ADDIS ABABA UNIVERSITY

COLLEGE OF DEVELOPMENT STUDIES

CENTER FOR FOOD SECURITY STUDIES

DETERMINANTS OF FOOD SECURITY AND COPING MECHANISMS IN AGRO-PASTORAL HOUSEHOULDS: A CASE OF ITANG WOREDA, GAMBELLA REGION, ETHIOPIA

BY

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DECEMBER, 2021

ADDIS ABABA, ETHIOPIA

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ADVISOR: TEMESGEN .T (PhD)

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Declaration

I declare that this thesis is my original work and has not been presented for a degree or certification in any other universities, institution and that all sources of material used for the thesis have been properly acknowledged.

Wiyual Chuol Kuach

December, 2021

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APPROVAL SHEET

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As supervisor of the thesis, I certify that I have read and evaluated the thesis prepared by **Wiyual Chuol Kuach** entitled *"Determinants of Food security and Coping Mechanisms in Agro-Pastoral Households: Case of Itang Woreda, Gambella Region, Ethiopia"* and recommend for open defense as fulfilling the requirement for the degree of **Master of Science in Food Security and Development**.

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As members of the Examining Board of the Thesis Open Defense, we certify that we have read and evaluated the thesis prepared by **Wiyual Chuol Kuach** entitled "*Determinants of Food security and Coping Mechanisms in Agro-Pastoral Households: Case of Itang Woreda, Gambella Region, Ethiopia"* and recommend that it is acceptable thesis required for the degree of **Master of Science in Food Security and Development.**

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ABBREVIATIONS

AIDS:	Acquired Immunity Deficiency Syndromes
CAS:	Central Statistical Agency
DRR:	Disaster Risk Reduction
EFSOR:	Ethiopia Food Security Outlook reports
EFSS:	Ethiopian Food Security Strategy
ETB:	Ethiopian Birr
FAD:	Food Availability Decline
FDRE:	Federal Democratic Republic of Ethiopia
FED:	Food Entitlement Decline
FFW	Food For Work
FGD:	Focus Group Discussion
GDP:	Growth Domestic Product
GPNRS:	Gambella People's National Regional State
HFIAS:	Household Food Insecurity Access Scale
HH:	Household
HIV:	Human immunity virus
IFPRI:	International Food Policy Research Institute
ISO	International Standardization for Organization
KII:	Key Informant Interview
LLA:	Lowland Areas
MASL:	Meter Above Sea Level
MEDAC:	Ministry of Economic Development and Cooperative
MOFED:	Ministry of Finance and Economic Development
NBE:	National Bank of Ethiopia
NGOs:	Non-Governmental Organization
SSA:	Sub Saharan Africa
TLU:	Tropical Livestock Unit
TOL:	Tolerance Level
USAID:	United States Agency for International Development
VIF:	Variance Inflation Factor
WFS:	World Food Submit
WHO	World Health Organization
WSFS:	World Summit on Food Security

ABSTRACT

An understanding of the major factors of food security is an important for interventions aiming at reducing those factors. Therefore, this study was conducted to determine the food security status of agro-pastoral households. The objectives of the study are to determining the food security status of agro-pastoral household, describing the coping mechanisms of used by household during food shortage. In order to achieve these objectives, cross-sectional data on demographic and socio-economic characteristics aspects were collected from 113 randomly selected household in two kebeles based on the probability sampling through semi-structure interview schedule. Descriptive statistics, like mean, standard deviation and percentage distribution were used. Binary regressions were used to achieve the stated objectives. The result of the HFIAS show that out of the total surveyed households, 23% were food secure and 77% were food insecure. The binary logit regression result show that among the fourteen variables, six were statistically significant determinants of household food security. The variables such as family size and dependency ratio were negatively related with food security. The remaining significant variables such as age of the household, livestock ownership, cultivating of your own land and distant to the nearest market center were positively related with household food security status. Furthermore, households used different coping mechanisms against food insecurity and these include: borrowing from friends and relatives sale of livestock, sale of firewood relaying on fishing, sale milk and milk product and eat fewer meals per day/ reducing quantity of food per day. . A set of recommendation: family size is one of the major problems in the studies areas since household who was economically inactive members are greater than economically active members, so awareness creation should be the first task to tackle this problem. Improving the quality of the land through improved soil and nutrient management by promoting agricultural technologies such as the use of fertilizer, improved seed, irrigation, and post-harvest management should be made by regional government.

Keywords: *determinants, food insecurity, coping mechanisms, Itang, district, Gambella region*

CHAPTER ONE

1. INTRODUCTION

1.1. Background of Study

Food is both a need and a human right; food security is a major concern in large parts of the developing world. Food production must clearly increase significantly to meet the future demands of an increasing and more prosperous world population (FAO, 2010). Hence the issue of food insecurity is of high importance in the effort to combat, increase income and improve food security in the world's poor country. The exact cause of food insecurity varies throughout the world and is very much dependent on the specific condition and location situated in a given country. In abroad terms, food insecurity is caused by natural disasters for instance natural disasters around the world caused a record US$380 billion in 2011. That is more than twice the score for 2010 and about US$ 115 billion more than the previous record (IFPRI, 2011). About 842 million people in the world remain food insecure with the many more suffering from hidden hunger, cause by micronutrient or protein deficiencies and where about 205 million children are malnourished. While food insecurity occurs in most countries to varying degree 75% of the food insecure people live in rural parts of the developing country in which two-thirds of these live just seven countries (Bangladesh, China, DRC Congo, Ethiopia, India, Indonesia and Pakistan) (graham *et al*., 2007 pp.33; Keating *et al*.; 2011., FAO 201; Khush *et al.;* 2012).

Despite improvement in some countries, the Africa state of affairs concerning food security has worsened since 1970 particularly in Sub-Saharan Africa (SSA) where the proportion of the population that is malnourished has remained at a level between 33%; this figure varies from region to region, being the lowest in North Africa at 4% and highest in central Africa at 40%. It is estimated that 70% of all people considered being food insecure live in rural areas and the remaining 30% are the urban poor. Throughout most of sub-Sahara Africa (SSA), there is food deficient, frequent drought, growing expenditure on food production and imports earning and rapid population growth have been cutting into living standards and growth prospects. The effect have been pervasive, not only on incomes of agricultural producers, who include most of Africa's poor, but also on supplies of food and raw material for industry, on employment, saving, government revenue and on the demand for goods and services producers outside agriculture.

Yet policy changes and planning for resumption of growth in agriculture are hampered by a serious lack of country-specific information. Reform affect all too often try to apply general remedies to Africa's diverse problem. In all the SSA countries, population growth has put intensive pressure on agricultural land and the size of land holding is inadequate to produce enough food for the whole family. As a result, population pressure has brought increasingly marginal land into cultivation which possibly affects statistics on average yield per hector, the need to increase land and labor is becoming urgent (Khush *et al* 2012).

As its true in most Sub-Sahara Africa, Ethiopia is currently facing challenging problems ranging from those induced by environmental crises to those caused by demographic and socio-economic factors which adversely affect peoples' production system. The country is generally characterized by extreme poverty, high population growth rate, severe environmental degradation and recurrent drought (World Bank, 1992, Getachew, 1995, Markos, 1997). This has resulting in agriculture being poor for several years, to the extent that the country could not adequately feed its population from domestic production. This has been manifested in the prevailing food insecurity, both chronic and transitory which have almost become a structural phenomenon and the way of life for a significant proportion of the population of the country.

Historically, Ethiopia has been relatively food secured in the imperial period (before the 1960s). However, since the early 1960s domestic food supply failed to meet the requirements of people both at national and household levels. In line with this, the food insecurity problem became an important agenda over time. In the 1990s about 30 million people were estimated to be food insecure in Ethiopia. In addition, a 50-100 kilogram per capital food gap has occurred (Frehiwot, Fantaw, 2007). Among these food-insecure people, a large number is found in rural areas of the country. The proportion of people who are unable to attain their minimum nutritional requirement is reported to 52% of the rural population (MEDAC, 2009). Ethiopia is worldwide one of the poorest late developing countries ranking at 174 out of 187 on the human development index with an HDI score of 0.363 well below the average for Sub-Sahara Africa of 0.463. Its population has for a long period of time grown at an average of 3% a year increasing from 39.8 in 1984 to 53.4 in 1994 up to 73.9 million in 2007 census and was stated by (Altenburg, 2010) to be 80.7 million in 2010, he also emphasizes that the economic structure has been stagnant. In Ethiopia's case this means that the manufacturing sector which is almost entirely made up of

simple Agro-processing activities has contributed with a constraint of only 5% of GDP in the last 20 years and overall production is based on a very low technological level, only 4% used technologies licensed by foreign countries and also only 4% have International Organization Standardization (ISO) certification, this is in both cases compared to an average of 12% in Sub-Sahara Africa. However, in recent years Ethiopia has been consecutively high GDP growth rates, especially since the last eight years. In 2010/11, real GDP growth was 11.4% moderately higher than the 10% year earlier (NBE, 2010/11).

The Federal democratic republic of Ethiopia (FDRE) issued Ethiopia's food security strategy (EFSS) in Nov 1996 and updated it in June 2010, the government tried to elaborate on the availability and accessibility of food to meet individual food needs to be sustainable (Beruk, 2011).In general, the objective of EFSS is to ensure food security at the household level. The strategy document highlighted the government's plan to address the problem of food insecurity in the country to ensure sustainable food security and also formulated rural development policies and strategies. The rural development policies envisage that development and food security would be ensured through agriculture-led and rural-centered development. The policy emphasized target intervention for drought-prone and food insecurity areas such as the Gambella region which is characterized by erratic rainfall, recurrent river flood hazard, the high incident of disease, pests, and weeds which causes food insecurity in the region particularly in Itang woreda (H/Mariam *et al*, 2011).

1.2. Statement of the Problem

Ethiopia is one of the most foods insecure and famine affected country. A large portion of the country's population has been affected by food insecurity; the situation of food insecure people is becoming more and more severe. Therefore, food security situation in the country is linked to recurring of food shortage and famine which are associated to recurrent drought (ADB, 2014). According to UNDP (2018), more than 23 percent of the Ethiopia population lives below the poverty line and above 20 million people are undernourished. Ethiopia, being one of the SSA countries which is prone to food insecurity and chronic food crises. In order to combat threats of famine and pervasive poverty and thereby ensuring food security for its population, the government strategy has rested on increasing the availability of food grains through significant investment in agricultural technology such as high yielding varieties of seeds, fertilizer and

services such as extension, credit, inputs and rural infrastructure such as road and markets. The impacts of these policies, however been observed as there are still million people who experience extreme hunger in the country (Bogale and Shimellis, 2009).

Numerous studies have confirmed that there is a problem of food insecurity in Ethiopia with wide range of area to be cover and large number of people to be attended for different identified causes of food insecurity problem. Among these causal factors per capita land holding with increasing population growth, livestock availability, education, per capita income of the household from the agricultural and non-agricultural activities, soil fertility, conflict, underfunded agriculture are the major and commonly mentioned factors (Gebre-selassie, 2005; Negatu, 2010; Ramakirshina *e t al*, 2009; Madeley, 2007).

Ethiopian government and international donors are implementing different categories of responses to food insecurity to attain food self-sufficiency and reduced food aid dependency. These categories are based on supply based responses such as increasing the level and stability of production, Increasing food reserve and influencing international food markets, demand based responses such as improving income, productive assets available to vulnerable groups and other market and non-market transfer and disaster prevention and preparedness capabilities having adequate early warning systems (IFPRI, 2011).Despite such effort food insecurity remains the main problem in our country and the need for food aid become increasing. There were and still are different food aid responses taken to solve the problem of food insecurity through both emergency reliefs as well as development works. But, many literatures come into different, incomparable and somewhat controversial results on the effect of food aid on the overall agriculture development, marketing behaviors and consumption patterns (Maxwell, 1994). Ethiopia Food Security Outlook reports on October 2011- march 2012 showed that the Meher harvest in Itang, Akobo, Wanthoa and Jikaw districts of Gambella region was not promising due to repeated dry spell and moisture stress damaged the Maize production in those district as the result of the overflow of the river bank. The main economic base of the region lies on a subsistence rain fed agriculture with high variability in weather condition such as spatial and temporal distribution of rainfall. Even under normal times, agricultural production often fails to sustain life for a prolonged period throughout the year. Farm management system in the region generally follows traditional method and the role of irrigation is very limited since the region is dependent on rain- fed agricultural production system and the role of livestock is constrained by

different factors such as diseases since there is lack of veterinary medicine and seasonal weather variability that lower the livestock production.

Itang woreda generally faces severe shortage of food approximately semi-starvation for most households lasting throughout the year. As noted by (Degefa, 2005), not only the amount of rainfall but also the quality of land affects the type and amount of crop that households harvest. Because of a shortage of rainfall and decline in soil fertility, intercropping the main crops with cash crops is becoming difficult, this, in turn, affects the household's level of food security. The major aggravating factors of food insecurity in study Kebele are shortage of rain and erratic rainfall nature distribution which leads to heavy soil erosion during rainy seasons and ethnic conflict within woreda. Per capita growth of production of major food items in the study areas is not sufficient to satisfy the demand of an increasing population. The rate of population growth is increasing due to cultural practices such as polygamy, lack of knowledge on family planning services on the parts of the household's head, limited health-related providers, and socio-cultural influence. These are the major phenomena that led to the asset depletion of many rural households in the study areas. Although the seriousness of food shortage varies from year to year, farm households faced seasonal food shortages almost every year. This implies the existence of structural, socio-economic, cultural, demographic, and other factors underlying the poverty and food insecurity problem in the study areas.

1.3. Objectives

1.3.1. General objective

The objective is to determine the food insecurity and coping mechanisms in Agro-pastoral households in the study areas.

1.3.2. Specific objectives

1. Examine the determinants of food insecurity in the studies areas.
2. Describe the coping mechanisms used by households during a food shortage.

1.4. Research question

The research questions are the following:

1. What are the most important determinants that influence food insecurity of the Agro-pastoral households in the study woreda?

2. What are the coping mechanisms pursued by the households during the food shortage?

1.5. Significance of the study

A study about determinants and coping mechanisms of agro-pastoral households is essential as it provide the information on the effective measure to be taken to ensure the implementation of the appropriate policies and strategies and enhance food security. Besides, the output of this research would help the development practitioners and policy makers to acquire better knowledge to carry out development interventions at the time of disaster and placed to decrease the vulnerability to food insecurity. It is also helpful to identify the different coping mechanisms used by household in order to make intervention appropriate to the area of the study. Finally the result of this study will contributed to the other studies on food security in the agro-pastoral communities and may be used as benchmark information by the researchers interested in this area for further study.

1.6. Scope and limitation of the study

The study was conducted to identify the determinants of food security at the household level in Agro-pastoral households and coping mechanisms they use during a food shortage. The study covers only 2 kebele from the 21 kebele of the study areas due to the financial and time limitations. However, the study deals with a limited number of households and focused on the determinants of food security and coping mechanisms. The major challenges that the researchers faced were lack of financial support and the willingness of the respondent to give appropriate response to the questions during data collection. Despite all these challenges, the researchers did his level best to capture reliable information explaining the purpose of the study and the benefits it contributes to their well-being.

