ADDIS ABABA UNIVERSITY

COLLEGE OF DEVELOPMENT STUDIES

CENTER FOR FOOD SECURITY STUDIES

HOUSEHOLD RESILIENCE TO MULTIDIMENSIONAL FOOD INSECURITY: THE CASE OF WEAVING-BASED HOUSEHOLDS IN CHENCHA DISTRICT, SOUTH ETHIOPIA REGIONAL STATE

A Doctoral Dissertation

By:

DESTA DEREJE DADO

December, 2024

ADDIS ABABA, ETHIOPIA

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Advisors

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Co-Advisor: Teshome Yirgu (Professor, PhD)

December, 2024

Addis Ababa, Ethiopia

Dedication

I dedicate this work to the memory of my heavenly mother, W/ro Ayelech (Turungo) Tukusso, who shaped me to be who I am today and whom I lost on March 20, 2006, when I was in grade 11.

Declaration

I, **Desta Dereje,** do hereby declare to Addis Ababa University School of Graduate Studies that this dissertation paper is a product of my original research work, and it has not been submitted to any other university for any academic degree. Materials and information other than my own are dually acknowledged.

Name: **Desta Dereje**

Signature: 

Date of Submission: December, 2024

APPROVAL SHEET

Addis Ababa University

College of Development Studies

Center for Food Security Studies

DISSERTATION APPROVAL

This is to certify that the thesis prepared by Desta Dereje Dado Entitled "*Household Resilience to Multidimensional Food Insecurity: The case of Weaving-Based Households in Chencha District, South Ethiopia Regional State*" and submitted to the Center of Food Security Studies in fulfillment of Degree of Doctor of Philosophy in Food Security and Development complies with the regulation of Addis Ababa University and meets the accepted standards with respect to originality and quality.

Approved by Board of Examiners

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Statement of the Author

By my signature below, I declare that this thesis is my own work. I have followed all ethical principles of scholarship in the preparation, data collection, data analysis and completion of this dissertation. I have given all scholarly matter recognition through citation and reference. I affirm that I have cited and referenced all sources used in this document. I have made every effort to avoid plagiarism. I submit this dissertation in partial fulfillment of the requirement for a **PhD degree in Food Security Studies** from Addis Ababa University. This PhD thesis will be available at the university library to borrowers under the rules of the library. I declare that I have not submitted this dissertation to any other institution anywhere for the award of any academic degree, diploma, or certificate.

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Executive Summary

Understanding households' resilience capacities in response to food insecurity shocks is increasingly recognized as a vital approach to addressing food insecurity. This involves identifying key sources of resilience that can mitigate the impacts of such challenges. This dissertation is concerned with investigating households' resilience to multidimensional food insecurity by examining food security status, livelihood diversification, resilience sources and its determinants. For this end, the study has used multi-stage mixed sampling techniques for research area and sample respondents' selection. The study has used mixed research design, pragmatist research paradigm by adopting a cross-sectional study which involve household survey of 303 households, KII, FGD and field observations. Data were analyzed using various descriptive statistics, PCA, One-way ANOVA, Pearson's correlation, X^2-test, and HHI and Ordered probit model.

The findings revealed; only 5.28% of households were food secure, with the majority experiencing multidimensional food insecurity. FGD and KII findings shown that land degradation, population pressure, climate change, lack of access to food due to lack of infrastructure and food item price inflation and limited access to production resources are indicated as root causes of food insecurity. As a result, 78.21% reduced the number of meals consumed in a day, 7.26% skipped entire days without eating, 65.67% consumed seed stock, and 50.49% rely on wild food. The livelihood diversification analysis revealed, 90.7% of households adopted more than one income source with an average of 4.53 income sources; small-scale farming (52.1%) and weaving (38.6%) as main income sources. The majority of households diversified their livelihood activities to; on-farm and non-farm (59.08%), on-farm, off-farm and non-farm (17.16%), non-farm only (14.85%), and Farm only (5.61%). Based on total household income, non-farm, on-farm and off-farm income sources accounted for 72.96%, 25.3%, and 1.74% shares, respectively. Formal employment, weaving, barber/hairdresser, cattle production and sale, cereal production, and vegetable production (Potato) were highly paying livelihood activities in order. Households who combined On-farm, Off-farm and Non-farm activities have gained far larger mean incomes. HHI analysis shown 37.45%, 34.325% and 28.22% of households diversified at 'Moderate', 'Low' and 'High' status, respectively. The study also revealed positive association between livelihood diversification and food security status of households.

Ordered Probit model results showed that landholding size, livestock holding size, and access to farmer training center (FTC) have positively affected the extent of livelihood diversification. PCA result revealed that among the eight dimensions of resilience to food insecurity, excluding adaptive capacity, and access to agricultural technology and practices; six were significantly contributed to the household resilience to food insecurity. Based on size of contribution, access to the social safety net, access to basic services, and access to non-agricultural assets were the most important sources of household resilience. Finally, household resilience estimation results show that 40.26% of the respondents were resilient and the rest, 59.74%, were non-resilient to multidimensional food insecurity. Food item price inflation, family member illness, food shortage, and drought were the most frequently reported shocks and stresses encountered by the respondents in the last five years. Finally, ordered probit model analysis shown that access to credit, average years of family education, crop diversity, income diversity, landholding size, livestock holding size, expected crop harvest, expected cash income from fruit trees, extension contact, FCS, annual food expenditure, ownership of radio, jewelry, a furnished bed, and membership in local associations have positively influenced the likelihood of attaining higher household resilience at probability less than 1%, 5%, and 10%. Whereas, lack of access to a mobile phone, family business, formal employment, transfers of payment and inability to read and write have decreased the likelihood of households achieving a higher resilience level. Hence, supporting the weaving activity, increasing other livelihood options, and modernizing the system with appropriate training, access to credit, education, and market linkage seem inevitable. Strengthening and improving the targeting system and quality of social safety services, access to basic services, and supporting agricultural intensification would be advisable to increase household resilience to food insecurity. Improving household access to credit, education, income diversification, livestock and land, agricultural extension services, membership in local associations, mobile services, and income diversification would enhance household income and food security. Regarding ensuring multidimensional food security and thereby attaining resilience to food insecurity, this study suggests different stakeholders to rethink and plan interventions to improve the food security status of households, considering the multidimensional aspects of the food security outcomes.

Key words: *Household, livelihood diversification, food security, multidimensional food security, resilience*

Table of Contents

List of Tables

List of Figures

Acknowledgements

A PhD dissertation work is both complex and an opportunity to find oneself in an academic environment. Particularly, organizing research outputs in several article forms makes the duty cumbersome and complex. Producing three to four articles of the dissertation output means almost the same as developing the same number of monograph-based master theses. It is found to be the most tiresome that needs patience and unreserved efforts. Besides this, proceeding PhD studies in Ethiopia especially going far away from family and fully disconnecting from your workplaces doubles the pain due to exponentially levitating inflation. As a result, the successful completion of this PhD dissertation is not only due to my strong efforts but also assistance of several individuals and institutions.

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Abbreviations and Acronyms

AA	Agricultural Assets
ABS	Access to Basic Services
AC	Adaptive Capacity
ADLI	Agricultural-Development-Led-Industrialization
ANOVA	Analysis of Variance
CSI	Coping Strategies Index
FAD	Food Availability Decline
FAO	Food and Agricultural Organization
FCS	Food Consumption Score
FDRE	Federal Democratic Republic of Ethiopia
FED	Food Entitlement Decline
FGD	Focus Group Discussion
GDP	Gross Domestic Product
GOs	Governmental Organizations
HDDS	Household Dietary Diversity Score
HFIAP	Household Food Insecurity Access Prevalence
HFIAS	Household Food Insecurity Access Scale
HHI	Herfindahl-Hirschman Index
HHS	Household Hunger Scale Human
HRI	Household Resilience Index
IFA	Income and Food Access
KII	Key Informant Interviews
KMO	Kaiser-Meyer-Olkin
MFS	Multidimensional Food Security
LD	Livelihood Diversification
NGOs	Non-Governmental Organizations
PSNP	Productive Safety Net Program
rCSI	Reduced Consumption Index
S	Stability
SAFS	Self-Assessed Food Security
SLA	Sustainable Livelihoods Approach
SLF	Sustainable Livelihood Framework
SNNP	Southern Nations, Nationalities and Peoples
SPSS	Statistical Package for Social Sciences
SSA	Sub-Sahara Africa
SSI	Social Safety Net Index
St. Dev.	Standard Deviation
TLU	Tropical Livestock Unit

CHAPTER ONE: GENERAL INTRODUCTION

1.1. Background of the Study

Achieving food security needs of human beings is the primary development agenda all over the world. Currently it has become a burning development and research agenda for scholars, governmental and non-governmental agencies since it's a very emergence in the early 1970s (FAO, 2003). Maxwell and Smith (1992) have collected more than 200 definitions for food security from different literatures. However, the commonly accepted definition of food security describes food security as it is said to be achieved when all people, at all times have physical, social and economic access to adequate, safe and nutritious food that helps to lead active and healthy life‖ (FAO, 1996). The concept of food security is a multifaceted which comprises availability, access, utilization, and stability dimensions (Adem, M., 2021). It can be understood and achieved at multidimensional levels—individual, household, regional, national, or global by addressing availability, access, utilization, and stability dimensions (Anon, 2015).Biodiversity loss, climate change, population pressure, deforestation, and conflict resulted in food and water shortage in the world (Baptista *et al*., 2022). G l o b a l l y , about 828 million people majority of who live in Africa and Asia threatened by hunger (FAO, 2017; USAID, 2022). Sub-Saharan Africa and Asia alone account 94% of these world's food insecure people. In 2022, there were about 735 million hungry people worldwide (122 million people more than before the COVID-19 pandemic), 2.4 billion people (29.6 percent) of the world population experience moderate to severe food insecurity; meanwhile hunger is still increasing in Western Asia, Caribbean countries and nearly every sub-regions of Africa (FAO et al., 2023). Even, an expected 600 million people will be chronically undernourished in the year 2030 that is almost 119 million more than the condition before the outbreak of neither COVID-19 pandemic nor the war between Ukraine and Russia. The ongoing Ukraine war, climate variability, economic contractions, and growing inequalities are driving food insecurity and malnutrition, limiting the agri-food system's capacity to provide nutritious, safe, and affordable diets (Baptista et al., 2022).

Similarly, food insecurity is long-term social and economic problem both in urban and rural areas of Ethiopia comprising of 29 percent of rural and 21 percent of urban population were considered food insecure (CSA, 2014 as cited in Adem, 2021). Undernourishment severity has been decreased to 32 percent in 2016 from 74 percent in 1990 (FAO and WFP, 2016) through policies like soil and water management, plant nutrient generation, drought and pest resistant crop varieties, productive safety net programs, livelihood diversification and post-harvest management (FAO, 2012).

The severity and distribution of the food insecurity problem are uneven over time and geographical space. Women and those who live in rural regions are disproportionately affected by food insecurity. In 2022, among 795 million food insecure people in the world, Africa account 28.05 percent, while Sub-Sahara Africa alone comprises 95 percent of the whole Africa's food insecure population (USDA, 2022; FAO *et al*., 2023) whereas SSA and Asia account 94 percent of the total global food insecure population. In SSA, climate change, COVID-19 and Ukraine and Russia war raised the number of food insecure people by 123 million (12 percent of the region) in 2022 (Baptista et al, 2022).

Hunger and malnutrition are caused by a deadly combination of several factors. Conflicts like as conditions in Ukraine and Ethiopia; is the biggest driver of hunger; about 70% of the world's hungry and food-insecure people live in areas affected by war and violence resulting in forced displacement of people, destroy resources, and ruining nation's economy (WFP, 2023). Drought resulting from climate change is another cause for poverty and food insecurity. Global market failure causing declining fertilizer production results in decreasing food production and supply. However, uncertainties and their effects on people's livelihood systems vary across geographical regions, periods, and socio-economic aspects of societies. Population pressure, diminishing landholding size and farm productivity, poor adoption of technology, repeated droughts, conflict, rising food prices, and epidemics affecting humans and cattle are some of the primary issues affecting Africa's ability to feed its people (FAO, 2015; Meskerem and Degefa, 2015). Food insecurity and famine have been major challenges in Ethiopia since the 1970s (Devereux, 2000; Kaluski et al., 2001; FAO, 2010). Recently, Ethiopia has been facing humanitarian emergencies due to two major reasons: internal conflicts, the historic drought of 2020–2023 in the south and southeast parts of the country (FWS NET, 2023). The main causes

of food insecurity in Ethiopia are attributed to the greater reliance on rain-fed agriculture, recurring droughts every 3 years, population pressure, limited access to basic infrastructure, irregular rainfall, and seasonal fluctuations (MoARD, 2009).

Despite their suitable and diverse agro-ecology, the southern areas of Ethiopia face both chronic and seasonal food insecurity. This could be due to the fact that about 90% of the population in the region lives in highland areas prone to soil erosion. Besides, the research area Chencha district, in particular, is highly exposed to various types of soil erosion (sheet, rill, and gully) (CWARDO, 2014). The district encounters severe seasonal food shortages from April to May and September to November (Tadesse *et al*., 2019). Declining landholding size, population pressure, drought, crop disease and pests, livestock and human diseases, seasonal fluctuation, and erratic rainfall are major causes of food insecurity in the area (Engdawork, 2012; Shambel, 2017). However, the status and main sources of households' capacity to withstand food insecurity (resilience) lacks empirical evidences.

