to create strategic approach for the utilizations of family planning facilities. Since the communities in the study area are Muslim, natural birth control and other alternatives should be assessed by considering the culture and religion aspects of family planning facilities.

Cultivated land is an important economic factor that negatively affects households' food insecurity status in the study area. However, with an increase in population size of the district, cultivated land is becoming in short supply and the farmers are producing crops on small plots of land with lack of technologies and low productivities. Improved agricultural technologies that enhance the productivity of land per unit area should be developed and training of agro-pastoral households on land management should be given a due emphasis.

Total livestock unit was a significant determinant and negatively related with food insecurity. Livestock is the major determinant which needs to be improved and livestock played a major role both in mitigating the hazards of food insecurity as well as coping mechanisms of the agro-pastoral households. Therefore, there should be intervention projects such as; Livestock alone cannot sustain the livelihood of agro-pastoralists without the complements of cultivation, Upgrading livestock productivity; by promoting it's genetically through artificial insemination, creating livestock market which can make livestock as well as its products more marketable. Create mobile livestock health teams, who can immediately respond to any outbreak disease at any time and also increase the livestock health infrastructure; the number of animal health posts, clinics, veterinarians and technicians.

Oxen was a significant determinant and is negatively related with food insecurity. Oxen is vital for food security due to its integral part with farm cultivation. A given household having enough number of oxen was more secured than the one had no oxen. Moreover, it was observed from the field survey that as a coping mechanism, agro-pastoral households sell their oxen during hard times so as to survive. Losing oxen made them very difficult to recover even during the normal seasons. Finally, this forces more agro-pastoralist farming households to be food insecure in the next unpromising season since they miss their integral part to cultivate the farm. Therefore, there should be intervention in the area; households should be supported to increase their oxen by enhancing rural credits to the farmers which can indeed overcome the farmers' capital problem, there should also be oxen restocking program for households who lost their oxen from drought or any other shock.

Distance to nearest market centre is significant determinant and positively related with food insecurity. Furthermore, as the distance of the market centre increase the food insecure households also increases because they don't have the opportunity to seek their daily labour activities. Therefore, government as well as the international and local organization should have to construct market centre and this will create a lot of opportunity for food insecure households and also minimize the problem of food insecurity.

On the other hand, off/non-farm income generating activities also play an important role in determining the food insecurity status of agro-pastoral households. In this regard, Promoting off-farm activities and further enhancing use of technologies can be materialized through provision of rural financial services that can help agro-pastoralists in solving capital problem to buy farm oxen, farm inputs, use for trade, and etc. Hence, this calls for enhancing and expanding the financial access for the food-insecure households in the study areas, and this should be one of the areas of intervention and policy option.

Barrowing of food or cash, sale of more livestock than usual, reduce number of meal, reduce size of meal and sale of firewood and charcoal are the most important coping strategies used by agro-pastoral households in the study area which has significant impact on food insecurity in the area. Therefore, the regional government, zonal and district administration should have to give technical skill training and provide some credit for the agro-pastoral households in order to increase the income of the household and reduce the food insecurity status. In addition to this district administration should also link with this agro-pastoral food insecure households for the different project that international and local organizations implementing in the district which are food and cash for work activities.

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7. APPENDICES

7.1. Tables in Appendix

Appendix table1: Conversion factor used to compute adult equivalent (AE)

Age group (years)	Male	Female
<10 years	0.6	0.6
10-13	0.9	0.8
14-16	1.0	0.75
17-50	1.0	0.75
>50	1.0	0.75

Source: Storck, et al. (1991)

Appendix table2: Conversion factor used to compute tropical livestock unit (TLU)

Animal category	TLU	Animal category	TLU
Calf	0.50	Donkey (young)	0.35
Weaned calf	0.34	Sheep and goat (adult)	0.13
Heifer	0.75	Sheep and goat (young)	0.06
Cow	1.00	Chicken	0.013
Ox	1.00		
Donkey (adult)	0.70		

Source: Storck, et al. (1991)

Appendix table3: Conversion factor used to estimate Kcal of food items

Food item	Unit	Kcal
Barley	Kg	3723
Maize	Kg	3751
Sorghum	Kg	3850
Wheat	Kg	3623
Lentils	Kg	3522
Onion	Kg	713
Pepper	Kg	933
Milk	Lt	737
Sugar	Kg	3850
Edible oil	Lt	8964
Coffee	Kg	1103
Peas	Kg	3553
Tomato	Kg	216
Salt	Kg	1700
Rice	Kg	3330
Meat	Kg	1148
Butter	Kg	7364
Spaghetti/Macaroni	Kg	3550