1.7. Ethnical consideration

One of the main concerns in scientific research which incorporates human subjects in the study is the ethical consideration for the research subjects. The researcher cognizant of this recognizes the ethical principle of scientific research declared in the Belmont Report of 1979. These principles were shedding the light on issues like informed consent, beneficence, anonymity, and respect for the respondents. The researchers first give awareness to the community leaders about

the purpose of the study and those leaders created awareness to the community about the impending field research. This ensures that the community appreciated the researchers and gave consent to get interviewed. The respondent's voluntary and informed consent of participation in the study was sought before data collection, informing and clarify to them that the study was for academic purposes only. The respondents were also assured of the confidentiality of the information they were given before, this should be done during the visit to their homes for the study.

1.8. Organization of the thesis

This thesis consists of five chapters. Chapter one presents the general introduction of the thesis that includes: background of the study, statement of the problem, objectives and research questions, significance of the study, scope, and limitation of the study. Chapter two is devoted to reviewing of the related literature. Relevant theories, concepts, and empirical literature are reviewed and discussed. The third chapter deals with methodological issues, under which the general descriptions of the study area, research design, sampling technique and determination, the data sources and acquisition technique, as well as method of data analysis, are discussed. The fourth chapter is also devoted to discussion and analysis of the finding. Finally, the fifth chapter is dedicated to the conclusion and recommendation based on the findings/results of the study.

CHAPTER TWO

2. LITERUTURE REVIEW

2.1. Definition of concepts

Food security: food security exists when all people, at all-time have physical, social, and economic access to sufficient, safe, and nutritious food to meet their dietary needs and food preferences for an active and healthy life. The four pillars of food security are availability, access, utilization, and stability. The nutritional dimension is integral to the concept of food security World Summit on Food Security-WSFS (2009).

Food availability: Refers to the physical presence of food which may come from own production, purchases from internal market or import from overseas (Gregory *et al.*, 2005). Food availability is about when sufficient quantities of appropriate, necessary types of food from domestic production, commercial imports, and commercial aid program or food stocks are consistently available to individual or nations.

Food access: Household food access is the ability to obtain sufficient food of guaranteed quality and quantity to meet nutritional requirements of all household members. Here, the food should be at right place at the right time and people should have economic freedom or purchasing power to buy adequate and nutritious food (Jrad et al., 2010).

Food utilization: refer to the appropriate biophysical conditions (good health) required to adequately utilized food to meet specific dietary need and security, as the balance between vulnerability, risk and insurance and time (Maxwell, frankenberg, 2009).

Stability of food: refers to the continuous supply of adequate food all year round without shortage (Jrad, *et al,* 2010). To be food secure a population, household, or individual must have access to food as a consequence of shocks (an economic or climatic crisis), or cyclically (during a particular period of the year, seasonal food insecurity). The concept of stability can therefore refer to both the availability and access dimension of food security.

Food insecurity: is a situation that exists when people lack secure access to sufficient amounts of safe and nutritious food required for normal growth and development and active and healthy

life (WFP, 2004). It is a dynamic phenomenon; its impact varies depending on its duration, its severity, and the local socio-economic and environmental conditions.

Chronic food insecurity: refers to a continuous inadequate diet resulting from a lack of resources to produce or acquire food (Reutlinger, 1987). It is argued that chronic food insecurity at the household level is mainly a problem of poor households in most parts of the world.

Transitory food insecurity: refers to a temporal decline in the household's access to enough food. It results from the instability of food prices, production, or income. The worst form of transitory food insecurity is famine. Hence, transitory food insecurity faced by farm households should be understood in the study as a seasonal food shortage of any magnitude ranging from mild to moderate (devereux, 2006).

Coping mechanisms: a response to reduce or minimize effects of a stressful event or an unfavorable situation where food access is abnormally disrupted, for instance by drought, flood, earthquake, or military activity.

2.2. Theoretical orientation

There are two existing approaches that explain the cause of famine. The first approach is the general explanation. In this explanation, a number of environmental and socio-economic factors are assumed to explain famine and have been pointed out. The principal ones include; rapid population growth, war and civil strife, drought, ecological degradation, government mismanagement, unequal access to resources and unequal exchange, and socio-economic and political dislocation (Getachew, 1995). The argument of this approach is that one or a combination of these factors can disrupt food production. However, production failure may or may not result in famine. Due to this fact, the attributes are not precise explanations of the causation of the process of famine. It is in response to this major weakness that the specific models of famine emerged (Degefa, 2002). The second approach comprises models of famine as Food Availability Decline (FAD) model and the Food Entitlement Decline (FED) model.

2.2.1. The food availability decline approach

The Food Availability Decline approach (FAD) had been a central theory explaining the cause of famine and how the food crises affect the development of the countries from the eighteenth

century until the year 1980. The food availability decline approach explains that famine or food shortage occurs when there is a shortfall decline in the food supply. According to this approach, people starve because of a local, national or regional decline in food availability to a level below the minimum requirement for survival motivated by natural factors such as drought, floods, and other human and natural factors that disrupt crops production that goes beyond supply (Diana, 2007). The central argument of this model is that anything which disrupts food production such as drought, floods, or war can cause famine, the logic being that drought, flood, or war cause crop failure and cattle death, reducing the availability of food in the affecting region and that such a food availability decline for an extended period consistently cause the famine (Devereux, 1988). Food availability decline has been criticized for its only dealing with the supply-side which disregards the demand side; it said nothing about people's income and purchasing power. Furthermore, he failed to address the vulnerability differences and access to food from outside of the affecting areas (Ejiga, 2006). This criticism over FAD ended up in the alternative model of entitlement proposed by the economist (AmartyaSen, 1981).

2.2.2. The food entitlement decline approach

Food Entitlement Decline (FED) theory focuses on the entitlement of food to the entire population; therefore, the distribution of food is far more important than its alleged availability. Sen (1984) define the entitlement as a set of alternative commodity bundles that a person can command in a society using the totality of rights and opportunities that he/she faces. In his theory access to food also refers to questions such as rich or poor, privileged or unprivileged, etc. thus he opens the discussion on discrimination which he entitles as the group contrast, while famine involved fairly widespread acute starvation; there is no reason to think that it will affect all groups in the famine-affected nation (Sen, 1981). Notwithstanding a broad approval, Sen's entitlement has been criticized for being historical, economistic, and static characterized by missing the interdisciplinary further as a failure to the recognized individual as socially embedded members of households, communities, and states and second a failure to recognize that famines are political crises as much as they are economic shocks or natural disaster. The result is an elegant analytical framework that privileges the economic aspects of famine and excludes the social and the political aspects (Devereux, 2001). Bowbrick, (2008) also argues that importing food in a situation of existing insecurity is the only way to minimize the food problem

and to save lives. Among the many positive features of the FED approach over the FAD, the following are very important (Devereux and Maxwell, 2003):

- First it has emphasized demand rather than supply.
- Second, it allows vulnerable groups to be identified.
- Finally, it suggests more appropriate policy intervention.

2.3. Empirical review of food security

2.3.1. Global food security

Despite growing attention in the world media and expending aid efforts by many organizations, the world household food insecurity continues to worsen as many communities struggle with daily hunger and starvation (project concern international, 2009). A myriad of factors have been responsible for the continuing world food insecurity. One factor is the rise in price of world staple foods (wheat, rice and corn). It is established that inflation of wheat is 120% and rice is 75% (Ibid). Another factor is the poverty. An estimated 100 million people have fallen into poverty in the last two years, for instance in 2007, Afghanistan households were spending 75% of their income on food (World Bank, 2008). Dependence on food imports also influences the global food insecurity. A case in point is Haiti where over 80% of staple rice is imported the result of it is that over half of the country population is undernourished and 24% children suffer from chronic malnutrition. Fresh food exports, for instance the export of horticulture produce from Ghana to Europe for monetary gains has resulted in the country importing a significant proportion of its staple food such as rice, ultimately leaving the country expose to the spirally world food prices. Moreover, the climate change due to the global warming has influenced world household food insecurity. El-ninos and La-ninas hamper good crop production in Latin America and Sub-Sahara Africa. Droughts caused by La-ninas have caused household food insecurity especially in Ethiopia where 7 million people are classified as food insecure and a further 10 million classified as prone to drought (Ibid). Other factors that contribute to the household food insecurity in the world include: shift to more none-agricultural technology, politics, environmental degradation and insecurity and population growth. Several consequences of global household food insecurity have manifested themselves; demand for food aid is a serious consequence of the food insecurity. Each year, 10% of Burundi's population requires food aid (FAO, 2008). Another consequence is poor health status exemplified in Benin, where by almost

a quarter of children below 5 years are underweight, (Ibid), there are also increased malnutrition rates globally whereby in 2004, the global malnutrition was 15% WHO,2004). World household food insecurity has also increased poverty among the global population and there was also serious global hunger index of 15.5% in 2010 (Grebmer, *et al*., 2010).

2.3.2. Food security situation in Africa

Various countries in Africa have experienced the devastating effects of household food insecurity for instance, Cameroon and Mali in West Africa, Egypt in Northern Africa, Ethiopia and Tanzania in the Eastern Africa and South Africa in the Southern Africa. The world food program (WFP) describes Cameroon as a food insecure country, and further demonstrated that food intake in households is lower than in the early 1980s, the result of this is that 19% of young children in the country are underweight and child mortality is rising than falling. According to the study of (Toulmin, 1986), the people of Bambara village of Kala in Mali face food shortages which are induced by two principal factors. One of the factors is climatic change, specifically lower and highly variable rainfall making the people very vulnerable to crop failure. The second class of risk is demographic in nature consisting of the high level of mortality, varying levels of fertility, and vulnerability of all producers to sickness and disability.

Egypt produces half of its demand for wheat, in spite of the average food production the country is exposed to the escalating food prices due to its wheat importer. It is classified as the number one importer of the produce in the world. The country also has a high population growth rate of 2% per annum. Moreover, the desert terrain of the Sahara limits crop production. A report by the World Bank indicates that the baladi bread subsidy costs Egyptian government almost $ 3.5 million per annum (oneworld.net (US), 2009).

Ethiopia experiences serious household food insecurity. Over 7 million people out of Ethiopia's population 76.9 million people are classified as food insecure, and further 10 million people are identified as prone to drought. High population growth rate in the country increases the food insecurity further (Chu, 2009). A study by (Ashimgo and Hella, 2000) in the Iringa region of Tanzania reveals that the transition to commercial agriculture has had a negative influence on food security. Deterioration in the ecological conditions of production has also been seen as a cause of hunger in several African nations. Although South Africa produces bumper harvest especially in the 2007/8 season, it has been affected by high food prices in the declining world

economy. High food prices are causing hardship particularly among the poorest family households who spend a huge proportion of their income on food (Oneworld.net (US), 2009).

2.3.3. Household food security in case of Ethiopia

The debate in Ethiopia over the causes and determinants of food insecurity has fueled highly disputed viewpoint between the academic disciplines and in development thinking in general over the past few decades, giving rise to a proliferation of human, demographic, economic, and political emphases across the food insecurity literature (Devereux, 2001, Shiferaw*et al*, 2003).

The demographic and human characteristic such as the sex, age, and education of the household's head were expected to affects the food insecurity negatively (shiferaw, *et al,* 2003). On the other hand, the family size and dependence ratio were believed to have a positive influence on households food insecurity, because most of the rural households are smallholder subsistence producers, an increase in the number of people in the households tends to exert more pressure on consumption than the labor it contributes (Shiferaw, *et al,* 2003). Ownership of assets such as cultivated land and livestock were expected to affect the food insecurity of the households negatively. According to Muluken, (2005), food production is increased extensively through the expansion of the area under cultivation, while livestock providers not only food for producers but also other products which could be sold to provide food or income. Fertilizer and improved seed are used by most studies as a proxy for technology. According to Adane (2008), subsistence farming by its nature is production for direct consumption, any farm input that augments agricultural productivity is expected to boost the overall production, this contributes towards attaining household's food security (Shiferaw, *et al* 2003). In the present study, fertilizer and improved seed usage were expected to increase household's food production and hence enhance food security. Income plays a key role in a household's accessibility to food; it enables households to modernize their production by giving them an opportunity to buy the necessary inputs and reduce the risk of food shortage during periods of unexpected crop failures through purchases. It was expected that the total annual income of the households and food insecurity would be negatively related (Muluken, 2005). Accesses to the non-farm activities and nearest to the market center were expected to have a negative impact on household's food insecurity. The availability of credit and remittance are another's important variable that was expected to influence the household food insecurity negatively. Households who have received credit had the

possibility to fulfill their needs for food (Debebe, 1995). Besides, availability and accessibility of food are the main determinants that cause the food insecurity (Anderson, 2011).

According to Mesfin Woldemariam (1991), explaining that most farmers in north-central Ethiopia could not produce enough to meet their annual food requirement. (Degafa, Tollosa, 1996) the study highlighted that 40% of the sample farm households in the Arsi zone, a zone known as a surplus producing area in the country faced seasonal food shortage. Another research finding by (Markos, 1997) shows that "household's average cereal production during normal harvest years is persistently lower than annual food requirements and hence many households feed themselves from their farm outputs only for less than three-fourth of the years."(Martha, 2000) study in Mekel, Habru, and Gubalafto woreda of north wello zone found out that 30%, 21%, and 40% of the sample households, respectively, were unable to satisfy the food demand of their family for more than five months in years. Based on an empirical study in Northern Shewa, by Yared argues that the seasonality of agriculture introduces fluctuation in the income, expenditure, and nutritional patterns of peasant households. He further states the coincidence of diminishing grain supplies and increasing grain prices is a liability for the economic status and food security of households" (Yared, 1999).

Despite small researches conducted on the local level of household food security in Ethiopia, one finds a large amount of evidence about the status of food insecurity at the national level is the most pressing issue in the analysis of household food security. A study by DegafaTollosa (1996) in Arsi listed farmers multiple reasons for food insecurity are: insufficient farmlands for 99% of the study household, lack of cash income to purchases farm input for 79% of the households, reliance on single harvest for 55% of the household and shortage of traction power for 33.7% of the households. Similarly (Webb *et al,* 1992), in their study of Ethiopia famine identifies multiple interrelated factors that contribute to food insecurity/famine these are climate-driven production fluctuations, lack of employment opportunities, limited assets base, isolation from major markets, low level of technology and low human capital.

(Driba, 1995) assert that food insecurity is aggravated by a long-term secular decline in access to productive assets, combined with unfavorable food policy intervention. A community assessment study of 21 kebele in south Wollo and Oromiya zone of Amhara region in 1999 found out several factors that result in severe food insecurity: drought, crop pest, frost, rust hailstorms,

untimely or excessive rainfall, land shortages, and degradation lack of oxygen, population growth and disease (Yared Amahara, *et al*, 1999).