Resilience to food insecurity is defined as the household's ability to sustain a particular level of well-being (food security) and recover its structure and functions in the face of shocks and stress (Bahadur, A., & Pichon, F., 2016). It depends on the options available (assets, services, and strategies) (Olamide Bisi-Amosun & Lafayette, 2019). However, resilience analysis in the context of food security takes into account units of analysis (individual, household, or community) and answers resilience of what and resilience to what (Alinovi et al., 2009). As opposed to vulnerability, resilience assesses the ability to withstand and recover from an anticipated shock or stress (USAID, 2013). Some researchers sought to assess household resistance to food insecurity in the face of shocks and stressors (Alinovi *et al.*, 2010, Ciani & Romano, 2013, Gebrerufael, 2019). It can be quantified using two types of data: longitudinal

time series data (longitudinal dynamics) and cross-sectional (static or current time) point-in-time data. A longitudinal data-based approach to resilience analysis, for example, has been used in a few research studies (Alinovi et al., 2009; 2010; Mulat and Negussie, 2010) due to a lack of available time series data. Whereas most researchers like Carter et al. (2006), Keil et al. (2008), and Debebe (2021) measured resilience to food insecurity using cross-sectional, one-time data-based techniques. Alinovi *et al*. (2009) discovered that household resilience to food insecurity varies by sub-region; Adane Atara (2018) discovered resilience differences across livelihood groups; Ciani & Romano (2013) confirmed that smallholders were found to be less resilient; and Maxwell et al. (2013) discovered a positive result of food security without causing changes in asset holding.

A thorough analysis of the related empirical literature on households' resilience to food insecurity revealed that most studies focused on the ability of livelihood groups centered on agriculture. However, the resilience of households that depend on traditional weaving and spinning as a source of income was the main focus of this study. Traditional weaving and spinning is one of the most popular form of employment in Ethiopia (Zali et al., 2018), but little is known about how it affects desired wellness results and its challenges. In Chencha district, the designated research area, the current study is novel because resilience studies there are the first of their type. In addition, the current study prefers to apply the modified Alinovi *et al*. (2010) version of the resilience framework to investigate weaving-based household resilience to food insecurity in the Chencha Zuriya District of Southern Ethiopia. It has also been interested to conceptualize the analysis of household resilience to food insecurity, putting households within a sustainable livelihood thinking framework. However, it differs from other empirical studies by (1) examining multidimensional food insecurity status (2) analyzing the effect of livelihood diversification on household resilience and (3) focusing on examining weaving-based livelihood as a source of household resilience to food insecurity, (4) determinants of household resilience to food insecurity. Hence, adopting the resilience concept, this study aims to examine multidimensional food security status (MFS), livelihood income diversification (LD), the different types of shocks households encounter, and determine the dimensions and status of household resilience to food insecurity at the household level.

1.2. Problem statement

Food insecurity remains burning livelihood and development challenge in the world on which almost every country tries to overcome it. Besides the continued efforts and resulting slow progress on reducing hunger and food insecurity, a significant proportion of the world population suffers from the challenges of hunger (FAO et al, 2021). In 2019, 820 million people worldwide were hungry, with 22.8 percent in Sub-Saharan Africa, 15% in South Asia, and 12% in Western Asia, and to a lesser extent in Latin America.(FAO, IFAD, UNICEF, 2019). The problem of hunger, exacerbated by droughts, poverty, low agricultural production, and diminishing landholdings, hence, was preventing slow decline in the number of hunger people. Undernourishment prevalence is uneven, with Asia (500 million) and Africa (260 million from which 90% live in Sub-Saharan Africa) and; 26.4 percent (2 billion people) of the world's population experiences moderate to severe food insecurity. The 195 nations aim to eliminate poverty (SDG 1) and eradicate hunger (SDG 2) by 2030. However, global hunger is estimated at 690-783 million people in 2022 due to vulnerabilities in agri-food systems, climate variability, economic contractions, and increasing inequalities (FAO et al., 2023). In the year 2022, the world faces from the consequences of malnutrition like stunting (148 million), wasting (45 million), and overweight (37 million) on children (FAO et al., 2023).

Food insecurity and hunger are increasing over time, more than 820 million has faced hunger in 2019 (FAO et al., 2019), with 828 million people suffering from hunger in 2021 and 924 million insecure in 2022, with a projected 670 million in 2030 (FAO, 2022). A 2015 spatial specific data shows about 28.05% of world's food insecure population is from Africa, from which Sub-Saharan Africa alone account 95% of the continent (USDA, 2022). Conflict and political instability, population pressure and resulting urbanization, climate change and resulting recurrent drought (Fawole et al., 2015) as cited in (Animaw & Abi, 2023). Sub-Saharan Africa faces increasing food insecurity due to drought, COVID-19 shocks, and food item price rise (Baptista et al., 2022). The Global Hunger Index shows severe hunger in 2022 and conflict as primary famine sources in 2021 (GHI, 2022).

Ethiopia has made significant strides in reducing hunger and food insecurity (WFP and CSA, 2014),, but the challenge of food insecurity persists since the 1970s *(Devereux, 2000; Kaluski et*

al, 2001; FAO, 2010), requiring continued national development agendas. Ethiopia, the second most populous country, experienced a significant number of hunger and malnutrition cases in 2017(FAO, 2017) as cited in (Animaw & Abi, 2023), with approximately 40 million people affected. The country's GHI increased from 24.1 in 2021 to 27.6 in 2022 (GHI, 2022), causing food insecurity and malnutrition challenges, with 20.1 million in need of humanitarian support (WFP, 2023). Food insecurity increased between 2020-2023 due to internal conflicts, severe droughts, food price rise, and lack of infrastructure (WFP, 2023; FWS NET, 2023). Conflict, drought, global market failure, over-reliance on rain-fed agriculture, population pressure, declining landholding size, diminishing land productivity, and seasonal fluctuations are major contributing factors to food insecurity in Africa and Ethiopia (MoARD, 2009). , however, conflict and violence account for 70% of world food insecure (WFP, 2023)

Food insecurity, both chronic and seasonal, is a prevalent issues in Southern Ethiopia, particularly in the Chencha Zuriya district (Dereje et al., 2024). Chencha district experiences prolonged seasonal food insecurity on April to May and September to November (Tadess *et al*., 2019; Abera *et al*., 2019), due to fragmented landholding, population pressure, drought, pest infestations, and seasonal fluctuations *(Engdawork, 2012; Shambel, 2017)*. People in the study area adopt various strategies to cope with food deficits and livelihood shocks, including income diversification, drought-resistant crop cultivation (Enset and Qoltso), weaving, and rural-urban migration *(Abera, 2014; Abera* ***et al****., 2019)*. But, to what extent, drivers and their capacity of withstanding the problem are yet not studied.

Despite the multidimensional and dynamic nature of food security, various actors have often focused on addressing single dimensions of it *(WFS, 1996 and Girmay, 2019)*. Food security is achieved by providing all people with adequate, safe, and nutritious food (FAO, 1996) involving access and control of livelihood capitals, and enabling sustainable life for active and healthy living. The definition comprises the multidimensional nature of food security: access to sufficient (availability), safe and nutritious (utilization) food to all (access), and all times (stability) *(Maxwell et al., 2013)*. But few studies have simultaneously measured all four aspects at once *(Girmay, 2019)*. Food security has also temporal dynamics, including current time, future exposure (vulnerability), and resilience to future food insecurity shocks and stresses *(Alinovi et al., 2010; Adane, 2018; Dhraief et al., 2019)*. Hence, this study uses a resilience approach *(Alinovi, et al., 2010)* to assess household capacity to withstand multidimensional food insecurity

shocks and stresses in Chencha Zuriya district, considering weaving livelihood strategy as a source of livelihood *(Maxwell et al., 2013)*.

Households face challenges in an uncertain food system, necessitating a study on their resilience to multidimensional food insecurity to identify potential resources and strategies for future resilience. Resilience analysis focuses on the capacity to react, cope, reduce, transfer, and adapt to shocks causing severe food insecurity *(Alinovi et al., 2008)*, widely accepted as a key to long-term solutions to poverty and food insecurity (Constas and Barrett, 2013; *Winderl, 2014; Bahadur* ***et al****, 2015*). Resilience refers to a system's ability to resist, absorb, accommodate to and recover from livelihood shocks without irreversible damage to its structure and functions *(Olamide Bisi-Amosun & Lafayette, 2019)*, based on household availability and management of livelihood options and available coping strategies *(FAO and WFP, 2014).* Scholars and development actors prefer resilience over vulnerability in food security analysis due to its optimistic or capacity-based approach. Scholars have adopted the resilience approach to study food security contexts, recognizing that food insecurity and resilience are dynamic (temporal and spatial) and multidimensional concepts (Alinovi et al., 2009 and 2010; Ciani and Romano, 2013; FAO, 2014; Maxwell et al., 2013, Mulat and Negussie, 2013, Mulugeta 2014, Guyu and Muluneh, 2015; Adane, 2018; Gebrerufael, 2019). Empirical studies categorize them into time series and point-in-time analysis (Adane, 2018; and Gebrerufael, 2019). The absence of context-specific panel data makes it challenging to study the dynamic nature of resilience at individual or household levels.

However, none of the above mentioned resilience studies covered the focus area of the current study; Chencha Zuriya district of Gamo zone Southern Ethiopia region. The area is threatened by different long-trending and short-run livelihood stresses and shocks. Chencha Zuriya district is one of the food deficit areas known in the region due to highly fragmented landholding size (an average 0.5-1 ha), highly exposed to different forms of soil erosion, population pressure, recurring drought, pests and seasonal fluctuation (CWARDO, 2014; Tadesse et al**.**, 2019; Abera et al, 2019). Consequently, the area experience chronic and about 6 months seasonal food insecurity. However, the area literally praised for high resistance to the threatening food shortages including countrywide recorded historical famines by losing no life ((Desalegn, 1996). This may be because of a number of factors, such as the use of social safety net programs in the

region, indigenous cultivation practices, and livelihood diversification strategies adopted, although this has not yet been empirically proven. This study, therefore, aimed to examine household resilience to multidimensional food insecurity sources, status and determinants factors by addressing major livelihood diversification strategies adopted in the case of weaving-based livelihood groups in the area by addressing the following research questions.

1.3. Research Objectives

1.3.1. General Objective of the Study

The main purpose of this study was to examine household resilience to multidimensional food insecurity through analysis of household livelihood alternatives, resilience sources and its determinants; the case of weaving-based livelihood groups in Chencha Zuriya District Southern Ethiopia region.

1.3.2. Specific objectives of the study

The study has addressed the following specific objectives:

1) Examine multidimensional food insecurity status of households in the area
2) Determine livelihood diversification options, status, determinants and its contributions to household food security among weaving-based livelihood groups in the Chencha Zuriya district.
3) Distinguish the major food insecurity causing shocks and stresses in the livelihood system
4) Identify the major resilience sources towards food insecurity
5) Determine the level of household resilience and determinant factors that affect household resilience status

1.4. Research questions

The study focused on analyzing livelihood system weaving-based livelihood groups and its resilience to multidimensional food insecurity conditions. By this aim, the research questions addressed are:

1) What does the area's multifaceted household food security situation look like?
2) What combinations of livelihood options are used by weaving-based livelihood groups in Chencha area? And, what is level of livelihood

diversification and its determinant factors?

3) What are the major food insecurity causing shocks and stresses faced by the households?
4) What are the main sources of household resilience to food insecurity in the study area?
5) How resilience level of households differs? And, what are the major determinant factors of household resilience to food insecurity challenges?

1.5. Scope and Limitation of the study

This study has mainly covered the analysis of sources of household resilience to multidimensional food insecurity at household level. Specifically, it has addressed the level of multidimensional food insecurity, livelihood diversification, and food insecurity causing shocks and stresses; and household resilience to food insecurity and its determinants. Its target geographical location has focused particularly at Chencha Zuriya District of Southern Ethiopia region. The mode of analytical framework used was the integration of Alinovi's updated resilience analysis framework and modified form of sustainable livelihood framework (SLF) (Alinovi et al, 2010 & Serrat, 2017) considering household resilience as an outcome of the interactive result of five basic building blocks of SLF and main sources of household resilience to food insecurity. The resilience level of household was measured at a point in time using cross-sectional data. Whereas, addressing patterns of resilience dynamics was not addressed due to difficulty getting longitudinal data (panel) at individual household level. Along with this, level of food insecurity, livelihood diversification, sources of resilience and coping strategy were examined. This has made the study more innovative and highly relevant to existing literature on food security study by using resilience thinking.

1.6. Significances and the Rationale of the Study

This study has aimed to examine the food security status, various types of coping strategies and the household resilience capacity to food insecurity in the weaving-based livelihood groups in Chencha Zuriya district Southern Ethiopia region. Both coping strategy and household resilience capacity to food insecurity depend on the availability of livelihood alternatives accessible for them. The study has a foreseen theoretical and practical importance to various academic and development stakeholders; Governmental Organizations (GOs) and Non-governmental Organizations (NGOs), researchers and policy makers.

Theoretically, it will contribute to the existing literature regarding resilience-based analysis of food security study in differing contexts using own modified sustainable livelihood framework. This can show the sources of household resilience and alternative coping strategies to food insecurity. Hence, sustainable livelihood framework was used to examine livelihood options. There is lack of an indicator which can show all multidimensional food security manifestation at once. However, this study has attempted to determine food security status by using unusual multi-dimensional food insecurity composite Index (MFI) (Maxwell *et al*., 2013). Furthermore, the relation among livelihood options, food security status, coping strategy and household resilience has been also examined. This will add new insights on existing food security literature. Practically, it can indicate major sources of household resilience, vulnerable group, and causes for shock and; help for planning possible development interventions. It can also become baseline for further studies that relate with food security and resilience analysis.

1.7. Ethical Consideration

Following an assessment of the proposal in compliance with academic norms at the university level and appropriateness of research instruments; informed written consent from respondents was obtained in order to conduct the data collection process for Key Informant Interviews (KII), Focused Group Discussions (FGD), and household surveys. Confirming this, the Academic Commission of Addis Ababa University provided a written consent ethical clearance letter (No. 029/01/2023) through close review of the Institutional Review Board (IRB) of College of Development Studies, Addis Ababa University. 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 the research. Finally, no information revealing the identity of any individual respondents included in the final report without their prior consent.

