Rural Households' Resilience to Food Insecurity in Southern Ethiopia:

The Case of Boricha *Woreda* in Sidama Zone

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The Case of Boricha *Woreda* in Sidama Zone

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This is to certify that the thesis prepared by Adane Atara entitled: Rural Houeholds' Resilience to Food Insecurity in Southern Ethiopia: the case of Boricha *woreda* in Sidama Zone and submitted in fulfillment for the requirement for the degree of Doctor of Philosophy (Rural Development) complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

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Declaration

I, the undersigned, declare that this PhD dissertation is a result of my research investigations and findings. Sources of information other than my own have been acknowledged and a reference list has been appended. This work has not been previously submitted to any other university for award of any type of academic degree.

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Abstract

This dissertation concerns rural household's resilience to food insecurity. It explores three interrelated questions: sources of rural household's resilience to food insecurity, food security status, and household's coping mechanisms. The study is based on cross-sectional field survey conducted by involving 420 households and key informants interview. It adapted sequentially explanatory mixed-method-research strategy. Stratified sampling coupled with simple random and systematic sampling methods were used to draw a sample from study population. PCA, ANOVA, descriptive statistics (mainly percentage), and Chi-square test were employed to analyze the data. PCA revealed that while all turned to be significant, income and food access, agricultural assets, and agricultural technology adoption are the three resilience dimensions toping in terms of contribution to the study area households' resilience to food insecurity. Though the majority of the surveyed households (61%) are non-resilient in general, the inter livelihood zones based analysis revealed that the household's resilience vary based on the livelihood systems. In this regard, the result of ANOVA shows significant effect, i.e., F-ratio is significant at $F(2, 417) = 4.991$, $p < 0.001$. With regards to food security, the analysis of HFIAS revealed that 62.4% of the served households have food insecurity situation that runs from 'moderate' to 'severe'. On the other hand, the analysis of FCS showed that 42.4% of the surveyed households have food security situation of below 'acceptable' threshold. Insights from key informants revealed that the combination of factors has contributed to the food insecurity problem of the Woreda including erratic rain, land fragmentation, and population pressure. The ANOVA, which was meant to see if food security situation is the same across livelihood zones, consistently indicated existence of statistically significant differences in mean food security scores both in the case of HFIAS for $F(2, 417) = 15.046$, $p < 0.001$ and FCS for $F(2, 417) = 6.626$, $p < 0.01$. The study's finding also indicated that households used a multitude of consumption based coping strategies that run from compromising quality of food by eating less preferred foods to food rationing. Repeatedly occurring food shortage has also forced some households to use some of the resilience erosive coping strategies such as selling reproductive assets, oxen, and even selling and/or renting out land holdings. The study also revealed the existence of statistically significant relationship between the nature coping strategies utilized in response to previously happened food insecurity related shocks and household's resilience to food insecurity with $\chi 2 (1) = 98.149$, $P < 0.001$. Policy implications emerging from this study

includes 1) making protection of the livelihood assets of the households among the targets of food insecurity problem based intervention. In context, this requires encouraging woreda level concerned offices to report the true picture of food security situation and making humanitarian food aid to play a role in reducing disposal of productive asset 2) promoting and supporting income and /or livelihood diversification of the households, and 3) most importantly addressing the problem of land fragmentation by carefully planning and implementing alternative employment opportunities for the youth as a long run solution. Job categories such as animal fattening, poultry, rural grain mills, construction materials such as sand mining, and providing skill acquisition based training that enable the rural youth to get employment in urban areas and in industries and facilitating employment then after are among the options to consider. Strengthening and making the local development institutions such SDC, SDA, SMFI and the like to work with their full potential is commendable as they can support the concerned line Government Offices such as Sports and Youth Bureau in this regard. This policy option has a role of decreasing the youth's demand for parent's land and hence contributing to have resilient smallholders.

Key words: Resilience, Food Security, Coping Strategy, Livelihood Zone

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List of abbreviations

ANOVA	Analysis of Variance
CSA	Central Statistical Authority
DA	Development Agent
FAD	Food Availability Decline
FAO	Food and Agricultural Organization
FCS	Food Consumption Score
FED	Food Entitlement Decline
HFIAS	Household Food Insecurity Access Scale
ILO	International Labour Organization
DFID	Department for International Development
DRMFSS	Disaster Risk Management and Food Security Sector
MDGs	Millennium Development Goals
OXFAM GB	Oxford Committee for Famine Relief Great Britain
MKC-RDA	Meserete Kirstos Church Relief and Development Association
MOFED	Ministry of Finance and Economic Development
SNNPR	South Nations Nationalities and Peoples Region
TANGO	Technical Assistance to Nongovernmental Organization
TLU	Tropical Livestock Unit
USAID	United States Agency for International Development
rCSI	Reduced Coping Strategy Index
SDA	Sidama Development Association
SDC	Sidama Development Corporation
SMFI	Sidama Microfinance Institution
WFP	World Food Program

Chapter 1: Introduction

1.1. Background of the study

We live in the world where millions experience worries about the very basic thing needed for the survival of human beings: the food. Decades back, this "*immoral state of affairs*" in the words of Degefa (2005) has invoked global concern that led to the emergence of the concept of food security. Food security emerged as an issue of importance in the mid-1970s at the World Food Conference of 1974, which was initiated in response to the global food crisis during this time (Clay, 2002). Since then, it has remained to be among the center of concern and attention for global, national, and local communities and institutions, as achieving food security remains to be a challenge at all level. As implicated in Degefa (2005) and Messay (2015), this is not because the world has entirely been impoverished to the level of not producing enough food. According Degefa (2005), the world has already attained the status of sufficiently producing enough food to feed every individual on this planet since long ago. Messay (2015:12) also underlines this position with statement that "There has been concern for over half a century about the high prevalence of hunger and malnutrition in a world that has the capacity to feed its people." However, significant proportion of the world's population still lives under the situation of varying level of food insecurity. In line with this, the report of FAO *et al.* (2015) shows that the world hosts about 795 million undernourished people of which 232.5 million constitute the Africa's share. The close examination of the report further indicates that food insecurity is particularly severe in the Sub-Saharan part of Africa. It hosts around 95% (or 220 million) of food insecure people of the continent (Africa), which is about 28% of the food insecure people of the entire globe.

Ethiopia is among the countries in Sub-Saharan Africa which has been repeatedly mentioned in connection with food insecurity problem. This can be evidenced from various sources and research works. For instance, Mwaniki (2005) and FAO (2010) in Shishay and Messay (2014) puts Ethiopia among the range of nations with shocking food security where daily calorie intake is below 2,100 kcal/person/day. According to Befekadu and Berhanu (2000:176) cited in Devereux (2000), the country has been structurally food deficit since at least 1980. The emergency food security assessment practice review of Haan *et al*. (2006) shows that frequent

occurrence of rainfall failure has caused food shortage since 1983 and the consequent need for food assistance was observed for millions of people in the country. According to Haan *et al*. (2006), for the year 2002/3, food assistance requiring people had reached 12.5 million.

Getnet (2007:120) shows increasingly unfavorably widening gap between national food availability per head per year and the minimum requirement, the food required to meet the minimum calorie need, between 1962 and 2001. According to Getnet (2007:120), in 1962, the food availability per head per year lagged behind the minimum requirement by 51 Kg/head/year and this gap ascended to 132 Kg /head/year in 2001. While underlining the depth of problem, Desalegn (2008:136) also says "the government now admits that rural food insecurity is a structural problem, and that in times when conditions are poor, up to 15 million people will face severe food shortage." Workneh (2008) on his part argues that food insecurity is wide spread both in urban and rural areas though the magnitude of intensity of the problem is higher in rural areas. In a way that buttresses this, Dorosh et al. (2011) report the undernourishment prevalence of 45% for rural Ethiopia, for the cutoff of 1,990 kilocalories/ day, for the year 2004/05.

Devereux (2000) also argues that both chronic and transitory food insecurity are endemic in Ethiopia. Similarly, the Bill and Melinda Gates Foundation report (2010) says, concentrations of food insecurity and malnutrition are endemic specially in rural areas of the country, with a population of six to seven million chronically food insecure, and up to 13 million seasonally food insecure. The joint report of WFP and CSA (2014) also indicates the persistence of poverty and food insecurity despite the long way the country has come in reducing them. The report reveals that in 2010/11, over 30% of the country's population lives below food poverty line. For the same period, MOFED (2014) reported the national level food poverty prevalence as 33.6% and estimated it to be 31.8% for the year 2012/13.

The SNNPR, the region where the current study area is located, has also been implicated in the report of WFP and CSA (2014). Accordingly, in the region, about 22% of the total households live below food poverty line. Similarly, the report of MDG (2014), which was released in 2015 by National Planning Commission and the United Nations in Ethiopia, reported the region's food consumption poverty as 25.9%. Sidama Zone is one of the 13 zones in the region and is located towards the east sharing borders mostly with the Oromia Zones (West Arsi, Bale, and Guji).

Currently, it is divided into 19 *woredas* and 3 self-administered towns. Boricha *woreda* is among 19 *woredas* of Sidama Zone in southern Ethiopia. It is one of the chronically food insecure *woredas* in the Sidama zone (Zeleke *et al.,* 2016) and is known for repeatedly occurring food insecurity shocks. For instance, Quinlan *et al.* (2016) reported that Boricha had a recent history of periodic drought leading to famine in 1998–1999, 2001, 2003, and 2008.

From the foregoing paragraphs, it is possible to draw that food insecurity has remained to be the most widespread problem many people are facing. Addressing problems of such magnitude requires collaborative and concerted efforts of various parties such as policy makers, practitioners, and scholars. When it comes to academics, for long, most scholarly research works in the field of food security has focused on development and refining of the methods of analysis that improves prediction accuracy of the likelihood of experiencing future loss of adequate food, i.e., vulnerability to food insecurity (Lovendahl *et al*., 2004 cited in Alinovi *et al.* ,2010). Vulnerability analysis tends to measure the susceptibility of people to damage when exposed to particular hazards or shocks. As described in Hoddinott and Quisumbing (2010) cited in (Hoddinott, 2014), vulnerability stands for the likelihood that at a given time in the future, an individual will have a level of welfare below some norm or benchmark. The emphasis of the other players such as international and local level nongovernmental organizations (NGOs) too has not been different as implicated in (Frankenberger and Nelson, 2013) though the focus in this case is more on addressing humanitarian crises.

However, more recently, a new organizing concept called resilience to food insecurity has emerged and is gaining wider attention. It aims at measuring the capability of systems such as households to absorb the negative effects of unpredictable shocks, rather than predicting the occurrence of a crisis. Recognizing the attention this new concept is gaining, Constas and Barrett (2013) says, the rapid and widespread embrace of the resilience concept by various parties indicates how it is being taken as one of the key solutions to poverty and food insecurity. Resilience refers to the ability of the household to maintain a certain level of well-being (for example, food security) withstanding shocks and stresses, depending on the options available to the household to make a living and its ability to handle risks (Alinovi *et al*. ,2010). Frankenberger and Nelson (2013) link the emergence of resilience approach to the recurring

crises in the Horn of Africa, the Sahel, and parts of Asia over the last few decades. Citing USAID (2011) the source says, despite meeting short-term humanitarian needs regarding survival, large-scale emergency interventions that are made in response to such crises have not substantially improved regional or local capacity to withstand future shocks and stresses. As pointed in Headey and Kennedy (2012) cited in Fan *et al.* (2014), humanitarian activities in response to shocks have saved lives, but in many cases they have done little to help communities withstand the next shock that comes along.

As a result, the concept of resilience has emerged as a plausible framework for improving capacity to withstand future shocks and stresses, and reducing the need for humanitarian response (Frankenberger and Nelson, 2013). According to Interagency Resilience Working Group (2012: 2) in Constas and Barrett (2013), the concept of resilience recognizes that current approaches to managing risks in development planning, peace-building and humanitarian response are disjointed and that better collaboration is required on analysis, planning, and implementing support for resilience-building. The concept of resilience seems to offer promise as a way out not only to address the challenges raised by shocks, but also to link short-term humanitarian efforts with longer-term development activities and to ensure that long-term development programs consider short-term vulnerabilities (Fan *et al.*, 2014. The source adds that building resilience means helping people, communities, countries, and global institutions prevent, anticipate, prepare for, cope with, and recover from shocks and not only bounce back to where they were before the shocks occurred, but become even better-off.

In relation to food security, one of the major innovations this framework has brought is the insight that addressing food insecurity problems in a given context requires understanding the sources and dynamics of resilience of a particular entity, such as households, to food insecurity shocks and stressors. This has the benefit of focusing attention on the capabilities that someone currently posses, leading to the policy direction of capitalizing on one's present capacity and resources in the attempt of improving its resilience to future food insecurity shocks.

1.2. Problem statement

Food insecurity is a global problem the world is struggling to address since decades back but still far away from a decisive victory. In this regard, FAO (2016) says despite undeniable progress in reducing rates of undernourishment and improving levels of nutrition and health, almost 800 million people are chronically hungry and about 2 billion suffer micronutrient deficiencies. It further predicts that the world will host about 653 million undernourished people even in 2030 if no additional efforts are made to promote pro-poor development. As mentioned in the previous section, Ethiopia has remained to be food insecure for long. Irrespective of the long distance the country has travelled in reducing food insecurity (WFP and CSA, 2014), ensuring food security still remains to be among top national agendas. Boricha *woreda* of Sidama Zone is one of the areas within the country that suffers from repeatedly occurring food insecurity shocks and is the site of intense relief efforts including food and development aid in recent years (Quinlan *et al.* 2016).

Resilience has emerged as a new approach to food insecurity analysis and focuses on the capability of systems such as households to absorb the negative effects of unpredictable shocks. Currently, it is rapidly and widely embraced by various parties and is being taken as one of the key solutions to poverty and food insecurity (Constas and Barrett, 2013). Though, this approach is increasingly gaining due attention by various parties, many things remain to be sufficiently clear. For instance, it is not sufficiently clear how the concept itself can be measured (Vaitla *et al*., 2012:5) cited in (Constas and Barrett, 2013), what indictors will be used, and how various indicators can be combined to be informed on the resilience level of an entity, such as a household. Though resilience appears to be conceptually appealing and highly promising to seek long term solution to food insecurity problems affecting a handful proportion of our population, as long as my knowledge is concerned, only very meager studies (Maxwell *et al.,* 2013, Mulat and Negussie 2013, Mulugeta 2014, Guyu and Muluneh, 2015) can be found addressing the issue relating to household's resilience to food insecurity in Ethiopia.

The study of Maxwell *et al.* (2013) was confined to the Tigray region in the northern Ethiopia and has made sense of resilience indirectly only. The focus was mainly on the determinants of

dynamics of food security and tracking dynamics of livelihood assets accumulation and loss. Mulugeta (2014) focused on pastoralists and relied on households' own assessment of resilience. With this approach in use, neither the multidimensional aspect of resilience can be captured nor can the individual household's resilience level be informed on. Mulat and Negussie (2013) based their study on the survey data covering few villages in central Ethiopia and treated households' resilience as latent variable represented by four directly observable household level variables. The objective of their study was to identify the determinants of sustainable resilience to food and nutrition insecurity. This study adapts the model that better captures the complexity of resilience as a multidimensional concept and becomes more informative by producing resilience scores indicating individual household's resilience level. However, as they used some of the theoretical constituents of resilience for its measurement and others as its determinants, the distinction between two set of variables remains vague and disputable. Moreover, given the context of rural households in our country, it can be argued that the set of variables representing household's resilience to food insecurity are broader than the four component items employed in their study.

Guyu and Muluneh (2015) analyzed households' resilience to seasonal food insecurity and identified its building blocks in the "green famine belt" in north-western Ethiopia, Benshagul Gumz region, using factor analysis. They also compared resilience status of indigenous and non-indigenous ethno-culture groups though the comparison lacks statistical rigor. In terms of making sense of households' resilience to future food insecurity shocks, their approach is similar to that of Mulat and Negussie (2013) but with incorporation of more number of variables.

However, none of the above mentioned studies has covered the focus area of the current study: Sidama zone in general and Borcha *woreda* in particular. I believe that it is commendable to have additional studies that fill the flanks of the existing ones by extending coverage both area wise ,as resilience is context specific (FAO, 2014), and in terms of issues to be addressed. The study area contains diverse agro-livelihood zones that runs from cash crop focused one to agro-pastoralists. The current study argues that approaching resilience as multidimensional concept is more appropriate and hence it is worthy to have a study that informs how each livelihood zone performs along various dimensions of resilience in addition to identifying the sources of resilience to household's food insecurity in general. When it comes to food security and household's responses in the event of food insecurity, multiple studies (Bechaye, 2011, Zeleke

et at., 2016, Negatu, 2011, Tsegaye, 2014) have previously covered the study area of the current study. With regards to food security, with the exception of Bechaye (2011), such studies lack bringing the livelihood differences into picture. However, the finding of Bechaye (2011) lacks statistical rigor as the observed differences in terms of average may not show the real differences among livelihood groups. The observed differences among livelihood groups should have been statistically proved by applying appropriate statistical tests. Moreover, though widely discussed at conceptual level (Frankenberger *et al*. 2012, Carter *et al*. 2006, Tran, 2013, LIFT and USAID, 2011), studies that empirically investigating the linkages between the way households cope with food insecurity shocks and their resilience to future food insecurity is scarcer even at wider geographic contexts.

Hence, considering these aspects of the previous studies, the well heralded promises of resilience as a way out to food insecurity challenges, and study area's food insecurity problem, the current study has made an endeavor to understand the rural household's resilience to food insecurity by addressing the research questions presented hereunder.

1.3. Research questions

With the backdrop of discussions in the previous section, this study aims to empirically address the following research questions.

Research questions:

1. What does the study area rural households' food security situation look like?
2. How do the study area rural households respond to food insecurity shocks? Does the resilience level of households vary based on previously employed coping mechanisms?
3. What are the sources of study area rural households' resilience to food insecurity? Does the resilience level of households vary based on agro-livelihood systems (zones)?

1.4. Research objectives

The overall objective of this study is to examine the rural households' resilience to food insecurity, food security situation, and response mechanisms in the event of food insecurity.

More specifically, it attempts to:

- analyze the rural household's food security situation.
- examine livelihood systems based differences in household's food security situation.
- assess the coping mechanisms of households in the event of food insecurity.
- identify sources of resilience to rural household's food insecurity.
- examine livelihood systems based differences in the level of household's resilience to food insecurity.
- understand the level of association between household's resilience and their food security/insecurity situation.
- analyze the relationship between nature of previously employed coping mechanisms and resilience level/status of the households.

1.5. Significance of the study

Currently, the promises of resilience as a way to address the poverty and food insecurity challenges are being widely preached. Given such promises, understanding the core of household's resilience to food insecurity in particular context is of a paramount theoretical and practical relevance. The audiences of the study, accordingly, include academicians, policy makers, and nongovernmental actors of development such as local NGOs. The results and findings of the research will, thus, benefit all of these audiences.

From theoretical point of view, the study is value adding as it contributes to the existing literature of resilience and food security in multiple ways. Firstly, it identifies sources of households' resilience to food insecurity in context. Resilience is context specific concept (FAO, 2014). That is, context is important for resilience study as factors contributing to the household's resilience to food insecurity in one livelihood context may not do the same for others even within one country or region. In this regard, the current study extends the frontier of extant literatures on resilience empirically. The study also employees wider bases of variables in estimating both resilience and its indicators and ties the analysis of resilience to food insecurity with agro-livelihood systems by comparing mean differences in resilience to food insecurity across livelihood groups employing theoretically more appropriate analytical model for such analysis. Moreover, it produces empirical evidence on the relationship between nature of previously used coping strategies of the households and their resilience status. Lastly, the study plays the role of

inspiring further research on resilience to food insecurity by pointing out the knowledge gap for future studies. In this regard, it serves as a spring board for future researches.

The study also provides picture of the study area's situation to the attention of policy makers, development practitioners and institutions, and other local actors who want to address food insecurity problems through building resilience at local level. Specifically, it generates information on sources and level of the households' resilience to food insecurity. Through the analysis of inter livelihood resilience, it identifies both the strong and weak areas of the livelihood zones along resilience dimensions. It also brings food security situation of the study areas as well as the contributing factors into picture. In general, the study points out the possible area of intervention for resilience building, livelihood protection, and food security ensuring efforts.

1.6. Scope and limitation

The current study considers households resilience and food security analysis only at household level and only at one point in time. As it is cross-sectional study, it has not examined the dynamics of resilience and food security. Moreover, because of the absence of time lag between data on resilience and food security situation, the study has not empirically established a causal link between observed resilience scores of households and their food security situation. That is, testing the theoretical proposition that households with higher resilience score at time T1 would score better on food security indicators at time T2 taking into account shocks/stressors happened in between T1 and T2 is not attempted due to cross-sectional nature of the study. Households respond to food insecurity problems using diverse strategies: a temporary response to the declining situation of food security called coping strategies and a permanent change in the mix of ways in which food is acquired called adaptive strategies. With the interest of making the study manageable scope wise, the current study focuses only on uncovering coping strategies of the study households. Hence, examining the adaptive strategies is not among the focus areas of the current study. Scope wise, the study is also limited to household level. That is analyzing resilience and food security at community as well as individual level is not the study's focus. Moreover, only Boricha *woreda* has been taken as case unit in the current study. Though, this helped the study to be the focused one and still informative enough, it leads to the missing out of Sidama-Enset-Barely-Livelihood-zone when it comes to inter-livelihood resilience analysis.

1.7. Ethical consideration

In the course of this undertaking, an appropriate acknowledgment and citation have been made for any concepts or ideas taken from the literatures. Moreover, no pressure or inducement of any kind was exerted to encourage an individual to become a subject of research. Also, concerned local authorities (administration offices) were informed about the research and their consent was secured before data collection. That is, a letter requiring cooperation of concerned parties in the study area were collected from Addis Ababa University and presented to both Sidama Zone and Boricha *woreda* agriculture offices for getting their consent. Finally, no information revealing the identity of any individual respondents has been included in this final report without their prior consent.

1.8. Thesis organization

This report of the study is organized into six chapters. The first chapter, the current one, is introductory chapter that sets the overall ground for the study. Chapter Two discusses literatures related to issues of the current study and provides general analytical framework for the study. The overall methodology including research philosophy of the study has been discussed in Chapter Three. Chapter Four and Five present the analysis and discussion of empirical findings related to the research objectives. Accordingly, Chapter Four presents the analysis and discussion on food security situation and coping mechanisms of the households. The chapter begins with providing the picture of the respondents' characteristics. Then, food security/insecurity situation of the households has been determined using HFIAS and FCS, first separately and then through cross classification. This is followed by inter-livelihood zones or systems based analysis of food security/insecurity of the households. Finally, the discussion turns to the coping strategies employed by households in the event of food insecurity. Both consumption based and other, non-consumption based, coping strategies of the households are covered. Chapter Five, on the other hand, presents findings and discussion on household's resilience. First, sources of the households' resilience to food insecurity have been discussed. This is followed by examination of inter-livelihood differences in the households' resilience to food insecurity and determination of the resilience status of the households. The chapter ends by providing brief discussion on the nexus between the nature of previously employed coping strategies and resilience level of the households. Finally, Chapter Six presents summary, conclusions and policy recommendations.

Chapter 2: Literature Review

2.1. Conceptual and theoretical underpinnings

2.1.1. Systems thinking and households as social-ecological systems

Resilience Alliance (2010) underlines that resilience is fundamentally a systems property. Similarly, Pisano (2012) argues that idea of resilience and resilience thinking is rooted in systems thinking. In systems thinking, system is conceptualized as a set of interdependent or interrelated parts that works as a unitary whole. A system comprises subsystems in it and is a subsystem to other larger systems. Its performances such as proper functioning, effectiveness, and even survival depends on how synergistically its components or subsystems are functioning, as well as, on how the larger systems to which it is a part or the broader environment is behaving and functioning.

Social-ecological systems is systems fitting to this conceptualization and is based on the notion that humans (social systems) and nature (ecological systems) are not isolated and independent systems rather the two are interdependent ones (Walker and Salt, 2006 cited in Pisano, 2012). In explaining such interdependency and social-ecological systems' linkage to resilience thinking, based on insights from Walker and Salt (2006), Pisano (2012:6) provides three concepts to be noted:

> (1) humans live and operate in social systems that are inextricably linked with the ecological systems in which they are embedded; (2) social-ecological systems are complex adaptive systems that do not change in a predictable, linear, incremental fashion; and (3) resilience thinking provides a framework for viewing a social-ecological system as one system operating over many linked scales of time and space. Its focus is on how the system changes and copes with disturbance.

Emphasizing the interdependence of the human and natural systems, Folke *et al*. (2002:1) cited in Pisano (2012:10), also says:

> ----natural and social systems behave in nonlinear ways, exhibit marked thresholds in their dynamics, and … social-ecological systems act as strongly coupled, complex and evolving integrated systems.

In Resilience Alliance (2010), social-ecological systems has been described as the one in which cultural, political, social, economic, and ecological components interact; it emphasizes the human-in-nature view in which human society is integrated with ecosystems.

Embarking on the conception of systems, systems thinking, and social-ecological systems, it can be argued that a household**,** whose resilience to food insecurity is a concern in the current study, can be viewed as systems in general, and social-ecological systems, in particular. This way of looking at household goes in line with Alinovi *et al*. (2010), which treats households as systems by themselves and subsystems to broader food systems, which is a social-ecological systems. In showing how characterization of household as systems fits to the general notion of systems, Alinovi *et al.* (2010: 10) quotes the definition of a household given by Spedding (1988: 18), which describes a household as *"*a group of interacting components, operating together for a common purpose, capable of reacting as a whole to external stimuli: it is affected directly by its own outputs and has a specified boundary based on the inclusion of all significant feedback*"*. Alinovi *et al*. (2010:10) further describes a household as a unit where various important decisions are taken. Stated in their words,

> ---- it is the unit within which the most important decisions to manage uncertain events, both ex ante and ex post, including the ones affecting food security, are made: for example, what income generating activities to engage in, how to allocate food and non-food consumption among household members, what strategies to implement in order to manage and cope with risks, etc.

2.1.2. Resilience thinking/theory

Pisano (2012) underlines the relevance of resilience thinking for understanding social-ecological systems by arguing that resilience provides a framework for viewing a social-ecological systems as one system operating over many linked scales of time and space. Resilience thinking focuses on how the systems changes and copes with disturbance. The concept of resilience is argued to be originated in the field of ecology as a measure of the persistence of systems and of their ability to absorb change and disturbance and still maintain the same relationships with state variables (Holling, 1973: 14) cited in (Pisano, 2012). Consistent with this position regarding the original home of resilience concept, Folke (2006) says the resilience perspective emerged from ecology in the 1960s and early 1970s through studies of interacting populations like predators

and prey and their functional responses in relation to ecological stability theory. However, according to Hoddinott (2014), its earliest usage goes back to 19th -century shipbuilding, and for long it has been used extensively in civil and mechanical engineering. This has the implication that resilience is an engineering concept too.

When conceptualized from engineering resilience point of view, systems resilience reflects the ability of the systems to return to the steady-state after a perturbation (Pimm, 1984, O'Neill *et al*. 1986, and Tilman *et al*. 1994 all cited in Alinovi *et al.* 2010). According to Folke (2006) & King (2008), engineering resilience focuses on behavior near a stable equilibrium and the rate at which a systems approaches steady state following a perturbation, i.e. the speed of return to equilibrium. According to Alinovi *et al.* (2010), engineering resilience focuses on efficiency, constancy, and predictability and it is the concept which engineers turn to in their attempt to develop optimal designs ("fail-safe" designs).

From engineering resilience perspective, systems assumed to exist close to a stable or equilibrium steady state, and its resilience is measured by resistance to disturbance and the speed of return to the steady state following a perturbation (King and Powell, 2000 in King 2008). According to King (2008), researchers who explore systems behavior near a known stable state, i.e. near-equilibrium behavior, operate deductively in the tradition of mathematical theory that imagines simplified, untouched ecological systems and draws on the engineering discipline which is motivated to design single operating systems, i.e. optimal design. This way of viewing systems resilience is grounded within a positivist epistemology, where scientists aim to develop an objective understanding about an ecological system making a couple of assumptions (King, 2008).

From ecological stand point, resilience stands for the amount of disturbance that systems can absorb before shifting into an alternative state (Holling, 1973) cited in (Hoddinott, 2014). In Walker *et al.* (2004), ecological resilience has been described as the capacity of systems to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feed-backs. The explanation of resilience vis-à-vis sensitivity, in the context of land resource management, by Blaikie & Brookfield (1987) in Degefa (2005) also reflects ecological line of conceptualizing resilience. Alinovi *et al.* (2010)

argues that both the engineering as well as ecological resilience basically stress on the capacity of a system to retain its function following disturbance or shock. That is, both deal with the stability of system equilibria but with different views of the reality: as engineers want to make things work while ecologists recognize that things can be breakdown and change their behavior (Alinovi *et al*., 2010).

The ecological way of conceptualizing systems resilience sounds more appealing for the analysis of the resilience of social and/or social-ecological systems such as food systems and household, a subsystem to food systems, as it recognizes the fact that things may change from one state of affairs to another. However, Folke (2006) proposes another and as argued in it more holistic way of conceptualizing system's resilience: what he calls social-ecological resilience. In comparing these ways of conceptualizing resilience and based on insights from (Folke, 2006), Pisano (2012), argues that engineering resilience is too narrow and the focus is on maintaining efficiency of function, constancy of the system, and a predictable world near a single steady state; it is all about resisting disturbance and change. Continuing its arguments, the Pisano (2012), says ecological view of resilience is very much linked to ecosystems. Hence, according to Pisano (2012), a very useful way of conceptualizing resilience in social systems such as household's resilience to food insecurity is through the lens of social-ecological resilience. The concept of resilience in relation to social–ecological systems incorporates the idea of adaptation, learning and self-organization in addition to the general ability to persist (Folke, 2006).

Drawing from Carpenter *et al.* (2001), Pisano (2012) describes social ecological resilience in terms of three crucial characteristics: the amount of disturbance systems can absorb and still remain within the same state or domain of attraction; the degree to which it is capable of self-organization; and the ability of systems to build and increase the capacity for learning and adaptation. Viewing from social ecological resilience angle, it can be said that the proper functioning and survival of social /social- ecological systems depends less on the stability of its individual components than on the system's ability to maintain its self-organization in the face of stress and shock; in other words, on its resilience. Systems with low resilience may still maintain its functions and generate resources and services - that is, it may seem to be in good shape – but when subject to disturbances and stochastic events, it may exceed or cross a critical threshold and change to a less desirable state (Alinovi *et al*., 2008, and Alinovi *et al*., 2010).

To bring ideas together, based on systems thinking (theory), one can say that a household/s is a social systems/or social-ecological systems as viewed from "human- in- nature perspective" and based on resilience thinking, it can be learned that persistence and self (re)-organizing ability of social/social-ecological systems in complex and dynamic environment depends largely on its resilience. Now the question is what is the source of systems resilience? I do not risk proposing universally applicable answer to this question. So it would be safe to say that it all depends on nature of systems. In a way that supports this point Alinovi L. *et al.* (2010:9) say: "Key sources of resilience lie in the requisite variety within functional groups. Examples include biodiversity in critical ecosystem functions, flexible options for management, norms and rules in human organizations, cultural and political diversity in social groups…."

With regard to household systems, literatures do suggest various elements as sources of a household's resilience to shocks in general and to food insecurity in particular. Constas and Barrett (2013), in their work that outlines resilience theory for poverty and food insecurity and principles for resilience measurement, argue that well-being dynamics, including how households respond to stressors or shocks, depends partly on their initial conditions or basic conditions. They define household's resilience to poverty and food insecurity as: " the likelihood over time of … a household or other unit being non-poor and food secure in the face of various stressors and in the wake of myriad shocks. If and only if that likelihood is and remains high, then the unit is resilient". They argue for the need to recognize state-dependence in resilience assessment and contend that the likelihood of being or becoming poor or food insecure, which is failing to be resilient in this context, must be estimated or inferred with reference to the initial or basic condition of the household. They identify this basic condition as a composite of indices such as food security index, assets index, social capital index, access to services index, ecological factors and health and also provide a room for consideration of other local or contextual factors.

There are also other theories and frameworks, though not originally meant directly for resilience, which can be embarked on in looking for theoretical explanation to the question of sources of resilience to household's food insecurity. Two of these may be Sen's Entitlement Theory and sustainable livelihood framework. As argued in Flaherty (2014), in the context of Sen's framework, food insecurity results from a cumulative collapse of entitlements. Hence, based on

Sen's theory, one may argue that household resilience to food insecurity rests on entitlements and the collapse of entitlements: such as an inability to grow subsistence food (direct entitlements), an inability to exchange labor or property on the market (indirect entitlements), or an absence of adequate systems of public relief and social security (transfer entitlements) can hamper a household's level of resilience. Accordingly, factors relating to these various form of entitlements can be linked to resilience.

Alinovi *et al.* (2010), talk about the value of combining resilience approach and the sustainable livelihood framework for the analysis of households' resilience to food insecurity. According to Alinovi *et al.* (2010), the contribution of the livelihood framework lays on singling out the different livelihood strategies of different socio-economic groups. Identifying different livelihood strategies makes it possible to analyze different level of resilience to food insecurity achieved by various livelihood groups as well as the different strategies pursued by such groups in order to gain resilience to food insecurity. Davies (1996) in Degefa (2005) also provides a good insight in this regard while explaining the concept of sensitivity and resilience by linking with livelihood strategies/systems. With the recognition that the livelihood systems pursued by households can have different level of resilience and sensitivity, the source implies that livelihood systems with low resilience and high sensitivity can easily shrink to undesirable food security state when interferences occur.

Cassidy and Barnes (2012), on the other hand, argue that the level of livelihood assets, a component in the sustainable livelihood framework, gauge the size of buffer that households have against shocks such as drought and disease. Linking livelihood frameworks to resilience, Frankenberger *et al.* (2012) argue that households and communities are more capable of dealing with shocks and stresses when they have more than one way of earning a living, access to sufficient livelihood assets, access to formal and informal governance structures, and social/cultural norms that enable manifesting adaptive capacity. Based on the arguments of the sources mentioned here, one can say that both the livelihood assets as well as livelihood strategies of a household can relevantly be linked to or considered as resilience sources at household level.

2.1.3. Concepts and theories of food security

2.1.3.1. The concept of food security

Over the years, several definitions have been forwarded to the concept of food security. Smith *et al.* (1992), for instance, have documented about 194 definitions of food security. However, the definition that appears in FAO (2000) is generally considered as more comprehensive one. FAO (2000) conceptualizes food security as a situation that occurs when "all people, at all times, have physical, social, and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life". According to Devereux (2004), the opposite of food security is food insecurity and hence people who do not satisfy the conditions in this definition are considered food insecure. Degefa (2005) underlines the importance of people's own perception in food security/insecurity definition and defines food insecurity, at household level, as the fear of being unable to sufficiently feed household members all year round. According to the Degefa (2005), such fear emerges from various situations of a household such as lack of information, past experiences in relation to hazards, social position in a society, and current circumstances. This way of conceptualizing food insecurity/security too is not at odds with the FAO's definition mentioned here except its emphasis on the importance of subjective views and evaluation of households about their own food security status when it comes to assessment.

Cognizant of the FAO's definition, literatures such as Gross *et al.* (2000), LIFT and USAID (2011), Upton *et al.* (2015), Tawodzera (2010), and Barrett, (2010), Pieters et al., (2013) and, Sasi, (2015) in Dula and Degefa (2017) identify four dimensions or components of food security: availability, access, utilization, and stability. According to Gross *et al.* (2000), availability is achieved if adequate food is ready to have at people's disposal. It refers to the physical existence of food, whether from the household's own production or from markets: domestic or international. Hoddinott and Yisehac (2002) consider availability as a measure of food that is, and will be, physically available in the relevant vicinity of a population during a given period. According to USAID (1992) and Goitom (2017), the availability requirement is met when sufficient quantities of appropriate and necessary types of food are consistently available either from domestic production, commercial imports, aid programs, or food stocks to individuals.

Access is ensured when households and individuals within those households have sufficient resources to obtain appropriate foods for a nutritious diet (Gross *et al.*, 2000, Hoddinott and Yisehac, 2002). Having adequate assets or incomes to produce, purchase or exchange to obtain appropriate foods required to maintain consumption of adequate diet represents the access component of food security (USAID, 1992). Individuals or households obtain food through own food production and consumption including wild food gathering, purchases in the market place, or in-kind transfers or loans from relatives, members of the community, the government, or foreign donors private citizens (LIFT and USAID, 2011, Smith *et al*., 2000). In general, the ability of an entity, household or individual, to access food from these sources is determined by a number of factors such as their asset endowment, the social, economic, policy, physical, and natural environments, which define the set of productive activities they can pursue in meeting their income and food security objectives (LIFT and USAID, 2011).

LIFT and USAID (2011) discusses the utilization component of food security by relating to the actual food that is consumed by individuals; how it is stored, prepared, and consumed; and what nutritional benefits the individual derives from consumption. According to LIFT and USAID (2011), food utilization has both a socio-economic dimension - decisions related to what food is consumed and how the food is allocated within the household and biological dimension- the ability of the human body to take food and transform it into energy for daily activities or to store it for future energy needs. Gross *et al.* (2000) also link utilization with the ability of the human body to ingest and metabolize food considering nutritious and safe diets, an adequate biological and social environment, a proper health care to avoid diseases as basic to ensure adequate utilization of food. Nutrient losses due to factors like knowledge gap in food preparation, nutrition, child care, and sanitation as well as cultural practices that limit consumption of a nutritionally adequate diet by certain groups or family members are deemed to be constraints to adequate utilization of food (USAID, 1992).

The fourth component of the food security implicated in the definition, which means stability, cuts across the other three components. It refers to the temporal dimension, or time-frame, of food security as implied by the phrase *"at all times"* in the above definition. Insights from the stability dimension of food security have brought the convention of seeing food insecurity in

terms of transitory and chronic perspectives (World Bank, 1986 and Reutlinger, 1987 in Alem, 2007, Maxwell and Smith, 1992, LIFT and USAID, 2011, Degefa, 2001). According to these sources, chronic food insecurity refers to the continuous/or persistent inability to meet food needs, while transitory food insecurity is a short-term food shortfall. Also there is a tendency to divide transitory food security in to two sub-classes: cyclical food insecurity and temporary food insecurity (CIDA, 1989 in Meseret, 2013). Cyclical (seasonal) food insecurity occurs periodically more or less on a predictable basis such as the 'lean season' that occurs in the period just before the harvest. Temporary food insecurity occurs for a short duration due to unforeseen and unpredictable conditions. Though conceptualized as distinct, the two types of food security are closely related as one has the potential of inducing the other. For instance, successively occurring transitory food insecurity or stress can increase households/individuals vulnerability to chronic food insecurity by making them to erode their assets to cope with such stress (Maxwell and Smith, 1992).

2.1.3.2. Food security theories

With the advancement of the food security concept/issue to the mainstream development agenda, there comes various theories or approaches that provides explanation on different aspects of it such as how and at what level should its analysis, measurement and focus be. As argued in Burchi and De Muro (2012) this, the way food security is theorized, measured, and finally analyzed, is important as it affects the typology of policies to be adopted. Some of these theories of food security have been briefly discussed below.

2.1.3.2.1. Food Availability Decline

Food Availability Decline (FAD) is considered as the oldest and still functional theory whose origin is, arguably, traced back to Thomas Malthus's work of 1789. As it goes in Malthusian tradition, the focus of this theory is on the (dis)equilibrium between population and food and argues that in order to maintain the equilibrium, the rate of growth of food availability should not be lower than the rate of growth of population (Burchi and De Muro, 2012).

However, Degefa (2005) disaggregates the FAD theory into two set of theories: climatic theories that links food shortages with natural calamities such as flood and draught and demographic theories that focuses on the nexus between food availability and population growth. The climatic

theories link food insecurity with such natural causes like drought and flood. According to Degefa (2005), climatic variables can lead to famine, specially, in rain –fed agricultural areas by causing crop failure, as well as, by adversely affecting other assets of livelihood among subsistence farmers.