Lemma and Gebrehiwot (1999) have come up with a long list of direct and indirect factors involved in food insecurity in Ethiopia: fragile of the natural resource base, inadequate and variable rainfall, improper farming practices, inaccessibility to productive resources, diminishing of land holdings, and tenure insecurity, low education, poor storage technology, inaccessibility to transport infrastructure, heavy workload on women, poor health status lower productive of livestock, high level of unemployment, misuse and poorly targeted food aids, socio-cultural barriers and lack of information for appropriate intervention. They also commonly observed that lowland communities and pastoralists in Ethiopia are vulnerable to food insecurity due to multiple ecological, economic, and infrastructural problems; these problems include recurrent drought, conflict over rangelands, and encroachment of unwanted plant species. There are multiple factors that inhibit the availability component of food security. For instance, degradation of natural capital undermines production capacity, while inadequacy and lack of access to improved agricultural inputs such as water, fertilizer, seeds, pesticides, and energy hinder productivity and thereby reducing production.

2.4. Coping mechanisms

Is defined as a mechanism by which household or community members meet their relief and recovery needs and adjusts to future disaster related risk by themselves without outside support (Tesfaye, 2005). The coping mechanisms used by different households may be different from place to place. A study conducted in three most deprived and poverty stricken regions in the Northern parts of Ghana showed that households use a wide range of coping mechanisms and communal support networks to cope with the situation which includes collection of wild food, market purchase, in kind payment, support from relatives and friends, sales of livestock and valuable assets, migration and wage labor, reduction in the number of meals served each day, reduction in the portion/size of the meals and consumption of less preferred foods (Wilhemina, 2008).

Food aid today is mainly considered as an instrument in addressing both transitory and chronic types of food insecurity in low-income countries. It is noted that the humanitarian agencies or donors implement food aid programs in the countries in order to give immediate response to the

needy people to increase income sustainability, to improve agricultural productivity, and improvement in health and nutrition among the residents. Moreover, it leads to improvement in the availability of food supplies at the national or regional level or to increase access to food at household levels through higher home production of food crops, market purchase, and /or other means or to make more effective utilization of food at the individual level to meet human biological needs (USAID, 1999). Most common application of food aid include: general distribution of free food to vulnerable group based on vulnerability criteria and needs assessment, food for work (FFW)- if the emergency intervention is mounted rapidly enough so that it begins before people have been badly affected by the crisis, since food for work is not an appropriate intervention for people who are already malnourished or who lack the energy necessary to undertake physical labour, specific feeding programs including supplementary or therapeutic feeding for acutely affected sub-groups and occasionally, the strategic use of monetization or the sale of food aid in local markets can be used as a means of controlling food price hikes in the event of acute food shortages and rapidly rising prices, particularly in urban areas or among populations that are heavily dependent on the market for their food (Maxwell, *et al.*, 2008).

2.5. Conceptual framework

The demographic factors such as the age of the household head, sex of the household head, family size, and dependency ratio, whereas family size and dependency ratio, affected the household food insecurity positively. The sex and age of the household head affected the household food insecurity negatively. Which mean households with large family sizes are more prone to be food insecurity than households with small family size, in addition households with a high dependency ratio have a high risk of food insecurity because of large burden by who are not productive. Variables like the size of cultivated land, livestock ownership and the number of milking cow owned, remittance, income earned from non-farm activities, and improved seed were the economic factors affecting the food insecurity of households negatively. This mean households with large cultivated land, a large number of livestock, milking cow, remittance from their relatives, and large income from non-farm income and used the improved seed have more probability to be food secure than those who have limited assets. A variable like food aid and distance to the nearest market are institutional factors affects the household's food insecurity

negatively. The variable educational level of the household head is the important human factor affecting the food insecurity negatively, which means as the educational level of the household head increases the food insecurity of that households decrease (Mohammed Abdulahi, 2016).

The institutional factors have a direct impact on a household's economy, which is lack of access to infrastructure affects the agricultural products and also have a direct impact on household demographic. Food aids create the dependency on households to look for food aid only which create dependency ratio. Human factors have an impact on household demographic such as educational level have a positive influence on the family size of households since households who are illiterate have no concern about family planning and would increase the severity of food insecurity. Demographic factors like large family size affect household food accessibility by influenced both the level of land under cultivation, non-farm income, and products from livestock. It affects the number of livestock products and the number of crop products as well as non-farm income generated from different activities.

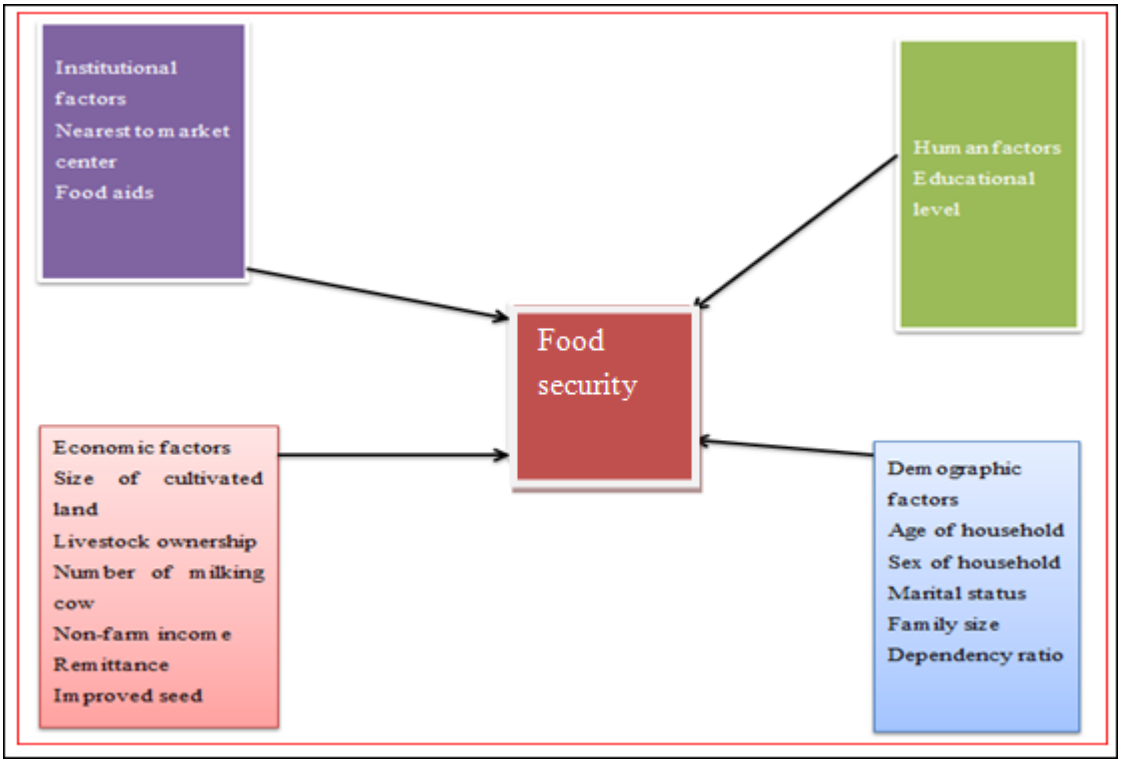

Figure 1 Conceptual framework of the study

Source: Modified from Mohammed Abdulahi (2016)

CHAPTER THREE

3. RESEARCH METHODS

3.1. Description of the study area

3.1.1. Biophysical features

Gambella People National Regional State (GPNRS) is located in South West Ethiopia between geographical coordinates $6^0$28'38" to $8^0$34' North Latitude and 33^0 to $35^0$11" East Longitude, which covers an area of about 29,782.82 Km^2 about 3% of the nation. The region bounded to North, North East and East by Oromiya National Regional State, to the South and southeast by the Southern Nations and Nationality People's Regional State, and to the South West, West and North West by the Republic of South Sudan. The regional capital city is Gambella which is about 767Km from Addis Ababa the capital city of Ethiopia. The region is divided into three ethnic zones (i.e., *Nuer* zone, *Anywuak* zone, and *Mejeng* zone) and 13 administrative districts that include one special district with five indigenous ethnic groups. Based on the 2017 population and housing census of the region, it has an estimated total population of 435,999, of which 227,000 were male and 208,000 were female, whereas Nuer constitutes 143189 (46.65%) followed by Anuak with 64,959 (21.17%), Mejang with 12,277(4%), Oppo with 990 (0.32%) and Komo with a population of only 224 (0.07%). An estimated 75% of the population of the region lives in rural area which is below the national proportion (nearly 84%).

3.1.2. Demographic and socio-economy

In the 2017 census conducted, the region has 65,445 households out of which the 45,855 are rural residents with an average family size of 4.6. 90.3% of the population belong to Christianity of all denomination while 4.9 and 3.8% belong Islam and traditional belief, respectively (CSA, 2017). According to CSA 2017%, among the population aged 10 years and above 34.4% are economically inactive and 64.4% were economically active. Based on the distribution of age among the male 73.3% were economically active, while in case of female it is 55.1%. In all zones, the percent economically active male were higher than female, this is true mainly because housewives are mostly engaged in activities that are not considered economic (CSA, 2017). As observed from the census data in rural areas of Gambella region, more active person were recorded as compared to urban. Specifically in the age group 10-14 years, the differences was

much wider, where the activity rate was 5.9% for the urban areas while it is 37.7% for rural areas (CSA,2017). The major reasons for such variation was that in the rural areas young children rather than going to school at an early age, get usually engaged in farm activities such as herding cattle and helping their parents in weeding and harvesting.

In 2017 the district has an estimated total population of 35,307 with male 17,780 and 17,527 females. It has a rural population of 29,352(83%) with a total area size of 2051Km^2 and its population density is 17.2 persons per square kilometer which are higher than the regional average. The study district has 6555 households with 5134 households from rural areas. More than 85% of the population of the district is rural and its livelihoods system can be put under the farming but mixed with fishing and livestock rearing zonation (CSA, 2017).

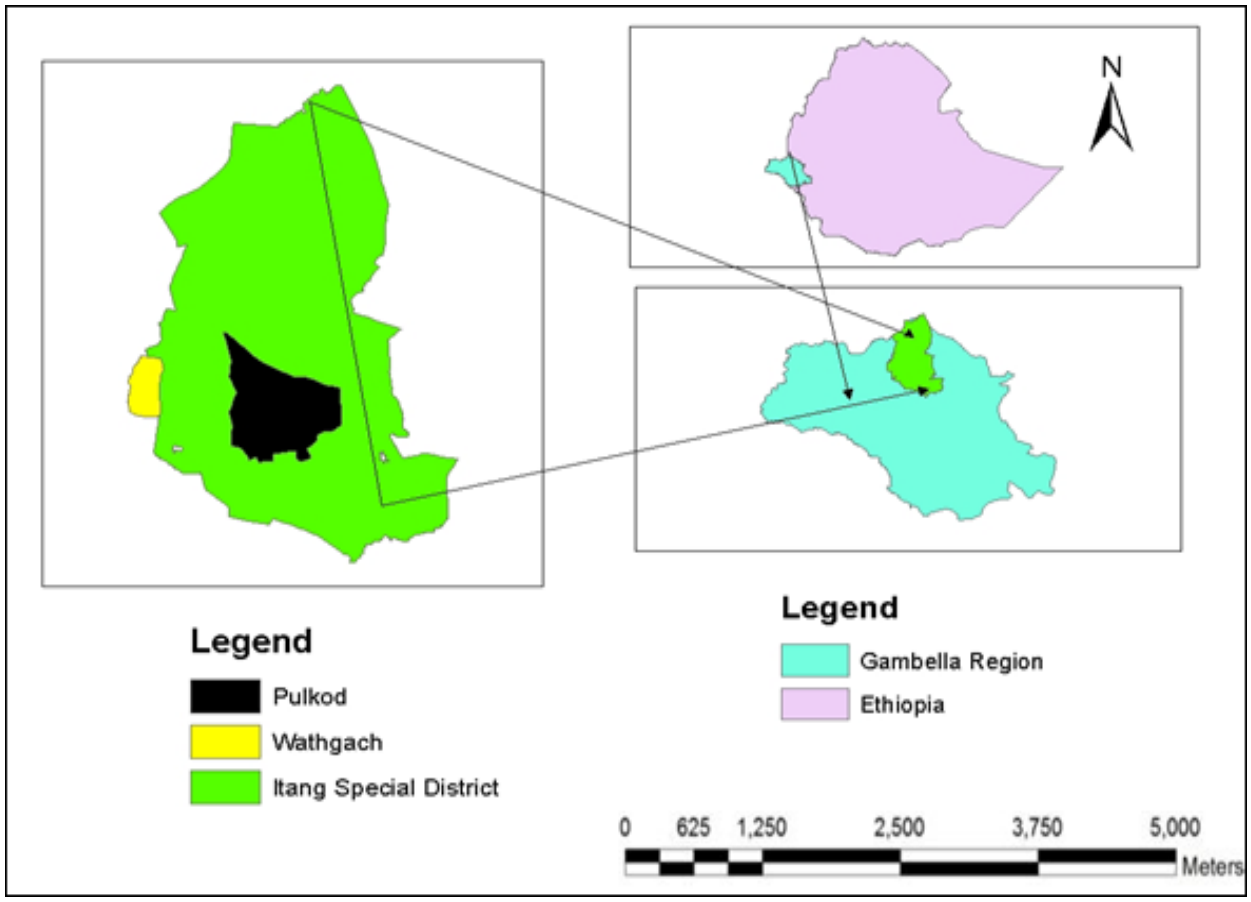

Figure 2 Administrative map of Ethiopia, Gambella and Itang special district

Source: http://www.gambella.gov.et/fi/web/guest/Itangworeda Retrieved at 6:20pm June 1, 2020.

3.1.3. The climate of the region

The climate of the region is formed under the influence of the tropical monsoon from the Indian Ocean, which is characterized by high rainfall in the wet period from May to October and has little rainfall during the dry season from November to April. Temperature and rainfall are important factors in soil formation and the range of crops that can grow in a particular environment. For instance, the Godere district has enormous variation in terms of soils, vegetation, and crops, because of variations in temperature and rainfall from the rest of the districts of the region. The mean annual temperature of the region varies from 17.3^0c to 28.3^0c and the annual monthly temperature varies throughout the year from 27^0c to 33^0c. The absolute maximum temperature occurs in mid-march and is about 45^0c and the absolute minimum temperature occurs in December and is 10.3^0c. The annual rainfall of the region in the lower altitudes varies from 900-1,500mm. At higher altitudes, it ranges from 1,900-2,100mm. The annual evapotranspiration in the Gambella reaches about 1,612mm and the maximum value occurs in March and is about 212mm.

3.1.4. Farming system

The regional farming system can be categorized as the *Nuer* livestock dominating system with some cropping system; the *Anyuak* cereals and livestock system and the *Mejang* Apiculture dominating system, which is more of mid to high altitude. Apiculture is indeed practiced in other systems too. Gambella region Lowland Areas (LLAs) are mainly located in the *Agnuak* and the *Nuer* zones of the region, while the remaining *Mejang* zone has more of midland agro ecology. The LLAs are characterized as Agro-pastoral areas and pastoral. Most settlements of the region are made following rivers, in order to get access to water for their animals and to access fishing. People of the LLAs in the Gambella region seasonally move with all members of families away from rivers during the rainy season as the rivers overflow and the flood is threatening the people settling around rivers and during winter, they move back the river banks.