1.8. Structure of the Dissertation

The dissertation was organized into seven (7) basic parts. The first part deals with the introductory section, which encompasses the background of the study, a statement of the problem, basic research objectives, and the relevance of the study to different stakeholders. The second part of the dissertation presents a thorough review result of literatures (concepts,

theoretical underpinnings regarding food security, empirical review results and gap identified) and conceptual framework of the study. The third part include, research methodology. The following chapters 4, 5, 6, & 7 have included articles, one, two, three and four. Following this conclusions, recommendation and references, data collection tools and appendices were included at the end of the dissertation paper.

CHAPTER TWO: LITERATURE REVIEW

2.1. Theoretical and Conceptual Foundations

2.1.1. Emergence and Evolution of Food Security Concept

The concept of food security originated some 50 years ago, at a time of global food crises in the early 1970s. Food security is multidimensional and a flexible concept (FAO, 2003). It has more than 200 contextually different definitions (Maxwell and Smith, 1992). It has come through many modifications of inclusion and extension of different issues, since 1970. In the 1970s, food security was mostly concerned with national and global level food supplies or availability and price stability of basic food items (Berry et al, 2015). For this end, Green Revolution was considered as the best alternative to boost agricultural production during the 1930s-1960s.

However, Green Revolution did not automatically lead to a dramatic reduction in poverty and levels of malnutrition. This observation necessitated further modification of the views on food security. As a result, in the mid-1980s the work of Amartya Sen *„theory on food entitlement"* forced to change the focus of household food security to food access (1980s). Later on, FAO analysis made in 1983 tried to balance in between the supply and demand sides. It included the concept of food access and the role of agricultural market in accessing available food (Berry et al., 2015).

In the early 1990s, a focus broadened to nutrition security, with an emphasis on food, health, and childcare, and considered food security as one component in understanding the causes of malnutrition (UNICEF, 1990). While in the late 1990s, the focus of food security changed to livelihood security, i.e., actions that contribute to an active and healthy life. Accordingly, the 1996 World Food Summit adopted the following more complex and acceptable definition of food security:

―Food security said to be achieved at different levels when all people, at all times have physical and economic access to adequate food that help to lead active and healthy life‖ (FAO, 1996).

The 2002 FAO definition included the concept of social access in the 1996 definition. However, there is a disparity among scholars in accepting the current all-encompassing definition of food security. In general, food security can be recognized at various levels: *individual*, *household*,

regional, *national* or *global*. As to Anon (2015), to achieve food security a minimum of two things need to be fulfilled. The first one is, *availability of nutritionally adequate and safe foods*; and the second one is *economic and social accessibility of food for all at all times.*

2.2. Food Security Theories and Perspectives

Due to its multi-dimensional concept, food security is a debatable issue. As a result, there are various views and theoretical perspectives used to understand the concept of food security and thereby to end poverty and food insecurity problems. Hence, this part entails reviews of major theoretical perspectives of food security and attributes of each to the food security understanding.

2.2.1. Food Security and the Production Problem Perspective

According to this view, food insecurity explained as a problem caused by lack of increased food production. It is an oldest and still influential perspective in analyzing food security concepts till 1970s (UN, 1974) and; it is known as a Multhesian approach (Burchi and Muro, 2012). It describes food insecurity as the (dis)equilibrium between human population growth and food production. In order to solve this problem, the rate of food production should not be below the ever-growing human population. Proponents of this view relate increased food production and trade liberalization are expected to facilitate economic expansion and technological innovation. Lack of increased food production by increased technology adoption and trade liberalization are taken as the main causes of food insecurity (Glickman, 1996; Spretnak, 1997).

In this perspective, food security is viewed as the amount of per capita food availability. In closed economy, per capita food availability depends up on food production and stocks. Whereas, in the open economy, food trade considered main source of food availability (Burchi and Muro, 2012). Analysis can be made at individual, household, regional, national and global level at a sector, a cluster of sector or at an economy wide level using food balance sheet method (FAO, 2001). However, this view did not value the associated cost of using production increasing technologies, challenge the poor face to get money to purchase imported food and it do not consider negative effect of introducing genetic modification in agriculture (Pretty, 1995; Conway and Pretty, 1991).

According to Burchi and De Muro (2012), the policy implications of this approach have two folds: ―the food demand side‖ and ―the supply side." In the former case, the approach indicates the need to reduce the rate of population growth through appropriate policies. Whereas, in the later one, it pinpoints the need to enhance the capacity of per capita food production (agricultural productivity). Besides its weaknesses, this perspective increased concerns about ecological wellbeing (e.g., carrying capacity and ecological footprint).

2.2.2 Basic Needs Approach to Food Security

The food availability decline approach to food security is criticized for its more micro-level focus on associating food security problems only with agricultural sector performance and trade. It needs to increase the scope of its focus to a more macro-economic approach. Food security is not a function of only an agricultural sector; rather, it is a result of interdependent components of the whole economy. The basic needs approach emerged in the 1970s as an alternative to the growth model for dealing with inequality and poverty (2005). The approach was developed by the International Labor Organization (ILO), indicating development as a process that satisfies the basic needs of all people (e.g., food) (Burchi and De Muro, 2012).

Thus, basic needs approach increased the level of analysis of the national economy as a whole, such as gross domestic product (GDP), economic growth, and the import-export market, which are highly dependent on food production and food availability as basic components of the national- level food security framework. It shifted food availability at the macro-level (national) to income at the micro-level (Reutlinger and Selowsky, 1976; Haq, 1976; Griffin and Khan, 1977) (Burchi and De Muro, 2012). It analyzes food poverty as a sub-category of poverty and considers it a lack of enough income to purchase a minimum need of life (e.g., food). It associates food poverty with a lack of income to afford food needs (Sibrian *et al.,* 2007; Sibrian, 2008). Food security status is analyzed based on the income spent on food items and converting it to the caloric equivalent at the household level (Frankenberger 1992: 96).

2.2.3. Food Security as an Entitlement Decline

Although there is enough food supply to feed the whole population of the world, millions of poor people continue to go hungry to bed. Food insecurity is not only caused by a lack of food

availability, unlike the Malthusian view (Burchi and Muro, 2012). The work of Amartya Sen in the 1980s shifted the view of food security from national food availability to people‘s food access. He associates the cause of food insecurity with ―lack of entitlement." Entitlement refers to each individual‘s entitlement to a necessary bundle of commodities, including food, and argues that famine and poverty are the result of a lack of entitlement to an adequate quantity of food (Sen 1981: 434). Trade liberalization as a strategy has failed to assure food security (Hopkins, 1998: 12). Entitlements have been defined by Sen (1984, p. 497) as,
"the *set of alternative commodity bundles that a person can command in a society using the totality of rights and opportunities that he or she faces.”.*

He divides the fundamental concept of entitlement into two categories: endowments, which refer to _control of assets‘ (Osmani 1995), and entitlements, which refer to _the set of alternative commodity bundles that a person can access in a society using the totality of rights and opportunities through trade and production (exchange entitlement mapping)‘ (Sen 1981: 435). A decline in the well-functioning of both can cause food insecurity in people. Direct entitlement failure encounters food producers, while trade entitlement failure faces non-food producers. People who are impoverished by famine are not entitled to food; instead, they are _entitled to starve‘ (Edkins, 1996, p. 550). The coincidence of hunger with increased food production implies the failure of entitlement to available food or the question of economic power (Lezberg, 1999). Sen defines poverty as restricted entitlement to different types of social and economic assets (Sen, 1996). Hence, he recommends a fair distribution of food for the problem, which depends on the ability to participate in the market economy (Hildyard and Sexton, 1996: 286). This approach focuses on the macro-level, which analyzes occupational groups.

This study also recognizes that food security and desirable livelihood outcomes cannot be attained only by increased access to food and the market economy; rather, the state‘s willingness and commitment to create conducive conditions are also basic to achieving food security. These will help people achieve food security and household resilience to food insecurity.

2.2.4. Sustainable Livelihoods Approach

The sustainable livelihood approach for the first time was designed by Chambers (1983), who focused on rural development and poverty (emphasis on livelihood). It is more advanced by

Chambers and other scholars (Chambers 1987; Chambers and Conway 1992; Chambers 1995; Ellis 2000; Scoones 2005). This approach uses the Sustainable Livelihood Framework (SLF) as an analytical and operational tool to understand food security status using the sustainable livelihood concept. It has similarities with the basic needs and entitlement approaches; all focus on "gaining the basic needs of living‖ (i.e., tangible and intangible) rather than focusing on a broader human development approach (Chambers and Conway 1992: 5).

The SLF can be applied to a diversity of development issues, such as food security, by different agents and scholars (WFP, 1998; Young et al., 2001; Devereux et al., 2004; Hussein, 2002; Gebrerufael, 2019). It considers a variety of contexts (political, economic, physical, social, cultural, etc.) and integrates three concepts: (1) external vulnerability contexts (risks, shocks, trends, and seasonality) and internal defenselessness (Chambers, 1995: 175); (2) sustainability issues (DFID, 1999); and (3) people‘s food insecurity coping strategies against shocks and stresses (Curtis 1993: 3, based on Davies 1993). SLF is more commonly used in measuring humanitarian-based food security goals (Maxwell 1995; Maxwell et al. 1999, 2003) and famines (Howe and Devereux 2004).

The Sustainable Livelihood Approach (SLA) merely uses the word ―capability in its analysis; however, the actual analysis starts with ―a pentagon of assets and related livelihood strategies. But the actual concept of capability—"what life we lead and what we can or cannot do, can or cannot be"—is not included (Sen 1987: 16). It also overlooked freedom and agency issues that are well stressed in the human capability approach, which are more imperative in food security analysis. It also neglected the food utilization dimension of the food security issue (Sen 1985: ch. IV), cited in Burgi & Muro (2012). Finally, it used a household as its unit of analysis and ignored individual-level food security status and intra-household food access differences.

2.2.5. A Human Development and Capability Approach to Food Security

For the first time, a capability approach to food security was developed by Jean Derez and Amartya Sen. They designed an analytical framework for a food security study based on the capability approach of Sen (1985, 1999). It is more comprehensive than Sen‘s former work; however, it is less known and less cited. It goes beyond a mere entitlement issue to attain nutritional capability. Entitlement deals with a means towards basic human capabilities‘(Drèze

and Sen 1989: 13), whereas a human capability is both a means and an end.‘ Capability includes complementary inputs with food, which enables the achievement of all three dimensions of food security (availability, access, and utilization) (FAO, 1996).

According to (Burchi and Muro (2012), due to a lack of operational guidelines, the capability approach is less utilized by policymakers and food security analysts. As a result, in their work, they designed operational guidelines in three phases: *1) analysis of food entitlements 2) analysis of basic capabilities for food security; 3) analysis of the capability to be food secure.*

2.2.6. Livelihood Diversification Perspectives to Food Security

Livelihood diversification in the rural context is receiving increasing attention in deals about poverty reduction (Ellis, 2000). Agriculture being the main income source in the rural areas of the developing countries, it is subject to the threatening effects of climate change, population pressure, being rain-fed, and other environmental factors (Warren, 2002). The concept of livelihood is framed by Chambers & Conway in 1991; its literal meaning could have various conceptual implications and; explained in different ways. It can be defined as adequate bonds and flows of kind or cash to meet basic needs of living. In another ways, household’s livelihood referred to as the means or set of activities (usually carried out repeatedly) of securing the basic necessities of life: food, water, shelter and clothing. It is said to be secure and sustainable when ownership of or access to resources and income-earning activities, stores and assets are sustained to counterbalance risk, ease shocks, and meet contingencies; where the natural resource productivity on long-term basis is maintained or enhanced (Chamber et al., 1992). A means, activities, resources, claims and functions employed through which households strive to attain sustainable livelihood security is said to be livelihood. From extensive learning and practical implication of the concept, the most commonly used definition suggested by Chambers and Conroy is: a livelihood comprises the capabilities, assets (both material and social resources) and activities required for means of living (Chambers and Conway, 1991).

The concept of ‘livelihood diversification’ has been organized by various academic and policy discussions over years, particularly that dealt on the context of rural development and poverty alleviation(Chambers & Conway, 1992; Ellis, 2000; Barrett et al., 2001). Livelihood diversification is defined as a household’s attempt to lessen its vulnerability or risk by engaging in multiple livelihood activities (Chamber et al., 1992). According to Ellis (2000), livelihood

diversification is the process by which rural households construct an increasingly diverse portfolio of activities and assets in order to survive and improve their standard of living. It also takes into account the role played by the well-functioning structures, policies, and processes that influence the choice and use of the available livelihood options in the rural areas ((Bedeke, 2013). Thus, it emphasizes availability of assets like savings, land, labor, education, access to market or employment and other public services that determine household's capability to diversify their livelihood. Diversification in the rural development context involves on-farm changes in the mix of agricultural activities or desirability of developing rural-based non-farm industries (Saith, 1992). The former aims in reducing unnecessary reliance on a single main farm output; while the latter seeks to provide full time employment opportunities out of farming activities in the rural settings. Most rural households have truly multiple income sources; this may include off-farm wage work in agriculture, wage work in non-farm activities, rural non-farm self-employment, or transfer of payments from abroad. Based on several literatures; alternatives of livelihood strategies categorized into on-farm, off-farm and non-farm sources (Gebru et al., 2018). Livelihood diversification in the current study is main subject and believed to be source of household resilience to food insecurity; the following operational definition was used. In simple terms, on-farm refers to all activities related to the production of crops and livestock which occur on the farm; off-farm means activities that are related to crops and livestock but occur outside of the field e.g. processing, packaging, etc. (value addition); whilst non-farm activities relate to all other activities that are not related to crop and livestock production e.g. education, petty trading in non-agricultural activities, barbering, building construction, etc. (Kankam-Boadu, Isaac, 2023). This classification focus on where does the activity carried out (Miller Anne, 2019).