Degefa (2005) points out the existence of two divergent and competing theories regarding the relationship between population growth and food availability. The first one focuses on comparing the relative pace at which population and food or means of subsistence increases and argues that while population grows 'geometrically', production and means of subsistence increase only 'arithmetically' with the clear outcome of such imbalance is inducing hunger and other forms of human poverty and misery. This outlook falls in the line of Malthusian thinking and a bit criticized by writers like Devereux (1993) in Degefa (2005) for its failure to foresee the mediation effect of technological improvements such as production, distribution, and communication technologies. This, the claimed, loophole of the Malthusian theory has given impetus for the emergence of alternative views regarding the population and food availability linkage: the Marxist line of thinking that associates food insecurity with the structure of society and the theory of Ester Boserup that argues for the positive effect of population on agricultural production. As indicated in Degefa (2005), Boserup (1965) sees population growth as a force leading to adoption and diffusion of technological innovation that expands agricultural production, thereby reducing vulnerability to food insecurity and hunger. As they stand at opposite poles, the Malthusian and Boserupian line of thinking may lead to different policy suggestions when it comes to the questions of which side of the food equation, supply or demand, the focus of the food security ensuring effort be.

Though there exist such divergent views under it, food security in the context of FAD theory in general is a matter of aggregate or per capita food availability (Alamgir, 1980 in Degefa, 2001, Burchi and De Muro, 2012) and the focus is merely on food production or supply side variables (Deverux, 1993 and Sen, 1981 in Tagel, 2012). According to Burchi and De Muro, (2012), achieving availability depends mainly on food production and stocks and also through food trade in the context of open economy. In terms of the level of analysis, the focus of food availability theory is at macro level including the whole globe, a nation or particular sector such as

agricultural sector. When it comes to measurement, Food Balance Sheet is a commonly utilized tool for food availability assessment (FAO, 2001 in Burchi and De Muro, 2012).

2.1.3.2.2. Income based approach

Income-based approach emerged as a critique to FAD whose focus is, as claimed, narrowly on the agricultural production. The FAD approach has been criticized for losing a sight about the interdependent nature of various sectors of the economy and viewing food insecurity as the problem of agricultural sector/production alone (Burchi and De Muro, 2012). In effect, the income based approach broadens the analysis of food security by shifting the attention to national economies as a whole and by bringing into the analysis such variables as Gross Domestic Product (GDP) and economic growth.

Moreover, it has brought a shift from food availability at macro-level to income at micro-level. Here, food insecurity is implicitly assumed as a sub-category of poverty, often referred to as "food poverty", representing lack of enough income necessary to buy at the given conditions the amount of food required. In particular, the different food items are converted into calories and if people's calorie availability is lower than a threshold identified by international nutritionists, they are considered food insecure (Sibrian *et al*., 2007 and Sibrian, 2008 both cited in Burchi and De Muro, 2012). With this, the level of analysis of food security is stretched down to the individual and/or household level with income and expenditure approach being a means of estimating the calorie level consumed. However, the problem with this approach is the difficulty of getting reliable income or expenditure data in the subsistence agricultural economy where people get part or all of their food from own production (Maxwell and Smith, 1992). A related problem of income based approach as argued in Burchi and De Muro (2012) is that it requires making several assumptions to logically move, step-by-step, from income or expenditure to food security. That is, to move from income/expenditure to food though price per unit information; then from food to calorie through equivalence tables; and lastly, from calorie availability to food security/insecurity depending on the threshold.

2.1.3.2.3. Basic needs/food first/ approach

The basic needs approach emerged in 1970s as alternative to 'growth models' for dealing with poverty and inequality (Degefa, 2005). According to Burchi and De Muro (2012), this approach was proposed by the International Labor Organization (ILO) as new model of development. For

the proponents of the basic needs approach, development is a process aiming at the satisfaction of basic needs of all people.

Though, the list of basic needs outlined by various authors varies slightly, food has emerged as the dominant basic need under this approach. This can be evidenced from the argument of Magrabi *et al.* (1991: 65) cited in Burchi and De Muro (2012) that "food is a basic need – probably the most basic need of all". The Maslow's Need Hierarchy Theory based assertion of Handy (1985:30) quoted in Maxwell & Smith (1992:28) as "Lower order needs are dominant until satisfied, whereupon the higher order needs come into operation … if you are starving, your needs for esteem or status will be unimportant; only food matters" and the argument of Hopkins (1986:4) also quoted in Maxwell & Smith (1992:28) as "--- Access to necessary nutrients is fundamental, not only to life per se, but also to stable and enduring social order" can also be regarded as arguments supplementing the primacy position that food holds relative to other human needs. Generally, the basic needs based discourse in development literature has heavily affected the debate on food security by giving birth to what is called *food first* view (Burchi and De Muro2012).

This approach considers food as a dominant basic need and priority element of food security. The framework focuses directly on whether people eat enough food and with this it contributed for further shifting of the analysis of food security from national/macro level to micro-level. The food security analysis methods such as food frequency assessment, direct observation of food consumption, and dietary diversity score fall under this framework and both individuals and households can be used as unit of analysis in the approach (Burchi and De Muro, 2012).

Comparing this view with the income based approach discussed above, Burchi and De Muro (2012) contends that the food first approach focuses on the commodity we are interested in, the food, rather than the income needed to buy a food and this, focusing directly on what is actually eaten, in turn avoids the problem arising from underestimation of the food grown at home. However, this approach draws attention to short-term food security: it tells us whether households have enough food to feed all its members in a given time, or, eventually, in the past as has been argued in (Burchi and De Muro, 2012).

2.1.3.2.4. Entitlement approach

According to Degefa (2001), the origin of this approach, which is also considered as Food Entitlement Decline (FED) in (Maxwell and Smith, 1992), is traced back to the work of Sen (1981). It emerged as an alternative to FAD and argues that food availability in the economy or in the market does not necessarily entitle a person to consume, and famine can occur without decline in aggregate food availability (Degefa, 2005). Sen (1981:45) describes this approach as "The entitlement approach concentrates on each person's entitlements to commodity bundles including food, and views starvation as resulting from a failure to be entitled to a bundle with enough food." In the context of this theory, food insecurity can be conceptualized as the result of entitlement failure. In a way of affirming this view Sen (1981:7) says "--- starvation --- is a function of entitlements and not of food availability as such." An entitlement failure such as an inability to grow subsistence food (direct entitlements), an inability to exchange labor or property on the market (indirect entitlements), or an absence of adequate systems of public relief and social security (transfer entitlements) (Osmani 1999 in Tincani, 2012, Flaherty, 2013) may result in food insecurity. According to Burchi and De Muro (2012), the groups that mostly face direct entitlement failure are food-producers and those who are exposed to trade /or indirect/ entitlement failures are producers of commodities other than food: when their terms of exchange fall or when the total availability of food declines.

Though it was primarily meant for the analysis of famine (Burchi and De Muro, 2012), the entitlement approach has significantly affected the notion of food security and contributed for food security analysis by adding the access dimension. With this comes the belief that having enough food per capita at national level can only be a necessary condition but not sufficient condition for food security. Hence, making a food security assessment needs widening the informational basis by incorporating variables related to people's endowments such as productive and non-productive assets, intangible resources such as education and social capital as well as information on wage, and other prices of food and non-food items (Burchi and De Muro, 2012). With this framework, food security assessment can be conducted at micro level and both individuals and households can be the unit of analysis. This approach is also appreciated for its capacity to provide information on the future vulnerability to food insecurity as it considers full set of assets or resources.

2.1.3.2.5. Sustainable livelihoods approach

Sustainable Livelihood Framework (SLF) is general approach to the analysis of development issues such as poverty and food security. According to Burchi and De Muro (2012), the emphasis on livelihood started in the 1980s by Chambers (1983) who introduced the basic elements of this approach, with a focus on rural development and poverty. Ellis (2000:10) cited in Devereux (2004) conceptualizes livelihoods as "the assets (natural, physical, human, financial and social capital), the activities, and the access to these (mediated by institutions and social relations) that together determine the living gained by individual or household." Chambers (1988) cited in Maxwell and Smith (1992) defined livelihood as adequate stocks and flows of food and cash to meet basic needs and linked sustainability with the maintenance or enhancement of resource productivity on the long term basis. A more comprehensive definition of sustainable livelihood is found in Chambers and Conway, (1991, p.6) in LIFT and USAID (2011:8) and Chambers and Conway (1992) in WFP (2009: 24) which says:

> "A Livelihood comprises the capabilities, assets (stores, resources, claims, and access) and activities required for a means of living: a livelihood is sustainable which can cope with and recover from stress and shocks, maintain or enhance its capabilities and assets, and provide sustainable livelihood opportunities for the next generation; and which contributes net benefits to other livelihoods at the local and global levels in the short and long term."

The sustainable livelihood framework is more comprehensive approach as it includes the main tents of other approaches such as basic needs and entitlement approaches. It focuses both on gaining the living or necessities of life like basic needs approach and on means of securing living as the case in entitlement approach (Burchi and De Muro, 2012). At the core of SLF is assets commanded by a household, which are very similar to the concept of "endowments" in the entitlement approach. The assets are classified into five categories: natural capital, physical capital, human capital, financial capital, social capital (Ellis, 2000 in Juma, 2009, LIFT and USAID 2011, Burchi and De Muro, 2012, Maxwell and Smith, 1992,). The SLF also explicitly gives attention to the broader context such as political, economic, physical, social, and cultural and is also known for its long term perspectives. These features of it together with the consideration of household assets mentioned here has brought about three interrelated concepts to the analysis of food security: the concept of vulnerability, the idea of sustainability, and

coping strategies that represent a set of activities that are undertaken by a household in response to shocks affecting food availability. The framework enables assessment of food security at micro level and household and community is the commonly used unit of analysis (Burchi and De Muro 2012).

2.1.3.2.6. Disaster based theory of food security

Disaster based theory was developed by Blaikie *et al.* (1994) cited in Degefa (2005) and Yasir (2009) and it was mainly meant for the analysis of vulnerability. The theory treats food insecurity as a disaster and argues that natural hazards cannot cause a disaster of food shortage unless combined with other human factors (Degefa, 2005). It argues that for disaster to happen there must be vulnerable people whose livelihood cannot withstand certain kinds of hazards (Degefa, 2005). According to Yasir (2009), disaster theory centre on the organized complexity of the interactions between natural hazards and human / institutional actions.

There exist two variants of disaster theories: pressure and Release (PAR) Model and Access Model. As cited in Degefa (2005: 79), Blaikie *et al.* (1994: 22) explained the notion of PAR as "The basis for the PAR idea is that a disaster is the intersection of two opposing forces: those processes generating vulnerability on one side, and physical exposure to a hazard on the other. The 'release' idea is incorporated to conceptualize the reduction of disaster." According to Yasir (2009) PAR Model emphasizes on the identification of various forces and their interactions at the macro level and the need to trace out the progression of vulnerability from the root causes to resultant unsafe conditions and their interaction with natural hazards. In the context of PAR, disaster, food insecurity in the context, is the outcome of the interaction between hazards and vulnerability, which in turn is produced by interaction between three factors: 'root causes' of a disaster, 'dynamic pressure', and the resultant 'unsafe conditions' in a way that dynamic pressures channeling root causes into unsafe conditions (Degefa, 2005). According to Degefa (2005), the root causes that give rise to vulnerability, are economic, demographic, and political processes having hands on the allocation and distribution of resources between different groups of people. They can affect the level of rural household's vulnerability to food shortage either by providing or denying equal access to resources such land, for instance. The focus of Access model is on explaining how the unsafe conditions arise in relation to the economic and political processes that allocate assets, income, and other resources in a society (Degefa, 2005, Twigg,

2001). The main argument is that, individual's or household's relative access to resources is a function of class structure in a society and hence ones position within the society or community can determine its access to resources which in turn determine its level of vulnerability to hazard impact.

2.1.3.2.7. Human development and capability approach

This is an approach proposed by (Burchi and De Muro 2012) based on, as they claim, insights from '*Hunger and Public Action'* book of Dreze and Sen (1989). The writers provide the following as the major innovations of the capability approach to food security (P: 18):

> By switching the focus from "command over food" to "nutritional capabilities," this approach goes beyond the "access" dimension of food security – that is the main concern of the basic needs, entitlement and sustainable livelihood approaches– and includes also the "utilization" dimension.

They further argue that, by analyzing the phenomenon through the three steps, the capability approach situates the food security study within the broader topic of wellbeing. In explaining what makes this approach distinct from the other existing frameworks, the writers further say (P: 27):

> The analysis of food security through the capability approach allows a more comprehensive examination of the phenomenon. While the income-based approach would take income as focal variable, the entitlement/capability approach provides information on how income is used to ultimately reach the capability to be food secure depending on personal and external conversion factors, food choices and behaviors. Unlike the food-first approach, the capability approach takes into account the quality, utilization and social acceptability of food, and the interaction with other basic capabilities such as health and education.

As a path to food security analysis under this framework, they proposed a three step procedure (Table 2.1): 1) analysis of '*food entitlements',* 2) analysis of '*basic capabilities'* for food security, and 3) analysis of the '*capability to be food secure'*. They argue that each phase implies adding a new informational basis, new variables, and new dimensions for the food security analysis.

According the Burchi and De Muro (2012), food entitlements analysis phase is necessary to collect information on the three key components of entitlements: endowments, exchange conditions, and production possibilities to examine whether people have currently, and probably in the near future, access to enough food for survival. This phase, according to writers, covers or yields information only on access and stability dimension of food security.

The second phase focuses on analysis of some basic capabilities and takes into account other factors beyond food entitlements. According to Burchi and De Muro (2012), the second phase moves the analysis of food security further from access to food to a broader analysis of basic capabilities such as, being free from hunger, in a good health, educated, and able to take part in household decision making and community life. As argued in Burchi and De Muro (2012), this phase provides information on access to food & other food security-related items plus stability dimensions of food security.

The final phase in the analysis involves the analysis of "capability to be food secure" and according to Burchi and De Muro (2012), it is a more complex capability which depends on the interaction among "basic capabilities" that lay foundational ground for it. When it comes to the meaning of this capability, the writers claim that their interpretation of the concept is close to the definition of "capability to be adequately nourished" of Dreze and Sen 1989. According to them, enjoying all the basic capabilities is only necessary condition but not sufficient to be able to be food secure. Hence, the food security analysis process should collect further data on the *utilization* of food. This requires securing information on the nutrition knowledge of the person, the quality and variety of the diet, and possibly on hygienic and cooking practices. With regards to informational base, it is given by the interaction between the capability of being free from hunger with the capabilities of being in a good health and being educated. In addition, it depends on food utilization and cultural/social acceptability. Under this framework, food insecurity is linked not only with lack of assets or purchasing power but also with lack of other basic capabilities that constitute people's wellbeing such as education and access to health care without disregarding cultural acceptability of food. In terms of food security dimension, this phase represents access to food and other food security-related items, Stability & Utilization.

Table 2.1: Pathway for operationalizion of capability approach to food security

Steps	What is Measured	Food security Dimension	Informational basis	Variables
1	Food Entitlements	Access to food + Stability	Endowments	-Employment status, type of employment, large set of assets (mainly livestock, land and house related assets), right/legal claim to public provision of food or income transfer from the state. -For the stability dimension: variation of endowments and strategies (coping strategies, adaptation)
			Exchange conditions	Wages from primary and secondary income generating activity, price of different food items/groups and prices of other goods and services.
			Production possibilities	Professional skills
2	Basic Capabilities	Access to food and other food security-related items + Stability	Being free from hunger, this also depends on another set of variables: personal conversion factors, Institutional conversion factors, and Environmental conversion factors.	-Quantity of food, food groups, calorie intake, -Sex, age. -Law, rules, norms, -Climate, frequency of natural disasters.
			Being educated	School enrolments, educational achievements, literacy, participation to adult literacy courses and other non-formal education programs.
			Being in a good health	Access to health services, sanitation, morbidity to main diseases, self-reported health status.
			Being able to take part in household decision making and community life	Participation in household decision making, participation in community life
3	Capability To Be Food Secure	Access to food and other food security-related items + Stability + Utilization	Given by the interaction between the capability "being free from hunger" with the capabilities "being in a good health" and "being educated". In addition, it depends on food *utilization* and *cultural/social acceptability*	-Diet quality, diet diversification, nutrition knowledge, hygienic practices. -Testes, cultural and religious beliefs with respect to food products.

Source: Adapted from Burchi and De Muro 2012

The theories or frameworks just reviewed above focus on one or more components of food security embedded in the food security definition of FAO (2000). Though, it seems comprehensive in terms covering most components, the newly proposed 'human development and capability approach' of (Burchi and De Muro, 2012) remains imprecise and data intensive as

it calls for collecting data on entitlements, other basic capabilities or indicators of human development, and nutritional and related aspects of food utilization. Also, it is not quite clear how these multiple data sets can be combined so as to produce a figure representing a particular entity's, such as household's, 'capability to be food secure'.

As a way out to a framework selection dilemma for a food security study, Degefa (2001) underlines the complementarities of frameworks/or models/ and argues for the value of mixing them. Mindful of this argument, the study at hand prefers not to stick to a single approach and rather it prefers to focus on selecting the assessment method that tries to, at least implicitly, encompass the major tents of food security definition found in FAO (2000). I argue that it is logical to think in terms of how to, at least tangentially, incorporate the major dimensions of food security for a study whose primary objective is to determine the household's food security status. Moreover, it is not insensible to think this way as the food security theories just reviewed link their explanation to one or more of the four dimensions of food security definition just mentioned here.

For instance, the food availability decline (FAD) theory can be mainly linked to the "*Availability*" dimension of food security which is embedded in the concept of "*sufficiency*" or "*enough food"* mentioned in (Maxwell and Smith, 1992). The approaches like food entitlement decline (FED), the basic needs approach or its extension the *food first* view, and the income based approach can be viewed as more of "*Access*" dimension focused food security theories. The sustainable livelihood framework comprehensively addresses most of the issues that all other theories deal with as argued in Degefa (2005) hence both the "Availability" as well as the *"Access"* components can be said a part of the broader issues covered under this approach. The human development and capability approach of (Burchi and De Muro, 2012), which has been argued for its comprehensiveness again, is claimed to cover not only the *"Access"* but also the *"Utilization"* dimension of food security together with the cultural/social acceptability of food though it remains imprecise as argued in the previous paragraph. The fourth dimension of the food security definition of the (FAO 2000), *"Stability ",* has remained to be the concern of all theories reviewed here.

Hence, for the current study, the theories reviewed here are, one way or the other, important in terms of providing insights, mainly through guiding the selection of household's food security

status assessment tools to be discussed latter. However, the insights from livelihood strategies of the sustainable livelihood framework have been found to be uniquely important for the analysis of between livelihood systems variations of the household's food security/insecurity situation.

2.1.3.3. Measuring household's food security /Food security indicators/

Abduselam (2017) says food security is a complex notion that is virtually impossible to measure directly. Barrett (2010) in Maxwell *et al.* (2013) argues for focusing food security measurement on the four major "pillars" of food security—availability, access, utilization, and risk, which is also alternatively labeled as stability or vulnerability. Similarly, Coates and Maxwell (2012) cited in Maxwell *et al.* (2013) notes that the most desirable measures of food security, if available, would be a single measure that is valid and reliable, comparable over time and space, and which captures different elements of food security. However, despite the efforts made in looking for such a measure for decades, no single measure emerged as comprehensive enough to meet these criteria (Maxwell *et al.,* 2013 and Upton *et al.,* 2015).

For example, per-capita caloric intake that was considered as the "gold standard" for access to food at the household level (Hoddinott and Yohannes 2002, Weismann *et al*., 2006, and *Coates et al.,* 2007) cited in (Maxwell *et al.*, 2013) reflects current consumption in terms of quantity but does not address many other elements of the complicated notion of food security such as quality, vulnerability and risks, and fluctuations and trends in consumption over time as argued in (Maxwell *et al.,* 2013). The absence of a 'holy grail' indicator in the words of (Maxwell *et al.,* 2013) seems to have lead to the proliferation of food security measurement indicators over the past few decades. For example, Frankenberger (1992) have presented several food security indicators (summarized in the next few paragraphs), that have been proposed overtime, under the caption of process indicators ,which reflect both supply and access, as claimed in the source here, and those serving as proxies for food consumption: the outcome indicators.

Frankenberger (1992) argues that the availability or the supply of food to obtain in the area is one of the critical dimensions of household's food security. Accordingly, one way of sensing about household's food security situation is through the indicators of food supply in a given area or nation as a whole. According to Frankenberger (1992), indicators under this category include such things as inputs and measures of agricultural production (agro-meteorological data), access

to natural resources, institutional development and market infrastructure, and exposure to regional conflict or its consequences such as influx of refugees. The food balance sheets, the principal tools used for calculating national food security (Davies *et al*. 1991a in Frankenberger, 1992) and the FAO's crop specific soil water balance model (Frankenberger, 1992) also fall under the food supply indicators of food security. Frankenberger (1992) also notes that the indicators mentioned here are not mutually exclusive of food access indicators, and considerable overlap and interaction between the two categories may exist in household level food security analysis. Though, they have a potential of providing general cues about food security situation in a given area, region, or nation, I argue that, these supply focused indicators seems to have little value in terms of dissecting between households regarding the level of food security experienced.

Under food access related process indicators, Frankenberger (1992) lists various forms of coping strategies as measures of household's food security. The idea is that it is possible to make sense of whether a particular household has experienced food insecurity or not and the level of food insecurity that it is experiencing based on the response actions of the household itself. Though each coping strategy can convey something about a household's food security situation, further systematizing efforts aimed to make various coping strategies, specially consumption based ones, to speak in combined manner through one indicator have resulted in what is called the coping strategy index (CSI).

Frankenberger (1992) considers such indicators like on food expenditure budget, household perception of food security, food frequency assessment data, storage estimates, subsistence potential ratio, and nutritional status assessment data as proxy indicators of food consumption. The writer considers these indicators as outcome indicators of household food security. With on food expenditure method, the total on food expenditure data of a household is converted into calorie equivalent. First, using the data gathered through budget expenditure surveys, the money spent on food by household or individual is determined. Then, data on food expenditures are converted to calories using price per unit and calorie per unit conversion factors (Kumar, 1989 in Frankenberger, 1992). However, this indicator is usually blamed for the underestimation of on food expenditures as it overlooks the value of food produced at home or locally gathered (Frankenberger, 1992).

Household's perception as food security indicator, on the other hand, relies on the opinions of households regarding their food security status (Frankenberger, 1992). However, it is arguable as to whether such indicator captures best the consumption aspect of food security or sufficiency (access and availability) aspect when it comes to household food security. Food frequency indicator, on the other hand, relies on the collection of minimum amounts of food consumption data. According to O'Brien-Place and Frankenberger (1988) cited in Frankenberger (1992), food frequency data inquiries are supposed to focus on a limited number of food items, which are aggregated by food groups, and ask for the frequency of consumption of food items rather than the quantity of consumption.

O'Brien-Place and Frankenberger (1988) cited in Frankenberger (1992) argues that estimates of food in storage during critical times of the year can give some indication of a households food security status, especially in communities that produce much of their own food. However, the problem of this approach is that some people may be reluctant to discuss food in storage due to cultural beliefs, or may obscure how much food is in storage by having food distributed in more than one location. The subsistence potential ratio, another outcome indicator as claimed, on the other hand is an indicator that measures the households' ability to feed itself to its need to feed itself (Whelan ,1983 cited in Frankenberger,1992). That is, it compares the amount of food, calculated in energy, which a household can produce over a year with the energy requirements of the entire household for the year. Determining the ratio requires data on size of farm, expected yield, and age and sex composition of household (Frankenberger, 1985 cited in Frankenberger 1992) and works best in communities that produce most of their own food (Frankenberger 1992). However, its reliability is down to the availability of correctly recorded food items production data, something that can be rarely available in rural context of developing countries.

The nutritional status assessment based indicator is believed to capture the utilization dimension of food security as it involves using anthropometric data for measuring food consumption. The anthropometric measures are mainly used for the assessment of the prevalence of malnutrition in a population by measuring the nutritional status of a random sample of children under five and the weight for age and height for age are widely used in nutrition surveillance programs

(Frankenberger, 1992). Though, nutritional status assessment with anthropometric measures as indicators of household food security is among the popular measures, as argued in Frankenberger (1992), there are a number of fundamental conceptual problems associated with its use. One of such problems is that as factors such as health status, sanitation, mother-care, and the level of activity of the individual can influence nutritional status outcomes (O'Brien-Place and Frankenberger, 1988 in Frankenberger, 1992), it does not always correlate directly with food availability and access. Another problem of this indicator is, though counter argued by (Young and Jaspars, 1991 in Frankenberger, 1992), that anthropometric measures are often a late indicator of food crises (Borton and York, 1987 in Frankenberger, 1992). That is, there is a time lag between food shortages and changes in body size and composition (Galvin, 1988 in Frankenberger, 1992).

One thing that can be learned from discussions in the above paragraphs, even if comprehensive review of indicators have not been made here, is that there is no single comprehensive measure of food security to rely on when it comes to food security assessment in general and at household level in particular. This is mainly because of the multidimensional nature of food security concept as Maxwell *et al.* (2013:12) meticulously put it: *"*The World Food Summit definition of food security, adopted and widely promoted by FAO, contains several key elements, or dimensions, each of them difficult enough to measure separately, but nearly impossible to measure in totality using any single indicator.*"* Hence, the measurement of food security can obviously be more of a compromised one rather than absolutely perfect. Such a compromise can usually be a particular framework or theory moderated. However, in the situation where the theories themselves do focus only on one or the other aspect of the concept under consideration, as is true in the case of food security, the choice will be between fixating to a particular framework and measuring the aspect of a concept emphasized by it or trying to take a combined view of theories and finding indicators that cover their tents to the extent possible. When the choice is the later one, as is the case in the current study, the central meaning of the concept to be measured or under consideration, in effect takes the lead in guiding the measurement indicators selection. In the case of the current study, however, this doesn't preclude the role of the theories as the food security theories themselves focus on one or more dimensions of food security concept.

Coates (2013) cited in Maxwell *et al.* (2013) has provided a disaggregated descriptions to the major elements/dimensions of the food security definition which says *"*Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life*"* (FAO, 2000; World Food Summit, 1996 in Maxwell *et al.,* 2013). According to Coates (2013) cited in Maxwell *et al.* (2013:12), the components embedded in the definition are: Quantity or Sufficiency (implied in the phrase … physical and economic access to sufficient…); Quality or Diversity (represented by a phrase…nutritious food that meets dietary needs…); Acceptability (embedded in the word …preferences…); Safety (linked to terms …safe…food); and Stability (implied in the phrase …at all times…).

Cognizant of these components of food security that a given measure is ought to capture, Maxwell *et al.* (2013) have examined about seven indicators in terms of the dimensions of food security that each captures using an empirical work on northern Ethiopia. The indicators include coping strategy index (CSI), reduced coping strategy index (rCSI), household food insecurity access scale (HFIAS), household hunger score (HHS), food consumption score (FCS), household dietary diversity score (HDDS), and self assessed food security (SAFS). They are argued for being rapid, accurate, and cross-contextual indicators of food security and for being mostly correlated individually with calorie based indicators in terms of identifying food security status (Maxwell *et al.*, 2013).

Maxwell *et al.*, (2013) have also identified the food security dimensions that each indicator appears to capture (Table 2.2) and empirically tested the extent of correlation between indicators or their component questions in terms of capturing the dimensions they are thought to capture. With their food security conceptualization driven testing of these indicators empirically, they learned that all of these indicators are well correlated in a manner that suggest they are all capturing some element of the multidimensional notion of food security/insecurity. They further claim that not only does each existing indicator capture different elements of food insecurity, but also the component questions of each, to some degree, capture differing elements of a more-nuanced understanding of food security**.** They have also underlined the value of combining these

indicators so as to avoid possible misclassification of households with regard to food security status and even further proposed what they call it multidimensional food security indicator (MFI): a single instrument or indicator formed by combining the non-redundant component questions of the individual indicators.

Mindful of the suggestion regarding the insufficiency of a single indicator, the current study have decided to use HFIAS, FCS, and rCSI) from among the seven listed in (Maxwell *et al*., 2013). HFIAS has been selected for its relative dimensional richness compared to others and the FCS for making sense of utilization aspect of food security as its component questions are tuned towards capturing nutritional diversity. The rCSI has been added as a supplement to cross validate the findings of the former two through examination of how the findings of the two individually correlate with the finding of the rCSI.

Table 2.2: Summary of food security dimensions captured by HFIAS, HHS, FCS, HDDS CSI, rCSI, SAFS

Indicators	Component questions	Dimensions of food security it measures
SAFS	Self-assessed food security during past 30 days	Stability
CSI/rCSI	In the past month, how often has the HH had to rely on less preferred or less expensive food?	Acceptability
CSI/rCSI	In the past month, how often has the HH had to borrow food, or rely on help from a relative?	Quantity
CSI	In the past month, how often has the HH had to purchase food on credit?	Quantity
	In the past month, how often has the HH had to gather wild food, hunt, or harvest immature crops?	Quantity
	In the past month, how often has the HH had to consume seed stock held for next season?	Quantity
	In the past month, how often has the HH had to send HH members to eat elsewhere?	Quantity
	In the past month, how often has the HH had to send HH members to beg?	Quantity
CSI/rCSI	In the past month, how often has the HH had to limit portion size at mealtimes?	Quantity
CSI/rCSI	In the past month, how often has the HH had to restrict consumption by adults in order to allow children to eat?	Quantity
CSI/rCSI	In the past month, how often has the HH had to reduce the number of meals eaten in a day?	Quantity

CSI	In the past month, how often has the HH had to skip entire days without eating?	Quantity
HFIAS	In the past 30 days, how often did you worry that your household (HH) would not have enough food?	Stability
	In the past 30 days, how often were you or any HH member not able to eat the kinds of foods you preferred?	Acceptability
	In the past 30 days, how often did you or any HH member have to eat a limited variety of foods?	Quality/Diversity
	In the past 30 days, how often did you or any HH member have to eat foods you did not want to eat?	Acceptability
	In the past 30 days, how often did you or any HH member have to eat a smaller meal than you felt like you needed?	Quantity/ Sufficiency
	In the past 30 days, how often did you or any HH member have to eat fewer meals in a day?	Quantity /Sufficiency
HFIAS/ HHS	In the past 30 days, how often was there ever no food in your HH?	Quantity/Sufficiency
	In the past 30 days, how often did you or any HH member go to sleep at night hungry?	Stability
	In the past 30 days, how often did you or any HH member have to go a whole day without eating?	Quantity /Sufficiency
FCS/HDDS	In the past month, how often has the household eaten any food made from grain (**Grain**)?	Quality/Diversity
	In the past month, how often has the household eaten any tubers (**Tubers**)?	Quality/Diversity
	In the past month, how often has the household eaten any pulses? (**Pulses**)	Quality/Diversity
	In the past month, how often has the household eaten any vegetables (**Vegetables**)?	Quality/Diversity
	In the past month, how often has the household eaten any fruits (**fruits**)?	Quality/Diversity
	In the past month, how often has the household eaten any meat, fish (**Meat**)?	Quality/Diversity
	In the past month, how often has the household eaten any dairy products (Dairy)?	Quality/Diversity
	In the past month, how often has the household eaten any sugar or honey (Sugar)?	Quality/Diversity
	In the past month, how often has the household eaten any oils, fat, or butter (Oil & Fat)?	Quality/Diversity

Source: Adopted from Maxwell *et al.*, (2013)

2.1.4. Households' coping mechanisms/strategies

Households do employ different coping strategies when facing shocks that challenge their food security. Devereux (2001) in Mjonono (2008) defines coping strategies as a response to adverse events or shocks. According to Ellis (2000) cited in Mjonono (2008), coping strategies comprises

the methods used by households to survive when confronted with unanticipated livelihood failure. In Fiseha and Degefa (2017), they have been described as responses by households to improve the declining situation of their food security. As rational decision takers, households do make a selection of such responses based on conscious assessment of the existing alternatives before them. In this regard, Devereux, (1993) and Ellis (2003) both cited in Mjonono (2008) say that within the limited options available to households, the households are asset managers with freedom of choice in relation to their actions. However, such actions, coping strategies in this context, may not always be successful in achieving the intended results. Rather, as argued in Mjonono (2008), they often have unintended effects.

In relation to this, Tran (2013) argues that adverse events (shocks) have the possibility of causing a decline in assets and incomes in the short-run and might have negative effects on household livelihoods in the longer-run. However, the extent of effects, according to Tran (2013), depends on the nature of shocks, the asset dynamics, as well as on coping strategies employed by a household in response to the shock. Carter *et al*. (2006) maintain that when a particular shock occurs, it affects the households assets/resources/ and in effect their resilience to future shocks both directly and indirectly. Firstly, the shock itself causes damages to or deterioration of assets quality directly. The indirect effect is through household's responses to such shocks. The idea is that the coping strategies employed following a particular shock at time (T1) can cause a decline in the household's ability to cope with or resilience to the future shocks that could occur at time (T2) depending on the coping strategies employed in between this two time period. This way of conceptualizing the shock, coping strategies, and resilience nexus is well endorsed by Frankenberger *et al*. (2012) with the argument that some household level responses can have negative and permanent consequences on resilience. In a way of relating coping strategies to resilience, Pasteur (2011) in Frankenberger *et al.* (2012) classifies household coping strategies into two categories: positive and negative coping strategies. Positive coping strategies are those that households use based on available skills and resources and that will not diminish their future ability to cope even if they are used to the level of their exhaustion. They include using stored assets such as savings, extra food, and excess livestock. Pasteur (2011) in Frankenberger *et al.* (2012) labels such strategies like eating less, eating less nutritious food, delaying medical treatment, taking children out of school, exploiting natural resources, and eroding productive

assets as negative coping strategies as they undermine future options, making it more difficult to cope with the next shock or stress.

Carter *et al*. (2006) puts the households' actions to cope with shock induced challenges on their wellbeing such as food security in a stage by stage order. First, households rely on the markets and other institutions to which they have access. Households with financial market access or access to informal finance might borrow against future earnings to sustain their consumption standard without further asset depletion. Insurance arrangements, disaster assistance receipt as well as increasing work time are also coping options that can be exercised before taking action against assets. According to Carter *et al*. (2006), households without access to such options may opt to sustain their consumption by drawing down on their assets: the decision which they argue can increase sensitivity of assets further and weaken the future capacity to cope. Finally, according to the same source, households may cope by reducing consumption. They say, this coping strategy can be an option of last resort for households that lack other assets and also may still be pursued by households who are reluctant to increase their future vulnerability by further depleting their stock of assets. However, coping by reducing consumption is regarded unfavorably by Hoddinott (2006) in Carter *et al*. (2006) as it does have multiple costs: the cost of immediate hunger as well as the long term effect of permanently reducing the growth and future capacity of younger children.

Watts (1988) cited in Frankenberger (1992) discusses pattern of coping strategies that show the sequence of responses farm households use when faced with food crises. According to Corbett (1988) in Frankenberger, (1992), such sequence of responses is divided in to three stages. The first stage, also called non-erosive coping (Mjonono, 2008, LIFT and USAID, 2011), comprises those coping strategies that involve low commitment of domestic resources, enabling speedy recovery once the crises has eased. The second stage, involves disposal of key productive assets (Corbett, 1988 in Frankenberger, 1992). Coping strategies of this stage are commonly considered as erosive strategies as they are difficult to reverse and they undermine the household's long-term productive capacity (LIFT and USAID, 2011). Stage three coping strategies represent a failure to cope with the food crises and usually involve destitution and distress migration (Corbett, 1988 in Frankenberger, 1992, LIFT and USAID, 2011).

Maxwell (1996:74) cited in Fiseha and Degefa,(2017) categorizes household responses to food insecurity into coping strategies and adaptive strategies. Coping strategies are responses made by households to improve the declining situation of household's food security. Adaptive strategies, on other hand, involve a permanent change in the mix of ways in which food is acquired. They refer to long-term adjustments. Maxwell and Caldwell (2008) identify four set of coping strategies that households employ when they face food shortage or don't have enough money/resource to buy food. First, households may change their diet from preferred foods to less preferred substitutes. The second option is attempting to increase their food supplies using short-term strategies such as borrowing, begging, consuming wild foods and the like. The third one is reducing the number of people that they have to feed by sending some of them elsewhere such as neighbors' houses. The fourth, and most common, is managing the shortfall by rationing the food available to the household through such actions like cutting portion size, the number of meals, favoring certain household members over others, or skipping whole days without eating. According to these authors, these strategies may not be taken in the same order by all households and do not have the same message to covey regarding the level of food insecurity of households. Conceptually, these strategies are more of consumption focused strategies that may be used by those households either do not have physical assets to dispose to acquire food or don't want to dispose them giving priority to livelihood or future food security.

2.2. Review of some empirical works

This section presents the summary of previously done similar works that have been accessed both directly and through others (Table 2.3). The recent study conducted in Nicaragua by Ciani and Romano (2013) aims at developing a methodology for quantitative assessment of resilience to food insecurity and testing whether the pre-shock resilience score of households predict their post shock food security status. Their study treated resilience as latent variable represented by a composite index comprising ten components. They have also attempted to show how a resilience index can be used as an instrument to policy evaluation. Following the line of Alinovi *et al*. (2008 and 2010), first each of the components is estimated separately and then combined to develop a resilience index. They observed positive relationship between pre-shock resilience

index and post-shock food security status at household level. Their findings also reveal small land owners and agricultural wage workers as livelihood groups with poor resilience scores in the livelihood based disaggregation.

Alinovi *et al*. (2010) undertook a study in Kenya on household's resilience to food insecurity by applying the FOA's conceptual model that was developed in 2008 and first applied for the resilience study in Palestinian state. Both Alinovi *et al*. (2008 and 2010), treat resilience as a latent variable to be measured by composite index. In Alinovi *et al*. (2008), all the components in the FAO's framework have been used except assets, due to lack of data on it, in the composite resilience estimation. However, in Alinovi *et al*. (2010), the components or indicators of resilience have been modified to give contextual flavor considering the importance of farming in Kenya's population. The objective of the study was to measure empirically the outcomes of different livelihoods strategies in terms of household resilience to food insecurity in the specific context of Kenyan households. They found out that the large-holder farmers' livelihood cluster is the most resilient one while the pastoralist group being the least resilient. They also learned that the determinants of resilience found to be different for each livelihood group. Measurement wise, the authors have designed a two stage process to resilience assessment. In the first stage, the observed variables are used to estimate the first set of latent variables and the resulting latent variables are, in turn, used to estimate resilience index using the latent variable model (factor analysis).

Keil *et al.* (2008) as reported in Ciani and Romano (2013) use observable variables as a proxy of resilience rather than using the composite index. In their study, resilience is measured as the observed degree of drought induced expenditure reductions for basic necessities. The logic here seems that households whose basic necessity expenditure has fallen because of this shock are deemed to be non-resilient. In their treatment about who is resilient and non-resilient, they assumed that the absolute value of negative variations in the consumption expenditure is negatively correlated with resilience and fully resilient household is expected to show null variations of basic consumption. Here, one needs to note that, though related, as food is one of the basic consumption good, in this study, resilience is not directly indexed to food security rather it is attached to basic necessities in general.

Mulat and Negussie (2013) undertook a study to identify determinants of sustainable resilience for food and nutrition security of farming rural households, using Ethiopian Rural Households' Survey (ERHS) data of 1994 to 2004. They estimated household's resilience to food insecurity as latent variable composed of four components: grain held in stock, in-kind precautionary savings, investment in child education, and participation in mutual aid association (Idir). They employed principal component analysis for measuring resilience and dynamic probit random effect model to find determinants of dynamics of household's resilience. Their study shows a true state (path)-dependence on dynamics of household resilience to food insecurity and positive and significant correlation between sustainable resilience to food insecurity and the following factors: land under cultivation; ownership of oxen, milking cows and transport animals, use of improved technologies, and membership in traditional saving groups (Iqub). However, the survey used by the researchers is limited in terms of coverage. Only few villages are covered and areas where the current study has been conducted and other areas in the vicinity are not reached by this survey. Also it is my feeling that conceptually, given the most widely accepted notion that household's resilience to food insecurity lies on the options available to the household to make a living and its ability to handle risks, the dividing line between what they call it resilience and determinants of its dynamics is not indisputable. In line of this, Ciani and Romano (2013) argue that in the works where resilience measurement and search for its determinants are handled separately, the distinction of measurement of resilience concept and its determinants detection is not always clear and easy to justify.

Maxwell *et al*. (2013), in their study in northern Ethiopia, in two woredas of Tigray region, considered resilience as one component of their study. However, they have not measured it directly. Their study traced the livelihood change over time in four rounds of household survey over two years: two rounds in the "hunger" season and two rounds in the "postharvest" season. In more specific terms, their study tracks household's food security status in each round, looks for its determinants, and changes in livelihoods, in particular the dynamics of asset accumulation or loss. The findings of the study have shown steady improvements in households' food security indicators without a corresponding improvement in the level of assets at the household level, with poverty traps being suspected source to blame.