3.1.5. Water resources

The Alwero, Baro, Gilo, and Akobo rivers are permanent rivers being tributaries of the White Nile. They are ideal for irrigation with a capacity of irrigation for about 500,000 hectares, according to a national survey conducted ten years. Moreover, they have huge potential for fish

production and hydroelectric power. Alwero River has already a reservoir dam system constructed in the Abobo district for 28 years, the derg government of Ethiopia constructed a big reservoir dam system about 45 km away from Gambella in the Abobo area to help produce food and industrial crops. However, the project failed to be completed by the current government as the remaining canals and agricultural projects could not be established. The Saudi Star commercial farm is established adjacent to it with a formal right given to use the dam. The rivers especially the Baro River have also been used for fishing and transportation of goods using boats within the Gambella region and to South Sudan.

3.2. Research design and approaches

In this study, cross-sectional surveys were used as a research design. Because cross sectional research design is appropriate to study the different units at a given time. The cross sectional research design was describe the characteristics of a particular individual or group and determining the frequency with which a variable occurs or its relationship with another variable. In other words, the study analyzing whether a certain variable is associated with another comprises a diagnostic research study (Panneerselvam, 2004). Mixed approach or both qualitative and quantitative was used to collect data from both primary and secondary sources in order to produce a comprehensive analysis of the study.

Qualitative Approach: used in order to gain a deep understanding about the food security program: its main activities, its contribution to improve household's food security and root causes of food insecurity condition of the households. Semi-structured interviews, focus group discussions and observation were carried out to gather qualitative type of data.

Quantitative Approach: involves the measurement of quantity or amount and used to quantify and see the relationship among variables. Household survey was carried out to conduct a cross-sectional study to collect data on the socio-economic and demographic information of households, causes of food insecurity of study area and determinants of household food security. Various available statistical and econometric methods are employed for analysis in this research. In addition it includes correlation and binary logistic regressions analysis the relationship among variables.

3.3. Sources and tool of data

This study used both primary and secondary data. The primary data were collected from a sample rural household head by employed FGD, KIIs, field observation and structured questionnaire prepared for the study with clothed ended and open-ended questions. Information pertaining to the respondents, household demographic, education, off-farm income, land ownership, livestock, access to remittance, distance to nearest market, milking cow's ownership, food aid, and coping mechanisms were collected through a self-administered structured questionnaire. Secondary data were extracted from publication and annual reports of the district of disaster prevention and food security agency, district of agricultural office and Gambella people's national regional state disaster prevention and food security agency, Regional Disaster Risk Reduction and Livelihood Recovery Program (DRR/LR) coordination office and WFP.

3.4. Sampling technique and sample size

Purposed sampling was used to get the location in which units of observation have the required characteristics, (Mugenda, 2003). It was also relevant when a researcher wished to use cases that have information with respect to the objectives of his study. Itang special district was purposively identified from a list of 13 administrative districts in the Gambella region because of the following reasons: first, ethnic conflict within the woreda, since the woreda was inhabited by five ethnic groups, conflict over the resources destruct the livelihood of the local community, second, the district is flood-prone area its located along the riverbank, because of that overflow of the river bank damage the livelihood of the people. Itang woreda has twenty-one Kebele, the *Anynuak* reside predominantly in eleven of them followed by *Nuer* who occupy seven Kebele, the remaining three occupied by shifting cultivators of *Oppo*and *Komo* and the capital *Achua* Kebele. The selection of two Kebeles Pulkod and Wathgach from woreda was done through simple random sampling from a list of Kebele inhabited by both ethnic groups. Therefore, the researcher would employ stratified sampling where stratification would be formed along ethnic lines. This is primarily due to the fact that each of the ethnic groups widely practices different livelihood mostly competed with each other.

Based on the information obtained from the Itang administration district indicate that Pulkod Kebele has 862 rural households and Wathgach Kebele has 511 rural households, a total of 1373

rural households in the two Kebele. Before the selection of sample households, a statistically representative size of sample households would determine based on the recommendation given by (Yamane, 1967) to calculate sample size which has a 91% confidence level and P = 0.09 level of precision.

$$n = \frac{N}{1+N\ (e)2} = \frac{1{,}373}{1+1{,}373\ (0.09)2} = 113$$ Is the sampling size of two kebele

Where

n is the sample size of the household

N is the population size of the household

e is the level of precision

3.5. Tools and techniques of data collection

The study employed both quantitative and qualitative methods of data collection. The researcher employs a household questionnaire survey, FGD, KIIs, and field observation to collect the primary data.

3.5.1. Primary Data Collection

3.5.1.1. Questionnaire survey

In order to generate information at the household level, the household-level survey was undertaken using a structured questionnaire from 113 rural households. Prior to conducting the interview, a pre-test of the interview schedule was undertaken. The data collection conducted based on the socio-economic and demographic information of households and to critically examine the cause of the food insecurity in the Agro-pastoral households in studies areas. Before starting the survey, informing about the research objectives and contents was important to get real information.

3.5.1.2. Focus Group Discussion (FGD)

Focus group discussions were also used to verify the information given by individual rural households during the survey and to catch an important issue that was not raised by respondent households. Two FGD were conducted from community members representing both men and women of the community and various age and ethnic groups and who especially were active

participants in the socio-economic and development affairs were major targets of the focus groups discussion, the reason why researcher employed two FGD is because the information are similar from key informant interviews during investigation. The focus group discussion in particular consists of a group of twenty people comprised of ten women and men drawn from all lifestyles were selected from each economic group and meeting held for half-day per group.

3.5.1.3. Key Informant Interviews (KIIs)

A study employed key informant interviews to get information on personal though; experience and attitude related to food security were investigated. Interview is the most commonly used qualitative technique which can provide rich sources of data on people's experiences, opinion, aspiration and feeling (Kitchin, Tate, 2000). Three key informant interviews were carried out with one administrator from woreda and two administrators from both two kebele, the members of key informants were PA administrators, development agents, influential women and influential youths, agents of active NGOs in the area, and woreda officials.

3.5.1.4. Field observation

The researchers were systematically observing the practices of men and women community members during their stay in the field. For this, he/she would transect-walk and informal discussion with community members from all walks of life. The researcher's own personal observation and experience in selected sample kebeles and the whole district were used for triangulation and interesting observation helped a lot to develop this discussion part. One of the most important data collection techniques is observation. The field observation was used to cope with the ground reality and to enhance the data collection from other methods. Using checklists, the field visit was accompanied by photographing and informal conversation with people. This technique is also important to critically examine the intra household's food insecurity.

3.5.2. Secondary data collection

Besides the above-mentioned data collection techniques and producers, intensive desk review of published and unpublished literature such as books, journals, articles, reports, and resources were carried out, different documents from the Bureau of the district of agricultural office and Gambella people's national regional state disaster prevention and food security agency.

3.6. Method of data analysis

Following data collection, the data were coded and entered into the SSPS version 24 computer software package of analysis. Data were analyzed using descriptive and econometric methods of analysis. The reason for employed descriptive statistics is that it classified the variables into continuous and discrete variables. Where the continuous variables were analyzed with mean, standard deviation and discrete variables were analyzed with frequency distribution, percentage and. Variance inflation factors (VIF) were used to measure the degree of linear relationship among the continuous explanatory variables and contingency coefficient were used to check multi-collinearity among discrete variables. The quantitative data were analyzed using Household Food Insecurity Access Scale (HFAIS) and logit model, whereas qualitative data were analyzed using FGD, KII and coping mechanisms.

3.6.1. Households Food Insecurity Access Scale (HFIAS)

Household food insecurity access scale which is an adaptation of the approach used to estimate the prevalence of food insecurity in the United State (U.S.) annually, the method is based on the idea that the experience of food insecurity causes predictable reaction and response that can be capture and quantified through a survey and summarized in a scale (Wehler, *et al*, 1992, Hamilton, 1997). The HFIAS consists of two types of related questions; the first question type is called an occurrence question. There are nine occurrences questions that ask whether a specific condition associated with the experience of food insecurity ever occurred during the previous four weeks (30 days). Each severity question is followed by a frequency of occurrence question, which asks how often a reported condition occurred during the previous weeks. Each occurrence question consists of the stem (timeframe for recall), the body of question (refer to a specific behavior or studies), and two respondent options (0=no, 1= yes). There is also a „skip code‟ next to each „no‟ respondent option. This code instructs the enumerator to skip the related frequency of occurrence followed up question whenever the respondents answer „no‟ to an occurrence question (Jennifer *et al*, 2007).

Each HFIAS frequency of occurrence question asks the respondent how often the condition reported in the previous occurrence question happened in the previous four weeks. There are three response options representing a range of frequencies (1= rarely, 2= sometime, 3= often). First, the HFIAS score variable is calculated for each household by summing the codes for each

frequency of occurrence question. Before summing the frequency of occurrence, the data analysis should code the frequency of occurrence as 0 for all cases where the answer to the corresponding occurrence question is „no" (i.e., if q1=0 then q1a=0 if q2=0 then q2a= 0, etc.). if the household response „no" to all occurrence question, frequency of occurrence question are skipped by the interviewer, and subsequently code as 0 by the data analysis, the higher the score, the more food insecurity (access) the household experienced. The lower the score, the less food insecurity (access) a household experience (USAID, 2007).

3.6.2. Econometric model analysis

In order to identify the determinants of the food security situation of the households a Logit model was used. In this study, the dependent variable Y (household food security status) is dichotomous variable taking value 1 if the household is food insecure and 2 if the household is food insecure. 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 quantitative, it is the probability of the dependent variable given independent variable that is determined, one the most common quantitative regression model is logit model (Gujarati, 2004).

Models which include a yes or no type dependent variable are called dichotomous or dummy variable regression models. Such models approximate the mathematical relationships between explanatory variables (independent) and the dependent variable that is always assigned quantitative response variables (Gujarati, 1988; Feder *et al.*, 1985; Pindyck and Runbinfeld, 1981).

The major point that distinguishes these functions from the linear regression model is that the outcome variable in these functions is binary or dichotomous (Hosmer and Lemeshow, 1989).

The choice between these two models revolves around practical concerns such as the availability and flexibility of computer program, personal preference, experience and other facilities. In fact, it represents a close approximation to the cumulative normal distribution. Hosmer and Lemshew (1989) pointed out that a logistic distribution has got advantage over others in the analysis of dichotomous outcome variable. There are two primary reasons for choosing the logistic distribution. These are: (1) from a mathematical point of view, it is an extremely flexible and easily used function, and (2) it lends itself to a biologically meaningful interpretation. Aldrich and Nelson (1984) also state that, the logit model is simpler in estimation than the probit model.

According to Gujarati (2004) the logistic distribution function for determining factors in Food insecurity status of the households can be specified as:

$$P1 = \frac{1}{1 + e^{-z1}} \quad (1)$$

Where: $\mathbf{p_i}$; is a probability of a household being food secure for ith household β

e; represents the base of natural logarithms (2.718) and

$\mathbf{Z_i}$; is a function of m explanatory variables (Xi) and is expressed as:-

$$Z = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots\ldots + \beta_M X_M \quad (2)$$

Where β_0 is the intercept and β_1 is the slopes parameter in the model which is estimated using maximum likelihood method. The slope tells how the log-odds in favor of food secure of the household change as independent variables change by a unit. The odds to be defined as the ratio of the probability that a household being food secure pi, to the probability that household is food insecure (1-Pi). But

$$\{1 - P1\} = \frac{1}{1 + e^{-z1}} \quad (3)$$

$$\frac{pi}{1 - pi} = \frac{1 + e^{z1}}{1 + e^{-z1}} = e^{z1} \quad (4)$$

$$\left[\frac{pi}{1 - pi}\right] = \frac{1 + e^{z1}}{1 + e^{-z1}} e^{z1} = e\,\{\beta 0 + \sum_{i=1}^{m} \beta 1 \chi 1 \quad (5)$$

Taking the natural logarithms of the odds ratio of equation (5) will result in what is known as the logit model as indicated below;

In

$$\left[\frac{pi}{1 - pi}\right] = \text{In}\left[e\,\beta 0 + \sum_{i=1}^{m} \beta 1 \chi 1\right] = Z \quad (6)$$

$$Zi = \beta 0 + \sum \beta 1 \chi 1 + Ui \quad (7)$$

For this analysis post-estimation test were done after logistic regression. In order to test the existence of multi-collinearity, both continuous and discrete explanatory variables were checked using variance inflation factors (VIF). This statistical analysis indicates that the there is no strong association among the variables. As a rule of thumb, if the VIF of a variable exceeds 10 that is said to be highly collinear and it can be concluded that multi-coninearity is a problem (Gujarati, 1995). Prior to estimation of the ordered regression model, the explanatory variables would be used to measure the degree of linear relationships among the continuous explanatory variables and contingency coefficient will be used to check multi-collinearity among discrete variables. Following (Gujarati, 2004), VIF is defined as:

$$\text{vif(xj)} = \frac{1}{1 - \text{RJ}^2}$$

Where: Xj= the jth quantitative explanatory variable regressed on the other quantitative explanatory variable, R2j= the coefficient of determination when the variable Xj regressed on the remaining explanatory variables. If the VIF of a variable exceeds 10 that variable is highly collinear and it can be concluded that multi-collinearity is the problem (Gujarati, 2004). The contingency coefficient is computed as follows

$$\mathbf{C} = \frac{\sqrt{\mathbf{x}^2 -}}{\mathbf{n} + \mathbf{x}^2}$$

Where, C= coefficient of contingency, X2 = a Chi-square random variable and n= total sample

3.7. Definition of variables and working hypothesis

After the analytical procedures are clearly defined, it had been necessary to identify the potential independent variables that would influence a household's food insecurity. Review of literature, past research findings, experts, and author's knowledge of the food insecurity situation was used to identify the potential determinants of household's food insecurity, therefore assigning the household food security status as the dependent variable, some of the common independent

variables that were expected to influence Agro-pastoral household's food security in the study areas; were categorized into demographic and socio-economic variables. The main socio-economic and demographic characteristics hypothesized to differentiate or discriminate between foods secure and food insecure household in the study area were: sex, age, family size, marital status, educational level, dependency ratio, livestock ownership, number of milking cow, cultivated of own land, non-farm income, improved seed, remittance, nearest to market center and food aid.

3.7.1. Dependent variable

Household Food security (FODS) is a dichotomous dependent variable in the model which takes 1 if the household is food secure, 2 if the household is food insecure.

3.7.2. Independent variables

In order to identify the potential independent variables that would expect to influence household food security with all of its categorical, the household food security was taken as the dependent variable for the logit model analysis. It was represented in the model by a value of 1 if a given household belongs to food security and 2 if the household food insecurity. The independent variables which are expected to have associations with food security status were identified as age of the household head, sex of the household heads, family size of the household, educational level of the household head, marital status of the household head, dependency ratio, livestock ownership, number of the milking cow, use if the improved seed, non-farm income, cultivated of the own land, nearest to the market center, remittance and food aid:

Sex of the household head (SXHHH): is a dummy variable which takes 0 if the household head is male, 1 if a household is female. Households headed by males are expected to have better chance of struggling to end food insecurity than households headed by females.

Age of household head (AGEHHH): it was hypothesized to influence food security positively which mean older households acquired experience and knowledge in farming and accumulate wealth through time which make them to be food security than younger household heads and was defined as the period from his/her birth to the time of his/her interview and was measured in years.