A livelihood diversification approach towards food security believes that household livelihood (food security) is often influenced by the ability (availability of) to diversify livelihood sources and assets (Stage et al., 2002). This demonstrates that households with more livelihood strategies and assets (i.e., greater ability and asset) have a better likelihood of having a more stable livelihood than those with less livelihood assets.

Advocates of livelihood diversification categorize the major rationales towards increasing their source of livelihood income as either to exploit new opportunities created due to market liberalization (Delgado and Siamwalla, 1997) or to cope with livelihood risks ((Barrett et al., 2001); having important impact on household income, income and risk distribution and

household welfare (Ellis, 1998, 2000). As of recent witnesses, a shift away from traditional farming towards the rural non-farm sectors contributes to the economic growth, rural employment and poverty reduction (Lanjouw and Lanjouw, 1995; Hagbblade et al., 2007). Livelihood diversification in rural context involves; agricultural production diversification, intensification, and migration or moving out of farming to cope up with increasing vulnerability (Ellis, 2000); however, it has long been ignored by policy makers who only focus on agriculture (Carswell, 2000). Various literatures attempt and promote identifying drivers of livelihood diversification to attain enhanced role on food security and poverty reduction. Jeremy Swift (1998) pointed out that increased population density, good road access and incoming migrants might all increase likelihood of economic diversification, however, and the range of off-farm activities actually employed depends on access to credit and savings, household size and composition, level of education and other cultural constraints. Ellis (2000) categorized reasons to adopt multiple livelihood strategies as; diversification of necessity and diversification by choice. He identified six determinants of diversification as seasonality, risk, labour and credit markets, asset strategies and coping strategies.

However, there were paradoxes towards the role of livelihood diversification on poverty reduction and food security; proponents of diversification and anti-diversifications. The first group who support livelihood diversification and the second group who opposes the idea of livelihood diversification. The former group who support livelihood diversification argue that it is a central mechanism for tackling rural poverty and best way out for ensuring household food security. For example, livelihood diversification is a mechanism that helps households improve the standard of living (Ellis, 1998). Diversification is an attempt of carrying out a combination of different income activities maintained over time in order to maximize the profit, spread risk or improve standard of living (Reddy et al., 2021). However, it is the result of varieties factors like; seasonality, differential markets, risk strategies, coping behavior, credit, market imperfections, saving and investment (Ellis, 2000). Livelihood diversification has enhanced food accessibility and availability of both male-headed and female-headed households in rural community of Zambia (Hegazi and Seyuba, 2024). The study by Dereje et al. (2024) has found positive association between livelihood diversification and food security. The second group debate claim that diversification livelihood activities can adversely affect an economy by demotivating “specialization” of production, decrease growth in agriculture by facilitating labor migration

from agriculture to non-agriculture, and undermines investment in agriculture (Degefa, 2008). This group advocates transition from backward to modern agriculture (Degefa, 2005). However, this research takes the stance of assuming positive view/role of livelihood diversification where a mere dependence on agriculture which is highly prone to climate change, diminishing land productivity, population pressure, declining landholding size and other risks makes agriculture not reliable sector. Therefore, this study has given due focused on positive contribution of diversification in enhancing household food security.

2.3. Measurement of Food Security

From the very beginning of the emergence of the concept of food security, a variety of food security measurement indicators were used. Both the food security concept and its measurements are dynamic and ever-evolving. Many of them used to measure different aspects of food security dimensions. However, there is a challenge of having universal indicators that capture all aspects of food security for a given unity of analysis. In this review, food security measures are categorized under different levels of analysis, i.e., global, national, household, and individual levels. This review is categorized into these three categories: global or national level, household level, and individual level (FAO, WFP, and IFAD, 2013).

Table 1: FAO suite of indicators for Food Security 2013

Food security indicators	**Dimensions measured**	**Level of analysis**
➢ Average dietary energy supply adequacy ➢ Average value of food production ➢ Share of dietary energy supply derived from cereals, roots and tubers ➢ Average protein supply ➢ Average supply of protein of animal origin	**Availability**	**National**
➢ Percentage of paved roads over total roads ➢ Road density ➢ Rail-lines density ➢ Domestic Food Price Level Index ➢ Prevalence of undernourishment ➢ Share of food expenditure of the poor ➢ Depth of the food deficit	**Accessibility**	**Household**

Prevalence of food inadequacy		
Access to improved water sources Access to improved sanitation facilities Percentage of children under 5 years of age affected by wasting Percentage of children under 5 years of age who are stunted Percentage of children under 5 years of age who are underweight Percentage of adults underweight	**Utilization**	**Individual**
Cereal import dependency ratio Percent of arable land equipped for irrigation Value of food imports over total merchandise exports Political stability and absence of violence/terrorism Domestic food price level index volatility Per Capita food production variability Per Capita food supply variability	**Stability/ Vulnerability**	**At all levels**

FAO, WFP and IFAD (2013).

2.4. Concept of Resilience and its Relation with Food Security

Life-sustaining activities in developing countries mainly depend on nature, which faces a variety of social, economic, and natural risks and uncertainties. In this regard, households differ from one another in their ability to withstand both short-run and long-run livelihood shocks from different sources. Thus, the capacity or ability to adapt, withstand, and recover from shocks is referred to as *resilience,* and this has become the main agenda for many development actors (Costas *et al.,* 2014a; Constas *et al.,* 2016). Resilience was used for the first time to explain the relative persistence of nature in many manifestations of complex and dynamic systems (Holling, 1973). FAO conceptualizes resilience as a capacity of a household to maintain the previous status of wellbeing (i.e., food security) after facing livelihood shocks. FAO used this concept for developing RIMA-II (Resilience Index Measurement and Analysis-II). Then, the resilience measurement technical group (RM-TG) developed the latest definition as an ability that enhances the household to resist the long-term adverse development effects of stresses and shocks‘(FAO, 2016). And it has become common to solve the food security problem. Currently, resilience is used in a multitude of dynamic systems, like social and economic conditions (food insecurity),

to explore its relative persistence (Lovedale, et *al.,* 2004).

The concept of resilience has two basic variants: ―engineering‖ and ―ecological‖ (Holling, 1996). According to Gunderson *et al. (*1997), engineering resilience refers to the ability of a system to return to a steady state after a perturbation. It focuses on efficiency, constancy, and predictability (fail-safe design). Ecological‘ resilience refers to the magnitude of disturbance a system can absorb before it redefines its structure by changing the variables and processes that control behavior (Walker *et al.*, 1969; Holling, 1973). However, two definitions explain resilience in two different ways. Engineering conditions imply that things will work in dynamic conditions. While ecological definitions recognize that things can breakdown and change their behavior, this system is characterized by path dependency, discontinuous changes, multiple equilibrium, and non- linearity.

Resilience as a concept originally derived from the field of ecology, understood as the ability of an entity (individual, household or community) to bounce back and return to a stable state when faced a disturbance (shocks) (Holling, 1973; Constas and Frankenberger, 2013). It is proposed to explore the relative stability of various state of nature in complex dynamic systems (Levin et al., 1998). The shock or disturbance could be a shared by a large group of people (covariate shock) or experienced only within a given household or community (idiosyncratic shocks). Levin' et al., (1998) argue that resilience offers an important way of thinking about evolution of social system by providing a means of analyzing, measuring and implementing the sustainability of such systems. The reason for this is because resilience thinking focuses on the system's ability to react creatively and constructively to short-term shocks and stresses rather than long-term equilibrium (Alinovi et al, 2010). Major sources of resilience in a given system vary as per the nature of functional groups. For instance, the size and depth of biodiversity in critical ecosystem functions, while flexible options for management, norms and rules in human organizations, and cultural and political diversity in social groups. Accumulation of assets in an ecological system (seeds and spatial recolonisation) plays a crucial role as a source of resilience. In social system, social capital of trust, networks, memory and relationships, or capital of ethics, values, and systems of knowledge in culture are main sources of resilience.

Resilience has got popularity as it bridges the gap between humanitarian and development

assistance, which emphasizes the need to build individual, household, and community capacity to withstand and adapt to various risks (Constas and Frankenberger, 2013). Due to the increasing attention given to resilience from different perspectives, multiple definitions were designed in last decades. TANGO international on high level expert forum on food insecurity defined resilience as the ability of households, communities, and countries to efficiently anticipate, adapt to, and/or recover from the effects of shocks (natural, economic, social conflict) (TANGO, 2012).

According to USAID, resilience is "the ability of people of people, households, communities, countries, or systems to mitigate, adapt to, and recover from shocks and stresses in a manner that reduces chronic vulnerability and facilitates inclusive growth" (USAID, 2012). In this view, resilience result in enhanced adaptive capacity, reduced risk, and improved status vulnerable populations. Whereas DFID define disaster resilience as "The capacity of nations, communities, and households to adapt to shocks or stresses, such earthquakes, droughts, or violent conflicts, while preserving or improving living standards without jeopardizing their long-term prospects" (DFID, 2011). For the IFRC, resilience is defined as: The ability of individuals, communities, organizations, or countries exposed to disasters and crises and underlying vulnerabilities to: anticipate, reduce the impact of, cope up with, and recover from the effects of adversity without compromising their long term prospects (IFRC, 2012).

2.5. Empirical Review and Literature Gap

Food security, since its emergence in the 1970s, has been a major area of research and conceptual dynamics for scholars. Its conceptual underpinning was changing with advances in understanding of the subject. The emphasis on food security changed from availability to food access. However, the resilience concept in food security studies is newly emerging (Alinovi *et al.*, 2009). Some studies attempted to measure household resilience to food insecurity in the face of shocks and stressors that cause food shortages in various contexts (Alinovi *et al.*, 2009; Alinovi *et al.*, 2010; Ciani & Romano, 2013; Adane, 2018; and Gebrerufael, 2019). It can be measured by using two data types, i.e., time series longitudinal data (longitudinal dynamics) and cross-sectional (a static or current time) points in time data. Lack of a well-organized longitudinal database is the main challenge. Scholars used both approaches to measure household resilience to food insecurity. Accordingly, studies like Alinovi *et al*. (2009 and 2010) and Mulat and Negussie (2010) used a longitudinal data-based approach. Carter *et al. (2006), Keil et al*. (2008),

Adane Atara (2018), and Gebrerufael (2019) used a cross-sectional, one-time data-based approach to measure units of resilience to food insecurity.

The first ever effort to integrate resilience into food security was a study conducted by Alinovi *et al.* (2009), which found varying resilience of households to food insecurity among differing sub-regions using four building blocks. A similar study by Alinovi *et al.* (2010) examined the household resilience differences among different livelihood groups in Kenya using longitudinal data from 2005–06. They used Alinovi's (2009) updated resilience framework. The large-holder farmers' clusters are the most resilient, while the pastoralist clusters are the least resilient. The study by Ciani & Romano (2013), which aimed to test the proposed resilience index, found households with small landholdings and agricultural wage workers as less resilient than other livelihood groups in the area. Maxwell *et al.* (2013) treated resilience as one component in examining food security and its determinants in the Tigray region. The result shows that some households have shown positive results in their food security status without bringing about changes in their asset holdings.

A cross-sectional study conducted by Adane Atara (2018) examined household resilience to food insecurity using a fixed-moment-in time approach. He found that a majority of households—about 61%—were non-resilient to food insecurity, and inter-livelihood zone resilience varied per livelihood zone. The current study also prefers to adopt the updated version of the Alinovi (2010) resilience framework in examining weaving-based household resilience to food insecurity in the Gamo highland areas of southern Ethiopia. Gebrerufael (2019) analyzed the resilience of rural households to food insecurity in Ahferom woreda of Tigray regional state. He examined household livelihood asset endowment, food security status, and household resilience to food insecurity, putting households in a sustainable livelihood thinking framework. The study finally confirmed that half of the surveyed households were resilient, and the remaining halves were non-resilient to food insecurity.

A thorough review of related empirical literature on household resilience to food insecurity revealed a main focus on the capacity of agricultural-based livelihood groups. However, there is a shortage of empirical studies on off-farm and non-farm livelihood strategies, particularly weaving as a livelihood strategy. Even though weaving is the most known livelihood alternative in the country next to agriculture, its role in desirable wellbeing outcomes and problems with it

have not yet been studied. Besides this, this study will be more innovative in its stance, which aims to investigate the relation between different livelihood strategies and coping strategies adopted and their effect on food security and household resilience to food insecurity.

This current study has also been interested in conceptualizing the analysis of household resilience to food insecurity within a sustainable livelihood thinking framework. However, it differs from other empirical studies by: (1) analyzing the effect of livelihood diversification on household resilience; (2) considering household food security as a result of the interactive outcome of sustainable livelihood components; (3) focusing on examining weaving-based livelihood as a source of household resilience to food insecurity; (4) using differing variables to develop a resilience index; and (5) attempting to investigate coping strategies adopted by households and their effect on their household food security status and household resilience to food insecurity.