Mulugeta (2014) undertook a study on resilience to drought induced food insecurity shocks in two districts of Borana Zone of Oromia Region. He conceptualized resilience as a recovery or ability of people to rehabilitate their livelihood assets to pre-drought level and relied on household's own assessment about the extent of recovery as a way of measuring resilience. The study considered lack of adequate social services as a potential barrier to improved resilience. Herd mobility, literacy, sanitation, and social networks have been identified as factors strongly linked with shock absorption capacity. More recently, Guyu and Muluneh (2015) undertook a study on household's resilience to seasonal food insecurity in north western Ethiopia. They estimated household's resilience in two stages treating resilience as a latent variable. Their findings reveal that the resilience capacity of households in the study area is very weak and households in the indigenous ethno-culture group are much less resilient than the non-indigenous ones.

Table 2.3: Summary of empirical works on household's resilience to food insecurity

Author	Objectives	Methodology	Findings
Alinovi *et al*. (2010) in Kenya	- Measuring empirically the outcomes of different livelihoods strategies in terms of household resilience to food insecurity	- Two stage factor analysis for resilience measurement, treating it as latent variable	- Large-holder farmers' livelihood cluster is the most resilient one while the pastoralist group being the least resilient. That is, pastoral livelihood strategy based group is found to be the least resilient one in terms of food security
Ciani and Romano (2013) in Nicaragua	- Developing a methodology for resilience measurement and testing its with household level data	- Two stage factor analysis for resilience measurement, treating resilience as latent variable and -Weighted least square model for testing predictive power of the resilience index	- They found positive relationship between pre-shock resilience index and post shock food security status of households - Small land owners and agricultural wage livelihood groups are found less resilient livelihood groups
Maxwell *et al*. (2013) in Ethiopia	- Tracking household food security status over time, as well as changes in livelihoods (in particular the dynamics of asset accumulation or loss).	-Resilience has not been measured directly	- They observed steady improvement in households' food security indicators over time without a corresponding improvement in the level of assets at the household level
Mulat and Negussie	- Identifying	- Employed principal	- They observed positive and

(2013) in Ethiopia	determinants of sustainable resilience for food and nutrition security	component analysis for measuring resilience and -Used dynamic probit random effect model to find determinants of dynamics of household's resilience.	significant correlation between sustainable resilience to food insecurity and land under cultivation; ownership of oxen, milking cows and transport animals, use of improved technologies, and membership in traditional saving groups (iqub).
Mulugeta (2014) in Ethiopia	-Identifying impacts of droughts on HH food security -identifying resilience capacities for recovery from shocks	-frequency analysis models (mainly percentage) & paired sample test to analyze pre and post drought asset level differences	- Herd mobility, literacy, sanitation, and social networks have been identified as factors strongly linked with shock absorption capacity
Guyu and Muluneh (2015) in Ethiopia	- Analyzing household's resilience to seasonal food insecurity and -Comparing resilience status of indigenous and non-indigenous ethno-culture groups.	-Two stage factor analysis for resilience measurement, treating it as latent variable -Regressing the estimated resilience index on its components (resilience dimensions) to detect their relative importance - Examining frequency distribution to compare resilience of the two groups (no statistical test was run)	-The resilience capacity of households in the study area is very weak - Households in the indigenous ethno-culture group were much less resilient than the non-indigenous ones.

2.3. Analytical framework for the study

Studies on households' resilience to food insecurity commonly employ/guided by the resilience frameworks. Resilience frameworks are based on the identification of factors that make households resilient to food insecurity shocks and assume that the resilience of a given household at a given point in time depends primarily on the options available to that household for making a living. Though, the emergence of resilience to the mainstream of development thought and for food security analysis is the recent one (Fan *et al*. 2014), many resilience analysis frameworks have been suggested by various parties such as FAO, OXFAM GB, and DFID/TANGO (FAO *et al.*, 2014). However, as has been argued in Hoddinott (2014), the plethora of frameworks for resilience analysis is not entirely divergent; rather they share common components. According to Hoddinott (2014:20), the communalities include highlighting the broader environment in which a household or other unit of observation resides; the resources available to that household; how that household uses those resources; how the economic returns

on those uses are affected by shocks that household experiences; and how the outcomes of those uses lead to consumption of food and other goods and services.

Considering these features of various suggested resilience frameworks by different parties and the basis of livelihood for rural households of Boricha *woreda*, the current study prefers to adapt the updated version of FAO's framework, originally developed by Alinovi *et al. (*2008) and updated and used in (Alinovi *et al.* 2010), as a main analytical framework with a minor modification made considering current study's objectives. The selection of the framework is justified by the fact that it is mainly proposed for the analysis of household's resilience to food insecurity (food insecurity shocks) and the variant mentioned here is the one that explicitly considers the importance of farming for the livelihood of the rural households in developing countries. Presented hereunder is the general analytical framework adapted for the study together with briefings about assumptions in it and the proposed resilience dimensions in the study area's context.

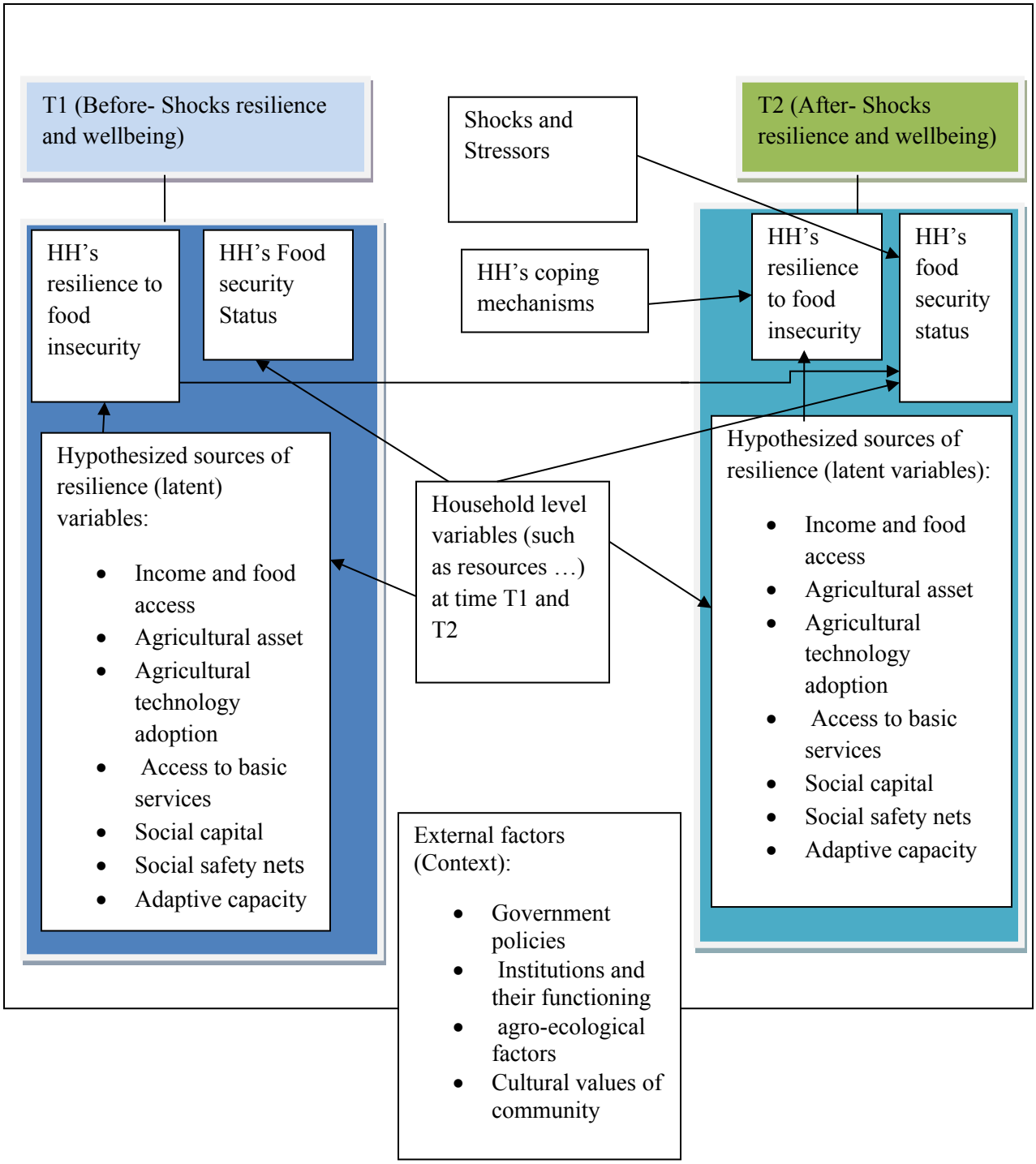

Figure 2.1: Generic Analytical framework for the study

Source: Adapted from Alinovi et al. (2010) with minor modification.

To provide the bird's eye view of the framework, the observable household level variables on which data can directly be obtained will be used (1) for estimating the latent variables that will be aggregated someway to estimate household's resilience to food insecurity and (2) for measuring the household's food security status as they may appear appropriate at time T1. The framework assumes, some shocks may occur between T1 to T2, which can be idiosyncratic or covariate and can have different level of impact on household's well being (food security in our case) depending on their ex ante (or before-shocks) resilience level. Hence, conceptually, household's food security status at time T2 (to be determined using household level variables at time T2) is mainly going to be a function of any type of shock that might happen in between time T1 and T2, initial resilience capacity, and household characteristics not accounted in resilience estimation.

The framework also shows that resilience to food insecurity as a dynamic concept can be analyzed both *ex ante* and *ex-post*. The *ex ante* analysis yields information beforehand on the relative resilience position of the households to future shocks and provides disaggregated view on both strong and weak positions of a household in terms of various compartments of resilience. By so doing, it points out areas of effective intervention at programmatic level so as to strengthen household's resilience beforehand. The ex-post analysis help understand how the shocks and the ways households respond to them affected their resilience and its various components. Conceptually, the cycle continues in a way that the ex-post analysis for a shock happened at a given point in time being the ex ante analysis for the upcoming shock. However, the current study as a cross-sectional one has focused on ex ante analysis of resilience. That is, it has estimated the household's resilience to (future) food insecurity and has examined their food security situation at time T1 only (the Ex ante/or before shocks/ analysis of resilience and food security situation). Hence, regarding resilience, this study at best can be understood as the analysis of rural household's resilience to future food insecurity. This is also the tradition of some of the previous studies such as (Alinovi *et al.,* 2008, Alinovi *et al.*, 2010, and, Guyu and Muluneh 2015) that utilized the FAO's framework under panel data constraint.

Households use different response mechanisms, both positive and negative, based on available skills and resources to face, manage, and recover from adverse conditions, when they face food insecurity shocks. Frankenberger *et al*. (2012) maintain that certain coping strategies may have

negative and permanent consequences with respect to resilience. Positive coping strategies are those that households use based on available skills and resources, to face, manage and recover from shocks and that doesn't diminish their resilience to future food insecurity. On the other hand, negative coping strategies, if employed, undermine future options and making it more difficult to cope with the next shock or stress (Pasteur 2011 in Frankenberger *et al.* 2012).

Based on this argument, in this framework, it is assumed that the coping strategies employed by a household in response to shocks happened prior to time (T1), though not shown on the framework for the interest of space, can have some sort of relationship with or influence on resilience level of the same household at time (T1) in a way that a household with negative coping strategies scoring less on resilience. In the same token, coping mechanisms employed between time (T1) and time (T2) can have some kind of linkage with resilience level at time (T2). As the household's coping mechanisms are the response actions to shocks, data on them can be captured usually ex post (or retroactively). In the current study, the linkage between the level of resilience and household coping mechanisms has been examined based on survey data requiring households to divulge coping mechanisms employed prior to time T1 in response to various stressors/ shocks challenging their food security situation. Conceptually, relating to the framework here, the study examines the relationship between nature of coping mechanisms employed at time (T0) and resilience status of households at time (T1).

With regard to indicators of resilience, income and food access, agricultural asset, agricultural technology adoption, access to basic services, social capital, social safety nets, and adaptive capacity have been taken as components making up household's resilience to food insecurity. Here, social capital is a newly added dimension in this study considering its importance in rural life and with the feeling that other dimensions listed here do not capture it well. However, one of the resilience components, stability, proposed by Alinovi *et al. (*2010) has not been included here by being convinced with the argument of Ciani and Romano (2013). Ciani and Romano (2013) argue that as the stability dimension has been proposed to capture the losses caused by various kinds of shocks, it indirectly embeds shocks in the definition of resilience. Hence, including shocks in resilience estimation model can have perverse consequences as it could be possible to identify a household as the most resilient, while it is only luckier. These, the included ones in the

above framework, dimensions of resilience also seem sensible in the context of the study area as well. The livelihood of rural households of Sidama Zone in general and Boricha *wereda* in particular is based on mixed farming system: crop production and rearing livestock. The brief description of each dimension is given relating with this livelihood base:

(1) Agricultural asset: given the importance of farming as a source of livelihood in the study area, the type and extent of agricultural resources/assets/ available to a household can be considered as one of the basic sources of household's resilience to food insecurity. In this study, it is proposed that land holding size, livestock size, number of matured enset stems, and number of coffee trees ready for giving harvest for upcoming yield, and the estimated monetary value of harvests of khat[1] owned by a household to constitute this asset. Here, given the study area's context, these items serve either directly as a source of food, as means of food production, or as income source for food purchase. All of them can be treated as agricultural assets as all remain to be source of food for multiple years and all are attached to land and survive for long providing the intended services. In case of livestock, though not attached to land unlike others, it has been included in agricultural productive assets as their manure is a single basic input for enset growth and it can be used as traction power for some farmers.

(2) Agricultural technology adoption: agricultural technology is believed to enhance the productivity and effective use of agricultural assets owned. Given this attribute of it, one can logically argue that adopting agricultural technology can contribute to the resilience of household's whose living is based on farming. In this study, household's practice regarding adoption of fertilizer, improved seeds, farmers training center (FTC) services, and services of agricultural development agents in terms of on farm visit are proposed to constitute agricultural technology element of resilience.

(3) Access to basic services: this has been considered as one dimension of household's resilience to food insecurity as it affects household's capacity to effectively utilize available household level assets for management of risks and responding to shocks when materializes. The basic services to be considered relevant in this regard includes access to safe water, access to telephone, and access to microfinance institutions (MFI).

[1] An ever green shrub whose leaves are chewed as stimulant

(4) Social capital: social capital such as group membership and networks is believed to play an important role in building resilience at household level. Such treatment of social capital is well supported by Adger (2003) and Nakagawa and Shaw (2004) both cited in Bernier and Meinzen-Dick (2014) who considers it as a vital component of resilience and key factor contributing to post shock or disaster recovery. Degefa (2009) also discusses how social capital augments household's food security by widening access to livelihood resources. So, one may argue that households who are able to cultivate and build this capital can have a capacity to maintain their wellbeing in the face of shocks. Receiving and pledging supports individually and in organized form in bad times are also a common practice in the study area's context. This study considers perceived social capital of a household, idir membership, and local church or other religious membership as components representing this aspect of resilience.

(5) Social safety nets: participation in safety net program and other development supports coming from various sources help poor households maintain their productive assets for future use. This way, safety nets can be a source of resilience to food insecurity for households participating in them. In this study, participation in official government safety net programs and any kind of aids or supports received from other sources as components making up this dimension of resilience.

(6) Adaptive capacity: The adaptive capacity indicates the ability of a household to cope and adapt after a shock, enabling it to continue performing its own key functions. The characteristic of adaptability is the buffer effect for the household's key functions (Alinovi *et al*. 2008). Pisano (2012) considers it as the capacity to adjust responses to changing external drivers and internal processes. In the current study, it is believed that this source of resilience too is important to the resilience of households of study area and level of income diversification, maximum education level achieved in the household, health status of a household head, and dependency ratio are proposed to constitute this component of resilience.

(7) Income and food access: This dimension is directly related to the household's degree of access to food (Alinovi *et al.* 2008). Considering the fact that the study area's rural households mostly self-produce foods that they consume, this study opts to use the household themselves

self assessment of their access to food. Accordingly, Households Food Insecurity Access Scale (HIFAS) and Food Consumption Score (FCS) proposed to represent this dimension of resilience.

2.4. Summary

This chapter has explored related conceptual and empirical literatures for the study. In the chapter, conceptual literatures have been reviewed on household's resilience, food security, and response mechanisms. Resilience has been understood as the capacity of systems that enable it to maintain its basic functions in the face of shocks and disturbances. In light of this, theoretical suggestions regarding the possible sources of household's resilience to food insecurity have been reviewed. Various theories of food security/insecurity, FAD, FED, income based view, basic needs or food first view, SLF, and capability and human development approach, are reviewed to get insights on household food insecurity. The chapter has also provided insights on household's coping strategies during food crisis and the theoretical nexus of resilience and household's response mechanisms in the general context of food insecurity shocks. Based on insights from literatures and empirical studies on the issue, as well as, the study-area-context, sources of household's resilience to food insecurity has been proposed and general analytical framework for the study has been developed.

Chapter 3: Study Area Setting and Methodology

3.1. Description of the study area

This study was conducted in Boricha *woreda* (Figure 3.3), which is located in the western part of the Sidama zone in SNNPR. It is bordered by Loko Abaya *woreda* on the south, Wolayita Zone on the west, Oromia Region on the northwest, Dore Bafano *woreda* on the northeast, Shebedino *woreda* on the east, and Dale *woreda* on the southeast. According to Bechaye (2011) the *woreda's* astronomical location extends from 6º 46'N - 7º01'N and 38º04'E - 38 º24'E. Area wise, Boricha *woreda* covers 588.1 square km, which makes it the third largest *woreda* in the sidama zone. As per the CSA (2007), Boricha *woreda* has a total population of 250,260, of which 125,524 are male and 124,736 female. In terms of the place of residence, only 4% of the total population of the *woreda* lives in the local urban (semi urban) cities whereas the rest 239,858 or about 96% are rural residents. Yirba is the administrative capital of the *woreda*.

Generally, Boricha *woreda* can be regarded as water scarcity area as there is no single permanently flowing river that crosses or stems from this *woreda*. Because of this, people in most *kebeles* largely depend on man-made ponds for both humans and livestock (Figure 3.1 and 3.2). These ponds tend to dry during winter season, making water unavailability a major problem. As is the case in the whole Sidama zone, the area receives a rain twice a year: the short rainy months (the *belg rain*) and the longer rainy months (the *kiremnt* rain). The remaining months constitute the dry season and during the dry months, both humans and animals face water shortages. Boricha w*oreda* is also well known for experiencing unreliable rainfall that shows variation both in amount and periodicity for a couple of years.

Figure 3.1: Old women fetching pond water for domestic consumption at Gasara Kuwe Kebele

Source: own photo

Figure 3.2: Plastic-made jars that villagers brought to fetch pond water at Sadama Chala kebele

Source: own photo

Mixed subsistence agriculture supports the livelihood of the *woreda's* population. Both enset and maize are known to be the two dominant food crops grown at the household level, with different level of concentration. Besides these two staple food crops, haricot bean, teff, sweet potato and

other vegetables like cabbage, onion, and fruits like banana and avocado also grown locally. Livestock (cattle, sheep and goat), sugar cane, khat and coffee are also part of the households' economy though concentration varies from village to village. Reliance on rain-fed farming for subsistence coupled with rainfall variability subject people to high risks of harvest loss that easily results in food insecurity. For instance, most of the *woreda's* households lost their crops due to drought for a period that runs from 2001 to 2004 and faced a chronic food shortage and eventually became dependent on external food-aid. As indicated in MKC-RDA (Meserete Kirstos Church Relief and Development Association) (2009), during this time, a three years (2002 – 2005) rehabilitation and development project was implemented in Boricha *woreda* and a total of 2,796 metric tons of food grains was distributed for 2400 households in 2002, 4000 households in 2003, and 5000 households in 2004; and provided supplementary food support for 600 children in 2002, 1200 children in 2003 and 1800 children in 2004. Though, the period mentioned here represent the time that big trouble was observed, the *woreda* is still marked as a top priority concern area in the Sidama zone when it comes to food insecurity.

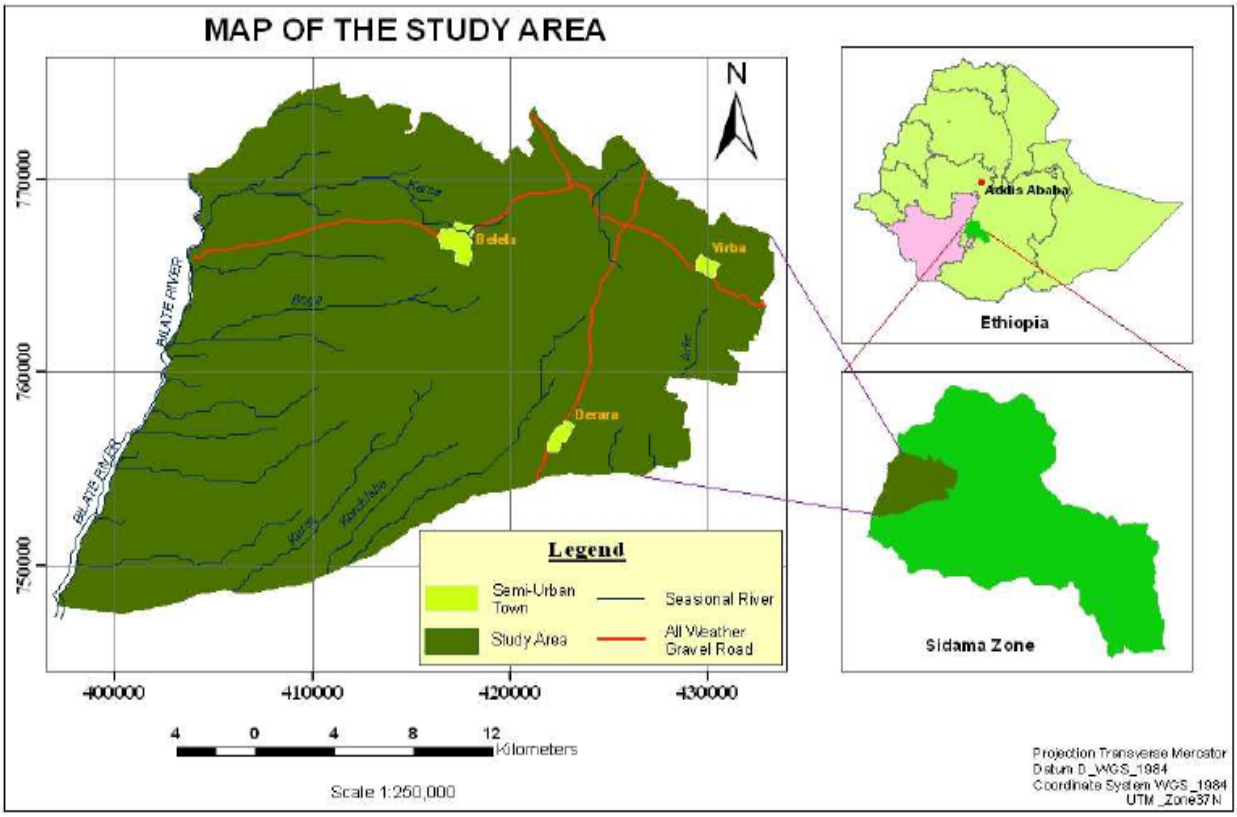

Figure 3.3: Location of the study area

Source: adapted from Bechaye, 2011

3.2. Research philosophy

Guba and Lincoln (1994:105) cited in Saunders *et al.* (2007), underline the need for research philosophy in a given study with the remark that questions of research methods are of secondary importance to questions of which paradigm is applicable to one's research. The research philosophy that one adopts reflects important assumptions about the way in which a researcher views the world and such assumptions will underpin the research strategy and the methods to be chosen as part of that strategy (Saunders *et al.* 2007). Two major research philosophies have been identified in the Western tradition of science, namely positivist and interpretivist (also known as antipositivist) regarding epistemology (the question of what constitutes acceptable knowledge in a field of study). Positivists believe that reality is stable and can be observed and described from an objective viewpoint, i.e., without interfering with the phenomena being studied. Interpretivists, on the other hand, contend that only through the subjective interpretation of and intervention in reality can that reality is fully understood. Ontologically (regarding the nature of knowledge), these positions can be expressed in terms of objectivism and subjectivism respectively.

According to Saunders *et al.* (2007), objectivism represents the position that social entities exist in reality external to social actors concerned with their existence. On the other hand, subjectivism holds that social phenomena are created from the perceptions and consequent actions of those social actors concerned with their existence. Saunders *et al.* (2007), also talk about the practical difficulty of choosing from this dichotomy when it comes to the choice of philosophy in social science research in particular and suggests pragmatism as a possible way-out. According to Saunders *et al.* (2007), pragmatism argues that the most important determinant of the research philosophy adopted is the research question – one approach may be better than the other for answering particular questions. Moreover, if the research question does not suggest unambiguously that either a positivist or interpretivist philosophy is to be adopted, it is confirmation of the pragmatist's view that it is perfectly possible to work with both philosophies. In line with this, Tashakkori and Teddlie (1998) in Saunders *et al.* (2007), propose that it is more appropriate for the researcher in a particular study to think of the philosophy adopted as a continuum rather than opposite positions arguing that at some points the knower and the known may be interactive while at others, one may more easily stand apart from what one is studying.

This philosophical dilemma can also be reflected in the methods to be adapted for a given research. One can make sense of this from Degefa (2005) that notes the existence of two major perspectives on combining qualitative and quantitative research methods: 'paradigm purity' and 'compatibility thesis'. According to Degefa (2005), 'paradigm purity' argument disallows combing the two methods in a single study on the basis that qualitative and quantitative methods are rooted in two distinct philosophies of 'positivism' and 'constructivism' respectively. While paradigm purists argue for the perfect alignment between philosophical stances and methods that follows (Knox, 2004 in Degefa, 2005) 'compatibility thesis', proponents argue that it is possible to address a research problem that philosophically falls under both positivism and constructivism by choosing the most appropriate method or combining the two (Degefa, 2005). This view of the 'compatibility thesis' also endorsed by Saunders *et al.* (2007), who argues, based on 'pragmatism' view, that mixed methods, both qualitative and quantitative, are possible, and possibly highly appropriate, within one study.

Regarding philosophical stance, the current study chooses to take the pragmatist's position. Though, it mostly accommodates the positivists view regarding what constitutes the acceptable knowledge and how and in what way the reality should be captured, at some points it fails to meet the strictest assumption of this philosophy. For instance, it has relied on respondent's perception in capturing data on some variables. This obviously fails to meet the positivist requirement that social phenomena should have independent existence apart from one's mind and that denounces impressions and consider only objectively measurable facts as true source of knowledge.

3.3. Research design

According to Saunders *et al.* (2007), research design is the general plan of how a researcher will go about answering the research question(s). For a particular research, design decisions are commonly made with respect to research strategies, research choices and time horizons (Robson, 2002 in Saunders *et al.* 2007). Regarding time horizon, the current study is cross-sectional one. That is, the data was gathered from different cross-sections, households in this case, at one point in time only. The study employed survey as its research strategy and dominantly used quantitative approach with qualitative triangulation when it comes to research choice. That is, it

adapted mixed method research design (sequentially explanatory) as a research approach. The specific methods related to research design of the current study have been discussed in the upcoming sub-sections.

3.3.1. Sources of data, data collection, and sampling technique

The study has mainly utilized primary data that was collected from scientifically selected sample of the rural households of the study area. Since this study is the household level analysis of resilience to food insecurity, the unit of analysis is a household. As a unit of analysis for the study is rural households, with the feeling that the respondents may not be able to read and write, the study utilized structured interview survey method for data collection. To this end, it employed well oriented and trained data collectors. However, the data from key informants was collected through unstructured interview by the researcher himself.

There are 39 *kebeles* in Boricha *woreda*. Of these, 3 (Yirba, Balela, and Darara) are urban *kebeles* and 36 are rural *kebeles.* According to SNNPR (2005) livelihood profile report and MOA DRMFSS Diroctrate reported in Bechaye (2011), these *kebeles* of the *woreda* are classified into three livelihood zones /clusters/: Sidama Coffee Livelihood Zone, Sidama Maize Belt Livelihood Zone, and Agro-pastoralist Livelihood Zone. Considering this nature of the *woreda*, it has been planned to obtain data in a way that allow adequate representation of households from all these three *kebele* clusters. Such an approach has also a benefit of making the study more informative as it allows making inter *kebeles* or livelihood zones comparison of the level of resilience and food security situation of the households.

Accordingly, the study has employed the combination of stratified, simple-random, and systematic sampling. First, following the existing livelihood classification, three strata (Sidama Coffee, Sidama Maize Belt, and Agro-pastoralist Livelihood Zones) was identified. Stratified sampling is preferred to ensure representation of all three livelihood zones and hence each group of *kebeles* or livelihood zone forms the stratum for sampling. Then, using simple random sampling, one *kebele* was selected from each stratum. The three *kebeles* selected this way are Yirba Duwancho, Aldada Dela, and Gasara Kuwe. Finally, 140 households were selected from each *kebele* through systematic sampling using the lists available at *kebele* administration office as sample frame. As the *kebele* level administration keeps records of all households in the name

of *willicho,* the sample frame utilized was an up-to-date list of the total number of households in that particular *kebele*.

3.3.2. Sample size determination

In a sample based study, having appropriate sample size is one of the prime requirements for the data to best represent the characteristics of the population from which it is collected. Representativeness of the sample generally increases with size and higher statistical efficiency can be achieved with larger sample size. However, a researcher may not be able to make the sample size indefinitely large given other possible impediments such as time and resources. Considering this, Saunders *et al.* (2007) say, the sample size decision is a compromise between the accuracy of findings and the amount of time and money one invests in collecting the data. According to Saunders *et al.* (2007), within this compromise, researcher's sample size choice is governed by: 1) the level of certainty that the characteristics of the data collected will represent the characteristics of the total population, 2) the margin of error that one can tolerate, 3) the types of analyses a researcher is going to undertake i.e., statistical techniques to be employed, and 4) the size of the total population from which a sample is being drawn. Within this consideration, the Saunders *et al.* (2007) suggests the minimum sample size of 357, 370, and 384 for the total population of 5000, 10,000, and 1,000,000 and above respectively for 95% degree of certainty and the error margin of 5%.

On the other hand, VanVoorhis *et al*. (2007) underline the need to have large sample size arguing that large sample size increases power or probability of rejecting null hypothesis while it is false and decreases estimation error. However, the question of how large is large is still one of the puzzles that researchers always face. VanVoorhis *et al*. (2007) recognize the fact that the sample size varies based on the type of statistical analysis to be conducted and hence the statistical model to be employed by a researcher. Accordingly, based on Cohen, (1988), they suggest 30 participants per cell for statistical tests designed to detect differences between or among groups such as the independent samples *t*-test, matched sample *t*-test, ANOVA, and MANOVA for maintaining 80% power, the minimum commonly suggested statistical power.

When it comes to correlation as well as regression analysis, literatures underline the need for consideration of the number of variables involved. For instance, Green (1991) in VanVoorhis *et*

al. (2007) suggests $N > 50 + 8m$ (where m is the number of independent variables or predictors) for testing the multiple correlation and $N > 104 + m$ for testing individual predictors. On the other hand, Harris (1985) in VanVoorhis *et al*. (2007) suggests the +50 rule as a criterion for minimum sample size determination. Accordingly, the number of participants is supposed to exceed the number of predictors by at least 50 (i.e., total number of participants equals the number of predictor variables plus 50). For statistical model to be employed for testing the independence of categorical variables (Chi square statistic), VanVoorhis *et al*. (2007) considers a minimum of 5 expected frequency as a conservative requirement. Hence, employing this model requires comparing the observed frequencies with the minimum expected ones and the larger sample size is generally desirable to this end. For such statistical models like principal component analysis, one of the models this study is going to employ, Tabachnick and Fidell, (1996) cited in VanVoorhis *et al*. (2007) and Tabachnick and Fidell, (2001) cited in Field (2005) says it is comforting to have at least 300 observations.

Israel (2013) presents mathematical formula for sample size determination. As indicated in Israel (2013), mathematical approach for sample size decision explicitly considers the desired level of precision or sampling error, the confidence or risk level and the degree of variability in the attributes being measured i.e., population variance in respect to the parameters of interest such as population Proportion or Mean. The sample size determination formula for the Mean or Proportion is basically the same and the difference lies only on the variability or variance component. However, the sample size determination is relatively easier with the Proportion than with Mean as population variance estimation is done using the maximum possible population variance in the former case. This nature of it makes sample size determination using population Proportion based formula frequently preferred one (Israel, 2013). As it involves estimating the parameters such as prevalence of food insecurity, it appears to be more plausible to apply population Proportion based approach for the current study too when it comes to sample size determination with mathematical formula.

Cochran (1963:75) cited in Israel (2013) suggests the following formula, for populations that are large, as one that yields a representative sample.

$n = (z^2pq)/e^2$

Where:

n= sample size

p= the estimated proportion of an attribute that is present in the population
q= 1-p

e= the desired level of precision

z= the desired confidence level

For more clarity, the above formula of sample size determination emerges out of some algebraic manipulation of the equation,

$e = z\sqrt{(p(1 - p))/n}$

In this equation, $\sqrt{(p(1 - p))/n}$ part or component represents population standard deviation (the square root of variance) and is the measure of variability. The major challenge in the sample size determination using mathematical formula is the lack of information on the population variance, mainly the value of p , in this case. The commonly used way-out to this problem is assigning the value for p that yield or represent the maximum possible variance that could be found in the population and the one that achieves this end is 0.5. With this value of p, the q or ($1 - p$) value too will be 0.5. For 95% degree of confidence (representing 1.96 standard error of the mean, commonly called Z value) and 5% precision level commonly employed in social science researches and also to be applied in the current study, the above sample size determination formula gives us the minimum sample size of 384.

$n = (1.96^2 \times 0.5 \times 0.5)/0.05^2$

n = 384.16

After comparing various suggestions, discussed in this section, regarding the minimum sample size, the size obtained here through mathematical formula has been taken as the minimum sample size for the current study. In order to keep the sample size large enough as much as possible, the finite population correction is not applied in the mathematical formula above. Rather, the actual sample size is set to be 420 households by adding 36 households to account for the possible non-responses and incomplete responses. This size puts the study comfortably well above the minimum sample size requirements suggested by all literatures reviewed here both in terms of study area's total population as well as the analytical models suggested for the study.

As the data was collected directly in person using local data collectors who know the area and even most of the households very well, the non response rate has been effectively avoided.

3.3.3. Measurement of research variables

With regard to measurement, the current study has mainly employed Household Food Insecurity Access Scale (HFIAS) and Food Consumption Scale (FCS) for measuring a household's food security status. The HFIAS is a food security indicator tool that assesses whether households have experienced food insecurity problems in the preceding 30 days. It is composed of nine questions that ask about modifications households made in their diet or food consumption patterns due to limited resources to acquire food. These nine questions of the HFIAS covers three themes regarding household's reactions to food insecurity: experiencing anxiety and uncertainty about the household food supply, altering quality of the diet and reducing quantity of food consumed. The FCS is a composite score based on dietary diversity, food frequency, and relative nutritional importance of different food groups. Though food security is multidimensional concept, using these indicators for assessing household's food security status is justifiable as they, the two indicators combined, incorporate more or less all the pillars of food security imbedded in food security definition of FAO (2000). According to Maxwell et al. (2013:13), out of the nine occurrence questions of HFIAS, four of them capture the sufficiency component; two of them the stability dimension; two of them the acceptability dimension, and one of the HFIAS and all of the FCS component questions represent diversity/quality dimension of food security (Table 2.2).

Furthermore, reduced Coping Strategy Index (rCSI) has been used as a supplement to these two indicators. The objective in mind in adding the reduced Coping Strategy Index (rCSI) is to cross examine further how validly the HFIAS and FCS has individually captured the real food security situation of households. The two indicators, HFIAS and FCS, do vary in terms of the dimensions of food security they represent in such a way that HFIAS capturing more of food sufficiency (access and availability dimension) and to some extent stability and the FCS capturing the utilization component of food security. The two indicators also vary in terms of the cutoff points with regard to categorization of households into different achieved food status group when their scores are used as categorical variables, and in terms of meaning of the scores that each household earns when the indicators are used as continuous variables. When the two indicators

are used as continuous variables, the higher score in HFIAS means more food insecurity and the higher score in FCS means less food insecurity. Given these nature of them, there is the possibility that the two indicators can end up in categorizing the households into different food security status groups differently. Under such circumstance, it is imperative to know whether such variations is only due to the inherent nature of the indicators/measures/ or not. Having the third indicator of food security and examining how the two indicators individually correlates with it is one way to get around this and hence the reduced Coping Strategy Index (rCSI) has been used as the supplementary measure with this in mind.

The reduced coping strategy index (rCSI) is consumption behavior based measure of food security that is derived from a Coping Strategy Index (CSI) (Table 2.2). Unlike the CSI, the rCSI is believed to be context free measure and can be universally used across cultures. As a food security measure, it counts the frequency and severity of behaviors in which people engage when they do not have enough food or enough money to buy food (Maxwell and Caldwell, 2008). Regarding coping mechanisms measurement, households have been provided with the list of coping strategies to food insecurity and asked to respond for each affirmatively if they used them in the last two years time. The study has also used the consumption based coping strategy questions to understand the most recently used food consumption related response of households to food shortage.

In the current study, household's resilience to food insecurity is measured by composite index. This is owing to the fact that resilience is multidimensional concept which is not directly observable. This nature of resilience, poses great challenge when it comes to measurement. In circumventing this problem, previous studies on similar topic have followed two different lines: developing composite index (Mulat and Negussie, 2013, Alinovi *et al*., 2008 &2010, Guyu and Muluneh ,2015, and Ciani and Romano 2013) representing this latent variable or using some sort of proxy indicator (Maxwell *et al*., 2013, Mulugeta,2014 and Keil *et al.* , 2008). Ciani and Romano (2013) appreciate the later approach for its simplicity but warn about loss of complexity when a complex concept like resilience is proxied by a single variable. Considering the benefit of capturing the complexity of the resilience concept when it comes to measurement and the capacity of the approaches in the former category to achieve this, the current study has inclined to adapt this approach for measuring resilience. To this end, the study has identified seven

indicators of resilience each of which is measured by its own composite index (Table 3.1 and 3.2). Accordingly, both resilience and its indicators are treated as latent variables. The first set of latent variables, i.e., values for each resilience indicators as index, has been estimated using data obtained directly from households and then the resilience index has been computed using these indices.

Table 3.1: Resilience indicators & measurement

Variables		Indicators	Measured by:
1	Resilience	Variables 2-8 below	Composite index
2	Agricultural asset	See Table 3.2	Composite index
3	Agricultural technology adoption	See Table 3.2	Composite index
4	Access to basic services	See Table 3.2	Composite index
5	Social capital	See Table 3.2	Composite index
6	Social safety nets	See Table 3.2	Composite index
7	Adaptive capacity	See Table 3.2	Composite index
8	Income and food access	See Table 3.2	Proxied by HFIAS and FCS

Table 3.2: Resilience dimension's indicators and measurement

Resilience dimensions	Indicators	Will be measured by:
Agricultural asset	land holding size	Hectare
	Livestock size	TLU
	Total area covered by enset	*Timad*
	Total number of coffee trees ready for giving harvest	Count
	Khat owned	Value of yearly harvests
Agricultural technology adoption	Fertilizer	The amount used in Kg
	Improved seeds	The amount used in Kg.
	FTC services	Number of types of training received
	Development agents services	Number of on-farm visits by development agents

Access to basic services	Access to safe water	Binary variable
	Telephone access	Mobile phone ownership (binary variable)
	Access to MFI	Participation in MFI (Binary variable)
Social capital	perceived social capital	Index estimated using PCA
	Idir membership	Binary variable
	Local church/or religious group membership	Binary variable
Social safety nets	Participation in safety nets (PSNP)	Estimated monetary value of benefits received
	Aids or supports received	Estimated monetary value of benefits received
Adaptive capacity	Level of income diversification	Number of income sources
	Maximum education in the HH (education)	Schooling years
	health status of HH head	Number of clinic visits within a year time
	Dependency ratio	Ratio scale
Income and food access	Proxied through food access indicator :HFIAS and FCS	HFIAS and FCS

3.3.4. Data analysis

Data analysis was done mostly quantitatively supported by qualitative analysis as needed. Specific suitable model is employed for each research questions and objectives. The mixture of Principal Component Analysis, simple descriptive statistics such as percentages, and tests of between group differences (ANOVA) and independence (Chi Square) were used as they appear appropriate for the research objectives under consideration.