Family size of household head (FSZHHH): family is categorical in the study; the expectation is that households with larger numbers of family will face food insecurity because of the high dependency burden. Thus, large family size affects the household's food security situation negatively.

Marital status of household head (MRTSTHHH): marriage is the biological and social engagement to support each other both socially and economically. Marriage is established with a view of helping each other and married people pool their resources and also reduce costs that would have been spent separately. Moreover, married households put aside some of the resources for unpredicted circumstances to smoothen their life. In this study marriage and food security is hypothesized to be positively relative.

Educational level (EDULEVEL): educational is a dummy variable taking a value of 0 if the household head is literate and 1 if it's illiterate. Households with better education levels are believed to have a chance to diversify household income sources and better manage their farm and agricultural inputs. It is hypothesized that the educational level of household heads and food security are expected to be positively related.

Dependency ratio (DEPRATIO): dependency ratio is the continuous variable in the study. The variable is the most significance to influence the food insecurity of the households. It's hypothesized that economically inactive members are burden to the other members of the household, the dependence ratio and food security of the households are negatively related.

Livestock ownership (TLU): livestock ownership was measured by the number of TLU owned by the household during the time including milking cows. Conversion factors were used in order to change each livestock of a household to its equivalent TLU. Thus, it is hypothesized that households with more livestock have a chance to cope with food insecurity.

Number of milking cow (NUMLKCOW): livestock as a source of income in the study areas in general and are assumed to play a big role in the reduction of food insecurity problem. In a similar manner, animal products like milk and butter are also assumed to be a good source of income. Thus, it is hypothesized that households with one and/or more milking cows have better food security chances than those without milking cows.

Cultivating own land (CULTOWNLAND): it is hypothesized that those households who cultivated their own land rather than renting out or sharing cropping land with others are expected to have a better chance of food security. It's 0 if he/she cultivated their own land and 1 if they are not.

Non-farm income (NONFARMIN)): Non-farm income and off-farm income are income generated from non-farm activities outside the farming activities. However, income from both activities by the household members in total is assumed to back households up to be in a better food security than from the single activities of income. For this reason, amount of income generated from activities other than crop and livestock production, income from own business-like, petty trading, home-made drinks, handicraft (weaving, blacksmith, etc.), and off-farm like food for work, daily labor are expected to reduce the problem of food insecurity.

Improved seed (IMPSEED): Improved genetic resource of seeds is essential to increase agricultural production. A high quality of improved seeds or indigenous crops adjusting with the ecological and environmental conditions boosts the overall crop production. The use of improved seeds is expected to have a positive effect on household food security.

Remittance (REMITA): this is a variable where most households in the study area are benefiting from, due to the support one after the other of the Nuer culture. (Gulled, 2006) in his study indicated that remittance and food security were positively related, it is expected that having relative economic support from abroad and within the country is negatively related to the food security of the household.

Distance to nearest market center (DISTMRKT): it refers to the distance between the farmer's home and nearest to market center that the household usually made transaction which is measured in kilometers. Proximity to market centers creates access to additional income by providing off-farm/non-farm employment opportunities, easy access to inputs transportation. It was expected that households nearer to the market center have a better chance to improve household food security status than those who do not have proximity to market centers. It is therefore hypothesized, in this study that the nearer the market center, the less would be the probability of being food insecure.

Total food aid (FOODAID): food aid is given as a coping strategy to food insecurity in the study area. Hence households in the study area are vulnerable to food insecurity and mostly cover their food shortfalls through emergency food aid. So the amount of food aid received by the household is a good indicator of household to reduce the food severity in the study area. Food aid can develop a dependency behavior among households which in turn will reduce farmers' motivation toward food self-sufficiency; the amount of food aid given was measured in birr. According to (Abebaw Shimeles, 2003) food aid has no significant effect on food security.

Table 1 Codes, types and nature of variables in the model

Codes	Description	Types	Nature	Expected sign
SXHHH	Sex of the household head	Dummy	1 and 2	+/-
AGEHHH	Age of the household head	Dummy	Year	+/-
FSZEHHH	Family size of household head	Dummy	1 and 2	+
MRSTHH	Marital status of the household	Dummy	1 and 2	+/-
EDUCSHHH	Education level	Dummy	1, and 2	-
CULTOWNLAND	Cultivated own land	Dummy	1 and 2	-
NONFMIN	Non-farm income	Dummy	Birr	-
IMPSEED	Improved seed	Dummy	1 and 2	-
REMITA	Remittance	Dummy	Birr	-
DISTNMRKT	Distant to nearest market	Dummy	Km	+/-
FOODAID	Total food aid	Dummy	1 and 2	+/-
DEPRATIO	No of economically in/ active members	Continuous	Number	+
TLU	Tropical livestock unite	Continuous	Number	-
NUMLKCOW	Number of milking cow	Continuous	Number	-

Source: survey result in 2020

CHAPTER FOUR

4. RESULT AND DISCUSSIONS

The survey results were presented into four categories as a descriptive, econometric model analysis, and coping mechanisms of the survey data. Descriptive statistics such as mean, standard deviation, percentage, frequency distribution, variance inflation factors, contingency coefficient. The econometric model which includes binary logit was used to identify determinants of food insecurity at households.

4.1. Demographic and socio-economic characteristic

The demographic and socio-economic characteristic of households by sex, age, family size, educational level, marital status, cultivated of own land, livestock ownership, number of milking cow, non-farm income, use of the improved seed, remittance, nearest to the market center, and food aid were explained in their relation to food insecurity at households' level. A possible explanation of variables supposed to have an influence on household food insecurity is also presented from the analysis of the model output.

4.1.1. Household food insecurity and sex of household head

Sex is the dummy variable taking the value of 0 if the household is male and 1 if the household is female, its important variable to influence the food security because households headed by female are more likely to be food insecure than household headed by male. According to the result of the survey in the table 2, from the total households, male headed household account for 45.13% while female headed household account for 54.87%. The percentage of male-headed households was 73.08% for food-secure households and 36.78% for food insecure household, whereas, the percentage of female-headed households for food security and food-insecure were 26.92% and 63.22% respectively. The result is similar to the finding of (Hamud Hussien, 2018).

Table 2 food security status by sex of household head

Sex of HH	Food secure N= (26)	Food insecure N= (87)	Total N=(113)
	%	%	%
Male	73.08	36.78	45.13
Female	26.92	63.22	54.87

Source: Survey result in 2020

4.1.2. Household food security and age of household head

Age is the dummy variable in the study area and it's an important demographic factor that can affect the food security of the Agro-pastoral households positively. According to the result presented in table 3, on their comparison (15.38%) of the household are food secure and (57.47%) of the household are food-insecure from the age group below 30 years. On the other hand, (53.85%) of households are food secure and (26.44%) of household are food-insecure from the age categories of 30 to 64 years. (30. 77%) of food secure households and (16.09%) of food-insecure households are from the age categories of 64 years above. It was argued that as the age of households increase, he/she could be less prone to be food insecure since he/she acquired more knowledge and experience. According to the result of the survey, the variable is significant at a 1% probability level.

Table 3 Food security status by age of household's head

Age of HH	Food secure N= (26)	Food insecure N=(87)	Total N=(113)
	%	%	%
below 30	15.38	57.47	47.79
from 30 to 64	53.85	26.44	32.74
above 64	30.77	16.09	19.47
Total	100	100	100

Source: Survey result 2020

4.2.3. Household's food insecurity and family size of households

Family size is the categorical variable in the study and has a positive relationship with the food insecurity of the household. The result of survey show that family size of 1-3 households has (34.62%) of food secure and (2.30%) of food-insecure households. Whereas (23.08%) of food secure households and (9.20%) of food-insecure households have a family size of 4-5 households. (15.38%) of food secure and (17.24%) of food-insecure households have a family size of 6-7 households. (15.38%) of food secure and (26.44%) of food-insecure households have a family size of 8-9 households and (11.54%) of food secure and (44.83%) of food-insecure households have a family size of 10 above households. It was hypothesized that households with large family sizes are more likely of becoming food insecure than households having less family size. The survey result indicated that there is a significant relationship between family size and food security at a 5% probability level.

Table 4 food security status by family size of household

Family size of HH	**Food secure N= (26)**	**Food insecure N=(87)**	**Total N=(113)**
Size of family	%	%	%
1-3	34.62	2.30	9.73
4-5	23.08	9.20	12.39
6-7	15.38	17.24	16.81
8-9	15.38	26.44	23.89
10 above	11.54	44.83	37.17
Mean	6.9615	6.7471	
Std. deviation	2.14	2.19	

Source: Survey result 2020

4.2.4. Household food insecurity and marital status

The marital status of the sampled household head indicated that married, divorced, and windowed household head average accounted for about (43.36%), (10.62%), and (46.02%) respectively. The survey result showed that (53.85%) of married, (38.46%) of divorce and (2.30%) of windowed were found to be food secure, whereas (40.23%) of marries, (7.69%) of divorce and (57.47%) of windowed households were found to be food insecure. The result of the survey showed that no significant relationship between marital status and household food insecurity.

Table 5 food security status by marital status of household

Marital status	**Food secure N= (26)**	**Food insecure N=(87)**	**Total N=(113)**
	%	%	%
Married	53.85	40.23	43.36
Divorce	38.46	2.30	10.62
Windowed	7.69	57.47	46.02

Source: Survey result 2020

4.2.5. Household food security and education of household head

The educational level is the dummy variable and it's an important human capital that can affect the food security of the household positively. That is, the more the educational level of the household head, the more the probability of the household to diversify their mean of income so that the less probability the household to become food insecure. According to the result presented in table 6, the average total of the sampled household consists of 50.44% was illiterate, whereas 49.56% were literate. The educational status of the household head in the sample was a little bit different between illiterate and literate. About 57.69% of literate and 42.31 of the illiterate household were food secure, whereas 48.28% of literate and 51.72% of illiterate were found to be food insecure, so that the educational level of the household head shows no significant relationship between educational level and household food insecurity.

Table 6 food security status by educational level of household

Educational level	Food secure N=(26)	Food insecure N=(87)	Total N=(113)
	%	%	%
Literate	57.69	48.28	50.44
Illiterate	42.31	51.72	49.56

Source Survey result 2020

4.2.6. Household food security and dependency ratio

Dependency ratio is the continuous variable in the study and it's hypothesized as having a negative relationship with the household food security in that household with the large dependency ratio is more food insecure than a household with less dependency ratio. The result presented in table 7, shows that the mean dependency ratio of the sampled household was 1.48 for a food secure with a maximum of 4.2 and a minimum of 1 and the mean dependency ratio was 1.52 for a food-insecure household with a maximum of 6.1 and a minimum of 2, whereas the standard deviation for food secure and food insecure households were 502 and 509 respectively. There is a significant relationship between the dependency ratio and food insecurity at a 5% probability level. Thus, food-insecure households had high dependency burden than food-secure which may increase the vulnerability of households to be food insecure.

Table 7 food security status by dependency ratio of household

Dependency ratio	Mean	Std. deviation	Maximum	Minimum	t. value
Food secure	1.48	502	4.2	1	1.697**
Food insecure	1.52	509	6.1	2	

Source: Survey result 2020

4.2.7. Household food security and livestock ownership

Livestock production plays a significance role in household food security such as a source of cash income and as a source of supplementary food. Thus, livestock is considered a means of food security and coping mechanisms during crop failure. Livestock provides milk, meat, fuel,

and manure. The sample mean of the household for food security were 15.65 and the sample mean for food-insecure were 13.95 livestock tropical unit. The standard deviation for food security and food insecurity were 6.255 and 4.303 livestock tropical units respectively. There is a statistically significant relationship between TLU and food security at a 5% probability level.

Table 8 food security status by livestock ownership

Livestock ownership	Mean	Std. deviation	t. value
TLU			-1.711**
Food secure	15.65	6.255	
Food insecure	13.95	4.303	

Source: Survey result 2020

4.2.8. Household food security and number of milk cow

Milking cows is an important variable that contribute to the reduction of food insecurity as a source of income on a daily based, it was believed that households with one or more milking cows were better food secure than those without milking cows. The survey result showed that 7.69% of food secure households and 26.44% of food-insecure household have 1 milking cow, 7.69% of food secure and 20.69% of food-insecure households have 2 milking cows, 11.54% of food secure and 16.09% of food-insecure households have 3 milking cows, 15.38% of food secure and 11.49% of food-insecure households have a 4 milking cows, 15.38% of food secure and 11.49% of food insecure households have a 5 milking cows, 19.23% of food secure and 8.05% of food-insecure households have a 6 milking cows, and 23.08% of food secure and 5.75% of food-insecure households have a 7 milking cows. In terms of wealth, households with more milking cows were wealthier than households with less milking cows. The survey result showed that there is a significant relationship between number of milking cows and food security at a 5% probability level.

Table 9 food security status by number of milking cow

Number of milk cow with in household	Food secure N=(26)	Food insecure N=(87)	t. value
	%	%	1.831**
1	7.69	26.44	
2	7.69	20.69	
3	11.54	16.09	
4	15.38	11.49	
5	15.38	11.49	
6	19.23	8.05	
7 above	23.08	5.75	

Source: Survey result 2020

4.2.9. Household food security and cultivating of own land

Landholding plays a significant role in influencing rural household food security (Tesfaye, 2002; Degefa, 2002). It was hypothesized that the size of cultivated land by households affects the food security of the households positively. That is, households with large cultivated land or household who cultivate is own land have more probability of becoming food secure than households with small cultivated land or household who rented out land. According to the survey result presented in table 10, cultivated of your own land per households for the sampled households were 15.38% for a food secure and 51.73% for food-insecure from those who have <0.25-0.5ha per household, whereas 34.62% of food secure households and 33.33% of food-insecure were from those who have a land size of 0.51-0.75ha and 50% of the sampled household were food secure and 14.94% of the sampled household were food insecure from those who have a land size of 0.76-1ha per households. By comparing food security and food insecurity, the households having a land size equal to 0.51 and greater than 0.76ha were less likely to be food insecure than households having a land size less than 0.25 or equal to 0.5ha. this result supports the hypothesis that farmers who have larger cultivated land size were more likely to be food secure than those who cultivated smaller land size due to the fact that there is a high possibility to produce more food. There is a statistically significant relationship between cultivated of your own land and food security at a 5% probability level.

Table 1 food security status by cultivating of own land

Cultivate own land	Food secure N=(26)	Food insecure N=(87)	Total N=(113)
	%	%	%
<0.25-0.5ha	15.38	51.73	43.36
0.51-0.75ha	34.62	33.33	33.63
0.76-1ha	50	14.94	23.01

Source: Survey result 2020

4.2.10. Household food security and non-farm incomes

Non-farm incomes are very significant in guaranteeing the on-farm income of the households in that it helps the households to access food when incomes from agriculture are inadequate to enable households to access food through the year. It is hypothesized to affect the food security of the households positively in which households who were managed to earn more incomes from such activities are more food secures than households who dependent only on agricultural activities. According to the survey result in table 11, about 37.17% of the sampled households earn birr <2500-3000 from non-farm income in the study area, 32.74% of the sampled households earn birr 3001-4000 and 30.09% from the sampled households earn birr greater than 400, thus their food security and food insecurity were showed in the Table 12 below. There is a statistically significant relationship between non-farm income and food security at a 5% probability level.