Source: EHNRI, 1997

7.2 Household Survey Questionnaire

Food Insecurity and Coping Strategies of Agro-pastoral Households in Babile District of Somali
Regional State, Ethiopia

Part.1. General Information

1. Kebele: _____
2. Name of Household Head: _____
3. Household Code No: _____
4. Date of interview: _____
5. Name of Enumerator: _____
6. Signature: _____
7. Name of Supervisor: _____
8. Signature: _____

Part 2. Demographic Characteristics of the Household

(Make a complete lists of all individuals who normally live and eat their meals together in this household, starting with the household head)

S/N	Name of the household members	Sex Male =1 Female=0	Relation to the head of household(c ode below)	Age	Marital status (code below)	Highest educational level you ever completed (code below)	Religion do you practices (code below)	Ethnic(code below)
01	02	03	04	05	06	07	08	09
1								
2								
3								
4								
5								
6								
7								
8								
9								

Code for 04: Relation

Household head __1
Wife/husband __2
Son/Daughter __3
Brother/sister __4
Grand child __5
Other relatives __6
Others (specify) __7

Code for 06: Marital status

single __1
married with one __2
divorced or separated __3
widowed __4
married with more than one __5

Code for 07: Educational level

illiterate __01
Read and Write __02

Code for 08: Religion

Islam __1

Orthodox __2

Others (specify) __3

Code for 09: Ethnicity

Somali _____1

Oromo __2

others (specify) __3

Part 3. Agriculture:**3. Land use information**

3.1. Do you have your own agricultural land?

Yes =1

No = 0

3.2. If yes to question no. 3.1 above, what is the total size of your land holding? ____ Ha.

1. Cultivated area _____

2. Grazing area _____

3. Forest land _____

4. Other (specify) _____

3.3. How did you acquire your own land?

1. Inherited/ gifts from family

2. Purchase

3. Land distribution

4. Other (specify) _____

3.4. Did you produce enough for your family to eat throughout the year? _____

Yes = 1

No = 0

3.5. If no, what are the constraints in order of importance, that prevent you from doing
So? _____

1) Shortage rainfall

2) Lack of early maturing variety

3) Lack of plough oxen

4) lack of money to rent a tractor

5) Others (specify) _____

Part 4. Livestock ownership

4.1. Do you own livestock?

Yes =1

No=0

4.2. If yes, fill the following table

s/n	Type of the livestock	No. owned	Average price in (Birr)	Sold during last 6 months		
				No	Total sales value	Reasons for sale (code)
1	Oxen/bull					
2	Young bull					
3	Cows (Milking)					
4	Cows (Non milking)					
5	Sheep					
6	Goat					
7	Donkey					
8	Camels					
9	Others specify					

Code: 01 = to buy some food items for family consumption

02 = to pay a loan

03 = to buy other animals

04 = to purchase agricultural inputs & implements

05= to cover health and education expenses

06 = others, specify

4.3. Gross income from the sale of milk

Milk type	Production in Kob*	Price of milk in Birr per Kob	For home consumption in Kob	For sale in Kob

* Kob: It is local milk measuring cup: 6 Kob = 1 liter

4.3 Did you use oxen for your farm operation?

Yes= 1

No=0

4.4. If yes, are your oxen enough for your farm operation?

Yes =1

No=0

4.5. If you do not have enough oxen, how do you get additional oxen you need?

- | | |
|--------------------------------------|-------------------------------------|
| 1. Pulling oxen to form a pair | 2. Borrow from friends & relatives |
| 3. Oxen obtained for labour exchange | 4. Oxen obtained with sharecropping |
| 5. Manually | 6. With other livestock |
| 7. Hire from someone/renting in | 8. Others (specify) ----- |

Part 5. Input Use

5.1 Do you use any fertilizer?

Yes = 1

No = 0

5.2. If yes, which ones? _____

1) Inorganic DAP and/or Urea

2) Organic (manure)