3.3.4.1. Data analysis method for resilience to food insecurity analysis

In the current study, resilience is treated as a latent variable to be estimated by using seven indicators specified in the above sections. Each of these indictors of resilience by themselves too is latent variables estimated using observable household level variables highlighted in the previous section (Table 3.2). In effect, the model that is used for resilience estimation is hierarchical one (multistage modeling) where some of the variables are dependent on one side

and independent from the other. Moreover, it also has to deal with unmeasured variables. The following path diagram has been adapted from (Alinovi *et al*. 2008), in order to visually depict this estimation procedure.

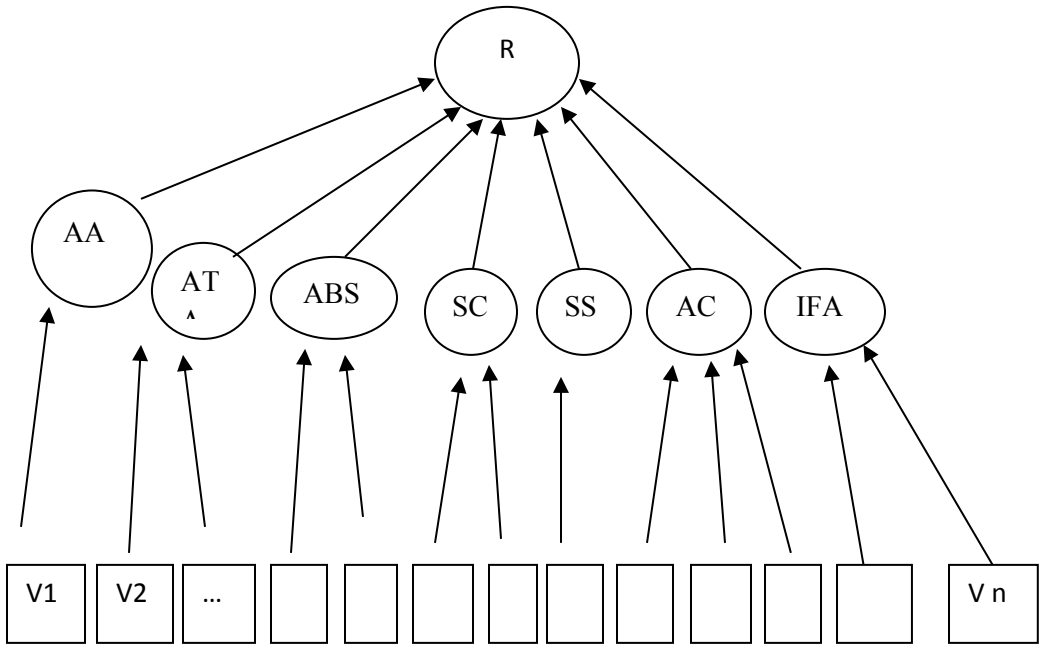

Figure 3.4: A path diagram of household's resilience estimation procedure

In the diagram, in line with causal model literatures such as Spirtes *et al.* (2000) and Tabachnick and Fidell (2007), the circles represent the latent variables and the boxes represent the observed variables. Following FAO (2014) and Alinovi *et al*. (2010), the current study models household's resilience to food insecurity as the function of its components. Accordingly,

R = f (AA, ATA, ABS, SC, SS, AC, IFA)

Where

R= resilience of household, AA= agricultural assets, ATA = agricultural technology adoption, ABS=access to basic services, SC= social capital, SS= social safety nets, AC=adaptive capacity, and IFA= income and food access

However, as the variables in this equation are not directly observable, we cannot directly estimate resilience. This in turn necessitates looking for statistical techniques that can facilitate

the estimation and latent variable estimation models like Factor Analysis (FA) and its families/variants such as Principal Component Analysis (PCA) appear to be apparent candidates (Alinovi *et al*., 2008). The current study utilized Principal Component Analysis (PCA) for resilience estimation. While explaining differences between PCA and FA from theoretical stand point, Tabachnick and Fidell (2007) says that, theoretically, the difference between FA and PCA lies in the reason that variables are associated with a factor or component. While factors are thought to cause observed variables- the underlying latent variable is what produces scores on the observable variables in FA, the observable variables are thought to cause or produce the component (latent variable) in case of PCA (Tabachnick and Fidell, 2007). Accordingly, the estimation of the resilience and detection of its determinants were done using PCA with 'Formative' measurement model orientation where the group of variables is believed to jointly determine the underlying construct. This is an opposite of 'Reflective' measurement model where the underlying construct is believed to shape the observable variables (i.e., causality flows from construct to indicators) (Coltman *et al.* 2008). However, the estimation of the components of resilience was done separately prior to resilience estimation. The approach was adapted as it makes the model more flexible allowing the inclusion of prior information and thus reducing parameter identification problems as argued in (Alinovi *et al*., 2008).

The PCA decomposes the original data into a set of linear variates and concerned only with establishing which linear components exist within the data and how a particular variable contribute to that component (Field, 2005). Using the Principal Component Analysis, the estimation was done hierarchically by estimating each of the resilience indicators or dimensions first separately and then combining them to estimate resilience scores for each household. However, the specification presented hereunder is only for the resilience estimation. But the same logic works for the estimation of each of the indicators of resilience. One thing to be noted at this juncture is that with PCA in use in the current study's context, both the measurement of resilience, i.e., estimating the resilience index, and detection of its determinants are done at the same time. That is, the size of the factor loadings indicates the substantive importance or relative contribution of a given variable to household's resilience to food security in addition to its instrumental role in resilience index estimation.

According to Field (2005:625), the factor loadings in a given analysis can be both correlation coefficients and regression coefficients. However, this depends on factor rotation undertaken. When orthogonal rotation is used, any underlying factors or components are assumed to be uncorrelated and the factor/component loading is the correlation between the factor/ component and the variable as well as the regression coefficient. That is, the values of correlation coefficients are the same as regression coefficient. But, in the situation where oblique rotation is used, the underlying factors/components are assumed to be correlated and the resulting Pearson correlations between variables and factors will differ from the corresponding regression coefficients (Field 2005).

However, the statistical significance determination rule of a factor or component loadings seem to lack consensus. While recognizing the common practice of taking loadings of an absolute value of more than 0.3 to be important by researchers, Feield (2005) argues that the significance of factor loading depends on the sample size. In this regard, Stevens (1992) cited in Field (2005) recommends the critical values against which the factor loadings can be compared. Accordingly, as stated in Field (2005:637), "--- for the sample size of 50 a loading of 0.722 can be considered significant, for 100 the loading should be greater than 0.512, for 200 it should be greater than 0.364, for 300 it should be greater than 0.298, for 600 it should be greater than 0.21, and for 1000 it should be greater than 0.162." These values according to Field (2005) are based on an alpha level of 0.01 (two tailed), which allows for the fact that several factor/component loadings will need to be tested. One thing that can be learned from these critical values is that as sample size gets larger and larger, even the small loadings can be statistically meaningful.

As mentioned above, the current study has employed Principal Component Analysis. Stated in terms of equation, in PCA context, the above functional relationship takes the form of equation (3.1).

$$R_i = w_{AA}AA_i + w_{ATA}ATA_i + w_{ABS}ABS_i + w_{SC}SC_i + w_{SS}SS_i + w_{AC}AC_i + \quad w_{IFA}IFA_i \tag{3.1}$$

Where:

R_i= resilience of household i, AA_i= agricultural assets, ATA_i = agricultural technology adoption, ABS_i =access to basic services, SC_i = social capital, SS_i = social safety nets, AC_i =adaptive

capacity, IFA_i= income and food access, $w =$ Weight for each indicator of resilience (factor loading)

Though loadings are stated as weights in this equation, they are rarely used in driving component scores, resilience scores in the context of the current study, in practice (Field, 2005). Rather two adjustments are made: standardizing the values of the variables in the model and transforming the factor loadings or loadings matrix into what is called factor score coefficients, also known with different names such as regression coefficients. According to the same source, the logic behind standardization of the variables values is that the differences in measurement scales used for observable variables can influence the resulting component scores. Hence, factor score coefficients are applied to standardized values of the variables in the model for estimating component scores. Accordingly, the specification in equation 3.1 will be transformed in to the one in equation (3.2). It (equation 3.2) is the one that was used for resilience index estimation in the current study.

$$R_i = \sum w_c[(X_i - X_j)/s_i] \quad (3.2)$$

Where

R_i = estimated resilience index for household i,

w_c = the weight (factor score coefficient) for the X^{th} indicator of resilience in the PCA,

X_i = the i^{th} household's value for the X^{th} variable (indicator) (Note: the X^{th}'s in the current study's context are the variables denoted by AA,ATA ,ABS, SC, SS, AC, and IFA in equation 1 above)

X_j = the mean of X^{th} variable for overall households.

s_i = standard deviation of the X^{th} variable for overall households

Literatures such Odum (2011), DiStefano *et al.* (2009), and Field (2005) identify variants of techniques for factor/or component score estimation that are based on the estimation model

specified here: Regression method, Bartlett method, and Anderson-Rubin method. In the current study, household's resilience scores as a composite index as well as the scores for each of the latent indicators of resilience are estimated using the Bartlett method. The Bartlett method generally produces latent variable scores that are unbiased and univocal (DiStefano *et al*, 2009). When it comes to detection of the substantive importance of each variable, the current study used the size of factor loadings as a means of examining how strongly each variable contributes to the household's resilience to food insecurity. This way of examining the relative importance of variables to latent variables is generally admissible in latent variable models.

The role of livelihood systems (zones) to which households belong in explaining variations in the level of their resilience to food insecurity was analyzed using the analysis of variance (AOVA) model. ANOVA was run to compare the mean differences in household's resilience level among the three livelihood systems and *F-statistic* was used for significance test.

3.3.4.2. Data analysis method for food security related question/objectives

With regard to the second research question, assessment of the household's food security status, the analysis was conducted descriptively using, mainly, percentages. It was further enriched by examining if there is household's livelihood systems or zones based differences in food security/insecurity situation. The relationship between the current food security situation and resilience scores of the households was analyzed with simple correlation.

The analysis of the household's food security situation involves examining the household's responses to HFIAS and FCS questions, with rCSI supplementing them as cross validation tool. According to Coates, Jennifer, et al. (2007), the HFIAS module yields information on four indicators on food insecurity at the household level. That is, four types of indicators can be calculated to understand the characteristics of and changes in household food security/insecurity in the surveyed population.

These indicators provide summary information on: (1) percent of households experiencing any of the conditions represented by the nine HFIAS generic questions (***Conditions)***; (2) summary information on the prevalence of households experiencing one or more behaviors in each of the three domains reflected in the HFIAS: '*Anxiety and uncertainty'*, '*Insufficient Quality'*, and

'*Insufficient food intake and its physical consequences'* (***Domains)***; (3) individual scores achieved by each household, a continuous variable that runs from 0 (minimum possible score) to 27 (maximum possible score) (***Scale Score)***; (4) the household food insecurity prevalence (P***revalence***). This, the last indicator, is the categorical indicator of food security that can be used to report the overall food security/insecurity prevalence of the surveyed households. Based on their food security situation, the prevalence indicator of HFIAS categorizes households into four categories: food secure, mildly food insecure, moderately food insecure, and severely food insecure. In the food security situation analysis, the current study generated and used these pieces of information with regard to this indicator.

According to WFP (2008), food consumption score (FCS) is frequency weighted diet diversity score calculated using the frequency of consumption of different food groups consumed by a household during the 7 days before the survey. According to Firehiwot and Degefa (2015), weights are given to each food group based on nutritional density and animal proteins receive the highest weight. The FCS analysis yields both continuous and categorical information on household's food consumption. Based on FCS, households are categorized in to three classes: Poor, Borderline, and Acceptable categories (WFP, 2008, Daniel and Gerber, 2016). In the analysis of food security situation of the households using this indicator, the current study too followed the same approach.

Reduced coping strategy index (rCSI) is a subset of full coping strategy index (CSI) proposed with the intention of making the cross-cultural comparison of food security information generated through coping strategies based measures. According to Maxwell and Caldwell (2008), the CSI was originally developed to capture the nature of the behavioral response to food insecurity in a given context. This nature of it makes CSI unhelpful in comparative analysis (Kennedy 2002 in Maxwell and Caldwell 2008) and has led to the development of rCSI that permit a broader across cultures comparative analysis (Maxwell and Caldwell 2008). As indicated in Maxwell and Caldwell (2008), the reduced CSI uses the five most common behavioral changes in response to food shortages and facilitate the comparison of food security across various strata by normalizing the behaviors and severity scores that are used to create the index. The five standard coping strategies are: eating less-preferred foods, borrowing

food/money from friends and relatives, limiting portions at mealtime, limiting adult intake, and reducing the number of meals per day.

As argued in Maxwell and Caldwell (2008), extensive researches have demonstrated that the rCSI reflects food security/insecurity nearly as well as the full or context-specific CSI. With the rCSI in use, a household score as index can run from 0 to 56 points where the lower scores indicating better food security situation and the higher scores the opposite. However, rCSI or the CSI to which it is a part or subset doesn't have suggested cutoff points for classifying households into different food security status groups unlike the two above mentioned indicators. Embarking on the arguments of the sources mentioned here regarding the validity of the indicator in terms of capturing food security situation information, the current study developed the rCSI using the universal weights attached each variable or question in it and used together with the other indicators in food security analysis. The examining of cross-livelihood systems differences in food security situation of the households was done through the analysis of variance (ANOVA). This is possible because all indicators here in use are continuous variables at household level.

3.3.4.3. Data analysis methods for coping mechanisms

When it comes to coping mechanisms, the analysis was done mostly descriptively using percentages. The linkage between household's resilience and the previously employed coping mechanisms was examined using contingency table and Chi-square tests. In the analysis, households were divided into two categories: those who previously used negative or resilience erosive coping strategies and those who did not use such coping mechanisms over the past two years. Though, previous studies have not established clear criteria for such classifications, based on insights from conceptual literatures like Corbett (1988) in Frankenberger, (1992), Carter *et al*. (2006), Mjonono, (2008), LIFT and USAID, (2011), Frankenberger *et al*. (2012), the current study used selling reproductive animals, selling oxen used for farming, selling land holdings, renting out land, removing children from school, borrowing money at high interest rate, and diversion of loans from MFIs as a base for categorization. Accordingly, households who employed any of these strategies over the past two years were classified under negative coping category.

As far as my knowledge is concerned, previous studies on household's resilience to food insecurity, similar with the current study in resilience analysis, have not established a cut-off point for identifying resilient households from the non resilient ones. However, following the prior similar works like that of Mulat and Negussie (2013) and Guyu and Muluneh (2015) and considering the relative location of the surveyed households on the latent variable (resilience scores), the current study categorized the households into two groups as well: resilient and non resilient.

After completing this job, i.e., categorization, the relationship between the household's resilience level and their previously used coping mechanisms was analyzed using the Chi-square. Chi-square is a data analysis model that is based on Chi-square distribution and mostly applied to frequency based nominal scaled categorical date analysis. In such applications, the Chi-square distribution is used to determine how well a theoretical distribution fits an observed distribution, and to test whether two or more categorical variables are independent or not (Myers and Well, 2003). It does so according to Field (2005), by comparing the observed frequencies in certain categories to the frequencies that one might expect to get in those categories by chance. In the current study's case, it is used to test whether the achieved relative resilience scores of the households are independent of the nature of coping mechanisms adapted in response to previously happened shocks or not.

3.3.4.4. Analysis of data from key informants interview (qualitative data)

As previously indicated, the current study was also collected data through key informants' interview that involves three groups: *Woreda* level agricultural office expert, Development Agents (DAs), and elderly people. The data that were generated through the key informants' interview were carefully transcribed and concomitantly analyzed with the quantitative data analysis. Such an approach is believed to help achieve better triangulation and facilitates the interpretation of quantitative findings in the analysis. According to Saunders *et al.* (2007), such an approach is tenable under mixed-method research approach of the mixed methods design, which is part of the multiple methods research design.

Chapter 4: Households' Characteristics, Food Security Situation, and Coping Mechanisms

4.1. Introduction

In this chapter, I will present summarized information about respondents' characteristics and detailed analysis on the food security situation and coping mechanisms of the households. The food security analysis begins by determining food security status of the households. Both household food insecurity access scale (HFIAS) and food consumption score (FCS) based food security/insecurity situation of the households have been covered. The food security analysis has also involved cross validation of the HFIAS and FCS findings using the rCSI and cross-classification of the HFIAS and FCS based food insecurity prevalence with the aim of understanding the proportion of the surveyed households who are food insecure both in terms of food sufficiency and food consumption. Then, the discussion of the chapter moves to the coping strategies of the households. Under this, both consumption based and other, non-consumption based, coping strategies of the households have been discussed.

4.2. Characteristics of respondents

This subsection is meant to provide the readers with the overall picture about the socio-economic and demographic characteristics of the respondents (Table 4.1).The data regarding households head involved in the survey shows wide variability in terms of age. The youngest is 20 years old and the oldest is with 80 years of age. Out of total respondents, 22.9% are 35 years old or less and, overall, majority of the respondents, about 80%, is within the age range of 50 or less. Religion wise, about 90 percent of the respondents are protestant Christians. This may not be surprising as the CSA (2007) report too shows that about 78% of the *woreda's* population belongs to this religion group and there is a tendency for other religion followers, mainly Orthodox and Muslims, to concentrate in urban centers with regard to the place of residence. Regarding the education level, about 46% of the respondents have never attended formal schooling and those who reached and crossed grade 9 are less than 9%. Those whose schooling year falls within the range of grade 1 to 4 and 5 to 8 are 23% and 22.8% respectively. This, the observed low educational attainment does not show aberration from intuitively expected as

education infrastructures like schools remained to be limited in terms of access in the past and the respondents of the current survey have already crossed schooling age not to take advantage of the recent expansion of schools. On the other hand, the mean number of maximum schooling years, proxied through attended grades, within the surveyed households is 8 years.

With regard to marital status, significantly noticeable proportion of the survey respondents (95%) lives within the marriage ties. As expected, farming turned to be a single dominant occupation of respondents being the only occupation for 90.7 % of them and joint occupation for the remaining respondents. The surveyed households have an average household size of about 6 members with moderate variations (with coefficient of variation of about 30.7%). Another important characteristic of the households, dependency ratio, shows the mean of 0.68 with the implication that on average 1.5 productive age individuals supporting 1 dependent.

Table 4.1: Respondents' Socio-economic and Demographic profile

Variable				
Age of HH head	Age range	Frequency	Percent	Cumulative percent
	≤ 35	96	22.9	22.9
	36-50	238	56.8	79.7
	≥51	85	20.3	100.0
	Total	419	100.0	
	Minimum	20		
	Maximum	80		
	Mean	43.44		
Religion		Frequency	Percent	
	Protestant	379	90.2	
	Orthodox	4	1.0	
	Catholic	15	3.6	
	Muslim	17	4.0	
	Others	3	1.2	
	Total	420	100.0	
Marital Status		Frequency	Percent	
	Single	2	.5	
	Married	399	95.0	
	Divorced	1	.2	
	Widow/er	18	4.3	
	Total	420	100.0	
Education of HH head		Frequency	Percent	Cumulative

				Percent
	No formal education	190	45.6	45.6
	Grade 1 to 4	96	23.0	68.6
	Grade 5 to 8	95	22.8	91.4
	Grade 9 and above	36	8.6	100.0
	Total	417	100.0	
Occupation of HH head		Frequency	Percent	
	Farming	381	90.7	
	Salaried employee	2	.5	
	Farming and Trade	27	6.4	
	Farming and Salaried employee	10	2.4	
	Total	420	100.0	
Household size	Minimum	Maximum	Mean	Std. Deviation
	2.00	12.00	6.2458	1.92048
Dependency ratio	Minimum	Maximum	Mean	Std. Deviation
	.00	2.50	.6824	.41443
Maximum level of education within the household	Minimum	Maximum	Mean	Std. deviation
	0	15	8	3.3

Source: Field Survey, 2016

4.3. Food security status of households

Food security is a multidimensional concept sufficiently challenging not only the operationalization effort of it but also decisions of who is food secure and who is not. For instance, the hugely acclaimed definition of FAO suggests considering the availability, access, utilization, and stability aspects in the determination of the state of food security. The scholars' suggestion for a need to consider the subjects own perception regarding their food security/insecurity situation when it comes to measurement also adds a brick to the complexity of already complex enough problem. Re-quoting Maxwell *et al.* (2013:12) "The World Food Summit definition of food security, adopted and widely promoted by FAO, contains several key elements, or dimensions, each of them difficult enough to measure separately, but nearly impossible to measure in totality using any single indicator*"* may make the whole point here louder. As discussed in chapter 2 and chapter 3, the current study utilized household food insecurity access scale (HFIAS) and food consumption score (FCS) as main food security

indicators and reduced coping strategy index (rCSI) as supplement for cross validation. The results of the investigation have been discussed hereunder.

4.3.1. Households food security status with HFIAS

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 frequency-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 HFIAS approach is that the experience of food insecurity causes predictable reactions and responses that can be captured and quantified through a survey and summarized in a scale. The analysis of HFIAS based data generally yields four pieces of information: information on conditions, domains, prevalence, and scale score (Coates *et al*. 2007).

The conditions indicators of HFIAS provide specific disaggregated information, about the behaviors and perceptions of the surveyed households, on each occurrence question. Table 4.2 presents the summary of results of the survey along each occurrence questions of the instrument.

Table 4.2: Summary of the frequency of the responses to the HFIAS questions

Generic question	No		Yes							
			Rarely		Sometimes		Often		Total	
	N	%	N	%	N	%	N	%	N	%
1.Worried about food	126	**30**	115	27.4	100	23.8	79	18.8	294	**70**
2. Unable to eat preferred food	119	**28.3**	91	21.7	159	37.9	51	12.1	301	**71.7**
3. Eat just a few kinds of foods	129	**30.7**	116	27.6	130	31	45	10.7	291	**69.3**
4. Eat foods they really do not want to eat	167	**39.8**	99	23.6	136	32.4	18	4.2	254	**60.2**
5. Eat a smaller meal	187	**44.5**	108	25.7	94	22.4	31	7.4	233	**55.5**
6. Eat fewer meals in a day	223	**53.1**	105	25	67	16	25	6	197	**46.9**
7. No food of any kind in the household	357	**85**	51	12.1	11	2.6	1	.2	63	**15**
8. Go to sleep hungry	361	**86**	46	11	12	2.9	1	.2	59	**14**
9. Go a whole day and night without eating	408	**97.1**	10	2.4	2	0.5	-	-	12	**2.9**

Source: Field Survey, 2016

The result of the survey shows that 70% (294) of the surveyed households experienced some kind of worries fearing that their respective household would run out of food or would not have enough food to eat. Domain wise, this sub question of the indicator is assumed to represent the stability dimension of food security (Maxwell *et al*., 2013). Hence, the fact that very significant proportion of the households experienced anxiety of varying level indicates that stable access and availability of food is a concern for the study area. This observation is in agreement with the finding of Garedew (2017) in East Shewa Zone of Oromia region. He found out that 69% of the households who were not members of agricultural cooperatives and 59% of the cooperatives member households worried about that they would run out of food.

The summary of the household's responses on three occurrence questions (unable to eat preferred food, eat just a few kinds/ limited variety/ of foods, and eat foods they really do not want to eat) that represent *insufficient quality* domain in the words of (Coates *et al*. 2007) also shows undesirable picture. Under this category, 71.7% (301) of the surveyed households reported that they ate less preferred food at least once over the last 30 days preceding the date of survey. Of these, 50% of the total households or about 70% of the households with "yes" responses experienced the behavior at least three times. On the other hand, 69.3% (291) and 60.2% (254) of the surveyed households reported that they ate limited variety of foods and the foods they really do not want to eat respectively at least once within 30 days. The findings regarding this, *insufficient quality*, domain of HFIAS is also in agreement with that of Garedew (2017), specially for non-cooperatives member households, whose findings revealed that 67% of households were not able to eat their preferred food due to lack of resources and 67% and 64% of the sampled households ate limited variety of food and the food they do not want to eat respectively.

Close examination of the proportion of respondent's with "yes" response to these three subsets of the HFIAS questions indicate that the majority of the surveyed households experienced undesirable behavior from food security stand point. The foods served at household level either lacked variety, or unacceptable under normal condition, or less desirable one or poor in all the three respects at least for one time during the past 30 days preceding the survey date. Though, the survey result presented here gives the picture of the past one month only, observation of one

of my elderly key informants from Aldada Dela *kebele* shows gradual deterioration of situation overtime on the availability of preferred food. In responding to the question of common staple food in the area, he said:

> In the past the common staple and also preferable food was kocho with milk and milk products. Maize was not common food item. However, milk, kocho, and even maize have become things in short of supply. If you ask me about now, there is no such luxury. Having something to eat, not something preferable is the first goal to hit for almost all households in the area.

The last four variables or occurrence questions in Table 4.2 fall under the *insufficient food intake* or quantity domain. This domain represents food rationing behavior and when compared to the above two domains, the behaviors under this domain indicate most severe food insecurity situation. Also it can be, at least intuitively, said that each behavioral action within the domain represent different level of food insecurity. For example, eating a smaller meal can be less severe behavior, in terms of the level of food insecurity experienced, than eating few meals within in a day, which in turn is less severe than going to bed with empty stomach. In the case of the present study, 55.5% (233) of the surveyed households reported that their respective household ate a smaller meal at different level of frequency. The proportion of households responded affirmatively to the question "Did you or any household member have to eat fewer meals in a day because there was not enough food?" is 46.9 % (197). Responses to these two occurrence questions indicate that noticeable number of the surveyed households engaged in food rationing behavior by taking action on quantity per intake or on frequency of intake, or taking actions on both. However, only very small number of households reported more severe reactions in the category/domain. The proportion of respondents with "yes" answer to the questions "Was there ever a time that 1) no food of any kind to eat in the household , 2) any member of household go to sleep hungry, and 3) any number of household go a whole day and night without eating " are 15% (63), 14%(59), 2.9%(12) respectively. The reason for this could be partly due to the timing of survey. As the survey was conducted after the harvest period, the households might not have completely gone devoid of food even if the harvest was not good due to crop failure. In the case of some households, it could be due to humanitarian aid that was under distribution during the time of survey (Figure 4.1).

HFIAS based household food insecurity prevalence is a categorical indicator of food security status (Jones et al. 2013, Coates *et al*. 2007). The indicator categorizes households into four categories: food secure, mildly food insecure, moderately food insecure, and severely food insecure. Households are categorized as increasingly food insecure as they respond affirmatively to more severe conditions and experience those conditions more frequently (Coates *et al*. 2007).

According to Coates *et al*. (2007), a food secure household experiences none of the food insecurity conditions, or just experiences worry, but rarely. On the other hand, a mildly food insecure household worries about not having enough food sometimes or often, and/or is unable to eat preferred foods, and/or eats a more monotonous diet than desired and/or some foods considered undesirable, but only rarely. However, a household who fall under this category is one that does not cut back on quantity nor experience any of three most severe conditions represented by the last three rows in Table 4.2. Unlike to the previous two categories here, a moderately food insecure household sacrifices quality more frequently, by eating a monotonous diet or undesirable foods sometimes or often, and/or has started to cut back on quantity by reducing the size of meals or number of meals, rarely or sometimes but does not experience any of the three most severe conditions mentioned here again. A household in the severely food insecure category is one who has graduated to cutting back on meal size or number of meals often, and/or experiences any of the three most severe conditions, running out of food, going to bed hungry, or going a whole day and night without eating, even as infrequently as rarely. In other words, any household that experiences one of these three conditions even once in the last 30 days is considered severely food insecure. Table 4.3 illustrates this categorization and as argued in Coates *et al*. (2007), the categorization scheme help to ensure that a households set of responses will place them in a single, unique category.

Table 4.3: HFIAS based food security/insecurity level categorization scheme (developed based on Coates et al. 2007)

Occurrence question		Household's response	Frequency		
			Rarely	Sometimes	Often
1*	Worry domain	Yes			
2	Insufficient quality domain	Yes			
3		Yes			
4		Yes			
5	Insufficient quantity domain	Yes			
6		Yes			
7		Yes			
8		Yes			
9		Yes			
Key			Food secure	Mildly food insecure	Moderately food insecure	Severely food insecure

* *Refer to Table 4.2 for identity of questions represented by numbers under each domain*

Based on this categorization rule and with the support of '*compute variable*' option of SPSS version 20, the current study has determined food security/insecurity status of the surveyed households and the result has been summarized in the Table 4.4.

Table 4.4: Food security status of the household (HFIAS)

Food security status	Frequency	Percent
Food secure	109	26.0
Mildly food insecure	49	11.6
Moderately food insecure	174	41.4
Severely food insecure	88	21.0
Total	420	100

Source: Field survey, 2016

Only 26 % (109) of the surveyed households were food secure. All the remaining households were food insecure at different level. More specifically, 11.6% (49), 41.4% (174) and 21.0% (88) households had mild, moderate, and severe food insecurity respectively. Even if, mildly food

insecure category is added to the food secure group, the food insecurity prevalence still stood as high at 62.4%. This finding mostly compares with previous similar studies. Previous studies that employed HFIAS tool for food security analysis have mostly reported high food insecurity prevalence. For instance, Worku *et al.* (2014) in Farta district in Northwest Ethiopia reported 70.7% food insecurity prevalence. A study by Negatu (2011) in Boricha *woreda* of Sidama zone revealed a food insecurity prevalence of 54%. In their study conducted in urban settings, Dula and Degefa (2017) reported that about 87.6 % of the surveyed households were food insecure.

4.3.2. Households food security status with FCS

Food consumption score (FCS) is a composite score based on dietary diversity, food frequency, and relative nutritional importance of different food groups. The relative nutritional importance of the food groups are used as a weight in the computation of the composite score (WFP, 2008). According to WFP (2008), computing food consumption score for each household requires 1) grouping food items into 8 standard food groups with a maximum consumption frequency value of 7 days/week; 2) multiplying the consumption frequency of each food group by nutrition content based assigned weight to each food group; and 3) summing up the resulting values to obtain the food consumption score (FCS). Table 4.5 presents the relative nutrition content based weight for each food group.

Table 4.5: Nutrition based weight for food groups

Food group[2]	Weight
Grains/Tubers	2
Vegetables	1
Pulses	3
Milk	4
Fruits	1
Meat/Fish	4
Oil/Butter	0.5
Sugar	0.5

Source: Adapted from WFP (2008)

[2] Food items in each group: Grain/ Tubers (maize, barely, wheat, sorghum, tef, kocho, potatoes, and cassava); Vegetables and leaves (cabbage, carrot…); Pulses (bean, pea, haricot bean); Fruits (avocado, pineapple, orange, apple, Papaya, banana, gishita); Meat and fish (meat, egg, fish); Milk related (local milk, powder milk); Sugar related (sugarcane, honey, sugar); Oil and fat (butter, processed oil)

For the current study, households were also asked about the frequency of consumption of different foodstuffs during the seven days preceding the date of survey. Using the collected data, food consumption scores (FCS) for the surveyed households were developed on the basis of the prescriptions given above and using the weights in the Table 4.5. The following equation summarizes the method used in the computation of the FCS.

$$FCS\ i = \sum (wXj)(fXji) \text{----------} \quad \text{(equation 4.1)}$$

Where,

$FCS\ i$ = Food consumption score for household i

wXj = Nutrition content based weight for food group Xj

$fXji$ = Frequency of consumption (number of days a food group consumed) of a food group Xj by a household i

The analysis of food security of households with food consumption score yields categorical information regarding the level of food consumptions achieved. As discussed under chapter three, on the basis of relative FCS achieved, households can be classified into three categories: those with *poor* consumption, with *borderline* consumption, and with *acceptable* consumption. Regarding the categorization criteria, literatures generally leave a room for decisions regarding what would be the cutoff points in a particular context. That is, researchers can decide the cutoff points on the basis of the pattern of observed consumption (Gürkan and Sanogo 2011).

In line of this, WFP (2007) in Wiesmann *et al.* (2008) and WFP (2008) provide two alternative set of cutoff points: 1) for observed consumption pattern where oil and sugar are part of frequently consumed food groups and 2) for observed consumption pattern where these two food groups are of a rare frequency. With the first alternative, households with FCS of ≤ 28, between 28.5 to 42, and ≥ 42.5 are classified as *poor*, *borderline*, and *acceptable* consumption groups respectively. If the observed consumption pattern conforms to the second pattern, the FCS based cutoff points would be ≤ 21 for *poor*, 21.5 to 35 for *borderline* and ≥ 35.5 for *acceptable* consumption groups. As part of the analysis leading to the categorical information regarding the

household's food security status, the current study too has examined the consumption pattern of the surveyed households and the result has been summarized in Table 4.6.

Table 4.6: Summary of the frequency of the food intake from different food groups during seven days before the start of the survey

Food groups	Number /proportion/ of households with intake for:				
		no consumption	1-2 days	3-4 days	5-7 days
Grains/ Tubers	Count	0	0	3	417
	Percent	0	0	0.7	99.3
Vegetables	Count	14	62	150	194
	Percent	3.3	14.8	35.7	46.2
Pulses	Count	40	134	199	47
	Percent	9.5	31.9	47.4	11.2
Milk	Count	144	120	88	68
	Percent	34.3	28.6	20.9	16.2
Fruits	Count	262	119	31	8
	Percent	62.4	28.4	7.4	1.9
Meat/ fish	Count	354	46	17	3
	Percent	84.3	11	4	0.7
Oil and Fat	Count	99	38	122	161
	Percent	23.6	9	29.1	38.3
Sugar	Count	359	36	16	9
	Percent	85.5	8.5	3.9	2.1

Source: Field survey, 2016

As the summarized data in the table shows, almost all of the surveyed households (99.3%) consumed main staples (grains/tubers) for at least 5 days during seven days preceding the survey. None of the households had zero or no consumption as far as grains and/or tubers are concerned. When it comes to vegetables, only 46.2% (194) of the surveyed households had consumed for 5 or more number of days within 7 days period. However, still good proportion of the surveyed households 35.7% (150) had consumed food items from this group for 3- 4 days within 7 days period.

However, the proportion of surveyed households with consumption of food represented by pulses significantly dropped when compared with the above two food groups. Only 11.2% (47) of the households had consumed from this food group for 5 days or more. About 32% (134) had consumed food stuffs from this group for1- 2 days only and 9.5% (40) of the households had not totally consumed foods from this group. About one third (34.3%) of the surveyed households reported that no member of their household had consumed milk during the indicated time period

and the proportion of households with only 1- 2 days consumption is 28.6%. When the two groups combined, the proportion of households with entirely no or with only 1-2 days consumption of milk is about 63%. Such figure regarding milk consumption is a clear indication of the deterioration of living condition of rural households in Sidama area context including Boricha *woreda* compared to what had been in the past. Quoting the explanation given by an elderly key informant, on the current land holding size per household may provide good insight on this food group: milk. This is how he put it:

> During my early age, land size was not an issue, though politically was. There were unoccupied abundant common range lands. A single household would keep large number of domestic animals like cows hence excessive milk for consumption. Someone grown up by drinking milk can easily recover from even sever wounds inflicted on him by enemies. No range lands today, hence no milk even for children. That available in few households' home is collected by traders in the town.

The consumption level of another livestock product, the meat, egg, and nutritionally related food (fish), is almost worse or non-existence. 84.3% (354) of the surveyed households had no consumption of this food group in the seven days period preceding the date of survey. The proportion of households that had consumed food items from this group (meat/fish) for maximum of one or two days is 11% (46). When these two groups are combined, it can be said that 95.3% (400) of the total households either had not consumed at all or consumed food items from this food group only for a maximum of 2 days. This picture is obviously unwelcomed from dietary nutritional content requirement point of view and associated consequences as Degefa (2005:294) put it: "Lack of consumption of livestock products results in severe protein deficiency in their diet, the implications of which are disastrous, particularly in case of children since this impairs their physical and mental growth."

The summary data on fruits consumption too show that about 91% of the surveyed households had either no consumption or consumed them only for 1-2 days. 62.4% (262) households reported that no member of their respective household had consumed any food item from fruits group within the 7 days that precede the date of survey. As one may expect, access to sugar, a

food item to which even the urban dwellers have rationed access at present, and related food items such as honey was also very limited. As indicated in Table 5.5, 85.5% (359) households had not consumed foods from sugar group within the 7 days period.

When it comes to oil and fat food group, about 38.3% (161) of the households had consumed some food items from this food group for at least 5 days and 29.1% (122) had consumed for 3 to 4 days from the total of 7 days. This may give a surprise to the readers as it seemingly appears to be conflicting with what has been reported above in relation to livestock products consumption. Though the disaggregated information is not presented here, the majority of households reported their consumption of foods belonging to this group referred to the processed (edible) oil. Only few households reported consumption of better. Availability of edible oil in the area can be attributed to food aid suppliers and as I was informed during may stay in the field, those who get put part of what they get for sale. For example, considering the price differences and with the logic that they have no luxury of consuming wheat that the aid suppliers provide, they sell wheat to traders and buy maize instead, which is also true for edible oil.

Having this information regarding the consumption patterns of different food groups by the surveyed households, it is possible to select appropriate thresholds or cutoff points and classify the households into FCS based consumption groups. As discussed above, two standard thresholds have been identified to distinguish different food consumption level: thresholds for oil and sugar loaded consumption pattern and for situations where the two food groups are not part of regular diet. In the present study's case, the close examination of Table 4.6 shows that the consumption of sugar was almost non-existent and that of oil is not to the extent that deserves unique attention for cutoff points decision. For example, about one-third of the surveyed households either had not consumed entirely the food items from oil/fat food group or had consumed only for 1 to 2 days. Based on this logic, the current study has preferred to use the thresholds of ≤ 21 (for *poor)*, 21.5 to 35 (for *borderline)* and ≥ 35.5 (for *acceptable)*. Table 4.7 presents summary of proportion of households falling under the three food groups developed on the basis of the chosen thresholds or cutoff points.

Table 4.7: FCS based food consumption categories of the households

Consumption category	Frequency	percent
Poor	30	7.1
Borderline	148	35.2
Acceptable	242	57.6
Total	420	100

Source: Field survey, 2016

Information summarized in Table 4.7 shows that only very small number of the surveyed households had *poor* consumption. The majority (57.6%) of the households had *acceptable* consumption level. The proportion of household with *borderline* consumption is 35.2% (148). If only those households having *acceptable* consumption are taken as food secure, which is reasonable treatment and also the practice of previous studies such as (Alemseged, 2016, Goitom, 2017), the food consumption score based food insecurity prevalence stands at 42. 4%. Such treatment simply confirms to the logic that the stated proportion of the households had less than acceptable level of nutritional intake, even under this rough approximation or proxy measure. Moreover, though a given level of food consumption score can be achieved with various combinations of consumption pattern of different food groups, it is arithmetically possible to achieve the upper bound of the *borderline* consumption even without consuming milk and meat families: the two food groups that had been rarely consumed by most of the households in the case of current study. In nutritional content wise, WFP (2008:20) describes the two food groups as "Meat and fish: highest quality protein, easily absorbable micronutrients (no phytates), energy dense, fat. Even when consumed in small quantities, improvements to the quality of diet are large. Milk: highest quality protein, micro-nutrients, vitamin A, energy*"* and assigns the highest weights for the two food groups.

The prevalence of 42.4% reported here for the current study indicates that noticeable level of the study area households are food insecure in terms of consumption of nutritional variety: the proxy of utilization dimension of food insecurity. Previous studies that employed FCS have also reported high food insecurity prevalence. For instance, Alemeseged, (2016) in Werie Leke District in Tigray National Regional State reported the consumption food insecurity prevalence of 59.7%. The peri-urban focused study of Goitom (2017) in Kobo town revealed the food insecurity prevalence of 67.5%. On the other hand, in their study in Yeka Sub-city of Addis

Ababa (Frehiwot and Degefa, 2015) found out that only 25.6% of the sample households were food insecure. The relatively low food insecurity prevalence in the study of Frehiwot and Degefa (2015), could conform to the general argument that food insecurity is more sever in rural Ethiopia than urban cities and hence does not refute the validity of the finding of the current study, as well as, those others that focused on rural and semi-urban areas.