Table 2 food security status by non-farm income

Non-farm income of households	Food secure N=(26)	Food insecure N=(87)	Total N=(113)
	%	%	%
<2500-3000	26.92	40.23	37.17
3001-4000	34.62	32.18	32.74
>400	38.46	27.59	30.09

Source: Survey result 2020

4.2.11. Household food security and improved seed

Improved seed is the agricultural input that improve the productivity of crop production, according to the survey result of the total sampled households, 30.09% of households used improved seed and 69.91% of households don't use improved seed. By comparing the food security and food insecurity of the households 73.08% of households who used improved seed were found to be food secure and 17.24% were food insecure, whereas 26.92% of those who don't use improved seed were food secure and 82.76% of those who don't use improved seed were food insecure. According to the survey result of households, those who use improved seed are more likely to be food secure than households who don't use improved seed.

Table 3: food security status by improved seed

Improved seed	**Food secure N=(26)**	**Food insecure N=(87)**	**Total N=(113)**
	%	%	%
Yes	73.08	17.24	30.09
No	26.92	82.76	69.91

Source: Survey result 2020

4.2.12. Household food security status and remittances

Remittances are the economic support from relatives in terms of money and other things such as livestock and crop sent to relatives during households' food shortage. *Nuer* have a culture that encourages helping one another's during food crises, the households can transfer help to relatives when one household has a problem. Family members always give a helping to their relatives' families when they go to the countries side or locally accessed some sort of cattle and quintal of crops when there is a problem from the others relatives. It was hypothesized that having relative support from abroad or within the country was positively related to the food security of the households. According to the result presented in Table 13, the economic support from relatives in terms of money given to the households ranged from birr 500 to 2000 above. About 59.29% of the households get economic support from their relatives, while about 40.71% of the households do not get economic support. According to the survey result, the members of food secure households from those who don't receive remittance were 15.38% and members of food-insecure

households were 48.28%. For those who receive remittance from birr 500-1000, 1001-2000 and greater than 2000 birr for food secure were 19.23%, 26.92%, and 38.46% respectively. Whereas, the members of food-insecure households for those who receive birr 500-1000, 1001-2000, and greater than 2000 were 31.03%, 12.64%, and 8.05% respectively.

Table 4 food security status by remittance

Remittance in birr	Food secure N=(26)	Food insecure N=(87)	Total N=(113)
	%	%	%
Don't receive	15.38	48.28	40.71
500- 1000	19.23	31.03	28.32
1001- 2000	26.92	12.64	15.93
>2000	38.46	8.05	15.04

Source: Survey result 2020

4.2.13. Household food security status and nearest to the market center

Access to infrastructure is essential for maintaining food security by ensuring low food price and efficient market that can respond to change in demand, market access allowed the information distribution between producers and consumers, brings new technology to the farmers and also buyers and sellers exchange their good and services within it. According to the result presented in table 14, the average numbers of households to the nearest market center for those who are around 1-15km are 46.90% and the average numbers of households to the market center for those who are around 16-30km are 53.10%. The average mean for food secure households was 1.55 (SD=0.761) whereas the average mean for food-insecure households was 1.761 (SD=0.788).

Table 5 food security status by nearest to the market center

Market center	Food secure N=(26)	Food insecure N=(87)	Total N=(113)
	%	%	%
1-15Km	73.08	39.08	46.90
16- 30Km above	26.92	60.92	53.10
Mean	1.55	1.67	
Std. deviation	0.761	0.784	

Source: Survey result 2020

4.2.14. Household food security status and total food aids

Food aids play a significance role to lessen households from being vulnerable to severe food insecurity. In this study, it was hypothesized that households who received more aid will be more likely to escape from being vulnerable to severe food insecurity than those who received less. According to the survey result presented in table 15, the total average numbers of the sample household for those who receive food aid were 28.32% and the average numbers for those who don't receive food aid were 71.68%. The numbers of food secure households for those who receive food aids were 80.77% and the numbers of food insecure households were 12.64%. Whereas the food security and food insecurity of the households for those who don't receive food aids were 19.23% and 87.36% respectively.

Table 6 food security status by total food aids

Total food aids	**Food secure N=(26)**	**Food insecure N=(87)**	**Total N=(113)**
	%	%	%
Yes	80.77	12.64	28.32
No	19.23	87.36	71.68

Source: Survey result 2020

4.3. Household Food Insecurity Access Scale (HFIAS) results

HFIAS was used to investigate a household's food insecurity status. It measured food insecurity occurrence based on the response of households about their access to food. It is a continuous measure of how households access food and was used to indicate the level and depth of severity of exposure to food insecurity as rarely, sometimes, and often (Maxwell, 2008). The household food insecurity access scale (HFIAS) consists of nine occurrence or generic questions that represent a generally increasing level of severity of food insecurity and nine frequencies of occurrence questions that are asked as a follow-up to each occurrence question to determine how often the condition occurred. It asks whether a specific condition associated with the experience of food insecurity ever occurred during the previous 30 days. The underlying assumption of the HFIAS approach is that the experience of food insecurity causes predictable reactions and responses that can be captured and quantified through a survey. The household food insecurity

access scale (HFIAS) is a categorical indicator of a household's exposure to food insecurity that shows its seriousness. It categorized households into four severity levels by using the formula given by (Coates *et al*, 2007) as food secure, mildly food insecure, moderately food insecure, and severely food insecure. The result of the survey shows that 23.01% of the survey households were food secure and 77% were food insecure. Out of this 77%, 22.13% of households were mildly food insecure, 37.16% were moderately food insecure and 17.7% were severely food insecure. This result is nearly similar to the finding of (Buom Ngen, 2013), which indicated that 80.08% of households were food insecure.

Table 7 food security status by household food insecurity access scale

Households food insecurity access scale (HFIAS)		
	N	%
Food secure	26	23.01
Mildly food insecure	25	22.13
Moderately food insecure	42	37.16
Severely food insecure	20	17.7
Total	113	100.0

Source: Survey result 2020

4.4. Econometric model

4.4.1. Determinants of food security in agro-pastoral household

In this study, the analysis of determinants of food security using binary model was used to check the food security of sample households. The logit analysis was made using demographic and socio-economic factors that could affect the food security of the households. The variables included in the model were tested for the existence of multicollinearity using the contingency coefficient and variance inflation factors for dummy and continuous variables.

4.4.2. Model diagnosis test results

Contingency coefficient value ranges between 0 and 1 and as a rule of thumb variable with contingency coefficient below 0.75 shows weak association and value above it indicates the

strong association of variables. The contingency coefficients for the dummy variables included in the model were less than 0.75 that didn't suggest multicollinearity problems **see appendix 1.**

Before running the model, the data were checked whether multicollinearity problems exist or not. In this case, the variance inflation factors (VIF) technique was employed for continuous explanatory variables only that were included in the model. According to the rule of thumb, continuous variables having variance inflation factors less than 10 or equal to 10, are believed to have no multicollinearity problem and those with VIF of above 10 are suggested to multicollinearity problem and should be excluded from the model. The computational result of the variance inflation factors showed no multicollinearity problem association between the variables that were included in the model **see appendix 2.**

4.4.3. Binary logistic regression model

Binary logistic regression was a type of logistic analysis that when the response variable is categorized into two. The main purpose of this is to specify the binary logistic regression model fitted to identify the potential variables affecting household food security in the study area, the variables described are used to estimate the logistic regression model using the household food security status as dependent variable where by a value of 1 is given to households belong to food secure and 2 for food insecure households. In this study, the researcher employed binary logit regression model to predict the impacts of food security on agro-pastoral households.

The result indicates that family size, educational level, dependency ratio, livestock ownership, and distance to the nearest market center are statistically significant. The rests of the variables are not significant; this indicates that the sig-value of five variables significantly influenced and determined the probability of becoming food insecure.

Table 8 result of binary logistic regression model

	Coefficient	Standard error	Wald	Sig. value	Odds Ratio
sex of household head	-0.770	0.636	1.466	.226	2.160
age of household head	-0.731	0.550	1.769	0.004	2.077***
family size of household	0.142	0.138	1.053	0.035	0.868**
marital status	-0.930	0.597	2.424	0.119	0.395
educational level	-20.499	2.240	.000	0.999	7.992
dependency ratio	0.770	0.555	.016	0.015	1.073**
livestock ownership	-0.738	0.399	3.429	0.019	2.092**
number of milking cow	-0.255	0.388	0.431	0.775	0.775
cultivating own land	-1.304	0.630	4.285	0.038	0.272**
Non-farm income	-0.774	0.558	1.924	0.246	2.169
improved seed	-0.066	1.290	.003	0.169	1.068
Remittance	-0.529	0.743	0.507	0.476	1.697
distance to nearest market center	-2.681	1.283	4.364	0.037	0.069**
total food aid	0.617	1.190	0.269	0.184	0.539
Constant	-28.990	3.009	0.000	0.999	0.000

Note: ***, ** and * significant at less than 1%, 5% and 10%, probability level of significance

Source: result of binary regression model with SPSS 24, 2021

Age of household head: This variable affects food insecurity status negatively and significantly at 1 % (P= 0.004) probability level in the study area. The negative relationship implies that when household heads get older, they are expected to have stable economy in farming. Moreover, older household heads are expected to have better access to land than younger heads, because younger men were not concentrated more on farming system compared to older men or older men have more knowledge about the farming system compared to younger men. If all other things are held constant, the odds ratio of 2.08 for household age implies that, the odds ratio in favor of being food secure increases by a factor of 2.08 as household age increase by one year.

Family size: the relationships between household's family size and food insecurity have already explained in the descriptive part. Households with large family size, having children of non-

productive age, could face the problem of food insecurity because of high dependency burden by non-productive households within the family. Therefore, this agrees with the fact that households with large family size will face the condition of food insecurity since they had no role play in the economics of the households, as a result the probability of households to become food secure would decrease. According to (Tesfaye, 2005) showed that the family size was significant in determining the probability of other variables for households to be food insecure and this study found the same result in that the variable is statistically significant and have a positive effect with household's food insecurity at 5% (P= 0.035) as indicated in table 17 above. The result indicates that households in the study area have no knowledge about family planning and how the family planning is important for the economics of the households. If all other things are held constant, the odds ratio of 0.87 for family size implies that, the odds ratio in favor of being food insecure increases by a factor of 0.87 as family size increase by one person.

Dependency ratio: dependency is the burden to every household; it is a determinant for food insecurity. The result of the binary logit regression model in table 17, above shows that the dependency ratio is statistically significant and has a positive relationship with the household's food insecurity at 1% (P=0.015). It indicated that if the number of active economic is less than the number of inactive economic members, then households would be more likely to be food insecure, the positive sign shows that an increase in the dependency ratio will increase the households to suffer from the food insecurity problems. If all other things are held constant, the odds ratio of 1.073 for dependency ratio implies that, the odds ratio in favor of being food insecure increases by a factor of 1.073 as dependency ratio increase by one member of inactive person.

Livestock ownership: livestock is the main source of livelihood of Agro-pastoralist communities in most part of lowland areas in the Gambella region. The relationship is significant at a 1% (P=0.019) probability level. Households that possess a large number of livestock are expected to be less vulnerable to food insecurity than the ones that have few livestock. The contribution of livestock to food security includes the manure and income from sales of livestock and livestock products which are often used for the purchase of food grains during times of food shortage. The finding implies that pastoral households who have more livestock are more likely to be in the higher eradication of food insecurity problem and less likely to be in severe food insecurity. The result was supported by (Adugna and Wogayehu, 2011) in their study in

Wolayita; found that households with more livestock have more probability to be less prone to severe food insecurity challenges than households with less number livestock. Therefore, it is hypothesized the higher the value of TLU the higher will be less risk of food insecurity problems. If other things are held constant the odds ratio in favor of food insecurity decrease by factor of 2.092 when the amount of livestock in the household rises by one TLU.

Cultivated own land: this variable had a negative relationship with food insecurity and significant at less than 5% (P= 0.038) probability level with regard to food security status of the households. This implies that the household who have more hectares of cropping land would be in a position to cope with food insecurity, this means households with large cultivated land produce more for household consumption and for sale and have better chance to be food secure than those having relatively small size of cultivated land. The odds ratio of 0.272 implied that if other things are help constant the probability of being food secure increased by factor of 0.272 as total land holding increased by one hectare.

Distance from the nearest market center: nearest to the market center affects the food security positively and significant at 5% (P=0.037) probability level, as it's indicated in table 17, above. According to the result of the binary logit model, the further from the market center of the households, the more likely would be in food insecurity as compared to households who are nearest to the market center. This is due to the fact that if the household's home is far distant from the market center, it is difficult to get the desired price from your products; this could be attributed to the fact that the farther the market center from the residence the greater would be the loss of crop production management. This implies that farmers who have no access to the market center from their homes would likely have less information on market price, this could also attribute to the challenges they would face in exercising proper and effective management as a result of the lack of information due to the distance of the market compared with their counterparts that live closer to the market center. If all other things are held constant, the odds ratio of 0.069 for distant to the nearest market implies that, the odds ratio in favor of being food secure decrease by a factor of 0.069 as market center increase by one kilo meter.

4.5. Households coping mechanisms of the study area

Households pursue different coping mechanisms for food shortages. However, the types of mechanisms used at the time of food shortages are different. Various researchers identified different coping mechanisms to maintain the food shortage. These include labor employment opportunities including migration, sales of productive assets, and remittances from the relatives who live elsewhere, diversification of crop and animal products can be mentioned as some of the coping mechanisms that mainly rural households practiced (Debebe, 1995).

During focus group discussion (2 FGD with 20 people), respondents were asked to list coping mechanisms they pursue at times of food shortage. Accordingly, they identified different coping mechanisms in their community such as limiting the size of meal and quantity of meal per day, borrowing cash and grain from relatives and friends, selling livestock, selling firewood, engaging in the fishery, and selling milk and milk product are main coping mechanisms discussed by local communities in the studies areas. According to the focus group discussion (FGD), the first most important coping mechanism used by a large number of surveyed households according to their ranking was borrowing of grain or cash which was the most coping mechanism of food insecurity at the time of food shortage. Households were relying on food assistance from their relatives in the form of borrowing to repay back after they recover from a disaster; the strategy was the most commonly practiced in the studies areas.

The second most important coping mechanisms used by the number of Agro-pastoral households was the sale of livestock when the crop production fail to harvest, the communities would look to sell livestock as a mean of coping mechanisms to overcome the food shortage problem when food produced is already consumed and no cash reserve is available to purchase food from the market, the live animal is sold as ways of getting access to cash income and to buy food for the household.

The third most important coping mechanisms is the fishing and product from a live animal, according to the FGD fishing is the another coping mechanisms when the crop and livestock fail to produce by different factors such as flooding, drought, and other crop and livestock disease, fishing stands as the source of income as well as for consumption to the households obtained from Baro river. The other is the product from live animals such as milk and butter as coping mechanisms during the food shortage, households could sell their milk and butter to buy food

and this is the first stage of coping mechanisms before the situation is becoming worse; households sold their milk and butter to overcome the food shortage problem.