2.6 Conceptual Framework

Food security is a condition in which all people, at all times, have physical, social, and economic access to sufficient, safe, nutritious, and socially acceptable food that meets their food preferences and dietary needs for an active and healthy life (World Food Summit, 1996). Household resilience to food insecurity is a new concept in the food security study, but, many food security studies focus on predicting future food insecurity (vulnerability) in households or communities (Ellis, 2003; Juhar, 2012; Scaramozzino, 2006; WFP, 2009a, 2009b; WHO, 2011). Resilience, originating from ecological literature, evolved through engineering and mathematics, and was later adopted by environmental institutions for policy making (Ciani and Romano, 2014). C.S. Holling's influential paper 'Resilience and stability of ecological systems' introduced the concept of resilience, focusing on a system's ability to absorb disturbances (C.S. Holling, 19973) without shifting into an alternate state and to restore after disturbance (Walker, B. and Salt, D., 2006). Resilience to food insecurity refers to a household's capacity to maintain well-being despite shocks and stresses, based on available options and handling abilities (Alinovi et al., 2010). The study has prompted socio-environmental scholars and development actors to enhance their understanding of adaptation, evolution, and accommodation to stress and shock (Bartlett, 1973; Coates et al., 2007). Resilience, a concept applied across various disciplines like ecology, engineering, economy, and mathematics, refers to a system's capacity to withstand and recover

from shocks and disturbances (Mamouda and Cheikh, 2010). Recently, the concept of resilience has been utilized by various individuals and groups to examine the stability of states in complex dynamic systems, including food and livelihood systems *(Alinovi et al., 2009, 2010;* Ciani F. and Romano, D., 2013; Fikiru Beyene, 2016; Debessa, A., 2018; Gebrerufael G., 2019; Debebe C., 2021*).*

Resilience thinking is the result of improving food security analysis models (Ciani F. and Romano, D., 2013) which enables tracking social system evolution by analyzing, measuring, and implementing effective adaptation mechanisms to shocks and constraints in different temporal contexts (Amaza et al., 2006). Resilience is primarily derived from biodiversity (Peng et al. 2002; Sjöberg 2000), later on it has been used in food security concept study to measure households' ability to handle unpredictable shocks, rather than predicting severe food insecurity crises (Mubaya et al. 2010; Nguyen and James 2013; Schreinemachers et al. 2017). This study examines the resilience of weaving-based households in Chencha Zuriya district, Southern Ethiopia, to multidimensional food insecurity, focusing on shock nature and response ability. The resilience of a household to food insecurity shocks at a specific time T_0 is primarily determined by the available livelihood options (Alinovi et al., 2008, 2010; Abebe, 2016; Gebrerufael, 2019; Debebe, 2021). Resilience, distinct from vulnerability analysis, aims to identify potential strategies for households to adapt, withstand, and transform in the face of livelihood shocks and constraints (Alinovi et al., 2009). The sustainable livelihood approach, similar to resilience, identifies potential strengths and endowments within households or communities to implement sustainable livelihood improvement programs (Chambers & Conway, 1992). SLA combines capability, equity, and sustainability used as a means and an end in livelihood thinking, analyzing available options, external vulnerability contexts, assets (tangible and intangible), mediating structures, accessible strategies, and resulting outcomes like food security (desirable or undesirable) (Chamber et al., 1992). Resilience and sustainable livelihood thinking are optimistic approaches that explore potential sources of wellbeing within external shocks, processes, and structures. This study combines resilience and sustainable livelihood thinking in which both focus on improving well-being, though they differ in focus areas, timeframes, interventions, and guiding principles.

Within the framework of sustainable livelihood thinking, household food security and resilience

to multidimensional food insecurity will therefore be treated and conceptualized as an interactive outcome of available livelihood assets, livelihood strategy options (livelihood diversification), and coping strategies within various socio-economic contexts (i.e. shocks, structures, and processes). By this thinking framework, the study examines food security, livelihood diversification, coping strategies, resilience, and factors affecting resilience in weaving-based livelihood groups in Chencha Zuriya district, Gamo Highlands.

Household resilience to food insecurity is the aggregate result of influenced various factors including livelihood options, income-generating activities, basic services, and social safety nets, which shape the household's ability to handle risks (Alinovi et al., 2008). Alinovi proposed a method for analyzing household resilience to food insecurity based on the interaction of interacting latent variables. In recognizant to this, the study adopted the updated FAO's resilience framework, developed by Alinovi et al. (2008) and updated in Alinovi *et al. (*2010), as the main conceptual and analytical framework with minor modification for livelihoods in rural weaving communities in Southern Ethiopia. The selection of the framework is justified by the fact that it is mainly proposed for the analysis of households' resilience to food insecurity (food insecurity shocks), and the variant mentioned here is the one that explicitly considers the importance of weaving for the livelihood of rural households in developing countries.

The study explores the potential options or factors deemed to affecting household resilience to food insecurity shocks, including access to basic services (ABS), agricultural assets (AA), Non-agricultural assets (NAA), agricultural technology (ATP), income and food access (IFA), social safety nets (SSN), adaptive capacity AC), and household's stability (S). The household's response to a risk, occurring between times T_0 and T_1, depends on its adaptive capacity, available assets, and available livelihood activities. To estimate the household resilience R, it is therefore necessary to separately estimate AA, ABS, NAA, ATP, IFA, SSN, AC, and S which are latent variables, hence, they cannot be directly observed in a given survey. Rather, they are most possibly estimated through employing multivariate techniques. Presented hereunder is the general conceptual framework adapted for the study, together with briefings about assumptions in it and the proposed resilience dimensions in the study area‘s context.

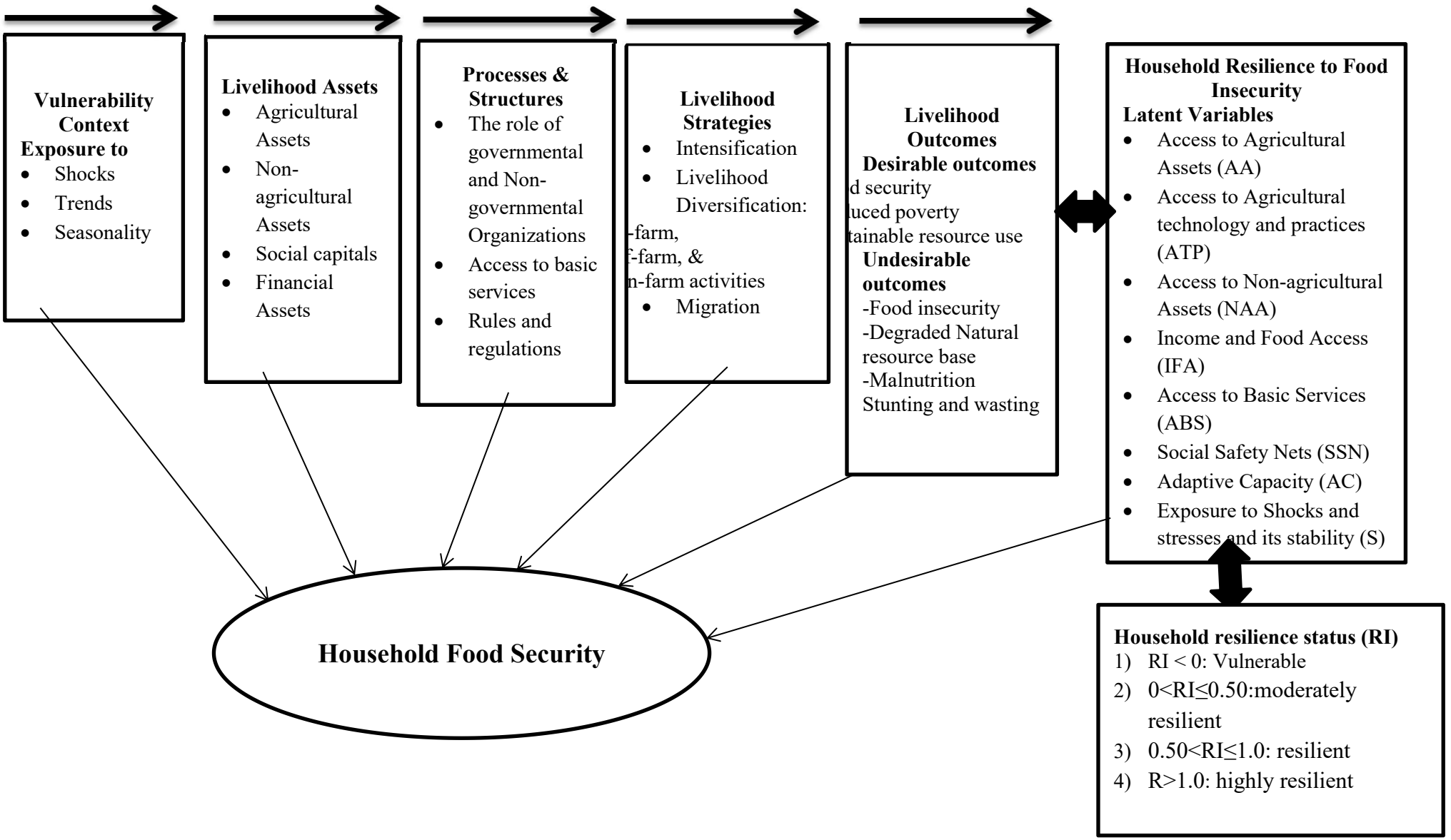


Figure 1: Conceptual framework for the study (DFID, 1999; Alinovi et al, 2010)

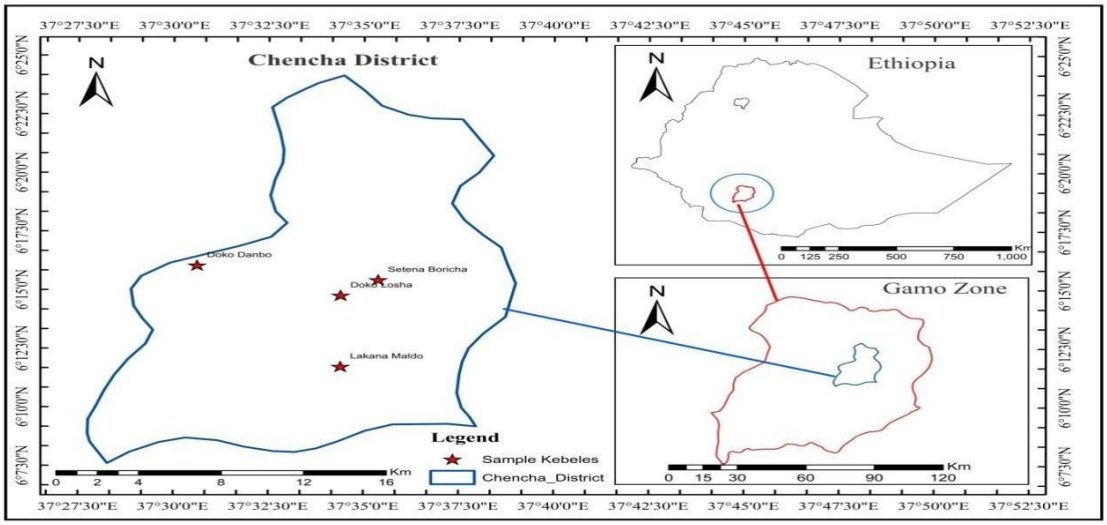
CHAPTER THREE: RESEARCH METHODOLOGY

3.1. Description of the Study Area

The study examined household resilience to multidimensional food insecurity in Chencha Zuriya district. With this topic the study has addressed multidimensional food insecurity status of households, the level of livelihood diversification and household resilience to food insecurity and its determinants. Chencha Zuriya district is located in Gamo zone, Southern Ethiopian region. It is one of the ten districts found in the Gamo zone of Southern Ethiopia; it is located 474 kilometers away from Addis Ababa and 37 kilometers North of Arba Minch town, the zonal town. Chencha has a longitude and latitude of: 6°14′ 60.00" N and Longitude of: 37°33′ 59.99" E and an elevation of 2732 meters above the sea. It has a total area of 373.5 km^2 shared by 33 kebeles[1] and a human population density of 388 persons per square kilometer (CSA, 2011). This makes the area one of among densely populated areas in Southern Ethiopia. Chencha has an agro-ecological category of highland (>2500 m.a.s.l) account 82%, and midland (Woyne-Dega) (2000-2500 meters above sea level) of 18% agro-ecology (Hassen, 2019). Currently, the district is shared by 33 kebeles and 3 transition towns, 65% mountainous topography (CSA, 2011; Hassen, 2019). The area receives biannual rainfall in two cropping seasons of *Belg* (March to May) and Meher (June to October) following these two rainy seasons with an average rainfall of 1172 millimeters. It has an average annual temperature of 16.5^0C (figure 1). The district's Agriculture and Natural Resource Office reports shown that the area is classified as 65% mountainous, only 13% plane, 5% gorges, and 17% sloppy lands (Essa, 2019). It is bordered by Arba Minch Zuriya woreda in the South and Southeast; Mirab Abaya in the East; the newly separated Kogota district in the North and Dita in the West. The district is one of the densely populated areas of the region with a 144, 918 people on 20,290 hectares of land with a population density of 388 persons per a square kilometer (CSA, 2011). From this, female population account 54.9 % of the population.

[1] 1 *Kebele* refers to the lowest administrative unit in Ethiopia since 1991.

Figure 2.0: Research Area Map



Source: Ethiopia Mapping Agency 2007 Shape file

The livelihood system of the people mainly depends on small-scale but intensive subsistence farming and; is supported with some off-farm and non-farm livelihood strategies; like weaving, wage labour, formal employment, out-migration to town areas for the search of a better life, trade, and so on. The district experiences a 3-6-months food shortage due to population growth, land degradation, unpredictable rainfall, crop diseases, and market access problem, primarily due to rain- fed subsistence agriculture (CWARDO, 2014). The study evaluates household multidimensional food insecurity, livelihood diversification, and resilience to food insecurity in Chencha Zuria district, focusing on weaving-based livelihood groups. Limited livestock ownership and coping strategies, such as Enset production, are explored. Empirical studies on sources and magnitudes of household resilience to food insecurity shocks have not been conducted in the area.

3.2. Research philosophy

In both qualitative and quantitative researches, following a research philosophy is advisable. Questions of research methods follow identification of research paradigm. Research philosophy is defined as the basic belief system or worldview that guides the investigator and defines the nature of the world, the individual's place in it, and the range of a relationship to the world and its parts (Guba E. & Lincoln Y, 1994). This enables the researcher to decide which approach to be adopted (Saunders *et al*, 2009).