4.3.3. Cross validation of HFIAS and FCS food security scores with rCSI

As discussed in chapter two and chapter three, household food insecurity access scale (HFIAS) and food consumption score (FCS) individually measures different dimensions of household food security. They are also meant to capture different set of data regarding food security. Whereas the former focuses on capturing the household's perception of food state and food-shortage/stress/management based reactions, the later focuses on capturing number of days various food items were actually eaten. Again, based on the inherent nature of these two indicators, the meaning of the resulting continuous scores to be obtained also varies. Moreover, the rules applied in generating categorical food security status information also vary for the two indicators leading to different food insecurity prevalence under the same empirical context. This difference in the food insecurity prevalence leaves one big doubt to be cleared out. That is, the question of whether the observed difference is due to the inherent nature of the indicators or the problem in the survey's data quality.

Though both HFIAS and FCS questionnaires are well empirically tested instruments and their understandability to my respondents was also checked prior to full scale date collection in the field, I have endeavored to add further confidence to readers regarding the validity of the data in the context. Literatures do also suggest such practice. For instance, WFP (2008), suggests running verification of the food consumption scores by comparing to other proxy indicators of food security such as wealth index, CSI and the like as it permits the triangulation of findings. Though examining the correlation between the HFIAS scores and the FCS of the households can serve the purpose by its own, for more confidence and further triangulation, I produced the reduced Coping Strategy Index (rCSI) for cross validation.

Reduced Coping Strategy Index was developed based on the five consumption based coping strategies and the associated weights presented in Table 4.8 for readers convenience and using the formulation represented by equation 4.2.

Table 4.8: Consumption coping strategies and associated severity weight for rCSI

Coping strategy (behavior) : (Xj)	Severity weight
Eating less-preferred foods	1.0
Borrowing food/money from friends and relatives	2.0
Limiting portions at mealtime	1.0
Limiting adult intake	3.0
Reducing the number of meals per day	1.0

$$rCSI\ i = \sum (fXji)(wXj)$$ ---------- (equation 4.2)

Where,

$rCSI\ i$= reduced coping strategy index for household i

$fXji$ = number of times (frequency) coping strategy Xj was used by household i within 7 days preceding the date of survey

wXj = severity weight attached to coping strategy Xj

As the rCSI does not have thresholds or cutoff points for classifying households into different food security groups, the continuous scores developed using the equation 4.2 were used for cross validation mentioned above. Cross validation was done by running simple bivariate correlation analysis using the continuous scores of the three indicators (rCSI, FCS, and HFIAS) and the result has been summarized in Table 4.9.

Table 4.9: Correlations of FCS, HFIAS, and rCSI

		FCS	HFIAS	rCSI
FCS	Pearson Correlation	1	**-.528****	**-.475****
	Sig. (2-tailed)		**.000**	**.000**
	N	420	420	420
HFIAS	Pearson Correlation	-.528**	1	**.749****
	Sig. (2-tailed)	.000		**.000**
	N	420	420	420
rCSI	Pearson Correlation	-.475**	.749**	1
	Sig. (2-tailed)	.000	.000	
	N	420	420	420

**. Correlation is significant at the 0.01 level (2-tailed).

Source: Field survey, 2016

Theoretically, for the data collected from the same community or empirical context, the FCS score is expected to be negatively correlated with both HFIAS and rCSI scores. On the other hand, household's score on HFIAS and rCSI is supposed to be positively correlated. This is because, whereas the higher scores of HFIAS and rCSI indicate greater food insecurity as compared to the lower scores, the reverse works for food consumption scores (FCS). In the case of present study, findings of the correlation analysis presented in Table 4.9 perfectly confirms to these theoretical expectations. FCS is negatively and significantly correlated with both HFIAS ($r = -0.528$, $p. <0.001$) and rCSI ($r =-0.475$, $p. <0.001$). As expected again, HFIAS is positively and significantly correlated with rCSI ($r = 0.749$, $p. <0.001$). Moreover, the level of correlations among the variables is also strong. This finding is also in line with the findings of Maxwell *et al.* (2013) whose study focus was examining how the different food security indicators compare.

Both of the main indicators of the households food security of the current study (HFIAS and FCS) are individually, strongly, and significantly correlated with third indicator (rCSI) introduced for cross validation. Based on this, one can now safely attribute the above observed differences in food insecurity prevalence, 62.4% in the case of HFIAS and 42.4% in the case of FCS, to the inherent differences in the nature of the indicators employed. That is, inherently, HFIAS is more sensitive to food insecurity. On the other hand, FCS is more lenient indicator than HFIAS and hence tends to favor the opposite end in the continuum.

4.3.4. Households food security status with cross-classification of HFIAS and FCS based food security categories

As reported in the previous sections, HFIAS and FCS based assessments provided their own respective picture regarding the households' food security/insecurity situation. Though these two set of information has their own meaning to convey, they are not univocal when it comes to food insecurity prevalence. The two indicators also yield different prevalence rate, 62.4% in the case of HFIAS and 42.4% in the case of FCS, when categories are reclassified. Given these disparities, I feel that it is fair to report the food insecurity prevalence rate that is jointly determined by the two food security indicators as a supplement through cross-classification.

Such an approach has also a benefit of controlling a possible misclassification effect: underestimating or inflating food insecurity prevalence as Maxwell *et al.* (2013: 15 &16) put it:

> It is clear that relying on only CSI, HFIAS or FCS alone would result in the misclassification of a substantial proportion of households as either food secure or food insecure by the measurement of the other indicator. However, cross tabulating them results in a new categorization. ---The obvious point arising from this kind of combined indicator is that there is less error (defined as a measurement more consistent with the definition of food security) in identifying the food-insecure and food-secure groups by using two indicators.

In the current study, the cross-classification was done simply by cross tabulating dichotomous food security status results of household food insecurity access scale (HFIAS) and food consumption score (FCS) based food security assessment. Table 4.10 summarizes the result of the cross-tabulation.

Table 4.10: FCS and HFIAS based food security status Cross-tabulation

			HFIAS based food security status		Total
			Food secure	Food insecure	
FCS based food security status	Food insecure	Count	25	**153**	178
		% within FCS based food security status	14	86	100
		% of Total	6.0	**36.4**	42.4
	Food secure	Count	133	109	242
		% within FCS based food security status	55	45	100
		% of Total	31.6	26	57.6
Total		Count	158	262	420
		% of Total	37.6	62.4	100

Source: Field survey, 2016

To provide a highlight about information in the Table 4.10, the food consumption score (FCS) based assessment has resulted in 42.4% food insecurity prevalence. Whereas, the food insecurity prevalence under HFIAS based assessment is 62.4%. Out of the total food insecure households according to FCS, which are 178 (42.4%), 153 (86%) has been correctly identified by HFIAS based classification as food insecure. Stated in relation to the total surveyed households, this amounts 36.4%. Hence, the jointly determined food insecurity prevalence in this study's context is 36.4%. That is, 36.4% of the surveyed households have a food insecurity problem both in

terms of (quality of) consumption as well as in terms of food sufficiency: access and availability as these dimensions converges specially at rural household level.

Based on this, it can be said that, at minimum, 36.4% of the surveyed households are food insecure. Here, I said *at minimum* because the data I got from my key informants made me to show more trust to HFIAS based food insecurity prevalence in terms of capturing real level of food insecurity prevalence in the study area's context. For instance, a DA working at *kebele* level (the name of *kebel* intentionally made anonymous) says, currently most of the households of the *kebele* need food aid. However, because of the shortage of aid supply, only those whose situation has become worse are being selected for aid provision at present. Another DA again working at different *kebele* describes the situation supporting with figures. This is how the DA put it:

> Currently about 209 households of the *Kebele* have been selected to receive food aid. However, about same size that still seek and deserve food aid have not been included due to limited size of available aid. In real assessment, the number of households who deserves to be screened in for food aid exceeds fifty percent. The household's screening criteria for aid distribution are set at *woreda* level on the basis of the available aid rather than realities on the ground.

As I learned from various key informants, surprisingly there is unacceptable practice in the area in relation to aid. That is, the number of food aid seekers is intentionally underreported by officials for the sake of saving the *woreda* image or to make the aid seekers number to fit to the inflated production data reported previously.

Given the time this survey was conducted, even 36.4% food insecurity prevalence indicates that the study area is generally a food stressed one. The pictures attached below also well support, the survey's finding in general. They are pictures taken while USAID was unloading food aid that will be immediately distributed at Dila Anole aid center despite the fact that the time was after harvest period.

Figure 4.1: Food aid under distribution by USAID at Dila Anole aid center

4.3.5. Causes of food insecurity

When we turn to reasons for food insecurity, the key informants provide their own explanations, which are, of course, more or less similar. In this sub-section, I present the key informants insight on the causes of food insecurity. I learned from my conversations with key informants of all the three groups, elderly people, Development Agents, and Agricultural Bureau expert, that food insecurity in the area is the recent phenomenon. Elderly key informants almost in agreement, though individually interviewed, say that the area started experiencing food insecurity only after the downfall of the Derg regime. According to them, food insecurity had never been an issue before that. Quoting a 78 year old elderly key informant from Gasara Kuwe *kebele* may be relevant here. Comparing his experience of the three regimes he has seen, he says:

> During the Emperor era, there was no land for farmers in their name, no market for farm products hence very tough to obtain cash to buy even clothes to wear. But there was no concern at all for something to eat. During the Derg regime, land was given to farmers, farmers hold sufficient land, but no enough market for farm products. Hence, cash remained to be scarce too. But still there was no concern for something to eat. It is only in this time that land becomes too small per holder and food becomes a problem of concern in this *woreda*.

The key informants attribute food insecurity problem of the *woreda* mainly to climate related factors: erratic rain and recurrent drought. Though rainfall problem takes the lead, a decline in

land holding size, population pressure, a decline in land productivity are among the factors responsible for food insecurity as per the key informants. Since the recent past, Boricaha *woreda* has been experiencing variation in the rainfall both in terms of amount and periodicity. The rain shows variation in the form of starting lately and/or stopping in the middle leading to total or major crop failures. In relation to this, referring to the last year farming seasons, one of DA key informants says:

> Those who cropped maize were affected by irregular rain. The rain started as early as desired but interrupted in the middle when maize is ready to give fruit, and then came back again. The interruption in the middle resulted in maize failure. However, those who cropped haricot been were not affected significantly as they benefited from the later rain as far as my *kebele* is concerned. It was mainly those farmers who cropped maize that were affected most.

Insufficient and erratic rain has been challenging both the availability of and access to food at household level for long by causing crop failures. This is how the *woreda* level agriculture bureau expert has described the situation.

> The distribution of rain has been showing variation both in terms of amount, timing, and spatial distribution. This has been the case almost for about last ten years. Though the normal and desirable starting time for rain is early in March, sometimes it doesn't start until late April. It also stops sometimes in the middle so as to cause crop failure. This usually causes production decline and hence a decline in food availability in the *woreda*. Similar case happened even in the last summer.

The data collected on the type of food insecurity related shocks in the current survey is also in agreement with the responses of my informants. When asked if they had experienced crop failure during the last two years time period, the majority of households answered affirmatively. Table 4.11 presents the summary of the household's responses. About 66% of the surveyed households had experienced crop failure over the last two years time.

Table 4.11: proportion of households experienced crop failure within the last two years

		Frequency	Percent
Response type	Experienced crop failure	277	66
	Not experienced crop failure	143	34
	Total	420	100

Source: Field survey, 2016

The key informants also argued, mostly in a similar fashion, that food insecurity can still remain to be an issue to most of the households in the area even if rain related problem disappears. The reason mentioned in this regard is small land holding size. From my discussions with key informants, I learned that the land holding size has become increasingly smaller and smaller from time to time to the extent that it doesn't enable farmers to produce crops enough to feed their households until the next harvest. This is how one of the elderly key informant explains it:

> In the absence of drought, those with small size households can better struggle to achieve food security. But for those with large household size, it doesn't matter whether there is a drought or not. They always live under food stress irrespective of the rain situation. Given the land holding size relative to their family size, they cannot produce enough to feed their households until the next harvest even in the good rain season.

Key informants attribute land fragmentation to the obvious factor: population growth. The elderly informants told me that population started to show high growth during the Derg regime but it is in the current regime that it showed an alarming rate increase, the direct outcome of which being a severe decline in land holding size. One elderly informant mentioned one more negative outcome of population increase that I found interesting enough to mention here. He argued that with population increase comes what is called '*baashe*': the term in sidama language used to describe the situation where one remains almost empty handed irrespective of the efforts or resources. His conceptualization of '*baashe'* partly fits to the common literatures definition of inflation. This is how he explains it:

> While I was young, earning 100 Birr was a big challenge but if you get it, it buys you a lot of things. Currently, everything is sellable. You can get a market even for *hashuwa*, a dried leaves of enset. But today thousands of birr does not earn you what 100 birr used to earn in the past. Even the land does not give you a yield as it used to in the past. It is a time of *baashe*.

When seen in the eyes of food security literatures or theories, these causal explanations by the key informants confirm that both population (demographic) as well as climatic theories of food availability decline (FAD) are heavily at work in the context of Boricha *woreda.* It seems that they have off-balancing or even nearly nullifying agricultural intensification effect of the demographic factor that falls under Boserupian line of thinking. Here, I am quoting the agricultural bureau expert's explanation to illuminate the point well.

> In the early years, with the application of chemical fertilizers, land productivity for maize cropping farmers was very promising. Being attracted by this, many farmers adjusted their choice and replaced their enset yards with maize. With this, preference for enset production/farming declines and maize replaces enset not only in the backyard but also on the dining table. However, the early observed productivity of maize failed to be sustainable and long lasting. Gradually, its productivity starts to decline even during good rain season. The soil losses its fertility and fails to effectively respond to chemical fertilizers as it used to be in the past. With the decline of land holding size, the traditional way of improving soil fertility through fallowing tradition has almost gone. Obviously, the rainfall variability is also causing the production failure to further nullify the bureaus effort of supporting farmers with existing technology.

Opinions of all the other key informants are also almost the same on the effect of agricultural technology. However, their blame goes not to the technology itself but the factor that renders the utilized agricultural technologies such as improved varieties and fertilizers fruitless: the climatic factor. The key informants further express their feelings and fears that the farmers may not be even willing to use chemical fertilizers as they are coming to believe that using fertilizers is pushing them further to poverty than working the other way round. This is how my elderly informant explains the situation:

> We farmers use improved seeds and fertilizers but the interruption of rain repeatedly in the middle of growth season usually makes us to end up with empty hands at the time of harvest. However, the administrators require us to pay back the fertilizer's debt and we pay it by selling our livestock. As crops usually fail, using them is not bringing differences for us. Even the interest for agricultural technology utilization is declining with repeated crop failures.

In relation to this, another elderly informant shared me what he called the farmers' dilemma. That is, since the indigenous maize seeds cannot be found, improved varieties are the only option for them. However, according to him, these improved varieties will not be effective without fertilizer. On the other hand, if the rain fails to show up as expected, farmers will not only loose the crop but also will be required to sell off their other assets to pay for fertilizers' debt. The risk of rain failure, according to him, is making farmers to face the decision dilemma of whether to keep investing on chemical fertilizer by assuming the risk of the possibility of negative return or abandoning such investment and consequential indebtedness. Abandoning investing on chemical fertilizer is equivalent to skipping the season without farming: the option that farmers cannot afford or advised to take given the obvious consequence: food insecurity or hunger. Clearly, this is the situation that indicates the need for wise intervention.

Based on these, the key informants' explanation, the food insecurity situation of the *woreda* can also be linked to the production entitlement component of the food entitlement decline (FED) theory of food security. Farmers obtain their food mainly through self production using their endowments such as land, labor…. The decline in land holding size, the natural asset, due to population pressure as well as crop failures due to climatic factor are causing deterioration not only to the food availability but also to food access by making their production entitlement to be insufficient or ineffective: production entitlement failure.

4.4. Food security/insecurity situation among livelihood systems

Understanding the cross-livelihood systems/zones/ differences in food security situation of the households is one of the study objectives of the current study. This section examines how the food security situations of the three livelihood groups vary using the household's scores on the FCS and HFIAS. The analysis of this subsection can be linked to the livelihood strategies component of the sustainable livelihood framework (SLF) discussed in Chapter Two. When seen in that lens, the three livelihood systems represent the livelihood strategies or choices pursued by households for attaining the livelihood objectives: food security in the case of the current study.

For examining the differences within livelihood systems or groups food security situations, I have compared the mean scores of the indicators using Analysis of Variance (ANOVA). The ANOVA model is preferred over the other between group's means comparison models such as t-test due to its relative advantage for achieving better statistical efficiency. That is, to minimize

the Type I error that increases with the number of groups when between groups comparisons are done one after the other, so as to lead to wrongly rejecting the true null hypothesis. The F-statistic was used to test the implicit null hypothesis that there is no livelihood zone or group based differences in food security situation of the households. Two set of variables are involved in the analysis: food security scores of households represented by FCS and HFIAS (dependent variables) and livelihood zones /or systems (independent variables). Accordingly, there are two ANOVA models: one for each dependent variable. Table 4.12 and Table 4.13 present summary of the disaggregated descriptive statistics and the results of the analysis of variance.

Table 4.12: Livelihood groups based descriptive statistics of FCS and HFIAS

	Livelihood zone	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
FCS	1	140	37.8250	13.36563	1.12960	35.5916	40.0584	16.00	83.50
	2	140	37.8536	12.68822	1.07235	35.7333	39.9738	16.00	79.50
	3	140	42.9714	14.72833	1.24477	40.5103	45.4326	16.00	85.50
	Total	420	39.5500	13.80217	.67348	38.2262	40.8738	16.00	85.50
HFIAS	1	140	7.9643	6.19400	.52349	6.9293	8.9993	.00	22.00
	2	140	7.9857	5.33077	.45053	7.0949	8.8765	.00	23.00
	3	140	4.8714	4.77982	.40397	4.0727	5.6701	.00	18.00
	Total	420	6.9405	5.64619	.27551	6.3989	7.4820	.00	23.00

Source: Field survey, 2016

Note: Livelihood zone 1= Sidama Coffee Livelihood Zone

Livelihood zone 2 = Sidama Maize Belt Livelihood Zone

Livelihood zone 3 = Agro-pastoralist Livelihood Zone

Table 4.13: Results of the ANOVA for livelihood group based household's food security

		Sum of Squares	Df	Mean Square	F	Sig.
FCS	Between Groups	2458.354	2	1229.177	6.626	.001
	Within Groups	77361.096	417	185.518		
	Total	79819.450	419			
HFIAS	Between Groups	899.033	2	449.517	15.046	.000
	Within Groups	12458.479	417	29.876		
	Total	13357.512	419			

Source: Field survey, 2016

The ANOVA results reported in Table 4.13 indicate the existence of significant between livelihood group differences in household's food security situation. The F-ratios were found to be significant for both indicators' scores. More specifically, the F-ratio was significant at $F(2, 417) = 6.626$, $p < 0.01$ for food consumption score (FCS) and $F(2, 417) = 15.046$, $p < 0.001$ for household food insecurity access scale (HFIAS). However, the Levene's test of the homogeneity of variances indicates the violation of equal variances assumption of the ANOVA in the case of HFIAS (Table 4.14) signaling the need for testing the robustness of the result further. As the Levene's test tests the null hypothesis that the variances of the groups are the same, significant result indicates that group's variances are different. Though, ANOVA is generally considered to be still fairly robust for equal group sample size even if equal variance assumption is violated, the robustness of the result was tasted in the current case for more confidence. According to Field (2005), literatures suggest two options to this end: Welch F and Brown-Forsythe F tests. These two techniques resolve the problems arising from violations of the homogeneity of variance assumption by making adjustments to the residuals degrees of freedom and hence to F statistic (Field, 2005). Table 4.15presents the results of these two tests of the robustness.

Table 4.14: Test of Homogeneity of Variances (HFIAS, FCS)

	Levene Statistic	df1	df2	Sig.
FCS	1.961	2	417	.142
HFIAS	7.514	2	417	.001

Source: Field survey, 2016

Table 4.15: Robust Tests of Equality of Means

		Statistic	df1	df2	Sig.
FCS score of households	Welch	6.097	2	276.994	.003
	Brown-Forsythe	6.626	2	410.499	.001
HFIAS score of households	Welch	17.189	2	275.068	.000
	Brown-Forsythe	15.046	2	398.600	.000

Source: Field survey, 2016

The robustness tests presented in Table 4.15 show that both Welch' F and Brown-Forsythe F tests are significant for both FCS and HFIAS (focal point in current case) reaffirming the main ANOVA results presented above. Hence, now it can be said with confidence that the fact that the surveyed households are from different livelihood zones significantly explain variations in food security scores of the households. Stated differently, based on the results, one can tell that the mean food security scores for the livelihood groups are not the same. However, it is imperative

to understand about where the difference lies as well. To this end, the post hoc analysis was conducted and the results of the analysis have been presented in Appendix 4.

In the post hoc analysis, multiple comparisons were done using Tukey's HSD (honestly significant difference) and Games-Howell tests. In the case of FCS, both test's results can be equally used and both consistently show that there does not exist significant differences in mean consumption scores between Sidama Coffee and Sidama Maiz Belt Livelihood Zones. On the other hand, both tests indicate that the mean FCS score of Agro-pastoralist Livelihood Zone is significantly different from the mean scores of the other two livelihood groups. In the case of HFIAS, though both tests lead to similar conclusion, Games-Howell test result would be interpreted as it is the one that provides robust result when there is a doubt in the stability of variances. The result of the test also indicates that where there does not exist significant differences between HFIAS based mean scores of the Sidama Coffee and Sidama Maiz Belt livelihood groups, the Agro-pastoralist livelihood group's one is significantly different from that of the other two livelihood groups.

The analysis of homogeneous subsets of the groups mean scores with Tukey HSD and REGWQ tests (Table 4.16) also provides results consistent with the above one. According to Field (2005), these two tests show subsets of groups that have the same means. Both tests confirm that for both food security indicators, the average food security scores are statistically not significantly different for Sidama Coffee and Sidama Maize Belt livelihood groups. However, both tests classify the Agro-pastoralist livelihood zone as separate group for both FCS as well as HFIAS.

Table 4.16: Post hoc analysis - homogeneous subsets: FCS and HFIAS scores of households

FCS	Livelihood zone	N	Subset for alpha = 0.05	
			1	2
Tukey HSD	1	140	37.8250	
	2	140	37.8536	
	3	140		42.9714
	Sig.		1.000	1.000
Ryan-Einot-Gabriel-Welsch Range	1	140	37.8250	
	2	140	37.8536	
	3	140		42.9714
	Sig.		0.986	1.000
HFIAS	Livelihood zone	N	Subset for alpha = 0.05	
			1	2
Tukey HSD	3	140	4.8714	
	1	140		7.9643
	2	140		7.9857
	Sig.		1.000	.999
Ryan-Einot-Gabriel-Welsch Range	3	140	4.8714	
	1	140		7.9643
	2	140		7.9857
	Sig.		1.000	0.974

Source: Field survey, 2016

To bring the findings of analysis of this subsection into picture, the fact that the surveyed households are from different livelihood zones with different farming focus has a role in explaining variation in the food security scores of the households. Moreover, the food security scores of the households of the coffee and maize focused farming households are the same on average. However, the average food security score of the Agro-pastoralist households is different from the other groups. At this juncture, it is logical to ask how different it is: is it above or below the average score of the other two groups. Based on the close examination of results of multiple comparisons and homogenous subsets analysis as well as the mean plots presented below, it can be said that the mean food security scores of the agro-pastoralist group is better than that of either of other two groups. That is, Agro-pastoralist group has significantly higher FCS and significantly lower HFIAS score on average than both the maize focused livelihood group as well as coffee focused livelihood group.

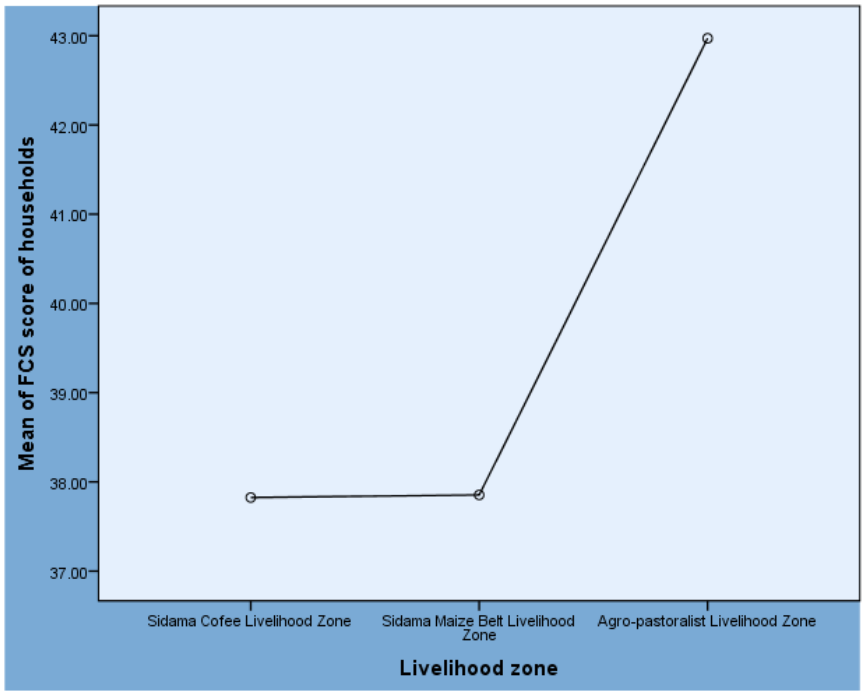

Figure 4.2: Livelihood group based means plots of FCS

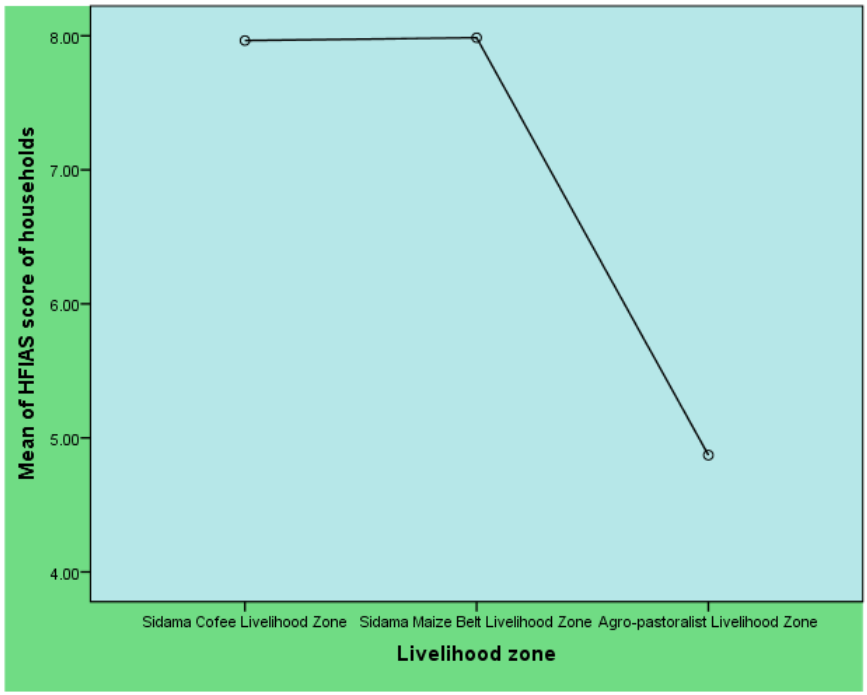

Figure 4.3: Livelihood group based means plots of HFIAS

The mean plots in Figures 4.2 and 4.3 take the opposite direction due to the fact that the relative size (high or low) of scores of two food security indicators here in use convey opposite cues regarding household food security situation. That is, whereas the higher score of FCS show better food security situation, the higher score of HFIAS indicates the reverse. One more thing that needs to be noted is that when we say Agro-pastoralist group has appeared the better group in comparison, it does not mean that there is no food insecurity of worrisome level in this group. Rather about 33% of the surveyed households from Agro-pastoralist Livelihood Zone are food insecure under reclassified FCS' categorical indicator. This amounts 26% of the total food insecure households under the same indicator. When we see the reclassified HFIAS based food insecurity prevalence, 51.4% of the surveyed households from Agro-pastoralist Livelihood Zone are food insecure. This represents about 28% of the total food insecure households under HFIAS based prevalence rate (Appendix 3).

The important question that should be addressed at this point is that of what does explain the observed difference between the livelihood groups regarding food security/insecurity situation. I learned from key informants that the study area households experienced crop failure for the season that precedes this survey and in the previous harvest season due to rain shortage. As the Sidima Coffee and Sidama Maize Belt Livelihood zones are crop production focused livelihood groups, the effect of, rain shortage caused, crop failure on food security could be more sever on them. Though, the rain effect is common to Agro-pastoralist Livelihood Zone as well, the presence of livestock might have given them more option to resort to as compared to the other two livelihood groups. Hence, this, the observed relative better performance of Agro-pastoralist group could be attributed to possession of livestock that they can selloff when they face food shortage due to crop failure.

4.5. Coping mechanisms of households in the event of food insecurity

Literatures argue that households do not passively view what is happening to them when their food security situation is challenged. Rather they respond in different ways and take various measures called coping strategies. These may involve changing their consumption habits, also called consumption based coping strategies, when they anticipate or actually face food shortage. They may also use non-consumption based coping strategies such as disposing the recourses at their disposal in order to get food or taking other related actions that they think appropriate:.

For instance, Christaensen and Boisvert (2000) in Maxwell and Caldwell (2008) argue that people start to change their consumption habits when they anticipate a problem and don't wait until food is completely gone. Changing consumption habits is generally meant for limiting short term effects of not having enough to eat. However, in the situation where a particular community lives under long standing food stress, such adjustments could go long as a normal habit even in the situation where non-consumption based strategies too are activated. That is to say that even if other strategies such as disposing assets are employed, foods obtained through such methods could be subject to consumption based coping such as rationing. The point of argument here is that the two set of coping strategies, consumption and non-consumption based, should not be perceived as entirely detached and mutually exclusive.

Notwithstanding the complexity here, the analysis of the households coping strategies are done in light of the general food security literatures that household as rational decision maker opt to go first for those options that least affect their livelihood security. In the current study, the surveyed households were asked two sets of coping strategy questions, consumption based and other/non-consumption based coping strategies, which cover different time span and the results of analysis of the responses have been discussed in the following sub-sections.

4.5.1. Consumption based coping strategies

Consumption based coping strategies constitute short term alteration of consumption patterns by households. Writers like Watts (1983), Corbett (1988), and Devereux (1993) in Maxwell and Caldwell (2008) consider them as easily reversible strategies that do not jeopardize long term prospects. They mostly do not require commitment of domestic resources. They could be chosen by those households: whose food insecurity situation is not worsening enough to force them to commit other resources at their disposal, who decide to take the brunt of the current food insecurity for the interest of future food security, or by those who don't have other assets to dispose for food acquisition. To understand the coping strategies that the study area households use as a response to their food insecurity, the current study collected and analyzed data on common consumption based coping strategies identified by literatures such as Maxwell and Caldwell (2008). As per the suggestion of literatures and for the interest of memory, households

were asked whether they employed each of the strategies within the last seven days prior to the date of survey. Table 4.17 presents the result of the analysis of the household's responses.

Table 4.17: Consumption based coping strategies

Coping strategy	Number /proportion of households employed	
	Count	Percentage
Relied on less preferred foods	253	60.2
Borrowed food or relied on help from a friend/relative	166	39.5
Purchased food on credit	136	32.4
Relied on wild foods, hunt, or immature crops	32	7.6
Consume seed stock held for next season	57	13.6
Household members sent to eat else where	51	12.1
Household members sent to beg	11	2.6
Portion size at mealtimes limited	181	43
Consumption by adults restricted in order to give priority to small children	191	45.5
Priority given for working members of household at the expense of non working members	75	17.9
Meals eaten in a day reduced	141	33.6
Entire days skipped without eating	7	1.7

As indicated in the previous sections, significant proportion of the surveyed households had food insecurity problem of varying level. As a response to the food insecurity situation experienced, households used various consumption based coping strategies that are summarized in Table 4.17. The households' responses summary indicates, 60.2% (253) of the households relied on less preferred foods at least once in a week. About 45.5% (191) of the households reported that the consumption of adults were restricted for the interest of children for at least 1 day within a seven days period preceding the date of the survey. According to one of my elderly informant, restricting the adult's consumption is specially common for mothers. He said: "during food shortage, usually mothers take the burden of not having to eat giving priority to children and father." Similarly, a total of 181 (43%) and 141 (33.6 %) households limited portion sizes of meals and reduced number of meals eaten within a day respectively for a minimum of one day within a week. The proportion of households who reported that they borrowed food or relied on help from a friend/relative and purchased food on credit are 39.5% (166) and 32.4% (136) respectively.

Relatively, all the remaining coping strategies summarized in Table 4.17 were utilized by small proportion of the households. Only 7.6% (32) of the surveyed households indicated that they

relied on wild foods and/or immature crops. Probably, this could be due to the timing of survey. As the time of survey was just after harvest period and dry season, both immature crops as well as wild foods are not commonly found during this time. Similarly, only small number of households, 17.9% (75), indicated that they gave priority to working members of households at the expense of non working members and only 1.7% (7) households reported skipping the entire days without eating. Again relatively small proportion of total households, 13.6% (57), consumed seed stock held for next season at least once within the time period indicated above.

The proportion of households who engaged in the coping behavior of sending household members to eat elsewhere and those who sent household members to beg are 12.1% (51) and 2.6% (11) respectively. Observing such findings regarding these two coping strategies could be due to the fact that the experienced level of food insecurity might not be of the extent that forces households to break cultural barriers regarding such practice or a conscious decision by households to stick to the strong local cultural norm irrespective of their food insecurity situation. Until the very recent past, begging of any sort was not considered as a livelihood option even by physically challenged individuals in the Sidama area. However, this, the well established norm seems to be gradually deteriorating as it has become common to observe more number of rural residents including teenagers engaged in begging in urban cities like Hawassa. At this juncture, I would like to point out the need for detail study to understand well the underlying causes of it above the possible common sense explanation.

Table 4.17 and the discussion that follows have shown us that the households of the study area employed various consumption based coping strategies. To get an insight on which households, in terms of level of food insecurity experienced, did use them, I have cross-tabulated the more frequently used coping strategies in Table 4.17 with the four HFIAS food security/insecurity category of households in Table 4.4. The result of cross-tabulation is presented in Appendix 5. The analysis revealed that the proportion of the households that utilized each coping strategy increases as the level of the experienced food insecurity deepens. For instance, out of the total severely food insecure households, 93.2% reported that they relied on less preferred food at least once in seven days time. The proportion of moderately food insecure households that employed this strategy was 81.6%. It drops to 46.9% for mildly food insecure group. Moreover, 86.4% of

the severely food insecure households did manage food shortage through borrowing food or relying on help from a friend/relative. On the other hand, the percentage of the households that employed this strategy was, 47.1% and 12.2% respectively for moderately and mildly food insecure group.

A coping strategy of managing food shortage through purchasing food on credit and reducing portion of meal size at meal time were used by equal (85.2%) proportion of the households from severely food insecure group. The proportion of households reported these coping strategies were lower for the moderately food insecure group and even further significantly lower for mildly food insecure group. Also similar trends observed for coping strategies of reducing meals eaten in a day and restricting consumption for adults to give priority for small children.

4.5.2. Other (non-consumption based) coping methods

The surveyed households were asked whether they employed a couple of strategies, other than consumption focused, over the past two year period in response to food insecurity problems/shocks. Most of the coping methods under this category are generally treated as relatively less reversible and households tend to revert to them if the experienced food insecurity situation is more severe. Table 4.18 shows the proportion (number) of the surveyed households that utilized various coping strategies other than those discussed in the previous section: non-consumption based.

Table 4.18: Non-consumption based coping strategies used by households

Coping strategies	Number of households adopted	
	Count	Percentage
Sold reproductive animals	179	42.6
Sold oxen used for farming	98	23.3
Sold land	9	2.1
Rented out land	42	10
Removed children from school	87	20.7
Borrowed money at high interest rate	88	21
Sold small animals	158	37.6
Migrated to nearer areas to wage labor	80	19
Drawing on savings	20	4.8
Selling fire wood	140	33.3
Diverting loans from MFIs to consumption	8	1.9
Appealed for aid	217	51.7

The result revealed that 42.6% (179) of the households sold their reproductive animals to cope with their food insecurity problem at least once within the last two year's period prior to the date of survey. About 23.3% (98) of the households reported that they sold their oxen as a response to food insecurity related shocks that affect their ability to feed their households. Only a very small proportion of the households, 2.1% (9), reported that they responded to food insecurity and related shocks by selling their land holdings. On the other hand, 10% (42) of the households rented out their land holdings during this two-year time period preceding the survey. However, there is one thing to be noted here. That is, since selling land holdings is not officially allowed, local people do sell their land in the name of long term contract. Hence, fearing the legal consequence, informants may not truthfully divulge the true nature of the contract involving their land holdings. My point here is that those households who reported as they rented out their holdings might be those who actually sold it. Irrespective of this doubt, one can say for sure that 12.1% of the surveyed households responded to the food insecurity and related shocks by using their land holdings.

About 20.7% (87) and 21% (88) of the households had removed their children from school and borrowed money at high interest rate respectively. A total of 37.6% (158) households reported that they coped by the selling small animals and about 19% (80) migrated to nearer areas in search of wage labor. Almost none, 1.9% (8), households had engaged in the coping behavior of diverting loans from MFIs to consumption and only 4.8% (20) households had drawn on financial savings to respond to food insecurity problem. This could be due to lack of cash savings to drew from or limited access to MFIs both of which cases are highly likely in the rural households context. On the other hand, about half of the surveyed households, 51.7% (217), reported that they appealed for food aid in looking a way out for food insecurity problem within the last two years period. One third of the households, 33.3% (140), reported that they used selling fire woods as a coping mechanism (Figure 4.4).

Figure 4.4: Household members taking fire woods collected form forests to market centers

The pictures were taken, while they were passing by, at the center of Gasara Kuwe *kebel* situated at about 37 km towards the south-west of the center of Boricha *woreda* and is about 6 to 7 hours travelling distance from the fire wood collection location. I also visually observed the other day many women who take the fire woods from the same areas to the indicated destination here by carrying on their back but I couldn't take picture as my camera was down due to battery problem. As I learned from the key informants, firewood is collected from the forest around Bilate River towards the border of Loka Abaya *woreda* and is supplied to Dila Anole and Balela towns. From my discussions, I also realized that due to sustained food stress, poor people are using collecting and selling fire woods as a regular source of income for food purchase.

However, the issue of concern exists here. That is, if left uncontrolled, such practice and heavily dependence for food on forests could wipe out the only left over of the ancient forests in the area. Almost all elderly key informants told me that most part of the *woreda* was covered by dense forests that hosted many wild animals including lions until the downfall of the Emperor regime. However, increasingly growing demand for farmland since then has resulted in clearance of forests to its demise according to the key informants. I myself have not witnessed any area covered by even small forests during my travel to all the three livelihood zones of the *woreda*. Rather, I have seen a range of barren and highly eroded land specially in the western part of the *woreda,* though the *woreda* Agricultural Bureau expert informed me that efforts are underway to rehabilitate them (Figure 4.5).

Figure 4.5: Degraded land at Gasara Kuwe *Kebele*

Source: Own photo

4.6. Summary

This chapter has explored the food security situation of the households and the coping strategies households employed as a response to the food insecurity that they experienced. The study has found out that significant proportion of the surveyed households is food insecure. The HFIAS indicator of food security revealed that 62.4% of the households have food insecurity situation that runs from moderate to severe. This shows that food access and also availability, as these two dimensions converge at rural household level that mostly self-produce what they consume, are major concern for the majority of the surveyed households.

The FCS indicator showed that 42.4% of the surveyed households have a consumption level that falls below the cutoff point suggested for acceptable consumption level. This indicates that food quality, which is the proxy of nutritional intake or utilization dimension of food security, is also a concern for noticeable level of the study area households. The cross-tabulation of HFIAS and FCS based categorical indicators of food security further revealed that 36.4% of the surveyed households have a food insecurity problem that can be expressed not only in terms of food insufficiency but also in terms of lack of dietary diversity or food quality.

In response to the food insecurity problem that they faced, the surveyed households employed different consumption and non-consumption based coping strategies. The consumption based coping strategies that they utilized ranges from compromising the quality of food they eat to that

of food rationing. In the mix of other, non-consumption based category, coping strategies utilized by the households we find such as appealing for humanitarian food aid, collecting and selling firewood, and disposing of productive assets: coping strategies that can erode their resilience to future food insecurity shocks. The cross-tabulation of the consumption based coping strategies and the four household categories of HFIAS indicated that the rate of utilization of a particular coping strategy increases as the severity of the level of food insecurity increases.