The fourth most important is the sold firewood and eating fewer meals and reduced the quantity of food per day, households were used to collect firewood from the forest as a way of earning money to buy food. Households reduced their number of meals and reduced the quantity of food due to the lack of resources when the food shortage is becoming worse, households would shift their meals on one chip to ensure that their meals will reach them to the next cropping season.

Table 18 coping mechanisms of food insecurity by households

S/No	**Coping mechanism**	Number of people	Ranking
1	Borrowed cash or grain	6	1
2	Sold livestock	4	2
3	Sold firewood	2	4=Q3 &4
4	Eat fewer meals per day /Reduced quantity of food per meal	2	4
5	Fishing	3	3=Q 5& 6
6	Sell milk and milk product	3	3

Source: Survey result 2020

According to the Key Informant Interview (KII), the most important determinants that influence household food insecurity are floods, pests, insecticides, erratic rainfall, and traditional farming system practice. Flood is the major determinants that affected the livelihoods of the people in the studies areas followed by traditional farming system, lack of agricultural inputs such as fertilizer and improved seed are the major challenges in the studies areas. According to the response of the KII indicated that rural households were vulnerable to food insecurity due to crops damage and livestock death by flood every year. This lead to lack of food access and inaccessibility of public services such as health centers, safe drinking water, market and schools which are the lifesaving institutions.

CHAPTER FIVE

5. SUMMARY AND RECOMMENDATIONS

5.1. Summary

This study was undertaken in Itang special woreda of Gambella region with the general objective to determining the food security and coping mechanism in agro-pastoral household and specific objectives: to identify the copping mechanism used by household during food shortage. Examine the determinants of the food security in the Itang woreda. To achieve these objectives the study relied more on primary data which were collected by conducting household survey from 113 randomly selected household's into two randomly selected kebeles of the district. Households' demographic and socioeconomic data which were believed to be relevant were collected, organized, analyzed and interpreted to come up with the results.

Data were analyzed using both descriptive statistics and econometric method. The descriptive statistics were used to study the demographic and socio-economic factors in relation to food security status of households, whereas copping mechanism was treated as a qualitative reflected from sampled households at the time of shocks. The econometric model in which binary logit model was specified and estimated was used to analyze the determinants of food security in the study area.

The sampled households were classified into food secure and food insecure groups based on the results of households food insecure access scale (HFIAS) as the tool or technique that measure the food security status, which indicated that about 23% and 77% of households were food secure and food insecure respectively. Out of total 77% food insecure households, 22.13% were mildly food insecure, 37.16% were moderately food insecure and 17.7% were severely food insecure. The analysis of Logit Model indicated that the independence variables such as age of household head, household family size, dependence ratio, cultivating of own land, livestock ownership, and nearest to the market center were statistically significance at probability level of 1%, 5% and 10%. According to the result of the model revealed that the variables household family size is significance at 5% (P= 0.035) and influenced the household's food security negatively, this means the probability for the households becoming food secure decreases as the

household size increases. The variable age of household is significance at 1 % (P= 0.004) and influenced the household's food security positively, which mean as the age of household increases, he/she could be less prone to be food insecure since he/ she acquires more knowledge and experience as age increase. Cultivating own land was also one of the important factors in ensuring food security to the households. Farmers with greater farm land size showed better food security status than farmers who rented land and farmers who cultivated small plot of land. Having large farm land size is not only essential to produce enough crops but also is a determinant factor for farmers to use new technologies such as fertilizers, improved seeds. Similarly, households who own smaller number of livestock is likely to be in food insecure situation than those who have own larger livestock. Livestock enables the households to be food secure either through the income earned or by direct consumption when crop fail to yield. Distance from the nearest market center affects food security positively and significant at a 5% (P=0.037) probability level. According to the result of the binary logit regression model the more distance from the market center the more likely to be in the food insecure as compared to households that are nearest to the market center. This is due to the fact that if the distance is very far from the household home to the market center, it is more difficult to get the desired price from your products. This could be attributed to the fact that the further the market center from the residence, the greater would be the loss of crop production management.

5.2. Recommendations

To improve the food security situation in the region and country as whole, it is suggested that the Ethiopian government through the Ministry of Agriculture and rural development and food security agency and other institutions should integrate different research outputs and design a policy that aims at building household food security capacity in link with the existing food security strategies and programs. The local government and other stakeholders should create awareness among the people so as to enable them to understand the importance of self-dependence so that they can struggle themselves to solve their problems of food insecurity, instead of depending from regional government. Short and long-term interventions should be emphasized rather than merely focusing on strategies that improve agricultural productivity, but also strengthening their capacity that helps people to bounce back and recovery from food insecurity shocks.

- Family size is one of the major problems in the studies areas since household who was economically inactive are greater than economically active members, so awareness creation should be the first task to tackle this problem. Therefore, the government working on health-related issues need to create a strategies approach for the utilization of family planning facilities. Since the communities in the study area are following polygamous marriage without birth control and other alternatives should be assessed by non-governmental organizations in collaboration with the government of Gambella regional state to give training on how family planning is important to the wellbeing of women and their economic stability.
- Expansion of education and improvement of the quality of education by employing qualify teachers and provision of school materials to students should be made by the Government of Itang woreda.
- The regional government should improve the quality of land through improved soil and nutrient management by promoting agricultural technologies such as the use of fertilizer, improved seed, irrigation, and post-harvest management.
- The regional government should improve the production and productivity of the livestock through the provision of sufficient veterinary services, improved water supply, provision of the effective security task force for the external invaders of Murle from South Sudan who took their cattle, launching sustainable and effective forage development programs to ensure their grazing land is not fired.
- The local government should expand and strengthen the non-farm income activities by providing training and credit services can increase their income and gradually will change their attitude of only depending on agricultural activities.
- Food aid availability over a long period had a negative effect on the attitude of farmers towards work and their own agricultural activities since a large number of households are receiving food aid in the form of refugees. The implication is that the local government should limit the household to access food aid that will reduce the attitude of dependency and will improve the household to work on their own farmland.

REFERENCES

Abebaw S (2003). Dimension and determinants of food insecurity among rural households in Dire Dawa, eastern Ethiopia. An MSc thesis presented to the school of graduate studies of AlemayaUniversity.

Adane, T, (2008). Correlates of household food insecurity in Daro-Labuworeda West Hararge Zone of Oromia National State.Addis Ababa University, Ethiopia.

Adugna E, Wogayehu B (2011). Causes of household food insecurity in Wolayita, Southern Ethiopia. Journal of stored producs and postharvest research, (3): 35-48.

Africa Development Bank (2014). Africa food security Brief: special focus on climate Africa food security change impacts. Statistics department. Issue. No. 5.

Ashimogo, G and Hella (2000) agrarinsation household level food security and the environmental, the case of Iringa region, a paper presented for the first RLDS international policy research work shop, Addis Ababa, April 14-15, 2000.

Beyene F and Muche M. (2010). Determinants of food security among rural household of central Ethiopia: an empirical analysis. Q. J int. agric, 49: 299-318.

Bouis, H. (1993). Food consumption survey. How random are measurement errors? in: Von

Bowbrick, P. (2008). A refutation of professor Sen,s theory of famines. Retrieved from http://www.bowbrick.org.uk[30.01.2013].

Bum Nguen (2013). Determinants of seasonal food insecurity coping mechanisms, household in Lare district, Gambella, Ethiopia: master Degree thesis in Mekele University.

Chu, S.(2009). Global food crisis May deteriorate: tackling climate change. Great Britain: Oxfam.

CSA (2017).population and housing census for Ethiopia: Gambella national regional state.

Debebe H (1995). Food security: conceptual framework and indicators, Addis Ababa, Ethiopia.

DegefaTolosa (1996). Belg crop production as a strategy of household food security: a comparative study of belg grower and non-belg grower farmers in munessaworeda, Arsiregion, unpublished M.A thesis, department of Geography, Addis Ababa University.

DegefaTolosa (2002). Household food insecurity in oromia zone, Ethiopia. (2005). rural livelihoods, poverty and food insecurity in Ethiopia: a case study at Erenssa and Gabri communities in oromiya zone, Amahara National Regional State. Doctoral thesis.University of Trodheim.

Devereux, S. (1988). Entitlement, availability and famine: revisionist view of wello, 1972-74. Food policy 13, no.3.

Devereux, S. (2001). Sen,s entitlement approach: critiques and counter-critiques. Oxford development studies, 29(3), 245-263.

Devereux, S. and Maxwell, S. (2003). Food insecurity in Sub-Sahara Africa, University of Natal press, piemartzuburg, South Africa.

Diana, P. (2007). Food security in development countries: a systematic perspective, medilin district, Eastern Wollega of Oromia, Ethiopia, thesis paper AAU.

Diriba (1995). Economy at the cross road: famine and food security in rural Ethiopia, AA: care international in Ethiopia.

Ejiga J. (2006). The persistent food crisis in Ethiopia: causes, government responses and household strategies, the case of enebsesamidir district. Mphil thesis in development studies.Norwegian University of Science and Technology (NTNU).Trodhiem, Norway.

FAO (1997).Integrated soil management for sustainable agricultural and food security in Southern and Eastern Africa proceeding of the expert consultation Harare, Zimbabwe.

FAO World Food Summit (1996).The state of food insecurity in the World, Rome.

FAO, (2010). Food insecurity in the world: addressing food insecurity in protracted crises. Food and agricultural organization of the United Nations, Rome, online available at http://www.fao.org/docrep/013/i1683e/i1683e.pdf. FDRE Nov. (1996) issued Ethiopia's food security strategy and updated in Jan, 2010, by Beruk, 2011.

Frehiwot, fantaw (2007). Food insecurity and its determinants in rural household in Amahara region of Ethiopia, master thesis paper, Addis Ababa University, Addis Ababa, Ethiopia.

Getachaw Diriba (1995). Economy at the cross road: famine and food security in rural Ethiopia, Addis Ababa. Care international in Ethiopia.

Graham, R.D., Welch, R.M., Saunders, D.A., Ortize- Monasterio, I. Bouis, H.E., Bonier bale, M., de Haan, S., Burgos, G., Thiele, G., Liria, R., Meisner, C.A., Beebe, S.E., Potts, M.J., Kadian, M., Hobbs, P.R., Gurta R.K. and Twomlow, (2002). Nutritious subsistence food System. Advance in Agronomy 92: 1-74.

Grember, K., Ruel M., oppeln C. et al. (2010). Global hunger index: the challenge of hunger: focus on the crisis of child under nutrition. Bonn, Washington DC and Dublin: Welt hunger Hilfe, IFPRI and Concern Worldwide.

Gregory, P.J., J.S. Ingram and M. Brklacich, 2005. Climate change and food security. Philos.

Gulled Abdullahi (2006).Food insecurity and coping strategies of agro-pastoral household in AwbareWoreda, Somali region Ethiopia. An M.sc thesis presented to school of graduate studies of Haramaya.

Gujarati, D, N. (2004). Basic econometric.Second edition. McGrew-Hill Inc. New York.

Hailemariam Behailu*et al* march (2011). Action plan of adaptation to climatic change in the Gambella People National Regional State, Ethiopia.

Hamud Hussien, (2018).determinants of food insecurity among pastoral households: case of erer district, sitti zone, Somali regional state, Ethiopia.

Hess-Biber, S.N. (2010). Mixed methods research: merging theory with practice New York: the Guilford press.

Hosmer, D.W. and lemeshew, S. (1989).Applied logistic regression. A wileyinter- science publication. New York, USA.

IFPRI (2011). International food policy research institute, proceeding from sustainable in emergency needs assessment, institute of development studies, Rome, Italy.

Jrad, S, B. Nahas and H. Baghasa, (2010).Food security models. Policy brief No. 33, ministry of agriculture and agrarian reform, national agricultural policy center, Syrian Arabic republic, august 2010, pp.: 1-32.

Jrad, S., B. Nahas and H. Baghasa, 2010. Food security models. Policy Brief No. 33, Ministry of Agriculture and Agrarian Reform, National Agricultural Policy Center, Syrian Arabic Republic, August 2010, pp: 1-32.

Keatinge, J.D.H., Yang, R-Y., Hughes, J. d, A., Easdown. W.J. and Holmer, R. (2011). The importance of vegetable in ensuring both food and nutritional security in attainment of the millennium development goals. Food security 3: 491-501.

Khush, G., Zee, S., Cho, J-I. and Jean, J.S. (2012) Bio-fortification of crops for reducing malnutrition. Plant Biotechnology Report 6: 195-202.

Kitchin, R. and Tate, N. (2000). Conducting Research into Human Geography: Theory, Methodology and Practice. London: Prentice Hall.

Lemma and Gebre-hiwot. (1999). the food security situation in Ethiopia: concepts status and trends. In the proceeding of the first national workshop of NOVIB partners forum on sustainable land use, Addis Ababa.

Markos Ezera. (1997). Demographic response to ecological degradation and food insecurity: drought prone areas in northern Ethiopia. Amsterdam: thesis publisher Ph.D. Dissertation.

Martha Nagash (2000). Environmental depletion as a way out to seasonal food insecurity: the case of North Wello, Ethiopia a paper presented for the first RLDS international policy research workshop, Addis Ababa, April 14-15, 2000.

Maxwell, S, Belache, D, and Lirenso, A. (1994).The distinctive effect of food for-work on labor supply and agricultural intensification in Ethiopia. Journal of agricultural economics 45(3): 351- 359.

MEDAC, (2009). Ministry of economic development and cooperative: survey of the Ethiopian economy: review of post reform development (1992/93-1997-98). Addis Ababa.

MesfinWolde Mariam (1991). Suffering under God's environment: at a vertical study of the predicament of peasant in north-central Ethiopia, Bern: African mountains association.

Mugenda, O. &Mugenda, A. (2003). Research methods: quantitative and qualitative approaches, Nairobi: acts press.

Muluken January (2005).Measuring rural household food security status and its determinants in the BenishangulGumuz region, Ethiopia: case of AssosaWoreda Master Thesis Alemaya University.

Oneworld.net (US), 2008). A growing global food crisis. Washington DC. Oneworld.net.

Panneerselvam.(2004). Research Methodology(Second). New Delhi.

Project concern international. (2009). Global food crisis. Retrieved March 26, 2009, from *http://*www.projectconcern.org.

Reutlinger, S. (1987).Food security and poverty in developing countries in gittinger, J. *et al*(Eds) food policy. Integrating supply, distribution and consumption, Baltimore: Johns Hopkins.

Sen, A. (1981). Poverty and famine.An essay on entitlement and deprivation. Oxford: Oxford University press.

Sen, A. (1984). Resource, values and development. Oxford: oxford university press.

Shiferaw, F., Kilmer, R. and Gladwin, C. (2003). Determinants of food security in Southern Ethiopia: a selected paper presented at the 2003 American agricultural economics association meeting in montrael, Canada. Oxford University press.

Tesfaye, K. (2005). Household food insecurity Dodota sires district, Arsi Zone. Coping strategy and policy options. A thesis submitted to the school of graduate of haramaya University, Ethiopia 142p.

Toulmin, C. (1986). Access to food, dry season strategies and household size among the Bambara of central Mali IDS bulletin, 17 No. 3: 58-66.

UNDP (2018), Ethiopia's process towards eradicating poverty: implementation of the third United Nations Decade for the Eradication of poverty, Addis Ababa, Ethiopia.