Basically, two philosophical stands are known, objectivist and subjectivist philosophies. 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). The author suggests pragmatism as a possible way if it is difficult to deal social aspects with the dichotomy. Tashakkori and Teddlie (1998) in Saunders *et al.* (2007) suggest the researcher to think of the philosophy adopted as a continuum rather than opposite to one another. In that the knower and the known may be interactive while at others one may more easily stand apart from what one is studying. Degefa (2005) indicated the existence of two perspectives from combination of qualitative and quantitative research methods: 'paradigm purity' and 'compatibility theses. Accordingly, 'paradigm purity' argument disallows combing the two methods in a single study 'quantitative' and 'qualitative' methods which rooted from 'positivism' and 'constructivism' philosophy. While, '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.

3.3. Research design

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 one time and cross-sectional one. That is, the data will be gathered from different cross-sections, households in this case, at one point in time only. The study will employ survey as its research strategy and dominantly use quantitative approach with qualitative triangulation when it comes to research choice. That is, it has adopted a mixed

method research design as a research approach.

3.4. Sampling Methods

Current study has focused on examining household resilience to multidimensional food insecurity shocks and stresses the case of households whose livelihood mainly focused on weaving as their main livelihood sources. Hence, multi-stage sampling technique has been used to select sample areas and sample respondents. In the first stage, major weaving-based livelihood areas were identified from Gamo zone such as Chencha, Bonke, Dita, Daramalo and Kamba woredas. In this regard, Chencha Zuriya district was purposively selected based on prevalence weaving households. In the second stage, four clusters were selected from five clusters namely, Mesho, Gembella, Dorze and Zozo and Zakota clusters. In the fourth stage, one kebele from each cluster a total of 4 kebeles namely Doko Danbo, Doko Loosha, Setena Boricha, and Lakana Maldo from each cluster were randomly selected based on prevalence of weaving households distribution. In the fifth stage, the sample respondents were chosen using systematic nvhjoijo random sampling techniques. Finally, the sample size of respondents was determined by using the following formula proposed by Yemane, (1967);

$$n = \frac{(N)}{2+(e)^2} \quad \text{..... Equ [1]}$$

Where, N = the total population size, n = the sample size, and e the level of precision. In this study, N=2485 and e=0.05 n=303. Then, the representative sample respondents were identified based on probability proportion to the population from four kebeles using a systematic random sampling technique per each 8-household interval.

3.5. Data Collection and Analysis Techniques

Data were collected through employing cross-sectional data collection techniques. Primary data were collected through household survey from households selected by multi-stage sampling methods, key informant interview, focus group discussion, and field observations. Secondary data collection was conducted by reviewing previous research works, reports, and official documents. Focusing the livelihood system of weaving-based households as the main unit of analysis; the data collection process has addressed the main sources of household livelihood

income activities engaged in and major shocks and stresses threatening the system, multidimensional food insecurity status of households, and resilience sources and status towards multidimensional food insecurity shocks and stresses, and its determinants. For this end, the study has employed various appropriate data analysis techniques for the respective objectives.

Objective one: This objective deals with analyzing multidimensional food insecurity status of households. Data was collected through adopting 24 generic occurrences and frequency of occurrence questions organized to examine how different food security indicators compare household food security status the case of Tigray region of Ethiopia (Maxwel et al., 2013; Gebrerufael, 2019). Then, data analyzed by descriptive analysis techniques such as; frequency, percentage, Chi-square test, Oneway-ANOVA and so on.

Objective two: This objective aims at examining the diversity of livelihood strategies adopted by the households and its determinants. For this end, descriptive statistics, chi—square test, Onaway-ANOVA, Herfindahl-Hirschman Index, pearson‘s correlation coefficient and Ordered probit model.

Objective three: This objective focus on the identification major livelihood and food insecurity inducing shocks and stresses the households encounter. Accordingly, the most frequently encountered livelihood shocks and stresses threatened the households’ livelihood system in the last five years since 2022. Then, data collected through household survey and other qualitative techniques were analyzed by simple descriptive statistics.

Objective four: This part deals with identifying major sources of household resilience to food insecurity shocks and its status. In this regard, exhaustive data about 86 directly observed variables were collected and analyzed by employing multivariate data analysis technique. For this, Principal Component Analysis (PCA) was used to reduce the dimensions to eight latent variables and later reduced to one index which indicates household resilience level. Based on the final index, households were categorized in to vulnerable (non-resilient) ($RI<0$), moderately resilient ($0<RI\leq0.50$), resilient ($0.50<RI\leq1.0$), and highly resilient ($RI>1.0$) following (Fikiru, 2016; Adane, 2018).

Objective five: This objective focused on identifying the major determinants of household resilience to food insecurity. It has identified various socio-economic and demographic factors

through employing descriptive statistics, Chi-square, Oneway-ANOVA, and ordered probit as the data analysis methods. The details of pertinent issues of methodological aspects such as philosophical stands, research design, sampling methods, methods of data generation and analysis techniques are covered under empirical chapters.

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CHAPTER FOUR: MULTIDIMENSIONAL FOOD SECURITY ANALYSIS: THE EXTENT AND DETERMINANTS, THE CASE OF CHENCHA ZURIYA DISTRICT, SOUTHERN ETHIOPIA

Abstract

Background

While food security is a multidimensional issue, most studies adopt a single indicator. The policies designed based on this result might also miss basic facets of food security. Aiming to fill the gap, this study has used the multidimensional food security composite index (MFI) to measure various dimensions of food security using cross-sectional data.

Methods

Data was collected from 303 randomly selected households using 24 generic questionnaires. It has combined the most commonly used food security indicators: HFIAS, CSI, FCS, HDDS, rCSI, and SAFS. The data was analyzed by descriptive techniques like chi-square and one-way ANOVA.

Results

The MFI analysis reveals that 94.72% of households in the study area are food insecure, i.e., 18.48% are mildly, 10.23% are moderately, and 66.01% are severely food insecure. The remaining 5.28% are only multidimensionally food secure, with a 3-6 month annual food shortage due to fragmented landholding and population pressure. About 84.8% of households experience food supply anxiety, with 57.75% eating unwanted, 80% eat monotonous, and 78.54% cannot afford food, while 78.87% consume grain-based food and only 15.84% consume high-value food. 13.3% of families occasionally or frequently experienced levels of the six most severe food insecurity situations. Consequently, 78.21% of respondents reduced daily meals, 7.26% skipped meals, 65.67% used seed stock, 50.49% relied on immature crops, and 17.82% borrowed food as a coping strategy. The chi-square test revealed significant differences in access to education, mobile phones, formal employment, weaving use, and on-farm income sources among MFI categories. A one-way ANOVA shows significant differences in TLU, weaving income, total income, and family size, SSI, IFA, and HRI across MFI categories.

Conclusions

Finally, the study suggests that stakeholders must reconsider and plan interventions to enhance household food security, considering the multidimensional aspects of food security outcomes.

Key words*: Food Security, Multidimensional Food Insecurity, Coping Strategy*

4.1. Introduction

Food insecurity has been a social and economic concern of governments worldwide. Food security has a multidimensional aspect namely; availability, access, utilization, and stability. The concept originated some 50 years ago during the global food crisis in the early 1970s (FAO, 2003). Since then, it has become the focus of development, scholars and governmental and non-governmental agencies. Currently, it has more than 200 definitions (Maxwell and Smith, 1992). However, the definition framed in the 1996 during World Food Summit is the most commonly adopted one. Food security is said to be achieved when all people, at all times have physical, social, and economic access to adequate, safe, and nutritious food that helps to lead an active and healthy life‖ (FAO, 1996). It can be understood and achieved at multidimensional levels; individual, household, regional, national, or global levels by addressing availability, access, utilization, and stability dimensions (Anon, 2015).

Biodiversity loss, climate change, population pressure, conflict and deforestation resulted in food and water shortages in the world. It is expected that the world population will grow nearly to 9 billion by 2050. Hence, this will increase food needs by more than double. Currently, 842 million, or 1 out of 8 people face hunger and severe food shortage every day. There are currently 1 billion people who are food insecure in the world; they do not have access to enough, affordable and nutritious food. More than 7.9 percent of the world's population suffered from malnutrition in 2022—roughly 9.2 percent—greater than it was before the COVID-19 pandemic. Around 735 million people in the world faced hunger in 2022 which is 122 million more than it was in 2019, before the global pandemic. In the years 2021 to 2022, efforts towards reducing hunger were promising in Asia and Latin America, but hunger is still rising in Western Asia, the Caribbean, and almost all sub-regions of Africa (FAO et al., 2023). Even, an expected 600 million people will be chronically undernourished in the year 2030 which is almost 119 million more than the condition before the outbreak of neither COVID-19 pandemic and the war between Ukraine and Russia. Accordingly, consequences of the ongoing war in Ukraine, climate variability and extremes, and economic contractions combined with growing inequalities are considered ―new normal‖ and major drivers of food insecurity and malnutrition which keep constraining the capacity of agri-food system to deliver nutritious, safe and affordable diets for all. Food security is a multidimensional as concept to understand and conceptualize; and a manifestation of

its outcome (food security and food insecurity)

Food insecurity is the main political and economic agenda around the world, hence about 828 million people majority of whom live in Africa and Asia threatened by hunger (FAO, 2017; USAID, 2022). Sub-Saharan Africa and Asia alone account for 94% of the world‘s food insecure people. Similarly, food insecurity is a long-term social and economic problem both in urban and rural areas of Ethiopia. According to CSA and WFP (2014) as cited in (Adem, 2021) about 29 percent of the rural and 21 percent of urban populations were food insecure in Ethiopia. Progresses were recorded in reducing the severity of undernourishment from 74 percent in 1990 to 32 percent in 2016 (FAO and WFP, 2016). Such promising results have been achieved as a result of the government efforts towards designing and implementing of comprehensive policies like; soil and water management, plant nutrient generation and recycling, introduction of drought and pest-resistant varieties, livelihood diversification, and post-harvest management practices (FAO, 2012).

Thus, designing effective policies and strategies, for food and nutrition security depends on the availability and use of comprehensive and relevant indicators (Lentz and Barrett, 2013). Due to the multidimensional (availability, access, utilization, and stability) aspect of food and nutrition security, there is a lack of agreement on both definitions and metrics of food security (Gebrerufael, 2019). Thus, the majority of the scholarly, academic, and developmental studies attempt to address a single or two facets of the food security dimension using a few metrics (Adane et al, 2023, Hidaru et al., 2023; Menza et al., 2014). But it is difficult, not impossible to address all multiple dimensions of food security in a single study.

Food and nutrition insecurity manifestations and metrics are multifaceted; thus, policies and interventions should have appropriate empirical evidence on all manifestations and dimensions of the food insecurity problem. According to the most commonly accepted definition articulated by the United Nations Food and Agricultural Organization, food security is achieved when all dimensions (availability, access, utilization, and stability) are addressed (FAO, 2002); hence, concepts, analyses, and policy interventions need to consider the diverse aspects of the food security issue. Most recent literatures strongly recommend combining more than one indicator (Headey & Ecker, 2012; D. Maxwell & Coates, 2012; Nathalie, 2012). Consistent with this, in this study, the Multidimensional Food Insecurity Index (MFI) is used to synthesize the

four dimensions of food security (availability, access, utilization, and stability) status in a composite index (Maxwell et al., 2013).

Composite measures like MFI enable the use of group indicators that capture different dimensions of food security in a single index. Hence, the techniques and indicators adopted differ from one another. For instance, a study adopted the MFI approach to measure the food security status of different world countries using timeline data from 1990–2009 (Napoli et al., 2011); Maxwell et al., (2013) also applied the MFI approach to measure the food security status in Tigray region of Northern Ethiopia; Gebrerufael (2019) measured multidimensional food security status of households in Ahferom district Tigray region by MFI using cross-sectional data. In another way, few others used more than one indicator separately at once to measure different dimensions of the food security status of households or another unit of analysis (Sandoval et al., 2020). The level and unit of analysis can vary from individual, community, region, and nation to global levels. Such a multifaceted data are relevant for designing food assistance programs and monitoring whether the already-launched programs are on the right track towards attaining the intended goal of reducing poverty and food insecurity in their multidimensional manifestations or not. This in turn helps to design a resilient and more sustainable food system in an ever-changing world. The majority of work done using composite measurements focused on national and global food and nutrition security at the macro-level. However, the current study has adopted composite MFI to fill the gap in the most common single indicator-based studies of measuring various dimensions of food security status at the household level. Besides this, in the study area of Chencha district, this study is new in its kind.

4.2. Research Methodology

4.2.1. Sampling Techniques and Sample Distribution

Chencha district is one of the food insecurity-stressed areas found in southern Ethiopia in general and the Gamo zone in particular. Food insecurity is exacerbated by fragmented landholdings, declining soil fertility, high population density, recurrent drought, irregular rainfall, and other factors. As a result, chronic and seasonal food insecurity is a critical development challenge in the area. However, the area has long been praised for its ability to endure the country's historical food crisis shocks without resulting in life losses (Desalegn, 1996. Abera et al, 2019). However, the causes and key sources of its ability to endure food instability and famine have yet to be

empirically proven.

In the Chencha district in particular and Southern Ethiopia in general, weaving and spinning are considered the second most important livelihood activity following small-scale agriculture which complements the food and income shortage households encounter due to very low agricultural production. As a result, this study was designed to investigate multidimensional household food security status in the Chencha district. In this study, households that based their livelihood system on income derived from weaving activity used as a target group of analysis. This study considered weaving activity as an important livelihood income alternative and source of household food security.

The study used a multistage sampling technique to choose the study district and sample households. In the first stage, the Chencha district was purposefully chosen because weaving is the most prevalent activity in the zone and the country in general. In the second stage, four kebeles were selected where weaving is dominantly practiced by running a scatter plot for all kebeles in terms of the numbers of households involved in weaving activity. In this regard, Doko Danbo, Doko Loosha, Lakana Maldo, and Setena Borcha were selected as sample kebeles. The sample respondents were chosen in the third stage using systematic random sampling techniques. Finally, the sample size of respondents was determined using the following formula proposed by Yemane (1967):

$$= \frac{}{2 + (\ )2}$$

Where,

N = the total population size,

n = the sample size and

e= the level of precision.