Chapter 5: Households' Resilience to Food Insecurity: Analysis and Discussion

5.1. Introduction

In this chapter, I will present analysis and discussion on households' resilience to food insecurity. The chapter mainly aims at understanding sources of household's resilience to food insecurity, examining livelihood systems or zones based differences in the level of resilience, and exploring the relationship between resilience and nature of previously employed coping strategies of the households. Firstly, using the survey data, the sources of the study area's rural household's resilience to food insecurity is examined. This step provides two piece of information: insights on substantive importance of the variables to resilience and resilience score or index achieved by individual households. Using the resilience index of the households involved in the survey, then the analysis move to examining if resilience level of the households vary based on the livelihood zones to which they belong or not. Then, steps are taken to provide categorical information pertaining to the resilience status of the surveyed households. Finally, the focus of the chapter turns to the discussion of the nexus between the household's resilience to food insecurity and the nature of coping strategies previously employed.

5.2. Households' resilience estimation and analysis

As described in previous chapters, in the current study, household's resilience to food insecurity is estimated using a two stage process. The study advanced with the most widely accepted notion that household's resilience to food insecurity lies on the resources and options available to the household to make a living and its ability to handle risks. Following this notion and the adapted general framework based on this notion, data was gathered on a handful of variables and resilience index was estimated hierarchically. In the first stage of the estimation process, each latent variable (variables used for resilience estimation) was estimated directly from observable variables. Then, the estimated values of these variables as index were used to estimate the resilience index for each household. So, this section provides detail discussions about this.

5.2.1. Sources of households' resilience to food insecurity and resilience index estimation

With regard to the sources of household's resilience to food insecurity, based on literatures and the study area's context, the present study has advanced by proposing seven variables: agricultural assets, agricultural technology adoption, access to basic services, social capital, social safety nets, adaptive capacity, and income and food access. Clusters of variables have also been proposed as indicators of each of these variables. In this sub-section, I summarize how the observed variables contribute to each of these variables based on how their loadings turn to be significant (stage one) and ultimately how each of the estimated seven variables contribute to the level of resilience (stage two).

5.2.1.1. Agricultural Assets (AA)

Land holding size, livestock ownership, and ownership of Enset, Coffee, and Khat were used to estimate agricultural asset component of resilience. As has been argued in chapter two, the three later variables, i.e., enset, coffee, and khat, have been treated as agricultural assets due to the fact that they are attached to land and serve as a source of food or income for food acquisition for multiple years in the study area's context. Table 5.1 summarizes component loadings for each of these observed variables that were used in agricultural index estimation. All the variables involved are continuous variables and hence satisfy the requirement that variables in the model need to be interval or ratio scaled so as to run Principal Component Analysis.

The components extraction was done using Principal Components Analysis method applying Eigenvalue of 1 as minimal criterion for selecting more meaningful components (Appendix 1-A) and using Bartlett scoring method to estimate a latent variable, Agricultural Asset, for each household. In the current case, only one component turned to be meaningful and has been considered as the underlying latent variable, i.e., the Agricultural Asset, after checking satisfaction of all the statistical requirements for good Principal Component Analysis model.

Table 5.1: Component loadings for the observed variables used to estimate the agricultural asset (AA) component of resilience

Variables	Component
	1
Total area covered by enset in 'Timad'	.732
Land holding size in hectare	.713
Livestock in TLU[3]	.652
Income from Khat	.637
Total number of coffee trees ready for giving harvest	.590

Source: Field survey, 2016

Influential level outliers were observed in the data on income from khat and number of coffee trees ready for giving harvest and taken care of through Log transformation. To test the factorability of the variables, all the requirements recommended for Principal Component Analysis model have been checked. Bartlett Test of Sphericity was run to check if the correlation matrix (R-matrix) resembles identity matrix. That is, to see whether the variables used in the model correlated badly with each other or not. In statistical terms, the Bartlett Test of Sphericity tests the null hypothesis that the original correlation matrix is identity matrix, with all diagonal element equal to 1 and all off diagonal elements 0, implying that each variable correlates only with itself. According to Field (2005), for good model, this test needs to be significant to fail to accept the null hypothesis. In simple terms, this means that there exists correlation of certain level between the variables in the model and hence they can jointly explain same underlying factor or component. For the current model, Bartlett Test of Sphericity is found to be significant with Approx. Chi-Square (329.425), df (10), Sig. ($p<.001$).

Though the sample size of the current study is more than sufficient for PCA, KMO (Kaiser-Meyer-Olkin) measure of sampling adequacy was used to test sufficiency of overall sample and also for each variable in the model. According to Field (2005), the KMO measure of sampling adequacy value should be 0.5 and above in a good model. For the current model, i.e., agricultural asset index estimation model, the overall KMO (Kaiser-Meyer-Olkin) measure of sampling adequacy is 0.706 and well above 0.5 for individual variables (not reported for the interest of space). The existence of multicolinearity and singularity was checked using determinant of the correlation coefficients matrix (R-matrix) of the variables in the model. In a

[3] A common unit indicating total number of livestock owned by a household: conversion was done based on Njuki *et al*. (2011) conversion equivalents table of Sub-Saharan Africa livestock in to TLU

good model, i.e., the one that doesn't have multicolinearty or singularity problem, the determinant of R-martix is supposed to be greater than 0.00001 (Field, 2005). In the current case, there is no concern for this as the determinant of R-matrix is 0 .447, which is far above 0.00001.

As can be seen in Table 5.1, all five variables have significant loadings on the first component extracted implying that they all are important to agricultural assets of households. According to Field (2005), factor/component loadings of size 0.298 and above are considered statistically significant for the sample size of 300. In the present study, the sample size is well above 300, and no variable has a loading even nearer to this cutoff point on the component. Field (2005) maintains that factor/component loadings can be taken as both correlation as well as regression coefficients if the factor/component rotation method applied is orthogonal though the two varies under oblique rotation. In the context of correlation coefficients interpretation, we can say that all the variables (land holding size, livestock, enset, coffee, and khat ownership) are meaningfully correlated with latent variable- agricultural asset. However, , sizes of enset owned, and land holding size are the two variables that come up front in terms of relative contribution. Using the first component that turned up significant, meeting criterion suggested by (Kaiser, 1960 cited in Jolliffe, 2002 and Field, 2005) for the selection of statistically meaningful number of components, the agricultural index was estimated as a component score to be used in the resilience estimation.

5.2.1.2. Agricultural Technology Adoption (ATA)

Agricultural technology adoption is one of the variables (latent) that are believed to contribute to household's resilience to food insecurity in farming based livelihoods. Four variables were used to estimate this latent variable: adoption of fertilizer, improved seeds, farmers training center services utilization, and utilization of services of agricultural Development Agents in terms of on-farm visit. Table 5.2 presents the component loadings of each of the variables used in the ATA estimation.

Table 5.2: Component loadings for the observed variables used to estimate the ATA component of resilience

Variables	Component	
	1	2
Amount of improved seeds used in KG within a year	.887	.063
Amount of fertilizer used in KG within a year	.867	.164
Number of types of training received within a year	.033	.867
Number of on-farm visits by Development Agents within a year	.192	.822

Source: Field survey, 2016

As all the observed variables are measured on continuous scale, the PCA was run without any inconveniences in measurement regards. The appropriateness of the model was also checked using all statistical requirements for good PCA model. Bartlett's Test of Sphericity was significant (Approx. Chi-Square = 290.168, df =6, $p<.001$); the KMO test of sampling adequacy and determinant of R-matrix are 0.574 and 0.493, respectively, all implying the appropriateness of the model.

Two components were extracted using the eigenvalue of 1 criterion (also called *Kaiser's rule)* suggested by (Kaiser, 1960 cited in Jolliffe, 2002 and Field, 2005) (Appendix 1-B). The two components together accounted for about 75.892% (component 1 an 2 individually accounting for 39.439 % and 36.453% variance respectively) of total variances in the data. As is clear from Table 5.2, the first two variables, amount of improved seeds and fertilizers used, are clustered together and have their higher loadings on the first component and the other two, number of FTC trainings received and number of on-farm visit by Development Agents, on the second component. Overall, all four variables loadings are significant (each has loadings greater than 0.298) to their respective component, implying the variables' meaningful contribution to ATA.

The clustering of the number of FTC trainings received more closely with the number of on-farm visit by Development Agents (DA) could be due to the fact that recruitment for training would be more likely as one's farm is visited more frequently by DAs. A close clustering of the other two variables too is also institutively expected. Hence, there is no theoretical or common- sense-based justification to regard only one component as ATA and leave the other aside. The proportion of variances in the data that each component explains also backs this position. Moreover, it is also logical to think that whereas the first component represents the actual technology utilization aspect of agricultural technology adoption, the second one represents the

technology utilization skill acquisition aspect. So, following the tradition of previous works regarding treatment of similar cases, Krishnan (2010) in the socio-economic index estimation and Guyu and Muluneh (2015) in the study of household's resilience to food insecurity, I have combined the component scores of both components, obtained through Bartlett scoring method, to estimate the latent variable: Agricultural Technology Adoption. This is done by using the relative variance explained by each component as a weight. Hence, the ATA score or index for each household is the weighted sum of its score on each of the two components as:

ATA i= 0.39439 × comp1 score i + 0.36453 × comp 2 score i --------- (equation 5.1)

Where

ATA i = agricultural technology adoption score for i^{th} household

Comp1 score i = component 1 score for i^{th} household

Comp 2 score i = component 2 score for i^{th} household

5.2.1.3. Access to Basic Services (ABS)

Access to basic services is argued to endow the households with several important key factors for enhancing their resilience (Guyu and Muluneh, 2015, Alinovi, 2010). It affects household's capacity to effectively utilize available household level assets for management of risks and responding to shocks when materializes. During the analysis, the current study has weighed two slightly different roots to estimate this latent variable (ABS): 1) focusing on the availability of various service centers around, which are represented by travelling distances or 2) making sense of the extent of household's utilization of the services. Based on what I learned during my field work time, I found the latter approach to be more meaningful to this latent variable and the subsequent resilience estimation than considering the mere distance. For instance, households use pond water, which is by no means can be taken as safe for drinking or even for other domestic uses (Figure 3.1 and 3.2). However, such ponds can be found at a walking distance or next to their home for most as the ponds were mostly prepared by the villagers themselves. Given this and similar cases regarding the nature of services, the choice I faced was either to focus on mere access or real access (quality of access). I inclined to the latter and used households' perception on whether their drinking water is safe or not (access to safe water), their

participation in microfinance institutions (access to financial institution's services) , and access to telephone services in terms of mobile phone ownership to estimate the latent variable ABS.

As all the three variables are categorical or nominal ones, they do not fit to the standard Principal Component Analysis model, which requires all variable to be measured on interval or ratio scale level. Following Guyu and Muluneh (2015), all the variables were transformed into continuous variables through Optimal Scaling. Optimal Scaling is the multidimensional data analysis method that quantifies categorical variables through the optimal assignment of quantitative values to such qualitative scales (Meulman *et al.,* 2004). Categorical Principal Components Analysis (CATPCA) option of SPSS version 20 was used for such transformation and standard Principal Component Analysis (PCA) was run on the transformed or quantified variables. The Table 5.3 presents the component loadings of each of the variables used in the model.

Table 5.3: Component loadings for the variables used to estimate the ABS component of resilience

Variables	Component
	1
Access to telephone services (mobile phone ownership)	.708
Access to safe drinking water	.689
Access to microfinance	.639

Source: Field survey, 2016

As presented in Table 5.3, following *Kaiser's rule*, only one component was extracted (Appendix 1-C). The appropriateness of the model was also checked using all statistical requirements for good PCA model mentioned above. Bartlett's Test of Sphericity was significant (Approx. Chi-Square = 42.607, df =3, $p<.001$). The KMO test of sampling adequacy and determinant of R-matrix are 0.582 and 0.902, respectively, both indicating the appropriateness of the model. All three variables have strong loadings on the first component: all are well above .298, the suggested minimum for the sample size of 300, implying that each of them is statistically important for the estimation of the latent variable. Hence, the component scores of the first component obtained through Bartlett scoring method was used to estimate ABS index for each household.

5.2.1.4. Social Capital (SC)

Locally occurring forms of social capital such as groups and networks are argued to play an important role in building resilience of rural communities and households to confront shocks. The current study too proposed social capital as one of the latent variable to be used for estimation of household's resilience to food insecurity. As a latent variable, it is not directly observable and also it may not be advisable to use a single proxy variable as its estimate. Since it takes various forms in different contexts, using more number of context based proxies can help capture it well. Table 5.4 presents the variables that are used in this particular study for its estimation together with their component loadings.

Table 5.4: Component loadings for the variables used to estimate social capital component of resilience

Variables	Component
	1
Perceived social capital	.812
Local church or other religious group membership	.772
Idir membership	.392

Source: Field survey, 2016

Three variables were used to estimate social capital: perceived social capital, local church or other religious membership, and idir membership. Perceived social capital is a latent variable, by itself, estimated using Principal Component Analysis based on three observable variables: 1) number of close friends that can be called for help; 2) number of people who are believed to be willing to lend 100 Birr if suddenly needed; and 3) expected number of households in the neighborhood who will be willing to feed one's children if sent to their home due to food shortage.

All the three variables are measured on ratio scale and hence suitable for running PCA. However, due to the presence of influential outliers in all the three variables, log transformation was needed to neutralize the possible undue influence of such outliers. Hence, the PCA was run on these log transformed variables. All the required statistically test were also undertaken to check appropriateness of the model. Though, the correlation between the first two variables mentioned in the above paragraph appeared to be high enough, to lead for suspicion of the existence of multicoleanerity problem, they were still kept in the model with compromise considering the value of determinants of R-matrix which falls above the required minimum

value. The first component is found to be significant and hence used to estimate perceived social capital index for each household. Then, this perceived social capital index is used together with the other two variables to estimate social capital. Since *idir* membership and local church or other religious group membership are categorical variables, they were quantified or converted into continuous variables through optimal scaling before using for social capital index estimation.

Based on *Kaiser's rule,* only the first component was extracted (Appendix 1-D). Bartlett's Test of Sphericity was significant (Approx. Chi-Square = 60.076, df =3, p<.001). KMO test of sampling adequacy and determinant of R-matrix were .518 and 0.853 respectively, both indicating the appropriateness of the model. All three variables are also found to be statistically significant, having loadings of greater than .298, in terms of contribution to the latent variable social capital though their loadings are not equally strong. The relatively low loading of *idir* membership may show that compared to the other two variables, it has less discriminating power among the households in terms of the ownership of social capital. Using the Bartlett scoring method, component scores was obtained for each household as the estimate of social capital index to be used in the resilience index estimation.

5.2.1.5. Social Safety Nets (SS)

Literatures consider social safety nets as one of the important source of household's resilience. For instance, Alinovi *et al.* (2008) and Guyu and Muluneh (2015) consider it as a capacity of the system to mitigate shocks and Alinovi *et al.(*2010) underlines its importance especially to poor households resilience. The current study has considered social safety nets as one of the variables to be used in the resilience estimation. The estimated monetary value of total benefits received from productive social safety net program (PSNP) and other supports received in the form of aid from government and non-governmental sources were used as indicator of this variable. However, rather than running the PCA, the observed values of these two variables were combined by simple summation and then the sum is standardized in order to have a latent variable with zero mean and variance equal to 1, before using for the estimation of household's resilience to food insecurity. This method was preferred over PCA because of extremely low correlation among the observed variables to make PCA model inappropriate, i.e., un-factorability problem. Lack of meaningful correlation between the two variables is intuitively

admissible as households participating in one of the program (PSNP for instance) may not be shortlisted to take a part in another programs.

5.2.1.6. Adaptive Capacity (AC)

It seems that literatures lack consensus on the treatment of adaptive capacity in relation to resilience. For instance, Walker (2004) considers it as the capacity of actors in a system to influence resilience, such as the capacity of humans to manage resilience. In this line of thinking, adaptive capacity and resilience are two distinct but functionally related concepts in a way that the former having some kind of effect over the state of the latter. On the other hand, Pisano (2012:13) treats adaptability as part of resilience and says it is the capacity to adjust responses to changing external drivers and internal processes. Frankenberger *et al.* (2013) too treat adaptive capacity as part of resilience and define it as the capacity of making proactive and informed choices about alternative livelihood strategies based on an understanding of changing conditions.

Given these diversity of views, the decision dilemma I faced was whether to treat it as resilience by itself or consider it as one of the latent variables to be used for resilience estimation. However, following the previous works (Alinovi *et al.*2008, Alinovi *et al.*2010, Ciani and Romano, 2013, Guyu and Muluneh 2015) and the FAO's Resilience Index Measurement and Analysis (RIMA) model (FAO, 2014), I kept adaptive capacity in the resilience estimation model as previously proposed. From measurement stand point, such treatment doesn't create conceptual inconsistency as it captures resilience dimensions not well captured by the other variables in the model. In the current study, it was estimated using four variables (maximum education, health, level of income diversification, and dependency ratio) and their component loadings are presented in Table 5.5.

Table 5.5: Component loadings for the variables used to estimate the Adaptive capacity (AC) component of resilience

Variables	Component	
	1	2
Education (maximum education level in the HH)	.813	.046
Dependency ratio	-.710	.052
Health status (Number of times a HH head visited clinic due to illness within a year)	.341	-.771
Level of income diversification	.401	.724

Source: Field survey, 2016

Using Principal Component Analysis, two components were extracted as both appeared significant, on the basis *Kaiser's rule,* in terms of explaining variations within the data (Appendix 1-E). Relevant statistical requirements for good PCA model were also checked and Bartlett's Test of Sphericity found to be significant at (Approx. Chi-Square = 73.343, df =6, p<.001). Both KMO test of sampling adequacy and determinant of R-matrix also satisfy the requirements with the value of 0.506 and 0.816 respectively. All four variables are found to be statistically significant, with absolute value of loadings greater than 0.298, in terms of contribution to the Adaptive Capacity.

Given the nature of the variables, the sign of the loadings are also as one may expect. For instance, health status of the household head was proxied with number of times the household head visited clinics due to illness within last 12 months (1 year) prior to the survey date. Here, the underlying assumption is that the poorer one's health condition, the higher the frequency of clinics visit be. Hence, negative loading of the variable indicates that adaptive capacity declines as one's health condition gets poorer. Dependency ratio is another variable with negative loadings implying that as the number of dependents increases in the household, the adaptive capacity of such household decreases.

The two components produced are quite meaningful in terms of the share of total variances each explained and both considered as the underlying latent variable for AC. Hence, the component's scores obtained through Bartlett scoring method were combined to estimate the latent variable (AC). This is accomplished by using the relative variance explained by each component as a weight. Hence, the AC index for each household is the weighted sum of its score on each of the two components as:

AC i= 0.36070 × comp1 score i + 0.28109 × comp 2 score i --------- (equation 5.2)

Where:

AC i = Adaptive Capacity score for i^{th} household

Comp1 score i = component 1 score for i^{th} household

Comp 2 score i = component 2 score for i^{th} household

5.2.1.7. Income and Food Access (IFA)

Income and food access is another indicator of resilience that is directly related to the household's degree of access to food. In the current study, the IFA index of the households is estimated by using two variables: food consumption score (FCS) and household food insecurity access scale (HFIAS). Only one component was extracted and the loadings of the variables are presented in Table 5.6. Both variables are equally important for IFA. HFIAS has negative loadings as high score on it indicates low food access and vice- versa. The KMO test of sampling adequacy was 0.500 and the Bartlett's test of Sphericity was significant at (Approx. Chi-Square = 136.083, df =1, p<.001). On the other hand, determinant of R-matrix stood at 0.721. In general, all the required statistical tests turned to be significant supporting the appropriateness of the PCA.

Table 5.6: Component loadings for the variables used to estimate the IFA component of resilience

Variables	Component
	1
Food consumption score (FCS)	.874
Household food insecurity access scale (HFIAS)	-.874

Source: Field survey, 2016

5.2.1.8. Households' resilience to food insecurity estimation

Following the estimation procedure and the approach proposed in chapter three, the resilience index was estimated for each household. Each of the seven latent variables separately estimated above, in stage one, were used to estimate resilience, in stage two, using Principal Component Analysis. To estimate resilience (R), PCA was run on the seven latent variables and their component loadings are presented in Table 5.7.

All statistical requirements for the goodness-of-fit of the PCA model were checked and all passed the tests. Bartlett's test of Sphericity was significant at (Approx. Chi-Square = 506.398, df =21, p<.001) implying the existence of sufficient correlation among variables for running PCA. KMO test of sampling adequacy and determinant of R-matrix stood at 0.827 and 0.204, respectively. Both statistics are well above the required minimum indicating that sample size insufficiency and multicolinearity are not issues of concern. Using *Kaiser's rule,* only one

component was extracted and the component scores obtained through Bartlett scoring method was used to estimate household's resilience to food insecurity.

Table 5.7: Component loadings for the variables used to estimate the household's resilience to food insecurity

Variable	Component
	1
Income and access to food	.816
Agricultural asset	.785
Agricultural technology adoption	.743
Access to basic services	.624
Social capital	.600
Adaptive capacity	.451
Social safety nets	-.403

Source: Field survey, 2016

Identifying sources of rural household's resilience to food insecurity in the study area is one of the research objectives of the current study. Based on the adapted framework (Chapter Two), a couple of variables have been proposed as possible sources of resilience. As these hypothesized sources themselves are latent variables, each of them were estimated as discussed in the foregoing sub-sections and they were combined to estimate Resilience Index for each of the study households. Now, I will turn the attention of the discussion from measurement aspect to address the question directly. That is, identifying the sources of resilience or more specifically answering the question of where the study area rural household's resilience to food insecure lies. Since, hypothetical sources are already identified in terms of the dimensions of resilience, the issue in effect is that of detection of substantive importance of each of the variables to the latent variable, resilience in this case.

In the current study, detection of the substantive importance or contribution of each variable is done by examining the size of their component loadings and comparing with the critical value suggested for factor/component loadings statistical significance test. Using the size of loadings for detection of substantive importance of variables to household's resilience was the tradition of the previous similar research works such as (Alinovi *et al.*2008, Alinovi *et al.*2010, Ciani and Romano, 2013).

Using the size of factor/component loading for the purpose at hand is admissible both theoretically and also to common sense as well. It is admissible to common sense logic because

the estimation of resilience was done hierarchically where the variables in the middle of the hierarchy are dependent on one side and independent from the other, in which case both measurement and detection of determinants are done at the same time (Figure 3.1). From theoretical or conceptual aspect, while discussing the theory of factor/principal component analysis, Field (2005:625) says that the factor loadings in a given analysis can be both correlation coefficients and regression coefficients and this is especially true with orthogonal rotation in use.

To be back to the question I am addressing here, all the variables proposed as hypothetical source of resilience are found to be statistically meaningful. All of them are strongly loaded on the first component having the absolute value of component loading greater than the minimum (.298) suggested for the study with the sample size of 300. This shows that they all are important for household's resilience to food insecurity. In terms of relative importance, income and food access tops the ladder followed by agricultural assets. The interpretation of the relationship between each variable and the resilience also goes with their loadings sign. For instance, all other things being equal, a household with more agricultural assets will be more resilient to food insecurity shocks.

While all the rest variables are positively and strongly loaded on the first component, surprisingly in contrary with the previous assumption, social safety nets appear with negative loading. This could signify that a requisite to inclusion in the social safety nets program is the erosion of other resilience basis and participation in the program is not helping in resources/assets building or protection. This is to mean that the role of social safety nets in the study area context may be that of life saving than protection of household's assets to cope with future shocks. This is not a blind guess however. Rather well supported by the complaints voiced by elderly key informants on the criteria used for food aid selection. They said that local administrators follow the approach that punishes those households who choose livelihood security over food security and the aid is not meant for protecting our assets. This position of elderly people is also well supported by other key informant groups. They reported that the numbers of food aid seekers are intentionally underreported by local administration for the sake of *woreda's* image and consequently only those households having nothing to sale, such as no single livestock, for food purchase are screened in for aid distribution. This practice has the effect of making those having meager assets, let say a single livestock, to sell off to survive and

became empty handed for next time. Probably, it is this contextual nature of it that made the social safety nets to stand at odds with all other resilience basis and in balance to appear with negative loadings.

5.2.2. The role of livelihood systems on households' resilience to food insecurity

From practical relevance angle, it is imperative to examine how resilience scores are distributed among different livelihood groups in addition to identifying sources of resilience. Boricha *woreda* comprises three livelihood zones: Sidama Coffee, Sidama Maize, and Agro-pastoralist livelihood zones. Since, resilience is no more a latent variable now and also the estimated resilience score of each household shows its position relative to the other households, it is possible to make comparison among the three groups. The instrumental value of such comparison is providing insights on which livelihood zone, or livelihood choice or strategy from household's angle, is contributing more to the households' resilience. Stated in statistical terms, the objective of such endeavor is to find out if differences in livelihood zones to which households belong explain variations in the level of their resilience to food insecurity. Accordingly, the livelihood zones are the independent variables and household's resilience is taken as dependent variable.

As indicated in Chapter 3, the current study employed the Analysis of Variance (ANOVA) model to this end. ANOVA is the statistical model that is more preferable for comparison of group means where the number group exceeds two. According to Field (2005), the approach is preferred over running several t-tests to compare all combination of group pair- by- pair as the later inflates '*family wise'* error rate. That is, running several t-tests multiplies the probability of falsely rejecting the null hypothesis, i.e., increases the chance of committing Type I error. Using ANOVA, the current study tests the null hypothesis that the mean resilience scores of the three livelihood groups are the same. The hypothesis has been stated this way as there was no antecedents or strong theoretical claims to take position or rank order the livelihood zones in terms of contribution to resilience (i.e., to have directional hypothesis). The result of the analysis is presented in Table 5.8.

Table 5.8: Summary table of ANOVA for livelihood group based household's resilience to food insecurity

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	9.795	2	4.897	4.991	.007
Within Groups	409.205	417	.981		
Total	419.000	419			

Source: Field survey, 2016

The goodness-of -fit of the model was tested using F-ratio, which is the ratio of the explained variation or variances explained by the model, to the unexplained variation. In more specific terms, it is the ratio of the average between group variations to average within-group variations. Conceptually, between-groups variation is variation due to the fact that the data comes from different groups, livelihood zones in our case, hence variations explained by the model. On the other hand, within group variations are variations due to factors other than group or livelihood zone differences. It is the variance that is represented by the '*error term'* in other multivariate models such as multiple regressions. In ANOVA terminology, the between-group variations and within-group variations are called model sum of squares and residual sum of squares respectively. In a good model, the average explained variation, i.e., model sum of squares divided by degree of freedom, is expected to exceed the average unexplained variation or the ratio of residual sum of squares divided by degree of freedom. Hence, the F-ratio would be greater than one and large enough as possible to be significant.

As reported in Table 5.8, in the current study, the result of the analysis of variance shows significant effect, i.e., F-ratio is significant at $F(2, 417) = 4.991$, $p < 0.001$ implying that the fact that the households of the study area are from different livelihood zones accounted for meaningful level of variations in the level of their resilience score. Stated differently, the mean resilience scores for the livelihood groups or zones are not the same. Since, the F-ratio tells us only that the mean resilience scores are not the same across the livelihood zones, but does not tell us where the differences between groups lie, it is necessary, after conducting ANOVA, to carry out further analysis to find out which groups differ.

To this end, the current study conducted post hoc analysis or comparison. According to Field (2005), Post hoc tests consist of pair-wise comparisons that are designed to compare all different combinations of groups without inflating Type I error. However, as there is a tradeoff between keeping Type I error low and maintaining statistical power of the test, there is a need to carefully

choose the type of pair-wise comparison to conduct. Following the suggestion of Field (2005), in the current study, three different tests, Tukey HSD, Games-Howell tests and Ryan, Einot, Gabriel, and Welsch Q procedure (REGWQ) tests were used and all the three comparisons detect between group differences consistently.

According to Field (2005), Games-Howell procedure is preferable when sample sizes of the groups are not equal and equality of population variance assumption is violated. On the other hand Tukey and REGWQ both have good power and tight control over Type I error and hence yield reliable result when groups have equal sample size and population variances are similar. In the current study, the homogeneity of variances was tested with Levene test and the levene Statistic was found to be statistically insignificant, Levene Statistic (2, 417) = .371, p= .690, indicating the homogeneity of variances assumption are maintained. Table 5.9 and Table 5.10 show the result of the post hoc analysis.

Table 5.9: Post hoc analysis result (for resilience): multiple comparisons

Multiple Comparisons							
Dependent Variable: resilience							
Statistical test type	(I) Livelihood Zone	(J) Livelihood zone	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Tukey HSD	1	2	-.06765	.11840	.835	-.3461	.2108
		3	-.35243*	.11840	.009	-.6309	-.0739
	2	1	.06765	.11840	.835	-.2108	.3461
		3	-.28478*	.11840	.044	-.5633	-.0063
	3	1	.35243*	.11840	.009	.0739	.6309
		2	.28478*	.11840	.044	.0063	.5633
Games-Howell	1	2	-.06765	.11802	.835	-.3457	.2104
		3	-.35243*	.11853	.009	-.6317	-.0731
	2	1	.06765	.11802	.835	-.2104	.3457
		3	-.28478*	.11865	.045	-.5644	-.0052
	3	1	.35243*	.11853	.009	.0731	.6317
		2	.28478*	.11865	.045	.0052	.5644

*. The mean difference is significant at the 0.05 level.

Source: Field survey, 2016

Note: *Livelihood zone 1= Sidama Coffee Livelihood Zone*

Livelihood zone 2 =Sidama Maize Belt Livelihood Zone

Livelihood zone 3 = Agro-pastoralist Livelihood Zone

Table 5.10: Post hoc analysis result (Homogeneous subsets)

Statistical test type	Livelihood zone	N	Subset for alpha = 0.05	
			1	2
Tukey HSD	1	140	-.1400	
	2	140	-.0724	
	3	140		.2124
	Sig.		.835	1.000
Ryan-Einot-Gabriel-Welsch Range	1	140	-.1400	
	2	140	-.0724	
	3	140		.2124
	Sig.		.568	1.000

Source: Field survey, 2016

Note: *Livelihood zone 1= Sidama Coffee Livelihood Zone*

Livelihood zone 2 =Sidama Maize Belt Livelihood Zone

Livelihood zone 3 = Agro-pastoralist Livelihood Zone

The close examination of the Table 5.9 shows that both Tukey's HSD and Games-Howell tests provided us with consistent results. In both cases, the difference between mean resilience scores of livelihood zone 1 (Sidama Coffee Livelihood Zone) and that of livelihood zone 2 (Sidama Maize Belt Livelihood Zone) failed to be statistically significant with p-value of 0.835. This means that the probability of obtaining mean resilience scores difference of this magnitude (i.e., 0.06765) by chance is about 83.5%. On the other hand, in both cases, the difference between the mean resilience scores of livelihood zone 3 (Agro-pastoralist Livelihood Zone) and the other two were found to be significant at p-value of less than 0.05: p=0.009 for difference between livelihood 1 and 3, and 0.045 for difference between livelihood zone 2 and 3.

Table 4.10 above provides more insight on the issue. It displays the result of Tukey's, also called Tukey's Honestly Significant Difference, test and REGWQ test. These two tests show subsets of groups that have the same means. The result shows that both tests identified two subsets of groups with statistically similar means. The first subset contains livelihood zone 1 and livelihood zone 2 with the indication that these two groups have similar means. The second subset contains only one group, i.e., Agro-pastoralist Livelihood Zone, clearly showing that the mean resilience score of this group is different from the other two.

With the support of post hoc analysis, now it becomes clear that the mean resilience scores of the two livelihood zones, Sidama Coffee Livelihood Zone and Sidama Maize Belt Livelihood Zone, are not different. However, the mean resilience score of Agro-pastoralist Livelihood Zone is different from the other two and it is this difference that is signaled in the ANOVA result presented in Table 4.9. Now one more question to be addressed, though implicitly answered, is "Is the mean resilience score of the Agro-pastoralist Livelihood Zone higher than the other two or vice versa?" The close examination of the differences (I-J) column of the Table 5.9 above, and the means plot presented in the Figure 5.1 show that the mean resilience score of the households from Agro-pastoralist Livelihood Zone is indeed greater than that of each of the other two livelihood zones.

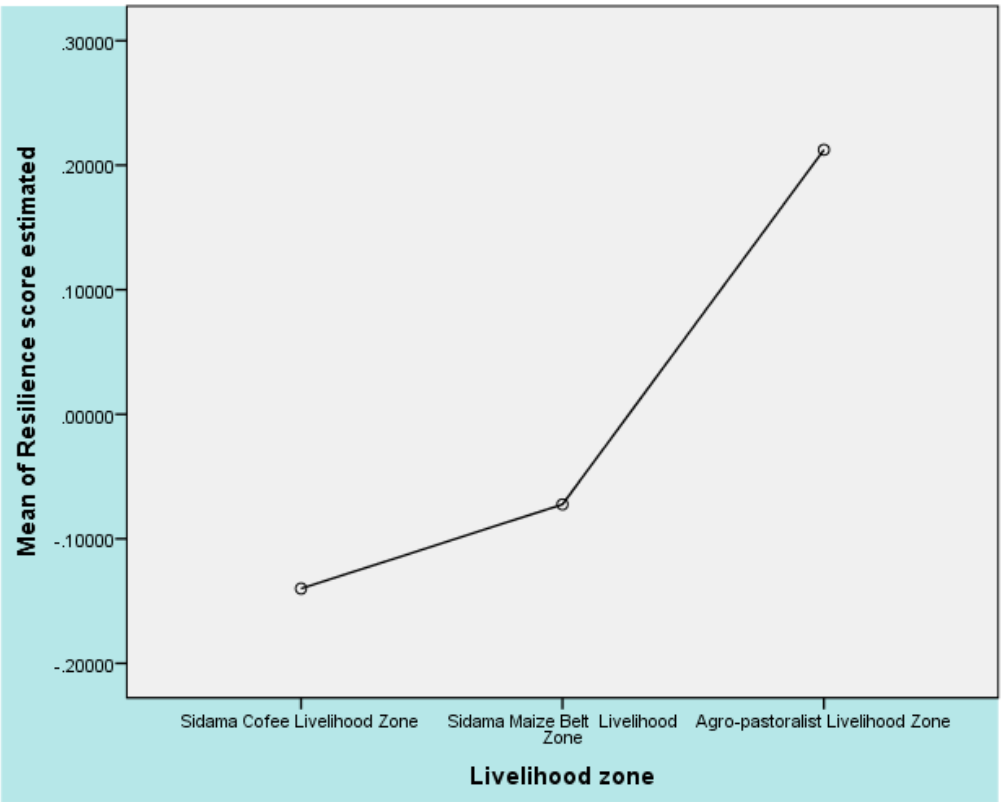

Figure 5.1: Plot of the livelihood zone based means of household's resilience to food insecurity

The means plot in the Figure 5.1shows that the mean resilience score of Agro-pastoralist Livelihood Zone is higher than the other two. Such result may appear to be surprising at first glance. However, it is still sensible when the context of the study area, Sidama zone in general

including Boricha *woreda,* is taken into account. In sidama culture, having large number of cattle together with large land holding size and enset are the main indicators of wealth. The Agro-pastoralist Livelihood Zone of the study area is one with a relatively less land fragmentation compared to the other livelihood zones and consists households keeping large number of livestock, specially cattle. As per one of my key informant, Development Agent, there are households that keep up to 30 cattle (Figure 5.2) and land too is not a constraint as there are farmers who hold even up to four and five hectares. The key informant further said that: "if it were not for rainfall problem, this area would be surplus producing one." On the contrary to this, another Development Agent from Sidama Coffee Livelihood Zone, mentioned that the land holding size per household was very small and due to this some risk taking households are moving to agro-pastoralist area, such as Loka Abaya *woreda* and around Billate river, in search of unoccupied land. The informant further added that, due to shortage of land and hence rangeland/fodder problem, households usually keep small number of livestock, mainly cattle. A response of a key informant from *woreda* level agricultural bureau to the question, which households tend to maintain their food security status irrespective of shocks such as crop failure also somewhat resounds that of the Development Agents' one. According to him, households having livestock and cash crops such as coffee and khat show more resilience than the other households. Though, it is not unique to the area, households in the Agro-pastoral Livelihood Zone produces khat as well (Figure 5.3) and khat produces from the area are supplied as far as to the markets in Aje area in the West Arsi zone, which is about 60 km, with motor bikes.

Since, the current study conceptualizes resilience as the ability to withstand shocks and stressors depending on the options available to the household to make a living and its ability to handle risks, the differences in the level of resilience among livelihood zones can be attributed to differences in the level of possessed resources such as livestock and land size. Specially, the role of variations in the level of agricultural assets to this observed difference is evident from the grand mean referenced relative position of the livelihood zone's mean scores of the variables used as covariates in resilience estimation. Though more emphasis has been given here for agricultural assets, by considering the central position it assumes in the livelihood base of study households, Agro-pastoralist Livelihood Zone scores better in all the top three

contributors to the household's resilience: income and food access, agricultural assets, and agricultural technology adoption (Appendix 2). One thing to be noted here is that though it appears a better performing group in aggregate terms, the disaggregated view shows that the agro-pastoralist group has performed less than its counterparts along some resilience dimensions. Specially, it appears weaker on access to basic services (ABS) and adaptive capacity (AC) (Appendix 2). Probably, this could be due to the remoteness of the location with reference to the center than the other two livelihood zones in relative terms.

Figure 5.2: Cattle herd of a household at Gasara Kuwe Kebele

Note: picture was taken after getting permission from the herders

Figure 5.3: Local market, where only khat is traded (left) and khat farm of a household at Gasara Kuwe Kebele (right), both in the agro-pastoralist livelihood zone.

5.2.3. Households' resilience status/level of resilience/

The analysis of resilience to this point has 1) estimated resilience index for households' resilience to food insecurity; 2) identified the variables contributing to households' resilience; and 3) examined the role of differences in livelihood systems or zones in determining variations in the level of households' resilience to food insecurity. However, the study can be more informative if the analysis is extended to address question: how resilient the households are? That is, level of resilience or resilience status of the household. Given this piece of information and the estimated relative resilience score or index of the households, it is also worth knowing how the achieved resilience score of the households associated with their food security situation and the linkage between resilience level of the households and the nature of previously employed coping strategies. This sub-section of the chapter addresses the first question: determining the resilience status of the households. The remaining issues raised here will be the concern of the two subsequent sub-sections of the chapter.

Most of the extant frameworks for resilience analysis, including the one adapted by the current study, fail to suggest cutoff points for decision regarding who is resilient and who is not. However, using some antecedents as a base, the current study has also ventured on this issue as well. In their study titled determinants of sustainable resilience to food and nutritional security, Mulat and Negussie (2013) use the mean resilience index (RI) as cutoff point for household's resilience status determination. They treat households whose resilience index falls below the

mean as non-resilient and those whose index falls above the mean as resilient. On the other hand, in their study of household's resilience to food insecurity, Guyu and Muluneh (2015) classify households into four resilience categories: vulnerable (with RI < 0.100), moderately resilient (0.100 ≤ RI < 0.250), resilient (0.250 ≤RI < 0.500) and highly-resilient (with RI ≥0.500). Though, the difference between the two approaches here is only meager in the current study's case when it comes to ultimate dichotomization, I adapted the approach of Guyu and Muluneh (2015) for household's resilience status determination. Table 5.11 presents the result of the analysis regarding the household's resilient status.

Table 5.11: Distribution of household resilience status by livelihood systems/zones

Livelihood system/zone	measurement	Households by resilience category				Total
		Non resilient	Moderately resilient	Resilient	Highly resilient	
Sidama Coffee	Count	95	7	8	30	140
	Percent	22.6	1.7	1.9	7.1	33.3
Sidama Maize	Count	93	2	4	41	140
	Percent	22.1	0.5	1	9.8	33.3
Agro-pastoralist	Count	68	13	6	53	140
	Percent	16.2	3	1.4	12.6	33.2
Total	Count	256	22	18	124	420
	Percent	61	5.2	4.3	29.5	100

Source: Field survey, 2016

The result summarized in Table 5.11 shows that very significant proportion of the surveyed households (61%) are not resilient and only 39 % are resilient at different level. The inter livelihood systems distribution of the households resilient status also mirrors the findings of the analysis of variance (ANOVA) discussed in previous sub-section. Though the cutoff point for resilience status determination is based on previous works, it is still well reflective of the study areas context, probably with some underestimation of the non-resilient group. In the current study, the surveyed respondents were asked their own assessment about the perceived effect of some food insecurity related shocks on their household's food security if they occur in the upcoming year. For instance, when asked to assess the extent of expected effect on their respective household's food security if their crop fails next year, 74.3% of the surveyed households reported as it will have an effect that runs from large to severe (Table 5.12).