USAID, (2012).Tackling food insecurity and malnutrition in Ethiopia through diversification.

Webb, P. *et al*(1992). Famine in ethiopia policy implication of the coping failure at national and household levels. Washington D.C: international food policy research institute, research report 92.

Wehler, C, R. Scott and J. Anderson (1992). The community childhood hunger identification project: a model of domestic hunger demonstration project in Seattle. Washington." Journal of nutrition education 24: 29S-35S.

WFP, (2009).Food security and vulnerability in Addis Ababa. WFP- Ethiopia, September 2009.

WHO. (2004). WHO and the global food insecurity crisis: the health and nutrition dimension. Geneva: world health organization.

Wilhemina Quaye (2008). Food security situation in Northern Ghana, coping strategies and related constraints. African journal of agricultural research Vol.3 (5), pp. 334-342, may, 2008.

World Bank (1992). Ethiopia toward poverty alleviation and social action program. Washington D.C.

World Bank. (2008). Global food crisis. Retrieved March 26, 2009, frohtt://www.worldbank.org.

WSFS, (2009).Declaration of the world summit on food security.Retrieved http://www.fao.org/fileadmin/templates/wsfs/summit/Docs/Final-Declaration/WSFS Declaration.pdf [27.09.2012].

YaredAmare (1999). Household resource, strategies and food security in Ethiopia: a study of Amhara households inWogda, Northern Shewa, A, A: AAU press.

YaredAmare (2001). Livelihood strategies and food security policy in Ethiopia, Addis Ababa, Ethiopia.

Appendixes

Appendix 1: Contingency coefficient value for dummy variables

Variable	Sex	Age	Family size	Marital	Education	Cultivated land size	None-farm	Improved seed	remittance	market center	Food aid
SEX HH	1										
AGEHH	-0.216	1									
SIZEHH	-0.095	0.401	1								
Marital	-0.038	-0.040	-0.182	1							
EDUHH	0.131	0.470	0.230	-0.008	1						
CLSZ	-0.120	0.199	0.143	-0.032	-0.060	1					
NONFMIN	0.075	0.023	-0.077	0.022	0.173	-0.251	1				
IMPSEED	-0.077	0.080	-0.059	0.045	0.010	0.030	-0.157	1			
RMT	0.135	0.045	-0.050	0.078	0.214	0.067	0.063	0.130	1		
MRKC	-0.035	0.241	0.157	-0.145	0.338	0.020	-0.032	-0.080	0.140	1	
TFD	-0.052	0.249	0.154	0.066	0.237	0.057	-0.166	0.046	-0.058	0.223	1

Appendix 2: Variance inflation factors of continuous variables

Variables	**Tolerance**	**VIF**
DEPNDRTO	0.984	1.016
TLU	1.000	1.000
NUMLKCOW	0.984	1.016

Appendix 3: Binary logit results

	Coefficient	Standard error	Wald	Sig. value	Odds Ratio
sex of household head	-0.770	0.636	1.466	.226	2.160
age of household head	-0.731	0.550	1.769	0.004	2.077***
family size of household	0.142	0.138	1.053	0.035	0.868**
marital status	-0.930	0.597	2.424	0.119	0.395
educational level	-20.499	2.240	.000	0.999	7.992
religion of household	-0.644	0.507	1.612	0.204	0.525
dependency ratio	0.770	0.555	.016	0.015	1.073**
livestock ownership	-0.738	0.399	3.429	0.019	2.092**
number of milking cow	-0.255	0.388	0.431	0.775	0.775
cultivating own land	-1.304	0.630	4.285	0.038	0.272**
Non-farm income	-0.774	0.558	1.924	0.246	2.169
improved seed	-0.066	1.290	.003	0.169	1.068
Remittance	-0.529	0.743	0.507	0.476	1.697
distance to nearest market center	-2.681	1.283	4.364	0.037	0.069**
total food aid	0.617	1.190	0.269	0.184	0.539
Constant	-28.990	3.009	0.000	0.999	0.000

Appendix 4: converging factors used to estimate Tropical Livestock Unit equivalents

Cow and oxen	1	Sheep and goat (young)	0.06
Bull	1	Horse and mule	1.1
Calf	0.25	Donkey (young)	0.35
Heifer	0.75	Donkey (adult)	0.7
Sheep and goat (adult)	0.13	Chechen	0.013

Source: *et al*. (1991)

Appendix 5: Household' Survey Questionnaires

Questionnaires for determinants of food security and coping mechanism in agro-pastoral households in Itang district of Gambella, Ethiopia

GENEREAL INFORMATION

1.1 Kebele _____

1.2 Village_____

1.3 Name of household head_____

1.4 Name of the enumerator_____

1.5 Date of interview_____ Signature _____

1. PART I: HOUSEHOLD INFORMATION AND DEMOGRAPHICS

1.1. Sex 0. Male □ 1. Female □

1.2. Age: 0. below 30 □ 1. 30- 64 □ 2. 64 and above □

1.3. Do you have family 0.Yes □ 1. No □

1.3.1 if yes, size of the household members _____

s/no	Number of the household members
1	1-3
2	4-5
3	6-7
4	8-9
5	<10

2. 1.4 marital statuses: 1. Married □ 2. Single □ 3. Divorce □ 4. Windowed □
3. 1.5. Education level: 1. Literate □ 2. Illiterate □
4. 1.6. Religion of HHH: 1. Christian □ 2. Muslim □ 3. Others □
5. 1.7. Number of economically active members and number of economically inactive members of the HH

Number of economically active members	Number of economically inactive members
1	1
2	2
3	3
4	4
5	5
6	6
7	7
>8	>8

2. PART II: LAND RESOURCES

2.1. Do you have your own land?_____ 0. Yes □ 1. No □

2.1.1 If no, where do you get the land for cultivation?

0. Rented□ 1. For free □ 2.Share land with others □ 3. Others _____

2.1.2. If yes, what is the total size of your land in hectare?

0. <0.25-0.5ha □

1. 0.51-0.75ha □

2. 0.76-1ha □

2.2. How many times do you plant a year?

0. One time □ 1. Two times □ 2. Three times □ 3. Others (specify) _____

2.3. List the types of crops you cultivated and their average production for the year 2019.

Type of crop	Year 2019		
	Area(in hectare) or local unit	Total production (in quintal Qt) or in kg	Value in Birr
Semiannual crops			
1			
2			
3			
4			
5			
Annual crops			
1			
2			
3			
4			
5			
Others			

2.4. What is the purpose for crop production?

0. Consumption□ 1. Marketing □ 2.Consumption and marketing □ 3. Others _____

2.4.1. If your answer is consumption and marketing, quantify the grain for consumption and for the marketing in quintal (Qt).

2.4.2 If no, how long did your grain last? _____months.

2.5 What do you use to plough your land?

0. Hand tools (hoe) □ 1. Oxen □ 2. Rented tractor □ 3. Others_____

2.6. What are the problems related to farming system in your area?

0. Shortage of seeds □ 1. Lack of fertilizer □ 2. Disease and insect pest □ 3. Weeds □ 4. Lack of land □ 5. Shortage of oxen/ tractor □ 6. Others specify_____

2. 7. Do you use irrigation system? 0. Yes □ 1. No□

2.7.1 If yes, what types of irrigation did you used 1. Drip□ 2. Aerial □ 3. Chanel 4. Hand □

2.8. What types of crop do you plant using irrigation?

s/no	Types of crops	Area (in hectare)	production (Qt)
1			
2			
3			

2.9. How was the availability of rain on your fields during 2019 cropping year?

1. Enough□ 2. Too much □ 3. Too little □ 4. Other_____

3. PART III: USE OF MODERN AGRICULTURAL INPUT

3.1 do you use chemical fertilizer?_____ 0. Yes □ 1. No □

3.1.1 If no, state your reason 1. Not heard about it □ 2. Not available □ 3. Not necessary for crop cultivation □ 4. Too expensive □ 5. Lack of credit □ 6. Others (if any) _____

3.1.2 If yes, indicate the amount of fertilizer you used

Types of crops		
	Fertilizer (Qt)	Area in hectare
1		
2		
3		

3.2 do you use improved seeds in your farm?____ 0. Yes □ 1. No □

3.2.1 If no state your reason

1. Not heard about it □ 2. Not available □3. No yield difference □ 4. Too expensive □ 5. Others_____

3.2.2 If yes, where did you get the seed from/ seed source? 1. Agricultural bureau □

2. Gambella agricultural research institute □ 3. NGOs □ 4. Relatives □ 5. Others_____

3.3 What were the factors affecting your crop production?

1. Disease□ 2. Pest □3. Weeds □4. Flood □ 5. Erratic rain fall 6. Drought □ 7. Others_____

4. PART IV: AGRICULTURAL EXTENSION SERVICES

4.1 have your household receive any agricultural extension services from any government/NGOs?

0. Yes □ 1. No □

4.1.1 If yes, what are the extension services? 1. Training □ 2. Crop protection □

3. Agronomic practice □ 4. Others _____

4.2. Have you ever participate in the new agricultural extension package program?

0. Yes □ 1. No □

4.2.1. If yes, what types package program? 1. Crop production □ 2. Animal production □ 3. Honey bee production □ 4. Fishing production □

5. PART V: LIVESTOCK PRODUCTION

5. 1 do you have livestock? 0. Yes □ 1. No □

5.1.1 If yes, can you tell us about your herd of livestock at present?

S/no	Types of livestock	Number owned at present time in your farm
1	Oxen	
2	Cows	
3	Milky cows	
4	Sheep	
5	Goats	
6	Horse	
7	Donkey	
8	Mules	
9	Camels	
10	Chickens	
11	Others	

2. Do you have milking cow in your farm? 0. Yes □ 1. No □

5.2.1 If yes, how many milking cows do you have?

1. One □ 2. Two □ 3. Three □ 4. Four □ 5. Five □ 6. Six □ 7. Seven above □

5.3 What are the factors affecting your animal production?

1. Animal disease □ 2. Insect pest (tsetse fly) □ 3.Flood hazard □ 4. Shortage of grazing □

6. PART VI: HOUSEHOLD INCOME

6.1 Do you or do any members of your family have off-farm (non-farm) job?

0. Yes □ 1. No □

6.1.1 If yes, indicate the amount of money monthly earned in that work.

1. <2500-3000 □

2. 3001-4000 □

3. >4001 □

PART VII: FOOD ACCESS INFORMATION (Household Food Insecurity Access Scale)

No	Questions	Response	code
1.	In the past four weeks, did you worry that your household would not have enough food?	0=No(skip to Q2) 1=Yes	
1.a	How often did this happen?	1= rarely (once or twice in the past four weeks) 2= sometimes (three to ten times in the past four weeks) 3= often (more than ten times in the past four weeks)	
2.	In the past four weeks, were you or any household members not able to eat the kinds of foods you preferred because of a lack of resources?	0= No (skip to Qt3) 1=Yes	
2.a	How often did this happen?	1= rarely (once or twice in the past four weeks) 2= sometimes (three to ten times in the past four weeks) 3= often (more than ten times in the past four weeks)	
3.	In the past four weeks, did you or any household member have to eat a limited variety of foods due to a lack of resources?	0= No (skip to Qt4) 1=Yes	
3.a	How often did this happen?	1= rarely (once or twice in the past four weeks) 2= sometimes (three to ten times in the past four weeks) 3= often (more than ten times in the past four weeks)	
4.	In the past four weeks, did you or any member have to eat some foods that you really did not want to eat because of lack of resources to obtain other types of food?	0= No (skip to Qt5) 1=Yes	
4.a	How often did this happen?	1= rarely (once or twice in the past four weeks) 2= sometimes (three to ten times in the past four weeks) 3= often (more than ten times in the past four weeks)	
5.	In the past four weeks, did or any household member have to eat a smaller meal than you felt you needed because there was not enough food?	0= No (skip to Qt6) 1=Yes	
5.a	How often did this happen?	1= rarely (once or twice in the past four weeks) 2= sometimes (three to ten times in	

		the past four weeks) 3= often (more than ten times in the past four weeks)	
6.	In the past four weeks, did you or any other household member have to eat fewer meals in a day because there was not enough food?	0= No (skip to Qt7) 1=Yes	
6.a	How often did this happen?	1= rarely (once or twice in the past four weeks) 2= sometimes (three to ten times in the past four weeks) 3= often (more than ten times in the past four weeks)	
7.	In the past four weeks, was there ever no food to eat of any kind in your household because of lack of resources to get food?	0= No (skip to Qt8) 1=Yes	
7.a	How often did this happen?	1= rarely (once or twice in the past four weeks) 2= sometimes (three to ten times in the past four weeks) 3= often (more than ten times in the past four weeks)	
8.	In the past four weeks, did you or any household member go to sleep at night hungry because there was not enough food?	0= No (skip to Qt9) 1=Yes	
8.a	How often did this happen?	1= rarely (once or twice in the past four weeks) 2= sometimes (three to ten times in the past four weeks) 3= often (more than ten times in the past four weeks)	
9.	In the past four weeks, did you or any household member go a whole day and night without eating anything because there was not enough food?	0= No (questionnaire is finished) 1=Yes	
9.a	How often did this happen?	1= rarely (once or twice in the past four weeks) 2= sometimes (three to ten times in the past four weeks) 3= often (more than ten times in the past four weeks)	

8. PART XIII: MARKETING

8.1 Which market (s) does your household use?_____

8.2 What means of transportation do you use to take your produce to the market?_____

1. Pack animals □ 2. Vehicles □ 3.Human □ 4. Others specify _____

8.3 What is the average market distance you traveled to nearest market from your home? Measured in kilo meter? 1. One-fifteen Mk □ 2. Sixteen-thirty Mk□

9. PART IX: CREDIT SERVICES AND REMITTANCE

9.1 Have you received any type of credit for the last couple of years? 0. Yes □ 1. No □

9.1.1 If yes, from where do you get the credit?_____

1. Local money lender □ 2. Friends and relatives □ 3.NGOs □4. Commercial bank of Ethiopia □ 5. Micro-finance □ 6. Others specify_____

9.2. Have the household received remittance in this year? 0. Yes □ 1. No □

9.3. If yes, the amount in birr/year.

1. 500-1000 □

2. 1001-2000 □

3. >2000 □

10. PART IIX: SHOCKING AND COPING MECHANISMS

10.1 What coping mechanisms do you use when you have food shortage at your home to have enough food? Rank the given option according to how you prioritize them.

S/No	Coping mechanisms	Ranking
1	Borrowed cash or grain	
2	Sold firewood	
3	Sold livestock	
4	Consume seed from stock	
5	Migrated to look for job	
6	Gathering wild fruit/food	
7	Eat fewer meals per day/ reduced quantity of food per meal	
8	Fishing	
9	Sell milk and milk product	
10	Prepared local wine	
11	Others_____	
12		

10.2 did you receive any food aid in year 2019? 0. Yes □ 1. No □

10.2.1 If yes, specify the types of food aid. 1. Cereal grain □ 2. Oil □ 3. Others_____

10.2.2 If yes, what is amount of food supply per household is provided (quintal/Kg)

S/No	Crop	Amount/unit
Kg/liter		
1	Maize	
2	Wheat	
3	Oil	