In this study, N=2485 and e=0.05 n=303. Then, the representative sample respondents were identified based on probability proportion to the population from four kebeles using systematic random sampling technique per each 8 household intervals. The study data were collected in 2022 from 303 sample rural households, 20 in-depth key informants, 6 focus group discussions, and substantiated by field observations and secondary document analysis.

4.2.2. Types and Methods of Data Collection

The study used cross-sectional data collection methods that included quantitative and qualitative data collection methods. This study relied on both primary and secondary data, which were quantitative and qualitative. As significant data-gathering methodologies, household surveys, focused group discussions (FGD), key informant interviews (KII), field observations, and secondary source analysis were used.

4.2.2.1. Key Informant Interview (KII)

Before conducting household surveys, intensive key informant interviews were employed with food security and early warning officers, health, education, social affairs, natural resource management officers and key informant households. Accordingly, 20 in-depth Key Informant Interviews (KII) were held with different stakeholders. The issues elaborated include: livelihood income sources, food security conditions at different social groups, major causes of food insecurity problem, food insecurity coping strategies, formal support systems, shocks and risks; access to and availability of basic livelihood options and services; and challenges.

4.2.2.2. Focused Group Discussion (FGD)

Six focus group discussions were held on March 10–20, 2022, to supplement the data acquired from the household survey: two in Doko Danbo, two in Doko Loosha kebeles, one in *Setena Boricha,* and one in *Lakana Maldo* kebeles, based on population size. It has consisted of 6–10 people who have extensive knowledge of the area's livelihood conditions and accompanying difficulties. Members of the group discussion comprised elders, women, and teenagers, taking into account the group's diversity and managing the participation of all members. The FGD addressed problems such as livelihood possibilities, constraints, food security conditions, livelihood shocks and stress, and potential sources of household resilience to food insecurity in the area.

4.2.2.3. Household Survey

A household survey has been conducted using a structured questionnaire that consists of 24 generic questions adopted from Maxwell *et al.* (2013). It combined six commonly used food security indicators, namely the Household Food Insecurity Access Scale (HFIAS), the Household Dietary Diversity Scale (HDDS), the Coping Strategy Index (CSI), the Reduced

Coping Strategy Index (rCSI), the Household Hunger Scale (HHS), and self-assessed food security status (SAFS). It addressed the issue of experiencing the most severe food insecurity conditions (household hunger scale and erosive food insecurity coping strategies), anxiety and uncertainty about food supply, reduced food quality and quantity, coping strategies, and self-assessed food security experiences. The survey process has been managed by trained enumerators under the close supervision of the researchers. The household survey data collection was done from March to April 2022 from 303 weaving-based households.

4.2.2.3 Field Observations

Transect walks were conducted throughout the research locations to observe people's livelihood situations, food consumption patterns, and current food security opportunities and difficulties. Secondary data were gathered by analyzing numerous published and unpublished secondary documents. The household survey was conducted by researchers and trained enumerators.

4.3. Data Analysis

Enough, wholesome, and secure food must be consistently available for consumption if people are to lead active, healthy, and productive lives. It states that everyone has an inalienable right to wholesome food, clothing, water, shelter, health care, and social protection (UN, 2015). However, famine, poverty, and food insecurity are the major social and economic problems facing human beings around the world. Governmental and non-governmental organizations are doing their level best to alleviate poverty and food insecurity. Since its establishment as a concept 50 years ago, there have been disparities among scholars in understanding and measuring food security conditions (Gebrerufael, 2019). As a result, food security has over 200 definitions and plenty of indicators. Meanwhile, the definition of the World Food Program of 1996 is the most commonly accepted one. Accordingly, food security is said to be achieved when all people, at all times, have physical, social, and economic access to adequate, safe, and nutritious food that helps to lead an active and healthy life‖ (FAO, 1996; Barrett, 2002). In this regard, food security studies are a matter of conceptualization and measurement. Hence, the concept and analysis of food security are multidimensional in subject (dimensions) and unit of analysis (global, national, household, or individual) (FAO, 2002).

There are multiple indicators available for food security measurement though most of them

attempt to address one or two dimensions of food security at a specific analysis level metrics (Maxwell and Smith, 1992, Adane Y. *et al*, 2023, Hidaru et al., 2023; Menza et al., 2014). This may fail to identify the actual nature of food security conditions and this in turn leads to misleading policy designing and intervention programs. As a result; many literatures underscore the adoption of composite indicators that enable measuring multiple dimensions of food security. Therefore; this study has adopted a multidimensional food insecurity composite index to fulfill the aforementioned gap. There are advantages to using multidimensional food Insecurity Index (MFI) over uni-dimensional ones. According to Maxwell *et al* (2013); MFI has three advantages; first, it captures multiple dimensions of food security; secondly, the indicator is highly responsive to food insecurity, detecting both moderate and severe signs of food insecurity, third, it stays away from arbitrary quantitative cut-offs for food security based on a raw score. Categorization of households into different food security categories is carried out carefully considering the severity of the food insecurity condition the household has experienced (Gebrerufael., 2019).

The Measurement process for MFI seems like the household food insecurity access scale (HFIAS) method which captures the behavioral experiences of households‘ prevalence of food insecurity within the last four weeks recalling period. Like HFIAS, it asks questions to capture whether the household has experienced a given condition or not. Then, for those who faced a given condition of food insecurity condition; it asks the frequency of occurrence within the last four weeks recalling period. Adopting HFIAS, there are four frequency of occurrence options within the recalling four weeks period; 1) ***Often*** (refers to occurrence of the condition more than 10 times; 2) ***Sometimes*** (implies occurrence of 3-10 times); 3) ***Rarely*** (implies the condition has occurred 1 or two times) and 4) ***Never*** (refers to non-occurrence of the condition). However, Unlike HFIAS, MFI does not give the severity and prevalence of household food security results in a continuous measure.

Rather, it provides food security conditions, severity, and prevalence of households in the specified recalling period based on their perceptions counting the occurrence of the condition and its frequency. Then, the result can be disaggregated into the percentage of households who experience each condition of food security condition. Accordingly, households were divided into four food security categories 1) Food secure, 2) Mildly food insecure, 3) Moderately food insecure, and 4) Severely food insecure (Maxwell et al., 2013; Gebrerufael, 2019).

Table 2: Multidimensional Food Security Categorization Procedure

MFI Food security category	Pre-conditions
Food Secure	If [(Q1–Q6 =Never) or (Q7-Q8=Often) or (Q9-Q13=Never) or (Q14-Q18=Never/Rarely), or (Q19= Food Secure/Mildly Food Insecure) or (Q20-Q24= Often/Sometimes/Rare)
Mildly Food Insecure	If [(Q7–Q8=Sometimes) or (Q9-Q13=Rarely) or (Q14 – Q18=Sometimes), or (Q19=Mildly Food Insecure), or (Q20-Q24=Never)
Moderately Food Insecure	If [(Q1-Q6=Rarely) or (Q7-Q8=Rarely) or (Q9-Q13=Sometimes) or (Q14-Q18=Often), or (Q19=Severely Food Insecure)
Severely Food Insecure	If [(Q1-Q6=Often/Sometimes), or (Q7 – Q8= Never) or (Q9-Q18=Often), or (Q19=Severely Food Insecure)]

Source: Maxwell et al (2013)

Households in Category 1 (***Food Secure***) should not encounter the worst conditions for the high-value food items; instead, they should experience favorable conditions for the first thirteen questions or second-best conditions for questions 14 through 19. Similarly, the mildly food insecure category only rarely worries about what to eat and experiences none of the first six extreme food insecurity conditions. These groups of households may not consume high-value foods during the designated recall period, such as meat, milk and milk products, fruits, or vegetable goods. On the other hand, households with ***moderate food insecurity*** status seldom face severe food insecurity conditions. However, severely food insecure categories of households experience the first six extreme food insecurity conditions (Table 2).

4.4. Results and Discussion

4.4.1. Descriptive statistics results

Households in Chencha district face a significant food deficit due to limited land (1.1 ha) and livestock (2.95 TLU) holdings (Table 3). They rely on weaving as an essential income source, with

90.75% using diverse income sources with an average annual income of 44,474.63 ETB[22]. Formal employment (75,025.66 ETB), weaving (38,162 ETB), and barber services (24,500 ETB) have higher average annual income returns. However, external shocks threaten livelihoods. Government-designed PSNP support helps address the strong seasonal food shortages by providing food for work and free aid access. As to Early warning office, Chencha district experiences 3-6 months of food shortages annually, primarily in April, May, June, September, and October. Coping strategies include transitory food aid, PSNP, soil and water conservations, and weaving activities.

Household survey result substantiated with key informant interview, focus group discussions and field observations revealed that drought, population pressure, food item price rises, COVID-pandemic, crop pests and livestock deaths contributed for food insecurity. Long-term risks include an excessive reliance on rain-fed agriculture, poor technological uptake, and soil erosion. 70% of respondents believe their current food consumption cannot be maintained if they face drought in the coming production season indicating strong vulnerability to food insecurity. As a result, the study investigated the multidimensional food security status of households. The tables 26 & 27 below show briefs of demographic and socio-economic results of the study.

Table 3: Demographic characteristics of the respondents

Demographic Characteristic		Frequency	Percent
Agro-ecology	Highland	276	91.1
	Midland	27	8.9
Sex of the hh	Male	278	91.7
	Female	25	8.3
Marital status of hh	Single	18	5.9
	Married	260	85.9

[2] ETB or Ethiopian Birr is the currency used in Ethiopia, 1 $ = 56.82 ETB

	Divorced	7	2.3
	Widowed	18	5.9
Access to education	Yes	217	70.96
	No	88	29.04
Educational category	No formal education	88	29.04
	Primary Education (1-6)	100	33
	Secondary education(7-10)	60	19.8
	Higher Secondary Education (11-12)	26	8.6
	Tertiary(College and Above)	29	9.57
Age category in years	Early working age (15-24)	23	7.59
	Prime working age (25-54)	174	57.43
	Mature working age(55-64)	53	17.49
	Elderly (65 and above)	53	17.49
PSNP Membership	Member on food for work	34	11.2
	Member on free access to food	7	2.3
	Not member	262	86.5

Source: Own Survey, 2022

Access to productive assets like land, labor, and livestock is crucial for household food security in rural areas. However, sample households have minimal landholding sizes and livestock holdings, attributed to declining landholding size and communal grazing lands (Table 4). Studies (Eshetu & Mekonnen, 2016) suggest an average household landholding size of 0.82 hectares, with minimal livestock holding of 2.8 in tropical units, attributed to declining landholding size and communal grazing lands.

Table 4: Demographic Characteristics of Respondents by Continuous Variables

Demographic characteristics	Mean
Age of the respondents	46.49
Family size	6.81
Productive labour size	3.78
Dependency Ratio	0.223
Years of formal education	5.54
Total Landholding size	1.11
Livestock size in TLU	2.95
Number of income sources adopted	4.53
Mean annual income	82,041

Source: Own survey, 2022

The area's income and food sources are largely derived from off-farm and non-farm livelihood activities because of the smaller amount of landholdings per population. The study shown that that 47.9% of respondents primarily rely on non-agricultural activities, while 52.1% rely on subsistence farming. Over 90% adopt multiple income sources, with only 8.25% focusing on one. About 13.5% of respondents received Productive Safety Net Program support.

4.4.2. Decompositions of Multidimensional Food Security Status

MFI measures food security using 24 perceptions based on behavioral food insecurity experiences. It combines HFIAS, CSI, FCS/HDDS, rCSI, and SAFS to capture all dimensions of food security status (Maxwell et al, 2013; Gebrerufael, 2019). Table 28 below shows distributions. MFI is a composite index that includes uni-dimensional indicators, providing separate and composite information on household food insecurity status. It disaggregates descriptive results on different dimensions.

a) ***Anxiety and uncertainty about the household food supply***

Like HFIAS, MFI measured whether and how frequently the households feel worried about food supply. The survey revealed that 84.8% of households are worried about their food supply, with only 15.18% not feeling worried about their food security (Figure 2).

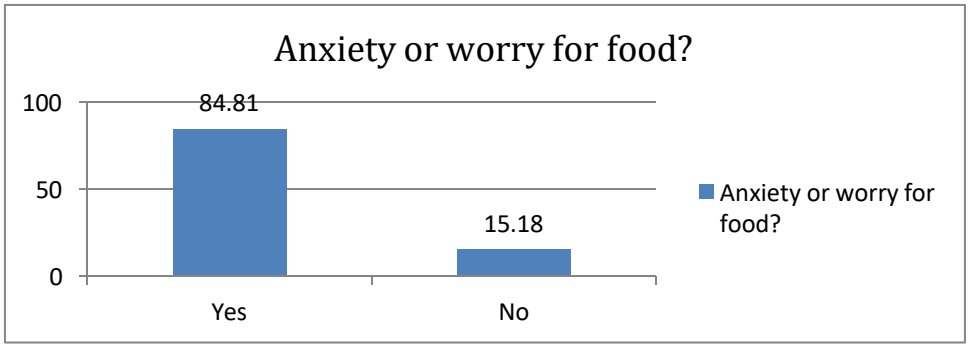

Figure 3: Do you worry that your household would not have enough food?

b) *Insufficient Quality*

Food security involves consuming enough quantity and quality of food. The MFI indicator measures food quality reduction, including not being able to eat preferred foods, having a limited variety, or not wanting certain foods. Table 4 shows the frequency of food insecurity. Table 4 shows that 57.55% of households consume food they do not want, 79.86% consume limited food variety, and 78.54% cannot eat their preferred foods frequently and sometimes.

c) *Food Consumption Score and Household Dietary Diversity*

The majority of respondents 38.28% and 40.59% consumed grain often and sometimes, with pulse consumption being relatively low, 5.28% and 16.17% at often and sometimes. High-value food items like milk, meat, eggs, fruits, and vegetables are consumed relatively low, with only 15.84% of respondents consuming dairy products and 9.9% eating eggs (Table 28). This low consumption of high-value food items implies low multidimensional food security.

d) *Household Hunger Scale* (*HHS*)

Table 5 shows that 35 (11.55%), 57 (18.81%), 62 (20.46%), 22 (7.26%), 4 (1.32%), and 15 (4.95%) households have experienced the first six most severe food insecurity conditions, causing them to fall under the severe multidimensional food insecure category.