Table 5.12: Extent of perceived on HH's food insecurity effect if crop fails next year

Perceived effect	Frequency	Percent	Cumulative Percent
	3*	.7	.7
Severe	175	41.7	42.4
Large	137	32.6	75.0
Moderate	49	11.7	86.7
Small	45	10.7	97.4
No impact	11	2.6	100.0
Total	420	100.0	

**missing*

Source: Field survey, 2016

If those respondents whose expected level of impact falls between 'no impacts' to 'moderate impact' are taken as resilient group, the household's own perception based assessment puts the household's with 'resilient' status only at 24%. The household's subjective (own) assessment about their resilience level has been incorporated here simply for cross validation purpose. However, the current study reports the household's resilience status that has been determined on the basis of their relative resilience index. Two things justify this: 1) the approach is more objective and reliable than the self-assessed position as the relative resilience scores was produced by aggregating the resources and options available to households- which is in line with the very notion of resilience, 2) it enables comparing the findings with other similar studies.

5.3. Relationship between households' resilience and food security

The current study is founded on the FAO based foundational works on resilience such as Alinovi *et al.* (2008), Alinovi *et al.* (2010), and FAO, (2014) that uses latent variables modeling approach to measure resilience and that treats resilience as both an unobserved outcome estimated by a set of variables and as a predictor variable: a predictor of food security in the face of shocks. Using the framework developed on the basis of this, I have estimated household's resilience to food insecurity by simultaneously performing the measurement and detection of substantive importance of the variables. In the previous chapter (Chapter 4), I have also elaborated the food security situation of the study area households.

The data for the current study was collected in the wake of the shock, as most farmers experienced crop failure during the cropping season that precedes the survey and even in the previous year as well. Given this, I believe that examining how the household's relative resilience scores correlated with their current food security scores is somehow informative. With

this belief, I run a bivariate correlation analysis between these variables. The analysis was undertaken after taking out the Income and Food Access variable from household's resilience estimation process. That is, first the resilience index for each household was estimated without incorporating the Income and Food Access component and then correlational analysis was run using the resulting scores. The result of the analysis has been presented in Table 5.13.

Table 5.13: Correlations between household's resilience and food security scores

		HFIAS score of households	FCS score of households	Resilience
HFIAS score of households	Pearson Correlation	1	**-.528****	**-.577****
	Sig. (2-tailed)		.000	.000
	N	420	420	420
FCS score of households	Pearson Correlation	-.528**	1	**.606****
	Sig. (2-tailed)	.000		.000
	N	420	420	420
Resilience	Pearson Correlation	-.577**	.606**	1
	Sig. (2-tailed)	.000	.000	
	N	420	420	420

**. Correlation is significant at the 0.01 level (2-tailed).

Source: Field survey, 2016

Table 5.13 shows that household's resilience to food insecurity is significantly correlated with both of the food security/insecurity indicators. It is negatively correlated with HFIAS and positively correlated with FCS. The direction of relationship is also as one might expect. That is, it signals that households with high resilience scores seem to have scored low on HFIAS and vice versa. On the other hand, households with high resilience scores seem to have scored high on FCS and vice versa. This finding provides the evidence that household's with higher resilience score can have better food security situation resisting the effect of shocks.

5.4. Relationship between previously employed coping mechanisms and resilience status (level) of the households

Discussion of this sub-section of the chapter is based on the ideas in the literatures such as Frankenberger *et al*. (2012), Carter *et al*. (2006), Tran (2013), LIFT and USAID (2011) that the types of coping mechanizes employed by households in response to previously happened shocks can affect their resilience to future shocks. For instance, in explaining economic anatomy of environmental shocks, Carter *et al*. (2006) posits that shocks if occur can bring about a direct

loss to household's assets through causing death or deterioration of quality or indirectly affect the same through the coping mechanisms employed by a household as a response to shocks. Households adapting costly coping mechanism such as eroding their assets can remain weak for long unless other factors aiding recovery is available. Frankenberger *et al*. (2012) argues that some household level responses can have negative and permanent consequences on resilience and Pasteur (2011) cited in Frankenberger *et al.* (2012) identifies the coping mechanisms that it considers negative or resilience erosive.

Based on these conceptual backdrops, the current study has made an endeavor to understand how the previously employed coping mechanisms by the surveyed households relate to their relative resilience position. To this end, households were asked if they encountered one or more shocks threatening their food security situation in the last two years preceding the survey. The responses of the households have been summarized in Table 5.14.

Table 5.14: Previously experienced food security situation threatening shocks

Variables	Response	Count	Percentage
If shocks affecting ability to feed HHs occurred within the last two years	Yes	333	79.3
	No	87	20.7
Number of shocks experienced*	Only one	99	29.7
	More than one	234	70.3

* *List of shocks include crop failure, household member death, livestock death, and* illness

Source: Field survey, 2016

Most of the surveyed households, 79.3% (333), experienced one or more types of shocks that they believe affected their food security situation. Only 20.7% (87) reported that they didn't experience shocks having effects on their food security. Out of these 333 households, 234 (70.3%), reported that they experienced more than one shocks.

Households were also provided with the list of coping strategies and asked if they employed them in the past two years time period as a way out to food insecurity problems/shocks that they experienced (Table 4.18). When it comes to identifying negative or resilience erosive coping strategies, it seems that literatures lack perfect unanimity. For instance, Pasteur (2011) cited in Frankenberger *et al.* (2012) considers such strategies as eating less, eating less nutritious food, delaying medical treatment, taking children out of school, exploiting natural resources, and

eroding productive assets as negative coping strategies. According to same source, these strategies undermine future options, making it more difficult to cope with the next shock or stress. However, some of the strategies considered as negative coping here are consumption based ones that involve temporary adjustments on eating and considered by others as easily reversible coping strategies commonly used by households before resorting to more punitive or costly strategies. However, responding to food insecurity related shocks with the commitment of resources on which one's livelihood is based such as land, oxen and the like are generally regarded as negative coping specially in case of poor households by food security literatures almost unanimously. Specially, stage 2 and stage 3 coping strategies[4] from the list identified by Donahue (2000) cited in LIFT and USAID (2011) and Corbett (1988) cited in Maxwell and Frankenberger(1992) are generally treated as erosive coping mechanisms (LIFT and USAID, 2011) and even the likes of distress migration represent the state of destitution.

Based on existing literatures and also study area's context, the current study considers selling reproductive animals, selling oxen used for farming, selling land holdings, renting out land, removing children from school, borrowing money at high interest rate, and diversion of loans from MFIs to consumption as negative or resilience erosive coping. Accordingly, the study households have been classified into two coping categories (Table 5.15): those who used negative coping in the past two year period prior to the current survey and those who did not. As indicated in Table 5.20, 59.5% (250) of the households employed one or more negative or erosive coping strategies in the last two years time period preceding the date of survey.

Table 5.15: Households by coping type

Coping type	Frequency	Percent
Non resilience erosive (positive) coping	170	40.5
Resilience erosive (negative) coping	250	59.5
Total	420	100.0

Source: Field survey, 2016

[4] Stage 2 include disposal of productive assets such as Selling or exchanging land, equipment, tools, or animals used for farming; borrowing at exorbitant interest rates; reducing spending more

Stage 3 is destitution stage and includes such actions like depending on charity, breaking up household, migrating under distress, engaging in transactional or commercial sex

With this piece of information on the nature of previously employed coping, now the discussion turns to examining the relationship between the nature of coping mechanisms and relative resilience position or status of the households (sub-section 5.2.3). As indicated in Chapter Two, the analysis here advances with the premises that the nature of previously employed coping strategy can have some sort of effect on the predictive resilience of households (estimated at time T1) in a way that those with negative coping strategy scoring less on resilience. The relationship between previously employed coping type and resilience status of the households was analyzed using Contingency Table and Chi-square test statistic. Table 5.16 presents cross-tabulation of households' resilience level by coping types previously employed.

Table 5.16: Cross-tabulation of households' resilience level and previously used coping strategy

			Coping type		Total
			Non-resilience erosive (positive coping)	Resilience erosive (negative coping)	
Resilience level	Resilient	Count	115	49	164
		% within resilience level	70.1	29.9	100
		% within coping type	67.6	19.6	39
		% of Total	27.4	11.7	39
	Non-resilient	Count	55	201	256
		% within resilience level	21.5	78.5	100
		% within coping type	32.4	80.4	61
		% of Total	13.1	47.9	61
Total		Count	170	250	420
		% within resilience level	40.5	59.5	100
		% within coping type	100	100	100
		% of Total	40.5	59.5	100

Source: Field survey, 2016

From the Table 5.16, it can be learned that about 59.5% (250) of the households used one or more types of resilience erosive (negative) coping strategies within two years time prior to the current survey. Out of these households, that employed negative coping strategies in the past, only 19.6% (49) found to be resilient (scoring relatively high on resilience index) at time T1: at the time of this survey. The very significant proportion of the households, 80.4% (201), that adapted one or more negative coping strategies found to be non resilient. On the other hand, out of the total households who did not previously use negative coping strategies, 67.6% (115) were found to be resilient at time T1 (scoring relatively high on resilience index). Those who scored relatively low on resilience or non- resilient from this group were 32.4% (55).

Still similar picture can be obtained if this contingency table is viewed from another angle. That is, out of the total 164 households who scored high on resilience (resilient households), 70.1% (115) are those who did not previously employ negative coping mechanisms. Only, 29.9% (49) of the resilient households are those who previously used negative coping. On the other hand, the great majority of non-resilient households, who scored relatively low on resilience, 78.5% (201), are those who had previously used one or the other resilience erosive coping strategies. Only 21.5% (55) of non-resilient households are those who did not use resilience erosive coping strategies.

From the contingency table and the interpretation that follows it, one can realize the existence of the relationship that confirms the premise the current study has made based on existing related literatures. That is, the hypothesized relationship that household who employed resilience erosive coping mechanisms in response to previously occurred shocks will be less resilient to the upcoming shocks. As the current study has estimated households' resilience to the future food insecurity shocks using the resilience index and their resilience status has been determined based on the achieved relative resilience scores, the stated relationship has been examined in terms of how dependent is the resilience status of the households on the previously used coping type. To this end, the Chi-Square test was run as way of checking if the observed frequency or percentage differences in the contingency table above are really statistically meaningful or not. In statistical terms, it tests the null hypothesis that there is no relationship between resilience status of the households and types/nature of previously employed coping strategies. That is, it tests the hypothesis that the household's resilience score (status) at time T1 is independent of types of coping methods employed by a household in response to shocks occurred prior to time T1.

The result of Chi-Square test has been presented in Table 5.17 together with Likelihood Ratio and Yates's Continuity Correction that have been included for more confidence. The two additional tests included here serve the same purposes and work under the same assumption but differ from Pearson's Chi-Square on the methods the test statistics are computed. According to Field (2005), Yates's Continuity Correction test serves the role of making the Chi-Square to recognize only a noticeable or real relationship by lowering its value. This alternative is needed because Chi-Square tends to produce significant values that are too small. In other words, it tends to make type I error in the case of 2 by 2 contingency table. On the other hand, the Likelihood

Ratio is an alternative to Pearson's Chi-Square and is preferred when the sample size is small. Though sample size sufficiency is not an issue in the case of the current study, this test too has been added as a means of confirming the main Chi-Square test result.

Table 5.17: Tests of association between resilience status and coping type

	Value	Df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	98.149[a]	1	.000	.000	.000
Continuity Correction [b]	96.141	1	.000		
Likelihood Ratio	100.493	1	.000	.000	.000
N of Valid Cases	420				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 66.38.
b. Computed only for a 2x2 table

Source: Field survey, 2016

The result in Table 5.17 reveals that the Chi-Square is highly significant for $\chi 2$ (1) = 98.149, P < 0.001 indicating that there exists significant association between household's resilience status and types of previously employed coping strategies. The other two tests', variants of chi-Square, results are also very significant confirming the main Chi-Square result. The assumption that no cell in the contingency table should have the expected frequency of less than 5 is also well satisfied, further ensuring the accuracy of the model. Statistically significant Chi-Square value here shows us the existence of association or relationship between two variables but it doesn't show the strength of the relationship that has been detected. Literatures suggest Phi test for 2 by 2 contingency table and Cramer's V or Contingency Coefficient tests when one or more of the variables contain more than two categories.

According to Field (2005), these test statistics are based on modifying the Chi-Square statistic to take care of sample size and their values vary between 0 (indication of no association) and 1 (indication of the existence of perfect association). The current study examined the strength of relationship using the Phi test and the results have been presented in Table 5.18. The test results shows existence of a noticeable level of association between the household's resilience level and types coping strategies previously employed. The Phi statistic was 0.483 and this value was highly significant ($p < 0.001$) indicating that the value of test statistic that is this big is unlikely to have happened by chance. The Phi statistic shows the existence of noticeable level association, in terms of level strength, between household's resilience and nature of previously employed coping strategies. The sign of relationship is also as expected as the two variables were

coded in similar fashion. That is, both non-resilient option of the resilience status variable and previous negative coping option of the nature of coping variable received 0 as a code and the other options of the dichotomy for each variable were coded with 1.

Table 5.18: Test of the strength of association (resilience level and coping type)

		Value	Approx. Sig.	Exact Sig.
Nominal by Nominal	Phi	.483	.000	.000
N of Valid Cases	420			

Source: Field survey, 2016

Both the tests of associations (Chi-Square and its variants) as well as the tests of the strength of associations, the Phi statistic, illuminated the existence of meaningful relationships between the two variables under consideration. Before winding up the discussion on the issue, I will further highlight on the strength of relationship we have seen here using the odds ratio as a supplement to Phi test. The odds ratio here refers to the ratio of the odds that a household will be resilient to future shocks with no prior use of negative coping strategies to the odds that a household will be resilient though it previously used some kind of negative coping strategies. On the basis of frequencies in the Table 5.18 above, I have computed the odds ratio manually as follows:

Odds ratio = Odds of being resilient with no prior use of negative coping ÷ Odds of being resilient with prior use of negative coping

Odds of being resilient with no prior use of negative coping = Number of resilient households who did not use negative coping ÷ Number of non-resilient households who did not use negative coping

$$= 115 \div 55 = 2.0909$$

This ratio indicates that the number of households who are resilient with no prior use of negative coping is as twice as those who are non-resilient though they did not employ negative or resilience erosive coping before. Here, it is possible to be resilient or non-resilient to future shocks without prior use of erosive coping. However, it is more likely to be resilient than to be non-resilient given the initial state is that of no negative or erosive coping strategy.

Odds of being resilient with prior use of negative coping =Number of resilient households who did use negative coping ÷ Number of non-resilient households who did use negative coping

= 49/201 = 0.24378

The ratio here shows that the number of households who are resilient with prior use of negative coping is about four times less that of the number of households who are non-resilient with prior use of negative coping strategies. The point is that it is possible to be resilient or non-resilient for households irrespective of the fact that they previously utilized some kind of negative coping strategies. However, it is more likely to be non-resilient than to be resilient given this initial state.

Given this two piece of information, the odds ratio can be computed as follows:

$$Odds\ ratio = 2.09090 \div 0.24378 = 8.57$$

The odds ratio indicates that households who did not previously use negative or resilience erosive coping strategies are 8.57 times more likely to be resilient to future shocks as compared to those who employed them. The obvious implication is that the nature of coping strategies used in response to a particular food insecurity related shocks at a given point in time will affect one's ability to respond to the future shocks. Stated in a more plain way, households that employed coping mechanisms that erode their resource basis will be less likely to maintain their food security in the event of shocks if occur again. To sum up the discussion, the finding of this study regarding coping strategy–resilience nexus is in line with the position of general conceptual literatures such as Frankenberger *et al.* (2012), LIFT and USAID (2011), Carter *et al*. (2006) and others on the issue.

5.5. Summary

The chapter has focused on identifying sources of household's resilience to food insecurity and examining the effect of differences in livelihood zones to which households belong on their resilience level. It has also explored the relationship between the types of coping strategies previously employed by the households and their resilience to food insecurity. Regarding the sources of resilience, it has been learned that income and food access, agricultural asset, agricultural technology adoption, social capital, access to basic services, and adaptive capacity

have substantive importance to household's resilience. This finding is generally in line with and confirms to the notion that household's resilience rests on the resources and options available to it to make a living and its ability to handle risks. The inter-livelihood zones based comparison of household's resilience to food insecurity revealed existence of significant differences. In this regard, the agro-pastoralist livelihood group was found better livelihood group on average terms but weaker in terms of access to basic services and adaptive capacity components of resilience in relative terms as compared to Sidama Coffee and Sidama Maize Belt livelihood groups. Overall, analysis of resilience showed that the majority of the surveyed households are non-resilient. In this regard, both resilience index and household's own perception based analyses provided consistent evidence.

In the chapter, the relationship between the nature of coping strategies employed by households and the level of their resilience was examined and the result that confirms the position of conceptual literature on the issue has been observed. The relationship was examined using Chi-Square test and the result has revealed that there exists the linkage between the household's current resilience status and the nature of previously employed coping strategies. The Phi test and the odds ratio that were used to test the strength of this relationship have signaled that the majority of the households that scored low on resilience index are those that utilized negative or resilience erosive coping strategies.

Chapter six: Summary, conclusion and policy implications

6.1. Introduction

The research investigated three interrelated empirical research questions. The first chapter has presented them together with the background and justification regarding relevance of undertaking the study. In the second chapter, the effort was geared towards providing theoretical and conceptual underpinnings and hence relevant literatures have been reviewed. In the third chapter, methodological issues have been discussed and appropriate methods of data analysis have been identified /specified for the investigated objectives. Using the identified methods of analysis for each research objectives, data analyses were done in the subsequent two chapters. So, the current chapter provides the summary of the findings of the analyses and conclusions drawn from them, policy recommendations, and contribution or theoretical implication of the current study.

6.2. Summary and conclusion

The empirical questions of the current research were addressed in Chapter Four and Five. The analysis in Chapter Four addressed the research objectives related to the first research question. Firstly, it examined the sources of household's resilience to food insecurity. Following the line of existing literatures such as FAO (2014), Alinovi *et al.* (2008), Alinovi *et al.* (2010), and Ciani and Romano (2013), this was done by treating resilience as an unobserved outcome estimated with hypothesized set of variables and using latent variables modeling (multistage modeling) approach. This approach is suggestive one to similar works as it allows measuring the different components of the constructs separately, which makes the model more flexible allowing the inclusion of prior information and thus reducing parameter identification problems.

Examination of loadings of PCA indicates that all hypothesized variables appear to be significant contributors for the resilience of households to food insecurity shocks. In terms of the order of importance, income and food access (IFA), agricultural asset (AA), and agricultural technology adoption (ATA) are variables having relatively more substantive importance to household's resilience. Social capital (SC), access to basic services (ABS), and adaptive capacity (AC) as well have significant positive contribution. These findings are also in line with similar previous works. For instance, Alinovi *et al.* (2010) report significant result for Kenya on IFA, ABS and AC, all with the loading size of above 0.3. However, their livelihood- based -disaggregated

report show that the other variables too appeared with higher loadings with different level of importance for different livelihood group's resilience. For instance, though not that noticeable for Kenya as a whole, the loadings between Agricultural assets (AA) and resilience was also meaningful for agriculture based livelihood groups (agro-pastoralists, small holders, and large holder farmers) in their case. Ciani and Romano (2013) also report significant and positive loadings (loading size larger than 0.3) between resilience and ABS, AA, ATA, AC as well as connectivity related variables.

Regarding the current study, almost all of the hypothesized variables, agricultural asset, income and food access, agricultural technology adoption, social capital, access to basic services, and adaptive capacity, as expected appear to have substantive importance for rural household's resilience to food insecurity. Hence, based on the very notion of resilience and the findings reported here, it can be concluded that the study area's households with higher possession of each of these resources can better cope with shocks and be able to maintain their food security in the face of shocks and stressors. Therefore, any efforts or interventions to be made to increase resilience of the study areas households need to focus on strengthening these capacity dimensions. However, the actors like local level government offices such as zonal and *woreda* level Agricultural Bureaus and NGOs need to reexamine the role of social safety nets, specially the implementation aspect, in the study area's context. Specially, the focus of humanitarian aid that is made in response to draught and crop failure induced food insecurity should be made to have a role in guarding against productive assets erosion.

The study also shows that only 39 % of the surveyed households are resilient to food insecurity and the remaining 61% found to be non-resilient even in very leniently set criteria adapted for resilience status determination. This finding is also in agreement with Guyu and Muluneh (2015) that reported 65.25% rural households as vulnerable and only 34.75% as resilient to potential or future food insecurity shocks. So, the conclusion is that unless sound and well planned intervention is taken, most of the study area households can easily lose their food security status to worse even by a very meager shock.

Though the majority of the surveyed households are not resilient in general, the inter livelihood systems or zones resilience analysis revealed that the household's level of resilience vary based

on the livelihood systems. The result of the analysis of variance reveal significant effect, i.e., F-ratio is significant at $F(2, 417) = 4.991$, $p < 0.001$ implying that the fact that the households of the study area are from different livelihood zones accounted for meaningful level of variations in the level of their resilience scores. Whereas there doesn't exist meaningful difference between Sidama Maize and Sidama Coffee livelihood groups, Agro-pastoralist livelihood group is a group with better resilience.

The implication is that resilience capacity building interventions require identifying the denominators to which the differences can be attributed. Specially, looking for a way of addressing population pressure on land and improving agricultural assets possessions of individual households can be good intervention priority for coffee and maize livelihood systems. Reducing the youths' demand for parents land share through designing and properly implementing alternative job packages can be a workable policy options for long term solution. Giving due emphasis to the agricultural intensification or technological factors such as supplying improved seeds and fertilizers with the goal of making them more workable and effective can be a commendable option for short term. The closer look of each contributing variables to household's resilience also reveal that the Agro-pastoralist livelihood group found to be relatively weaker than the other two groups along access to basic services (ABS) and adaptive capacity (AC) dimensions of resilience on average. Hence, giving attention to these areas need to be among the priorities of resilience capacity building interventions.

In chapter five the analysis of data about household's food security situation and coping mechanisms were done. HFIAS and FCS are used for measurement of the household's food security and food security status determination. The analysis of HFIAS based data shows the food insecurity prevalence of 62.4%. That is, 62.4% of the served households have food insecurity situation that runs from 'moderate' to 'severe'. On the other hand, the analysis of FCS based data indicates the food insecurity prevalence of 42.4%. This means that 42.4% of the surveyed households have the food security situation of below 'acceptable' level. These two indicators vary not only in terms of the aspects of food security they capture but also in terms of level of sensitivity to food insecurity when it comes to level of food insecurity prevalence determination. Though separately reporting each food security indicator's based prevalence may

be sufficient for readers from academic sphere, it is imperative to get around this problem for the interest of those from nonacademic areas. The cross classification, an attempt made to reconcile the problem arising from differences in measurement, of the two indicator's food insecurity prevalence shows that 36.4% of the surveyed households have a food insecurity problem that can be expressed not only in terms of food insufficiency but also in terms of lack of dietary diversity or food quality. The prevalence of this level, specially for the survey undertaken after harvest period, is too big to undermine and generally it ascertains the fact that the study area, Boricha *woreda,* is the area of noticeable level food stress. This is similar with the assertion of the study of Negatu (2011) and also that of Bechaye (2011) though the statistical findings are not directly comparable in the later case due to differences in the adapted approach or method. The combination of factors has contributed to the food insecurity problem of the *Woreda*: irregular rain, land fragmentation, and population pressure.

The inter livelihood zones/systems/ comparison was done regarding food security/insecurity situation among the three livelihood zones. The result of the analysis of variance (ANOVA) revealed the existence of statistically significant differences in mean food security scores both in the case of HFIAS for $F(2, 417) = 15.046$, $p < 0.001$ and FCS for $F(2, 417) = 6.626$, $p < 0.01$. This indicates that the fact that the surveyed households are from different livelihood zones has significantly explains variations in food security scores of the households. The post hoc analysis with multiple comparisons, on the other hand, reveals that the mean food security scores of Sidama Coffee livelihood group and Sidama Maize livelihood group are not statistically different. However, the Agro-pastoralist livelihood is found to be better than the other two livelihood groups on average terms. Nonetheless, this shouldn't be mistakenly understood as if this group doesn't have food insecurity of worrying level.

It has also been learned that the surveyed households employed a combination of various coping strategies, both consumption and non-consumption based, as a response to food insecurity problems. The consumption based coping strategies utilized by households run from compromising quality in terms of eating less preferred food, a behavior reported by most household's (60.2%), to food rationing behaviors such as reducing portion size at mealtimes (43%), restricting adults' consumption for the interest of children (45.5%), and reducing number of meals eaten per day (33.6%).

The analysis of the data on non consumption based coping strategies utilized over the last two years period also revealed that the households responded to food insecurity shocks by utilizing a range coping mechanisms. The non-consumption based coping strategy reported by most of the surveyed households is appealing for food aid (51.7%). This is followed by selling reproductive animals: employed by 42.6% of the total households. They study also revealed that the proportion of households who employed such coping strategies like selling small animals, selling firewood, and selling oxen are 37.6%, 33.3%, and 23.3% respectively. Coping strategies such as removing children from school (20.7%), migrating to nearer areas to wage labor (19%), borrowing money at high interest rate (21%), and renting out land (10%) were also in the mix of response mechanisms. These findings has the implication that depending on the initial state of the households who utilized them, some of these coping mechanisms can lead them to the poverty trap and erode their ability to cope similar problems in the future. If not properly managed, even the coping strategy that doesn't have immediate individual impact, selling firewood in the current study's case, may not be environmentally sustainable. This is specially true in the case of the current study area as the source of firewood collection is, mostly, the single leftover of the ancient forest, which is confined to marginal area around Billate River.

The current study has also made the endeavor to statistically show the linkage between the types of previously employed (at time T0) coping mechanisms by households and their estimated resilience (at time T1) to future food insecurity shocks. The Chi-Square test employed to this end was found to be significant for $\chi 2\ (1) = 98.149$, $P < 0.001$ indicating that there exists significant association between household's resilience status and types of previously employed coping strategies. This finding goes in line with the existing literatures on shocks-coping strategies-resilience nexus. The conclusion emerged from this is that the coping mechanisms utilized by households today can have important implication on their capacity to cope with the future shocks, if occur, depending on their resource base. Hence, well targeted intervention that goes beyond saving lives or humanitarian emergency and that focuses on livelihood protection and building the household's capacity to future shocks is needed.

6.3. Policy implications

Based on observations both from the survey and key informants interview, the study makes the following recommendations.

- Resilience has become an important concept in the analysis of development issues such as household's food security. Resilient households can maintain their food security in the event of shocks or more quickly recovery from the effect of shocks as compared to the non-resilient counterparts. This warrants strengthening the resilience capacity of households if they can maintain their food security withstanding the effect of shocks. Strengthening resilience through intervention in turn requires understanding where their resilience capacity lies as it enables building on the existing strengths. Regarding Boricha *woreda,* the current study found that income and food access, agricultural asset, and agricultural technology adaptation are the most contributing variables to overall resilience. Hence, finding out ways of improving food access, increasing agricultural asset possession, and ensuring access to and effective utilization of agricultural technologies are among areas that can boost up rural household's resilience to food insecurity.
- Agro-livelihood zones based analysis of resilience indicates that the level of ex ante resilience of households varies based on the livelihood zones to which they belong. Sidama Coffee Livelihood and Sidama Maize Livelihood Zones are found to be relatively less resilient group as compared to Agro-pastoralist Livelihood Zone. The disaggregated view of the sources of resilience revealed that these two livelihood zones have underperformed in all the three variables contributing more to resilience. Discussion with key informants has specially buttresses findings related to agricultural asset, mainly the problem of land shortage due to high population pressure. The policy implication of this is that looking for a way of addressing population pressure on land and improving agricultural assets possessions of individual households can be good intervention priority for coffee and maize livelihood systems. Reducing the youths' demand for parents land share through designing and properly implementing alternative job packages can be a workable policy option.

- The Agro-pastoralist Livelihood Zone based households are found to be weaker on average on access to basic services proxied through access to safe water, MFI, and telephone and adaptive capacity which is proxied through education, health, dependency ratio, and diversity of income sources dimensions of resilience. In some of these individual variables cases, this could be due to location that this zone is situated in relation to the center. Hence, planning for action by assessing the relative size of the problems in each of these areas can be good entry point for resilience capacity building interventions. Based on what I have observed during my stay in the field, I personally suggest all concerned parties such as Regional, Zonal, and Woreda level concerned government offices and local level development organizations to strive specially to address the access to safe water problem.
- Households can respond to shocks and resist its effects mainly based on the resources they possess. The external support made to them in the event of shocks can contribute best to resilience building if they are geared towards not only to life saving but also to that of saving household's productive assets and resources. This is how the resilience approach has bridged the gap between humanitarian emergency and development efforts by bringing them together. However, it doesn't seem this is the case in Boricha *woreda* as per the study's statistical finding, which is well supported by the key informants' interview. The policy implication is that, specially, the food related aid component of the social safety nets need to be redressed implementation wise so as to make it support the livelihood assets saving efforts of the of the households in the event of food insecurity shocks.
- Food security situation of sizeable proportion of the survived households is not found satisfactory in almost all aspects of food security that the proxy measures employed in this survey can capture. For instance, very large proportion of the study households experienced worries of varying level with the indication that stable access and availability of food is a concern for the study area. The key informants' insight on the problem revealed that a multitude of factors are working to cause this problem though the extent of effect of each may not be equal for all livelihood zones. Whereas, population pressure and resulting land shortage together with climatic variables, erratic rain and drought, are factors to blame specially for Sidama Coffee Livelihood Zone and also Sidama Maize

Livelihood Zone as well, the blame goes mainly to climatic factor in the case of Agro-pastoralist Livelihood Zone. As a way out to the study area's food insecurity problem, I suggest the decision makers to consider well targeted policy measures. Copying and directly applying nationwide packages as they are may not address the local problem well. In this regard, I would suggest the following specific actions:

- Providing access to food through public transfer mechanisms such as humanitarian food aid aiming at saving not only life but also the livelihood assets of the households
- Making sure that household's access to agricultural technologies, specially fertilizers, is not working to erode their assets. Here, guarding households from being over indebted is important. Introducing crop insurance to farmers to guard against losses of crop failure should also be among the options to consider.
- Capitalizing on the local practice of holding water on ponds to make farmers at least partly survive the effect of erratic rain by growing short maturity period crops. This option works better if the competing demand for pond water is addressed by proving households with access to safe water for domestic use. To this end, the local as well as zonal level administration need to show more commitment to reach rural residents as previously planned through Awada-Boricha-Water-Project.
- Encouraging and well supporting the livelihoods or income diversification efforts of the farmers is also a worthy policy option
- Reducing the youth's demand for already highly fragmented land holdings by wisely designing and carefully implementing alternative job options. This is specially commendable policy option to consider not only for the current study's area but also for Sidama Zone at large. Job categories such as animal fattening, poultry, rural grain mills, and construction materials such as sand mining can be considered in this regard. Moreover, providing skill acquisition based training that enable the rural youth to get employment in urban areas and industries and facilitating employment then after are also among the options to consider. Strengthening and making the local development institutions such SDC, SDA, SMFI and the like to work with their full potential is also commendable as they

can support the concerned line Government Bureaus such as Sports and Youth Bureau and other collaborating offices in the Regional, Zonal, and *Woreda* level Government structure in this regard.

6.4. Theoretical implications

Using resilience approach to the analysis of development issues in general and food security analysis in particular is the recent one. As argued in literatures, regarding food security, it is the vulnerability analysis that has dominated most of the scholarly works for long. However, recently the concept of resilience has emerged as a new organizing concept and resilience approach to food security analysis has been gaining wider acceptance. The current study is one of the few studies that have adapted such an approach, which is currently gaining momentum. In addition to adapting resilience approach, the current study has contributed to the existing literature in the following ways.

- Studies I come across with are either food security and coping strategy focused or resilience focused. Those that bring them together are rarely found. The exception in this case is Ciani and Romano (2013) who examined the relationship between food security and resilience as way to validate methodology they proposed for resilience to food insecurity analysis. Literatures have widely covered, at conceptual level, the possible impact of the nature of coping strategies employed by households on their resilience to food insecurity. However, to the best of my knowledge, none of the previous studies on household's resilience to food insecurity have empirically explored them. The current study has bridged this knowledge gap in the existing literature by empirically examining the linkage between the nature of previously employed coping strategies and household's resilience to food insecurity.
- Literatures argue for the value of combining resilience analysis with livelihood strategies pursued by households. This makes it possible to analyze different level of resilience to food insecurity achieved by various livelihood groups as well as the different strategies pursued by such groups in order to gain resilience to food insecurity. The current study too has also linked the analysis of household's resilience to food insecurity to livelihood systems, or livelihood choice as viewed from households stand point, by employing appropriate method of analysis. The previous studies that can be mentioned in this regard (Alinovi *et al.,* 2010, Ciani and Romano, 2013) are methodologically limited when it comes to inter livelihood groups' resilience analysis. They simply compared the size of

the loadings of different livelihood groups. Without the application of some statistical tests, it is not always easy to check whether observed differences are the result of chance or the true characteristic of population from which the data was drawn. Though it is not about inter livelihood systems analysis, the study of Alinovi *et al.* (2008) compared different administrative regions in Palestine state by using t- tests. Field (2005) argues that the use of t tests for comparison of multiple groups one after the other inflates *family wise* or Type I error. The recommended statistical technique in such analysis where the numbers of livelihood groups are three or more is multivariate techniques such as ANOVA and MANOVA. So, the livelihood systems resilience analysis with ANOVA is the contribution of this thesis, in terms of improvement in methods of analysis.

- The existing works on quantitative analysis of household's resilience to food insecurity have not given sufficient emphasis to social capital. Though Guyu and Muluneh, (2015) have captured it well with the variable they named as 'Cultural-bond-Reciprocity and Practices (CLRBP)', their focus was only on social capital proxies that were actually take place such as whether a household had been involved in hosting gust and/or being hosted as a gust and fed. However, in such treatment, there is a room that a household who did not previously involved in such activity by chance but having a potential to do so if occasions leading to that happened would receive zero score and hence would be potentially treated as non-resilient. This indicates the need for incorporating some proxies of social capital that is not yet demonstrated in action. So, the current study has bridged this gap in the resilience literature by using perceived social capital, a latent variable in the case of current study, as one indicator of social capital.
- Though a couple of empirical works can be found on food security in the current study area, most of them have not brought in to picture differences in livelihood system/zones regarding food security situation. The study of Bechaye (2011) can be taken as exception in this regard. Bechaye (2011) has simply compared the average calorie intake of the three livelihood zones. However, as the study was based on sample, the observed mean difference might happen by chance and may not reflect the real difference among the livelihood groups. The application of more sound method, ANOVA in this case, for the analysis of food security situation among livelihood groups is methodological improvement of the current study in the context.

- The current study has also bridges the research gaps in terms of geographical coverage regarding household's resilience to food insecurity. In this regard, it has contributed context based evidence on household's resilience to food insecurity too.

6.5. **Suggestion for future research**

The current study has analyzed the household's resilience to food insecurity at one point in time. It is the ex ante analysis aimed at measuring the household's resilience to potential (future) shocks. By linking the analysis to household's livelihood system (choice), it also tries to examine the heterogeneity (understanding the differences in resilience across categories of livelihood groups) in addition to shading a light on shocks- coping strategies- resilience nexus. However, resilience analysis in a given context would be more informative if the analysis is done both ex ante and ex post temporal wise. With such analysis, it is possible to see its dynamism in addition to heterogeneity (variability). That is, to understand how resilience as well as its components has changed overtime as resources that comprise resilience capacity are often sacrificed. It is worth examining such dynamism owing to the fact that resilience is dynamic concept. Moreover, with such analysis, it is possible to see well how the current resilience helped households to maintain their food security withstanding the effect of shocks. So, addressing this gap using the panel data should be the direction of future research as far as the household's resilience to food insecurity is concerned. In regards to the response mechanisms employed by households, the current study has focused only on short term adjustments to food insecurity problem. The long term adjustments in the mix of methods of securing food or income needed for obtaining food is not the focus of the current study. That is, though adaptive capacity has been included as one of the variables in the resilience analysis, adaptive strategies have not been explored in detail. Hence, exploring the adaptive strategies in the study area context in detail is another area that the future research can focus.

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Appendices

Appendix 1: Results of principal component analysis: total variances explained

Appendix 1-A: Agricultural asset

Total Variance Explained						
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.224	44.484	44.484	2.224	44.484	44.484
2	.988	19.752	64.237			
3	.735	14.690	78.927			
4	.544	10.883	89.810			
5	.509	10.190	100.000			

Extraction Method: Principal Component Analysis.

Source: Field survey, 2016

Appendix 1-B: Agricultural technology adoption

Total Variance Explained									
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1.907	47.682	47.682	1.907	47.682	47.682	1.578	39.439	39.439
2	1.128	28.210	75.892	1.128	28.210	75.892	1.458	36.453	75.892
3	.542	13.551	89.443						
4	.422	10.557	100.000						

Extraction Method: Principal Component Analysis.

Source: Field Survey, 2016

Appendix 1-C: Access to basic services

Total Variance Explained						
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1.384	46.148	46.148	1.384	46.148	46.148
2	.841	28.048	74.196			
3	.774	25.804	100.000			

Extraction Method: Principal Component Analysis.

Source: Field survey, 2016

Appendix 1- D: Social capital

Total Variance Explained						
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1.410	47.001	47.001	1.410	47.001	47.001
2	.959	31.973	78.974			
3	.631	21.026	100.000			

Extraction Method: Principal Component Analysis.

Source: Field survey, 2016

Appendix 1-E: Adaptive capacity

Total Variance Explained									
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1.445	36.129	36.129	1.445	36.129	36.129	1.443	36.070	36.070
2	1.122	28.050	64.179	1.122	28.050	64.179	1.124	28.109	64.179
3	.818	20.442	84.621						
4	.615	15.379	100.000						

Extraction Method: Principal Component Analysis.

Source: Field survey, 2016

Appendix 1-F: Income and access to food

Total Variance Explained						
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1.528	76.397	76.397	1.528	76.397	76.397
2	.472	23.603	100.000			

Extraction Method: Principal Component Analysis.