3) Both 4) None

5.3. If no, why

1) Not necessary for cultivated crops

2) Not available

3) Harmful to the soil

4) It is costly

5) Land is fertile

6) others (specify) _____

5.4. Did you use improved seed on your farm in last year production period?

Yes = 1

No = 0

5.5. If 'yes', what type of improved seed did you use _____

5.6. Where did you obtain these improved seeds?

1. Research bureau

2. Seed enterprise

3. Cooperatives

4. Agricultural bureau

5. District agricultural office

6. Others (specify) _____

5.6. If 'no', why?

- | | |
|------------------------------|----------------------------|
| 1. Not heard about it | 2. Too expensive |
| 3. Not available (no supply) | 4. Not know its importance |
| 5. Not enough land | 5. Other (specify) ----- |

5.7. Did you use herbicides or insecticides at least one of your plots in the last production year?

Yes = 1

No = 0

Part 6. Marketing

6.1. Which market (s) does your household use? _____

- 1) Main market 2) local market 3) both

6.2. What is average market distance you travelled to nearest market from your home measured in hours of walk? _____

- | | | | | |
|------|--------|--------|--------|-----------|
| 1) ½ | 2) 1 | 3) 1 ½ | 4) 2 | 5) 2 ½ |
| 6) 3 | 7) 3 ½ | 8) 4 | 9) 4 ½ | 10) > 4 ½ |

6.3. Where do you sell your farm produce? ____ (multiple answers possible)

- | | |
|-------------------------------------|--------------------------|
| 1. On farm | 2. Local market |
| 3. Through services of cooperatives | 4. Other (specify) _____ |

6.4. What means of transport do you use to transport your produce to the market? _____

- | | |
|--------------------|---------------------------|
| 1. Truck (vehicle) | 2. Animal power |
| 3. Human power | 4. Others (specify) _____ |

6.5. When do you sell most of your produce? _____ month

6.6. Did you get reasonable price for your produce at this particular time?

Yes =1

No=0

6.7. If no why did you sell at that particular time of lower (unreasonable) price?

1. To settle debt
2. To pay taxes
3. For social obligation
4. To meet family requirement
5. Others (specify) _____

6.8. What are the problems in marketing of your produce?

1. Transportation
2. Low price
3. Low bargaining power
4. Too far from market
5. Others (specify) _____

Part 7. Credit Services

7.1. Have you received any type of credit for the last years? _____

Yes = 1

No = 0

7.2. If yes, for what purposes? _____ (multiple answers possible)

1. Purchase of seeds
2. Purchase of fertilizers
3. Purchase of chemicals
4. Purchase of oxen
5. Purchase of farm implement
6. For family consumption
7. To buy other livestock
8. School fee
9. For medication
10. Others (specify) _____

7.3. What are the sources of your credit? (Multiple answers possible)

1. Cooperatives
2. Neighbours and friends
3. Relatives
4. Local money lenders
5. Micro finance institution
6. Commercial banks
7. Others (specify) _____

7.4. Amount borrowed in Birr last year _____

Part.8. Off-farm and Non-farm employment

8.1. Do you or any member of your family have off/non-farm job?

Yes =1

No=0

8.2. If yes indicate the type of work and annual income:

Family member	Types of jobs(see below)	Annual income(birr)*
1.		
2.		
3.		
4		
5		

*if payment were made in kind, convert them into birr at price prevailing at time.

- | | |
|---|--------------------------------|
| 1. Weaving/spinning | 2. Milling |
| 3. Other handicrafts (pottery, metal works, etc.) | 4. Livestock trade |
| 5. Sale of local drinks | 6. Agricultural employment |
| 7. Petty trade (grain, vegetables, fruits, etc.) | 8. Sell of fire wood and grass |
| 9. Charcoaling | 10. Government employment |
| 11. Others (specify) _____ | |

8.3. Has the household received remittance in this year?

Yes =1

No=0

8.4. If yes, the amount in birr/ year: _____

Part 10. Coping Mechanisms

10.1. Have you ever resorted to the below mechanisms in cases of severe food crises?

s/n	Type of response to crises	Yes/No	How often do you do this?		
			Most years	Every year	Only in famine year*
1	Sale of livestock more than usual				
2	Borrowing of food or cash				
3	Reduce number of meals				
4	Reduce Size of Meal				
5	Sale fire wood and charcoal				
6	Short term/seasonal migration				
7	Seek alternative or additional jobs				
8	Rely on less preferred and less expensive food				
9	Seeking relief Assistance				
10	Becoming temporary trader				
11	Household splitting				
12	Consume Wild Food				
13	Remittance				
15	Participating in cash basis project works				