Source: field survey, 2016

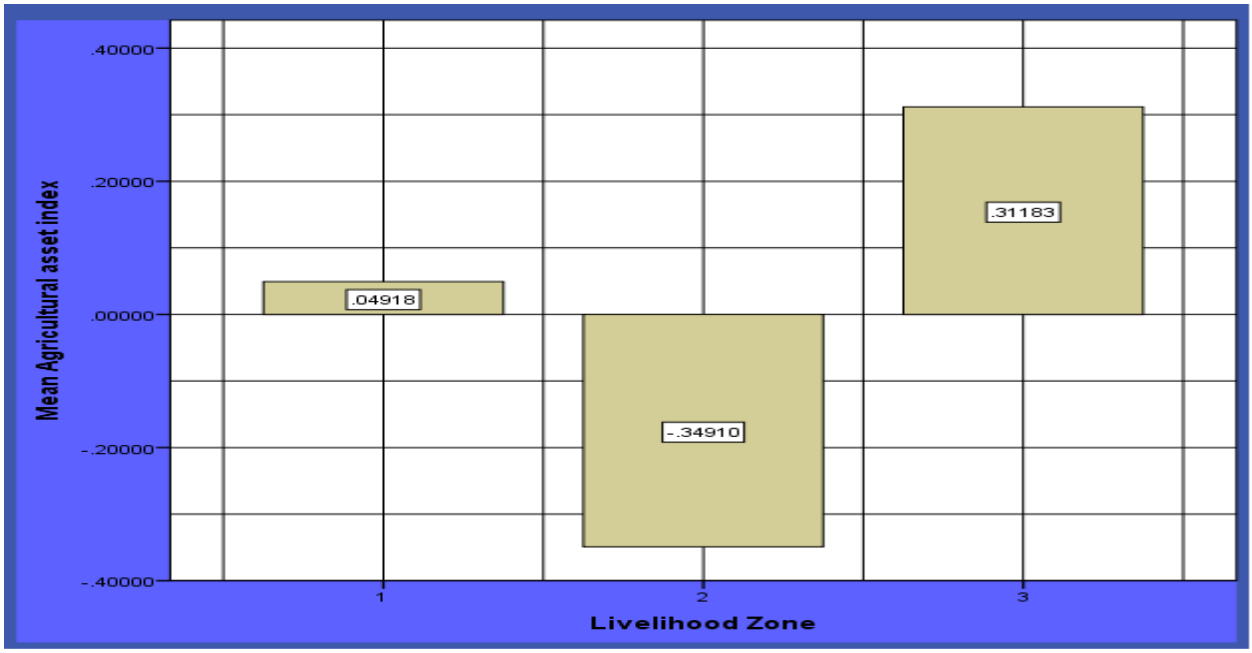
Appendix 1-G: Resilience (R)

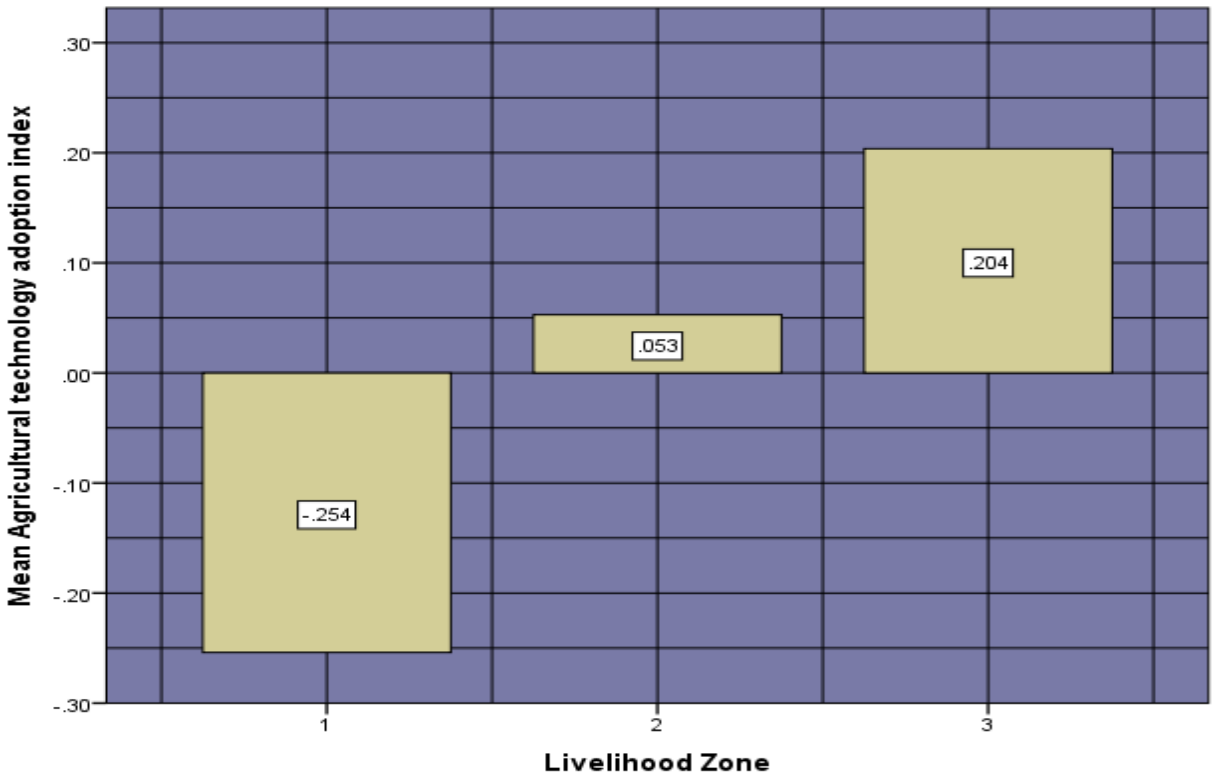
Total Variance Explained						
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.949	42.134	42.134	2.949	42.134	42.134
2	.935	13.356	55.489			
3	.898	12.824	68.313			
4	.742	10.601	78.915			
5	.635	9.065	87.980			
6	.462	6.606	94.586			
7	.379	5.414	100.000			

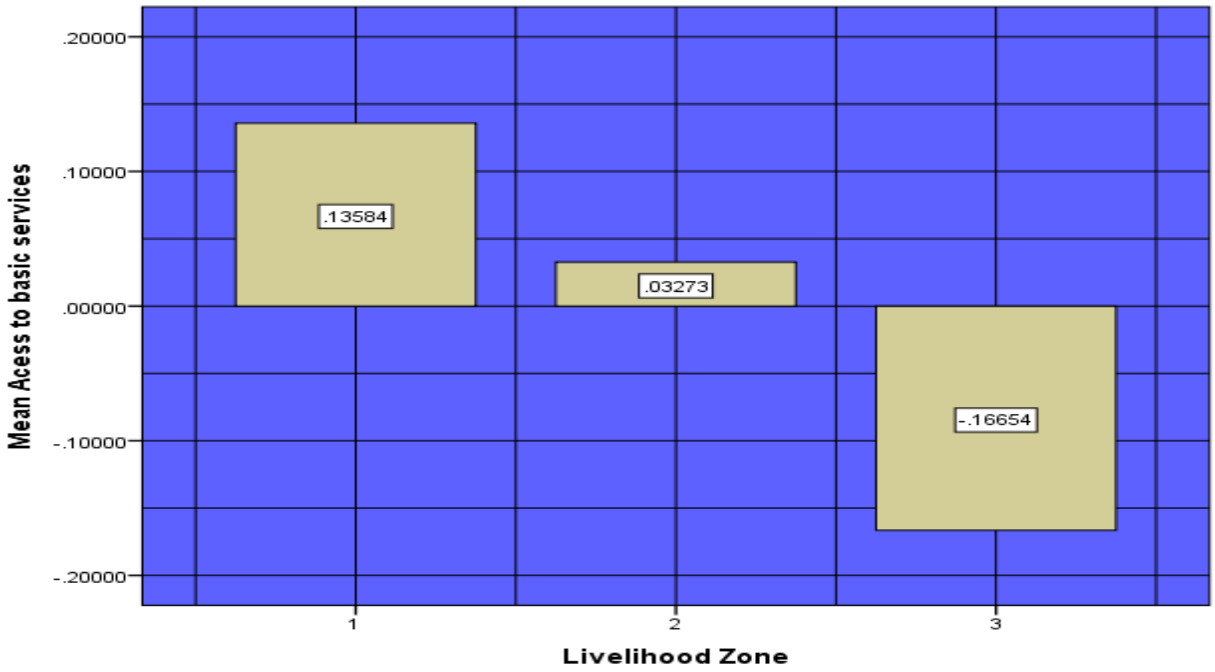
Extraction Method: Principal Component Analysis.

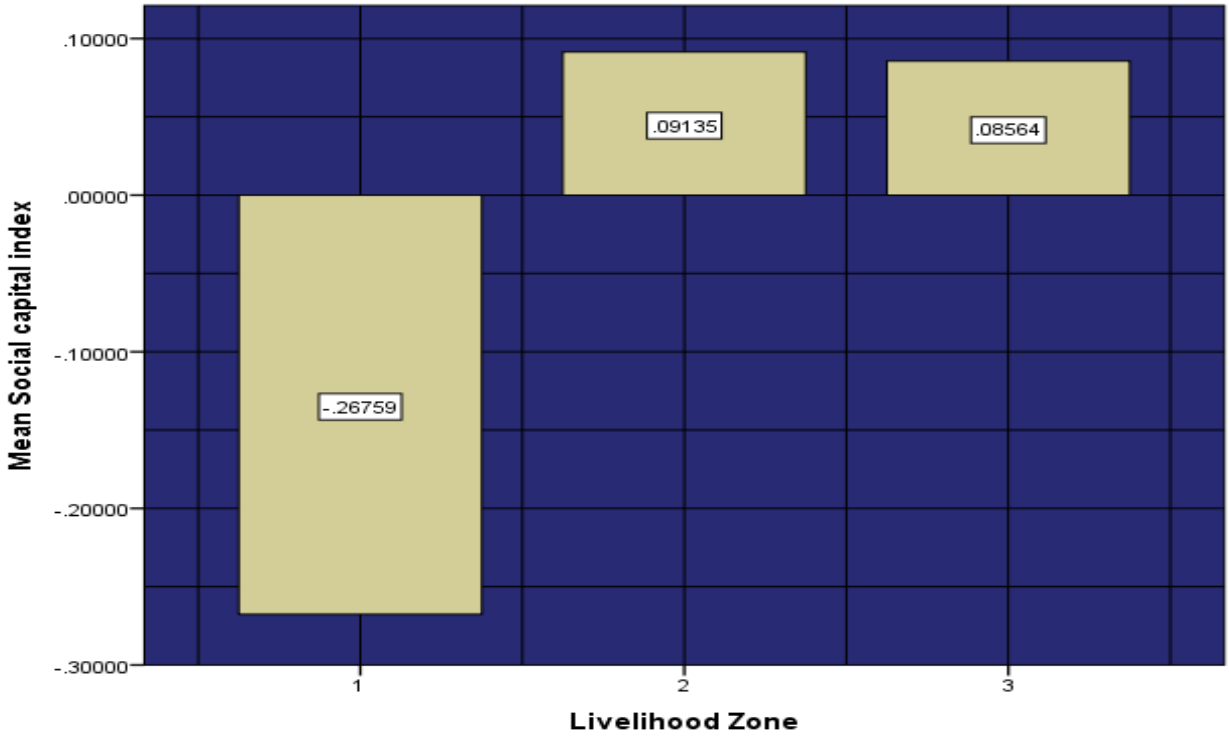
Source: Field survey, 2016

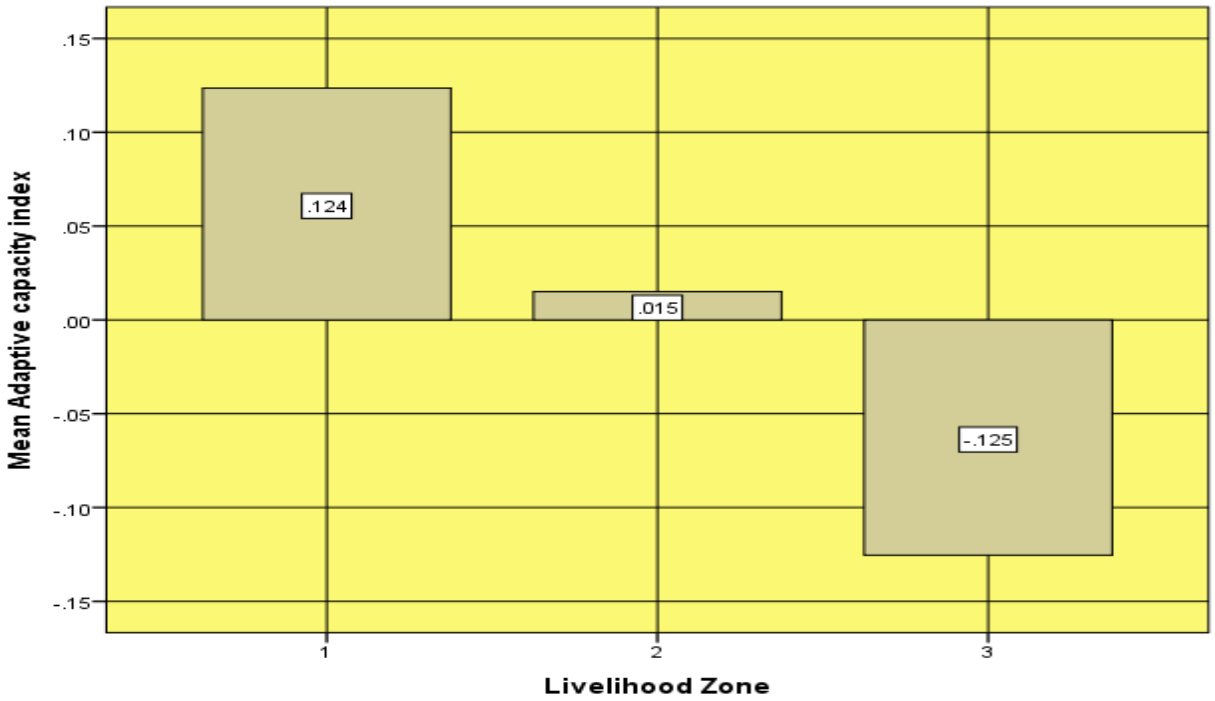
Appendix 2: Grand mean referenced relative position of the livelihood zone's mean scores of the covariates of resilience

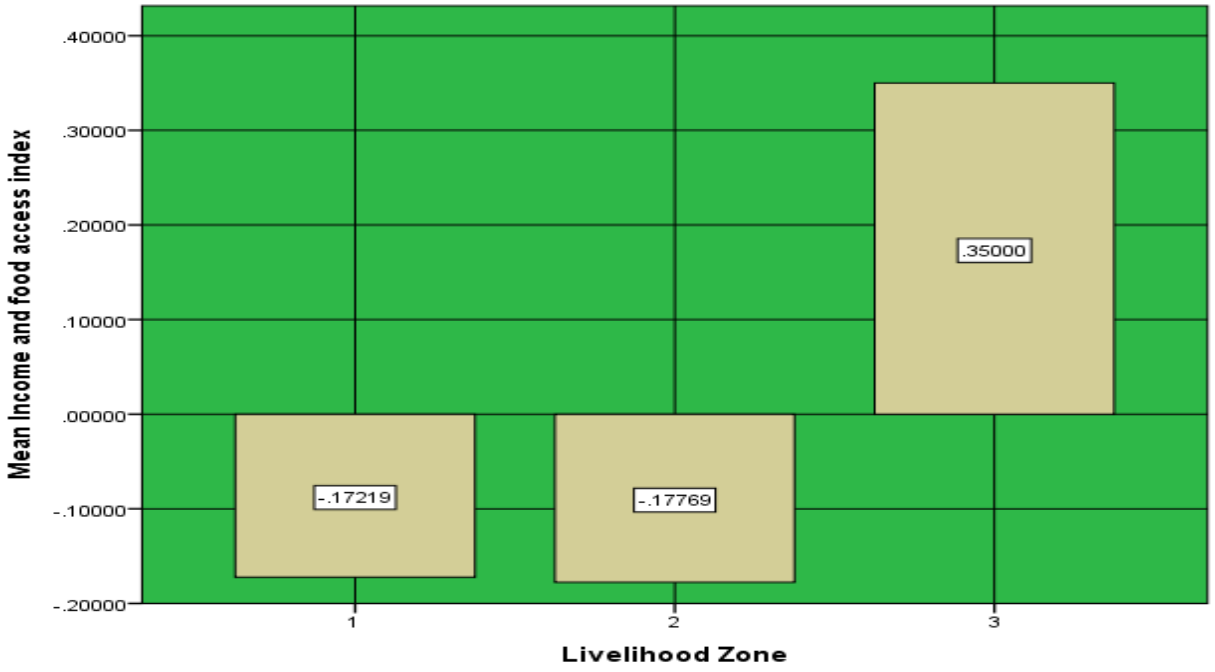


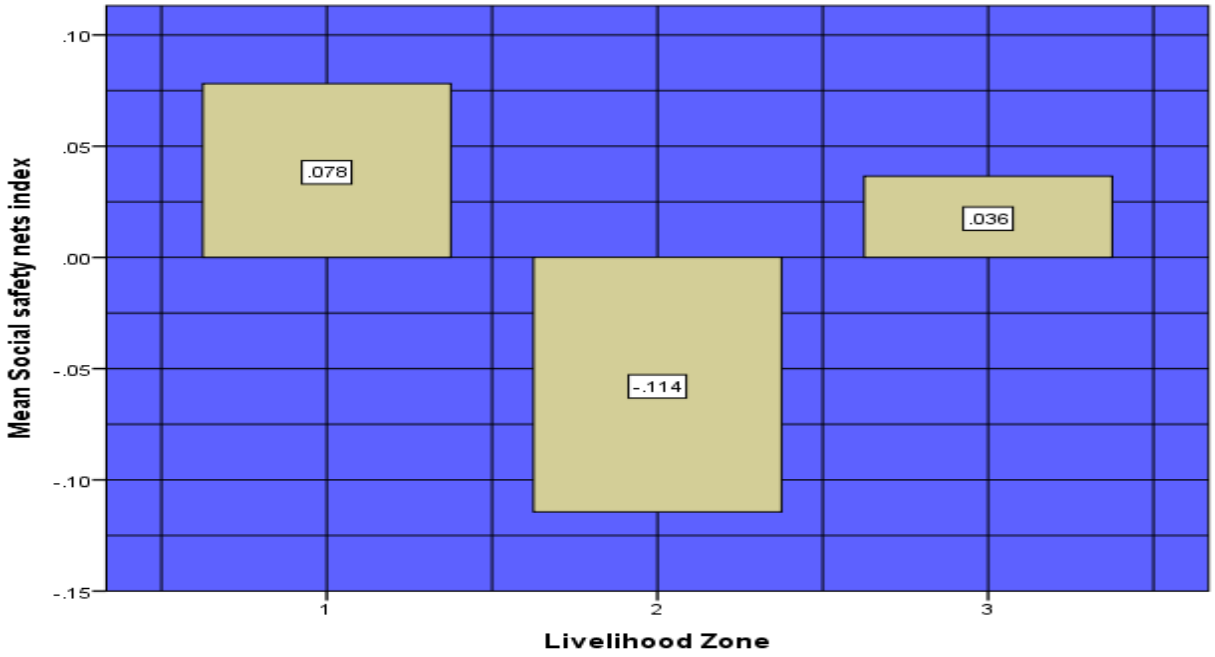



.20000
.10000
.00000
-.10000
-.20000
Mean Acess to basic services
.13584
.03273
-.16654
1
2
3
Livelihood Zone


.10000
.00000
-.10000
-.20000
-.30000
Mean Social capital index
.09135
.08564
-.26759
1
2
3
Livelihood Zone


Mean Adaptive capacity index
.15
.10
.05
.00
-.05
-.10
-.15
.124
.015
-.125
1
2
3
Livelihood Zone


Mean Income and food access index
.40000
.30000
.20000
.10000
.00000
-.10000
-.20000
-.17219
-.17769
.35000
1
2
3
Livelihood Zone



Note: *Livelihood zone 1= Sidama Coffee Livelihood Zone*

Livelihood zone 2 = Sidama Maize Belt Livelihood Zone

Livelihood zone 3 = Agro-pastoralist Livelihood Zone

Appendix 3: Cross-tabulation of households' food insecurity status and Livelihood zone

			Livelihood Zone			Total
			1	2	3	
FCS based food security status	Food insecure	Count	68	64	46	178
		% within FCS based food security status	38.2	36	25.8	100
		% within Livelihood Zone	48.6	45.7	32.9	42.4
	Food secure	Count	72	76	94	242
		% within FCS based food security status	29.8	31.4	38.8	100
		% within Livelihood Zone	51.4	54.3	67.1	57.6
	Total	Count	140	140	140	420
		% within FCS based food security status	33.3	33.3	33.3	100.0
		% within Livelihood Zone	100	100	100	100
HFIAS based food security status	Food secure	Count	49	41	68	158
		% within HFIAS based food security status	31	25.9	43	100
		% within Livelihood Zone	35	29.3	48.6	37.6
	Food insecure	Count	91	99	72	262
		% within HFIAS based food security status	34.7	37.8	27.5	100
		% within Livelihood Zone	65	70.7	51.4	62.4
	Total	Count	140	140	140	420
		% within HFIAS based food security status	33.3	33.3	33.3	100
		% within Livelihood Zone	100	100	100	100

Source: Field survey, 2016

Note: *Livelihood zone 1= Sidama Coffee Livelihood Zone*

Livelihood zone 2 = Sidama Maize Belt Livelihood Zone

Livelihood zone 3 = Agro-pastoralist Livelihood Zone

Appendix 4: Post hoc analysis results for livelihood group based differences in food security situation: multiple comparisons

Dependent variable	Statistical test type	(I) Livelihood zone	(J) Livelihood zone	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
							Lower Bound	Upper Bound
FCS	Tukey HSD	1	2	-.02857	1.62796	1.000	-3.8577	3.8006
			3	-5.14643*	1.62796	.005	-8.9756	-1.3173
		2	1	.02857	1.62796	1.000	-3.8006	3.8577
			3	-5.11786*	1.62796	.005	-8.9470	-1.2887
		3	1	5.14643*	1.62796	.005	1.3173	8.9756
			2	5.11786*	1.62796	.005	1.2887	8.9470
	Games-Howell	1	2	-.02857	1.55754	1.000	-3.6987	3.6416
			3	-5.14643*	1.68091	.007	-9.1074	-1.1854
		2	1	.02857	1.55754	1.000	-3.6416	3.6987
			3	-5.11786*	1.64298	.006	-8.9897	-1.2460
		3	1	5.14643*	1.68091	.007	1.1854	9.1074
			2	5.11786*	1.64298	.006	1.2460	8.9897
HFIAS	Tukey HSD	1	2	-.02143	.65330	.999	-1.5581	1.5152
			3	3.09286*	.65330	.000	1.5562	4.6295
		2	1	.02143	.65330	.999	-1.5152	1.5581
			3	3.11429*	.65330	.000	1.5776	4.6509
		3	1	-3.09286*	.65330	.000	-4.6295	-1.5562
			2	-3.11429*	.65330	.000	-4.6509	-1.5776
	Games-Howell	1	2	-.02143	.69067	.999	-1.6491	1.6062
			3	3.09286*	.66123	.000	1.5342	4.6515
		2	1	.02143	.69067	.999	-1.6062	1.6491
			3	3.11429*	.60512	.000	1.6883	4.5402
		3	1	-3.09286*	.66123	.000	-4.6515	-1.5342
			2	-3.11429*	.60512	.000	-4.5402	-1.6883

*. The mean difference is significant at the 0.05 level.

Source: Field survey, 2016

Note: *Livelihood zone 1= Sidama Coffee Livelihood Zone*

Livelihood zone 2 = Sidama Maize Belt Livelihood Zone

Livelihood zone 3 = Agro-pastoralist Livelihood Zone

Appendix 5: Cross tabulation of selected consumption based coping strategies and HFIAS based categories of households

Relied on less preferred foods * Food Security Status-HFIAS Cross-tabulation							
			Food Security Status-HFIAS				Total
			Food secure	Mildly food insecure	Moderately food insecure	Severely food insecure	
Relied on less preferred foods	No	Count	103	26	32	6	167
		% within Food Security Status-HFIAS	94.5	53.1	18.4	6.8	39.8
	Yes	Count	6	23	142	82	253
		% within Food Security Status-HFIAS	5.5	46.9	81.6	93.2	60.2
	Total	Count	109	49	174	88	420
		% within Food Security Status-HFIAS	100	100	100	100	100

Source: Field survey, 2016

Borrowed food or relied on help from a friend/relative * Food Security Status-HFIAS Cross-tabulation							
			Food Security Status-HFIAS				Total
			Food secure	Mildly food insecure	Moderately food insecure	Severely food insecure	
Borrowed food or relied on help from a friend/ relative	No	Count	107	43	92	12	254
		% within Food Security Status-HFIAS	98.2	87.8	52.9	13.6	60.5
	Yes	Count	2	6	82	76	166
		% within Food Security Status-HFIAS	1.8	12.2	47.1	86.4	39.5
	Total	Count	109	49	174	88	420
		% within Food Security Status-HFIAS	100	100	100	100	100

Source: Field survey, 2016

Purchased food on credit * Food Security Status-HFIAS Cross-tabulation							
			Food Security Status-HFIAS				Total
			Food secure	Mildly food insecure	Moderately food insecure	Severely food insecure	
Purchased food on credit	No	Count	107	48	116	13	284
		% within Food Security Status-HFIAS	98.2	98	66.7	14.8	67.6
	Yes	Count	2	1	58	75	136
		% within Food Security Status-HFIAS	1.8	2	33.3	85.2	32.4
	Total	Count	109	49	174	88	420
		% within Food Security Status-HFIAS	100	100	100	100	100

Source: Field survey, 2016

Portion size at mealtime limited * Food Security Status-HFIAS Cross-tabulation							
			Food Security Status-HFIAS				Total
			Food secure	Mildly food insecure	Moderately food insecure	Severely food insecure	
Portion size at mealtime limited	No	Count	106	43	77	13	239
		% within Food Security Status-HFIAS	97.2	87.8	44.3	14.8	56.9
	Yes	Count	3	6	97	75	181
		% within Food Security Status-HFIAS	2.8	12.2	55.7	85.2	43.1
	Total	Count	109	49	174	88	420
		% within Food Security Status-HFIAS	100	100	100	100	100

Source: Field survey, 2016

Meals eaten in a day reduced * Food Security Status-HFIAS Cross-tabulation							
			Food Security Status-HFIAS				Total
			Food secure	Mildly food insecure	Moderately food insecure	Severely food insecure	
Meals eaten in a day reduced	No	Count	108	49	104	18	279
		% within Food Security Status-HFIAS	99.1	100	59.8	20.5	66.4
	Yes	Count	1	-	70	70	141
		% within Food Security Status-HFIAS	0.9	-	40.2	79.5	33.6
	Total	Count	109	49	174	88	420
		% within Food Security Status-HFIAS	100	100	100	100	100

Source: Field survey, 2016

Consumption for adults restricted in order to give priority for small children * Food Security Status-HFIAS Cross-tabulation							
			Food Security Status-HFIAS				Total
			Food secure	Mildly food insecure	Moderately food insecure	Severely food insecure	
Consumption for adults restricted in order to give priority for small children	No	Count	105	44	75	5	229
		% within Food Security Status-HFIAS	96.3	89.8	43.1	5.7	54.5
	Yes	Count	4	5	99	83	191
		% within Food Security Status-HFIAS	3.7	10.2	56.9	94.3	45.5
	Total	Count	109	49	174	88	420
		% within Food Security Status-HFIAS	100	100	100	100	100

Source: Field survey, 2016

Appendix 6: Questionnaire for data collection

Addis Ababa University
College of Development Studies Center for Rural Development
PhD Dissertation Research questionnaire

Introduction: I am a student of Addis Ababa University College of Development studies. Currently, I am undertaking a research study with the title: ***Rural Household's Resilience to Food Insecurity in Southern Ethiopia, the case of Boricha Woreda in Sidama Zone.*** The purpose of this questionnaire is to systematically and objectively secure information to understand the sources of resilience to food insecurity and food security situation of the households. To this end, the data will be collected from randomly selected households of three *Kebeles* of *Boricha Woreda*. So you are kindly requested to extend your cooperation for the success of this study by genuinely answering all questions in the questionnaire. I assure you that your individual answers will be kept strictly confidential. I would like to thank you in advance for your kind cooperation.

I: General questions

1	Name of *Kebele*							
2	Age of the household head							
3	Religion	Protestant	Orthodox	Catholic	Muslim	others		
4	Level of education of household head							
5	Marital status of household head	Single	Married	Divorced	Widow/r			
6	Household size	Male	Female	Total				
7	Age of household head's wife/husband/							
8	Level of education of household head's wife/husband/							
9	Number of household members with age of 65 and above							
10	Number of household members with age of below 15							
11	Maximum education level in the household							
12	Occupation of the household head	Farming(1)	Trade (2)	Employed (3)	1 & 2	1 & 3	2 & 3	Others
	If others (specify)							
13	If farming is part of your occupation, in what activity have you been involving	Crop production	Animal rearing	Both				

14	If crop production is part of your farming activities, what is the primary crop you produce	Enset	Coffee	Maize	Others

II. Resilience related questions

Agricultural assets

1	Do you own land?	Yes	No
1.1	If yes, what is your land holding size in hectare?		
1.2	How much of this is suitable for farming (in terms of hectare)?		
2	Do you own/keep/ livestock?	Yes	No
2.1	If yes, how many of each of the following do you have?		
	Cows		
	Horses		
	Donkeys		
	Mules		
	Sheep		
	Goats		
	Hens		
3	Do you own enset?	Yes	No
3.1	If yes, how many matured stems (ready for consumption) do you have at present?		
3.2	How long (in terms of years) do you think it will feed your household?		
4	Do you have coffee trees?	Yes	No
4.1	If yes, would you tell me total number of trees planted		
4.2	How many of them (total coffee trees planted) are ready for giving harvest next year?		
4.3	How much cash income do you expect from the upcoming harvest?		
5	Do you have eucalyptus trees ready for cut?	Yes	No
5.1	If yes, how much do you expect the market (buyers) would offer to you if you put all of them for sale?		
6	Do you produce khat?	Yes	No
6.1	If yes, how many harvests do you expect next year?		
6.2	How much cash income do you expect from it next year?		
7	Currently, does your household have mature sugarcane?	Yes	No
7.1	If yes, how much cash can it bring for you if you put for sale next year?		
8	Do you have fruit bearing trees such as Avocado, banana etc…?	Yes	No
8.1	If yes, how much income do you expect from upcoming yield?		

Non-agricultural asset:

Does your household have (own)?

	Item	If yes, purchase price in Birr
1	Jewelries such as gold rings	
2.	A watch/clock	
3.	A radio	
4.	A tape recorder	
5.	A television	
6.	A mobile telephone apparatus	
6.	A table (s)	
7.	A chair(s)	
8.	A bed (s) with cotton/sponge/spring mattress	
9.	A bicycle (s)	
10.	A motorcycle (s)	
11.	Energy saving stove(s)	
12	An animal-drawn cart?	

Agricultural technology adoption:

Over the past 12 months time (1 year period), did your household:

		Yes	No	If yes:
1.	Use chemical fertilizer			Amount in KG _____
2.	Use improved seeds			Amount in Kg _____
3.	Utilize pesticides			How many times? _____
4.	Utilize FTC services			Number of times services have been received _____
5.	Receive development agents (DA) services			Number of times visited by DA_____

Access to basic services:

Given the transportation service available to your (consider the fastest one frequently used) household, what time does it take you to reach (travel to):

		Time in hours	
1.	All weather road		
2.	Water to be used for domestic use		
3.	The nearest local market		
4.	The nearest staffed and equipped health center		
5.	Microfinance institutions		
6.	School:		
	Primary school 1st cycle		
	Primary school 2nd cycle		
	Secondary school (9-10)		
	Preparatory school		
	Other Related questions		
7	Are you the user of microfinance institutions' (MFIs) services?	Yes	No

7.1	If yes, how much savings do you have in MFIs at present?		
8	Does your household have access to electricity?	Yes	No
9	Does any member of your household own mobile telephone?	Yes	No
10	Do you think that a drinking water available for your household is safe?	Yes	No

Adaptive capacity:

1	Indicate the number of income sources available to your household			
2	How much is your household able to save per month?			
3	How much total cash savings does your household have at present?			
4	Over the past 1year time, have you visited clinics /health centers due to illness (health problem)?	Yes	No	
4.1	If yes, indicate number of time you visited clinics			
5	How do you assess your present health situation? (Encircle one that applies from options)	1.excellnt	2. very good	3.good
		4. poor	5. very poor	
6	Is there a household member having health problem of worrisome level at present?	Yes	No	
7	Is there a household member with disability problem?	Yes	No	
7.1	If yes, indicate the total number of household members having such problem			
8	Indicate the number of household members, who have not formed their own family, currently earning salary income			

Social Capital

1	Are you a member of 'Idir' in your village?	Yes	No
2	Are you a member of church or other religious group?	Yes	No
3	Indicate number of associations if any, other than the two mentioned above, to which you are a member		
4	Do you think that people in your village are supportive enough to one another during bad times?	Yes	No
4	About how many close friends, people that you feel at ease with and can talk to about private matters, or call on for help, do you have at present?		
5	If you suddenly need 100 Br, how many people, other than your household members, do you think will lend for you?		
6	If your household members suddenly face serious illness or death, do think that your neighbors provide you with the assistance your household needs?	Yes	No

7	If your household faces shortage of food and wants to send children to other households' home in the neighborhood, how many households do you think be willing to feed your children?		

Social safety nets:

1	Has your household participated in the government social safety net program?	Yes	No
1.1	If yes, indicate the estimated value of benefits received (in Birr) in one year time.		
2	Has your household received financial or non financial support from government/NGOS other than through PSNP?	Yes	No
2.1	If yes, indicate the estimated value of benefits received (in Birr) in one year time.		

Other resilience related questions:

1	Over the past two year time, has your household faced any shock affecting your household's ability to sufficiently feed its members?		Yes	No	
1.1	If yes, which of the following has happened to you (put X if event occurred)?				
		Write **X** if occurred	When did the event occur?		
1	Death of a family member				
2	Illness of a family member				
3.	Crop failure due to drought				
4.	Crop failure due to other factors				
5.	Death of livestock				
6.	other event (specify):				
1.2	If your answer yes to question 1 above is yes, to what extent have you recovered from it (brought your food consumption back to pre-shock level) now?		Fully recovered	Somewhat recovered	Not reco-vered
1.3	If your answer to 1.2 is fully recovered, what time did it take you to recover (in months)?				

2. To what extent do you think the following events, if they occur in the next year, will affect your household's food security?

Event	Extent of effect will be:				
	Sever	Large	Moderate	Small	No impact
Household members illness					
Household members death					
Drought					
Livestock death					
Food items price rise					
Crop failure due to disease					

3. If drought occurs in the upcoming year, do you think that your household will be able to feed its members to the extent that it can do at present? Yes _____ No_____

III Food security related: (1) HFIAS questions

	QUESTION	Yes/ No	If yes, how often 1= 1 to 2 times 2= 3 to 10 times 3= more than 10 times
1	In the past four weeks, did you worry that your household would not have enough food?		
2	In the past four weeks, were you or any household member not able to eat the kinds of foods you preferred because of a lack of resources?		
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?		
4	In the past four weeks, did you or any household member have to eat some foods that you really did not want to eat because of a lack of resources to obtain other types of food?		
5	In the past four weeks, did you or any household member have to eat a smaller meal than you felt you needed because there was not enough food?		
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?		
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?		
8	In the past four weeks, did you or any household member go to sleep at night hungry because there was not enough food?		
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?		

(2) Food Consumption Score (FCS) questions

Could you please tell me how many days in the past week (7 days) your household has eaten the following foods?

	Food item	No. of days eaten over the past 7 days
Grains	Made of Maize	
	Made of Barely	
	Made of Wheat	
	Made of Tef	
	Made of Sorghum	
Tubers	Enset (Kocho)	
	Potatoes	
	Cassava	
Vegetables and leaves	Cabbage	
	Carrot and related	
Pulses	Bean	
	Pea	
	Haricot bean	
Fruits	Avocado	
	Pineapple	
	Orange	
	Apple	
	Papaya	
	Banana	
	Gishita	
Meat and fish	Meat	
	Egg	
	Fish	
Milk related	Local Milk	
	Powder milk	
Sugar related	Sugarcane	
	Sugar	
	Honey	
Oil and fat	Butter	
	Processed oil	

IV. Coping mechanisms related

a. Consumption based coping strategies

In the past 7 days, was there a time your households use the following coping method as a response to food shortage	Yes	No	If yes, how often (number of days each is used)
Rely on less preferred and less expensive foods?			
Borrow food, or rely on help from a friend or relative?			
Purchase food on credit?			

Gather wild food, hunt, or harvest immature crops?			
Consume seed stock held for next season?			
Send household members to eat elsewhere?			
Send household members to beg?			
Limit portion size at mealtimes?			
Restrict consumption by adults in order for small children to eat?			
Feed working members of HH at the expense of non-working members?			
Reduce number of meals eaten in a day?			
Skip entire days without eating?			

b. Other coping strategies

Were there times your household used the following coping strategies over the past **two** years' period as a response to problems/shocks/ facing your household such as food shortage?	Yes	No	If yes, number of times you employed it
Desperate migration			
Sold reproductive animals (not excess ones)			
Sold Oxen used for farming			
Sold land			
Rented out land			
Remove children from school			
Borrowed money at high interest rate			
Consumed seed stock held for next season			
Reduced number of meals			
Selling small animals			
Migration to nearer areas for wage labor			
Drawing on savings			
Selling firewood			
Selling non productive assets			
Diverting loan from microfinance institutions			
Appeal for food aid			

V. Key informants interview outlines

Key informants - Boricha wereda agriculture bureau officer/s

1. Would you describe your *woreda* in terms of:
    - Area of the *wereda* in km2,
    - Agro-climate (type, distribution, and proportion),
    - Land-use, land cover (type and distribution),
    - Vegetation cover: types, density, and deforestation,
    - Soils: types, distribution, degradation (erosion, leaching, salinization),
    - Rainfall: (amount, distribution and variability and the impact,
    - Population size, ethnic composition, and religion,
    - Main staple foods,
    - Migration patterns,
    - Main economic activities and livelihood basis,
    - Main field crops and perennial crops,
    - Cultivated lands, productivity (production time-series data if available),

- Constraints to production – risks of failure,
- Off-farm incomes

2. How do you characterize your *woreda* in terms of Food Security?
    - Food availability/sufficiency: surplus or deficit *wereda*?
    - If there has been deficit, why? Since when? What the trends over time looks like: increase or decrease? (provide me with time- series data if available)
3. What about the accessibility aspect? How do you characterize your *woreda* households in terms of access/entitlement: sufficiency of resource to produce food, sufficiency of income to purchase food, access to common resources or public transfers?
4. Which areas of the *wereda* are most vulnerable to food insecurity? Would you tell me areas with severe, moderate, or less food insecurity, or areas not affected by the problem of food shortages? Are there any factors that explain this spatial variation?
5. How do you characterize the nature of food insecurity in this *woreda*: Permanent or seasonal? If seasonal, which season in the year?
6. What are the household's coping mechanisms?
7. Would you tell me your feelings about the effectiveness of the rural policy and institutions to alleviate the food insecurity problems? What do you suggest as a way out to food insecurity problem?
8. What are the commonly happening shocks in this area? How often they occur?
9. Have you observed them in the near past? If yes, when?
10. How did they affect the household's food security?
11. Are the effects the same for all households?
12. Which type of households manages to remain food secure irrespective of the occurrence of the shocks you mentioned? Quickly recovered from the effects of shocks? Couldn't recover at all?
13. What do you think makes/or will make/ the households in your *woreda* more resilient to food insecurity shocks?

Key informants – community elderly

1. How long have you been here?
2. Would you tell me about the demography of this community such as age, household composition, population size, religion, and ethnic composition?
3. How do you describe the trend of these demographic characteristics of the community? Have there been changes? If yes, would you tell me the nature of changes and the effects they brought in the area: (positive and negative effects)?
4. Would you tell me about history of the area with regards to: landscape, settlement density and patterns, ethnic and religious tension, and migration?
5. Can you tell me about drought and famine history in this area? Have they ever been an issue of concern? If they are recent phenomena, when and how they emerge?
6. Have you witnessed changes on land resources such as vegetation, soils, water use and distribution? If yes, what do you think their causes and effects are?
7. Would you share me your observation about changes in type of staple foods and foodstuffs of your community
8. Would you tell me your perception towards population increase, having large family size, food shortage, and rural poverty and their linkages in your community?
9. Would you tell me your perception towards government's policy, extension packages, and the role of development agents?
10. Would you tell me your memory about food situation in the area comparing the past and present?

Key informants -Development Agents

1. How long have you been here?
2. Would you tell me about main agricultural extension services available to the farmers here, the extent they have been adapted, liked, and afforded by farmers?

3. Any constraints to delivering proper services to the community and individual farmers:
- Lack of adequate skills/training
- Lack of technical support
- Lack of basic facilities
- Low salary and non-existence of incentives
- Imposition from the administrators
- Instability due to problems of adjustment

4. Would you tell me about economic activities of this area: crop production, types of crops commonly produced, livestock rearing, and basis of livelihood in general, etc---?
5. How do you describe the land holding size, land use, and land cover?
6. Would you tell me the extent of DAs collaborations and integration with community and individual farmers
7. Major problems of farmers in the area with regard to:
- Crop production
- Livestock raising
- Off- farm or non-farm income-generating ventures
- Use of common property resources to supplement sources of livelihood

8. Is the food produced by the farmers adequate to cover their annual consumption requirement?
9. If they are unable to produce sufficient amount at home, can they purchase from local markets?
10. Are there households who supplement their source of livelihoods by receiving remittances from relatives or by receiving relief support freely or through PSNP?
11. What types of households are most vulnerable to food shortages?
12. What does the temporal aspects in food insecurity looks like: is the food insecurity experienced by households chronic or seasonal? If seasonal, what are the common seasons of food insecurity challenges?
13. Can you tell me about characteristics of the households of your community to whom food shortage is not an issue?
14. What are the household's main coping mechanisms? Which of these mechanisms seem sustainable and/or viable?
15. Are the coping mechanisms the same for all households? If not, how do they differ?