Table 5: Descriptive Result of Multidimensional Food Security Perception

MFI indicator	Indicator Questions (30 days recall period)	Dimension measured	Response options							
			Often		Sometimes		Rarely		Never	
			Yes	%	Yes	%	Yes	%	Yes	%
1)HFIAS/HH	How often did you or any HH member have go a whole day without eating?	Quantity	13	4.29	22	7.26	24	7.92	245	80.86
2)HFIAS/HHS	How often did you or any HH member go to sleep at night hungry?	Stability	6	1.98	51	16.83	87	28.71	159	52.48
3)HFIAS/HHS	How often was there ever no food in your HH?	Quantity	12	3.96	50	16.50	94	31.02	147	48.51
4)CSI	How often has the HH had to skip entire days without eating?	Quantity	5	1.65	17	5.61	34	11.22	248	81.85
5)CSI	How often has the HH had to send HH Members to beg?	Quantity	2	.66	2	.66	1	.33	298	98.35
6)CSI	How often has the HH had to send HH members to eat elsewhere?	Quantity	3	.99	12	3.96	71	23.43	217	71.62
7)FCS/HDDS	How often has the HH eaten any pulses?	Quality/Diversity	16	5.28	49	16.17	141	46.53	97	32.01
8)FCS/HDDS	How often has the HH eaten any food made from grain?	Quality/Diversity	116	38.28	123	40.59	43	14.19	21	6.93
9)CSI	How often has the HH had to consume seed stock held for next season?	Quantity	87	28.71	112	36.96	35	11.55	69	22.77
10)CSI	How often has the HH had to gather wild food, hunt, or harvest immature crops?	Quantity	60	19.80	93	30.69	47	15.51	103	33.99
11)CSI	How often has the HH had to purchase food on credit?	Quantity	23	7.59	47	15.51	66	21.78	167	55.12
12)CSI/rCSI	How often has the HH had to borrow food, or rely on help from a relative?	Quantity	16	5.28	38	12.54	58	19.14	191	63.04
13)HFIAS	How often did you or any HH member have to eat foods you did not want to eat?	Acceptability	77	25.41	98	32.34	63	20.79	65	21.45
14)HFIAS	How often did you or any HH member have to eat a limited variety of foods?	Quality/Diversity	116	38.28	126	41.58	41	13.53	20	6.60
15)HFIAS	How often were you/any HH member not able to eat the kinds of foods you preferred?	Acceptability	124	40.92	114	37.62	37	12.21	28	9.24
16)CSI/rCSI	How often has the HH had to reduce the number of meals eaten in a day?	Quantity	105	34.65	132	43.56	36	11.88	30	9.90
17)CSI/rCSI	How often has the HH had to limit the portion size at meal times?	Quantity	96	31.68	148	48.84	35	11.55	24	7.92
18)HFIAS	How often did you worry that your HH would not have enough food?	Stability	60	19.80	135	44.55	62	20.46	46	15.18
19)SAFS	Self-assessed food security during the past 30 Days	Stability	46	15.18	140	46.20	100	33.00	17	5.61
20)FCS/HDDS	How often has the HH eaten any dairy Products?	Quality/Diversity	9	2.97	39	12.87	92	30.36	163	53.80
21)FCS/HDDS	How often has the HH eaten any eggs?	Quality/Diversity	5	1.65	25	8.25	60	19.80	213	70.30

22)FCS/HDDS	How often has the HH eaten any meat, or fish?	Quality/Diversity	1	.33	9	2.97	92	30.36	201	66.34
23)FCS/HDDS	How often has the HH eaten any fruits?	Quality/Diversity	1	.33	13	4.29	96	31.68	191	63.04
24)FCS/HDDS	How often has the HH eaten any vegetables?	Quality/Diversity	96	31.68	133	43.89	47	15.51	27	8.91

* = Food Secure *=Mildly Food Insecure ♥= Moderately Food Insecure ♦= Severely Food Insecure

Source: Own Compilation from survey, 2022

e) *Food Insecurity Coping Strategy*

The study examined households' coping strategies for food insecurity using MFI questionnaires, which are destructive and non-destructive strategies. Regarding adoption of non- destructive (acceptable) coping strategies, 34.65% and 43.56% reduced meal numbers often and sometimes, while destructive coping strategies included 7.26% skipped meals for entire days, 1.32% begging, 4.95% eating elsewhere, 65.67% consuming seed stock, 50.49% gathering wild food, 23.1% purchasing food on credit, and 17.82% borrowing food or relying on relatives often and sometimes (figure 5).

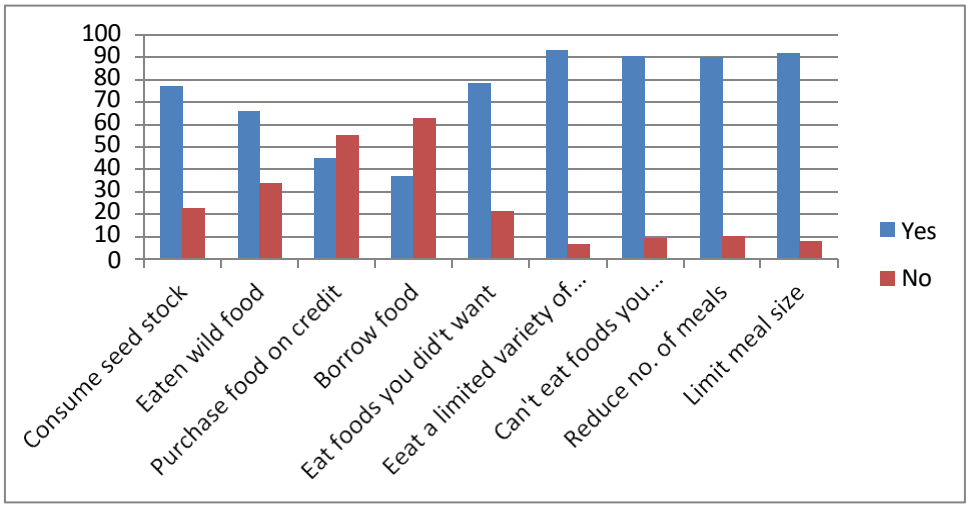

Figure 4: Food Insecurity Coping Strategy Adopted by the Households

f) *Self-Assessed Food Security Status*

The survey revealed that 13.53% of sample households felt food secure, while 38.14%, 35.64%, and 11.88% felt mildly, moderately, and severely insecure, with 84.82% identifying as multidimensional food insecure.

4.4.2. Multidimensional Household Food Security Status

The MFI indicator categorizes households' food security status into four levels: food secure, mildly insecure, moderately insecure, and severely insecure, using 24 questions to assess frequency of food insecurity conditions (Maxwell et al., 2013; Gebrerufael, 2019). The frequency of occurrences was re-coded as 'Often=1', 'Sometimes=2', 'rarely=3', and 'Never=4', where;

Often: households have experience food security conditions more than 10 times in the last four weeks.

Sometimes: implies experiences of food security conditions 3-10 times.

Rarely: households experience the condition for 1-2 times.

Never: refers to the non-occurrence of the condition.

The determination procedures and the characteristics of households in each category are discussed as follows;

Food Secure (Category 1): Food-secure households should have favorable conditions for the first 13 questions and second-best conditions for questions 14-19, but not experience severe food insecurity indicators for questions 1-6; like hunger and starvation, going a whole day without eating, going to bed hungry, absence of food at home, skipping entire days without eating, begging, or going elsewhere to eat. They should not consume seed stock, gather wild foods, borrow food, or purchase credit. They should at least consume milk, meat, eggs, fruits, and vegetables occasionally.

MFICategory1=IF(AND(Q1=4,Q2=4,Q3=4,Q4=4,Q5=4,Q6=4,Q7=1,Q8=1,Q9=4,Q10=4

,Q11=4,Q12=4,Q13=4,Q14>2,Q15>2,Q16>2,Q17>2,Q18>2,Q19>1,Q20<4,Q21<4,Q22<4,Q23<4,Q24<4),"1"))

About 5.28% of individuals in the last four weeks are multidimensional food secure, despite food shortages due to declining landholding size as indicated by key informants and focus group discussants. Livelihood diversification into off-farm activities like weaving, trade, and daily labor is reported as the main livelihood-supporting strategy (Table 6).

Mildly Food Insecure (Category 2): Mildly food insecure households are those without extreme food insecurity but worry about food choices on rare occasions. They may consume a monotonous diet, borrow food, reduce meals, and avoid high-value food items like milk, eggs, fish, meat, fruits, and vegetables. It is defined by using the command;

MFICategory2=IF(OR(Q7=2,Q8=2,Q9=3,Q10=3,Q11=3,Q12=3,Q13=3,Q14=2,Q15=2,Q16=2,Q17=2,Q18=2,Q19=3,Q20=4,Q21=4,Q22=4,Q23=4,Q24=4),"2"))

The MFI survey revealed that 18.48% of households were mildly food insecure within four

weeks. They consume limited carbohydrate sources, root crops, grain products, and vegetables, with high-value items rarely consumed, resulting in small proportions falling under this category.

Table 6: Multidimensional Food Insecurity Status of Households

MFI Category	No. of respondents	Percent
Food Secure	16	5.28
Mildly Food Insecure	56	18.48
Moderately Food Insecure	31	10.23
Severely Food Insecure	200	66.01
Total	303	100

Source: Compilation from own survey, 2022

Moderately Food Insecure (Category 3): Those households that are rarely experiencing extreme food insecurity, such as hunger and starvation, may consume less desirable food items, collect wild or immature foods, borrow food, reduce meal numbers, and compromise food preferences. They may also experience anxiety about food. However, they never consume high-value food items. The statistical data indicates that 10.23% of the respondents' families are moderately food insecure. It is defined by the following statistical commands;

MFICategory3=IF(OR(Q1=3,Q2=3,Q3=3,Q4=3,Q5=3,Q6=3,Q7=3,Q8=3,Q9=2,Q10=2, Q11=2, Q12=2, Q13=2,Q14=1,Q15=1,Q16=1,Q17=1,Q18=1,Q19=4),"3"))

Severely Food Insecure (Category 4): as can be observed from figure 4 below, severe food-insecure households often or sometimes experience extreme conditions like running without food, begging, and eating elsewhere (Figure 6). They consume monotonous food items and rely on aid (PSNP). This category is determined using a command;

MFICategory4=IF(OR(Q1<3,Q2<3,Q3<3,Q4<3,Q5<3,Q6<3,Q7=4,Q8=4,Q9=1,Q10=1,Q11=1,Q12=1, Q13=1),"4"))

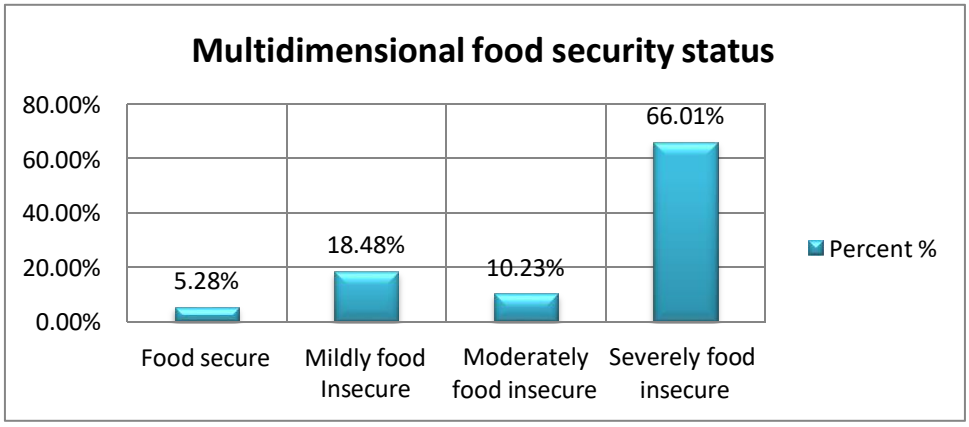

Figure 5: Multidimensional Food Security Status of Households

The key informant interviews confirm that the most severely food insecure households in Chencha district are those without land, orphans, the elderly, women, and children. Additionally, a lack of labor capacity exposes them to extreme food insecurity. About 200 (66.01%) households were found to be under severe conditions in the four-week recall period (Table 6).

4.4.3. Socio-economic Characteristics Affecting Multidimensional Food Insecurity Status

4.4.3.1. Dummy and Categorical Variables

This study investigates the differences in multidimensional food insecurity across different socioeconomic and demographic factors in households. It categorizes households into four groups: food secure, mildly food insecure, moderately food insecure, and severely food insecure. The dynamics of food security status across various socio-economic levels were examined using chi-square and one-way ANOVA tests (Tables 7 and 8).

Table 6 shows that 95.83 % of multidimensional food secures and mildly food insecure households are male-headed, with 88% of female-headed households being food insecure. However, chi-square confirms this difference is not statistically significant. About 81.25% of food-secure households have formal education, and 100% have an acceptable food consumption score (>35). The study suggests that households with male-headed households, better access to formal education, and acceptable food consumption scores have better multidimensional food security.

The Productive Safety Net Program (PSNP) is not utilized by all multidimensional food-secure

households, and none of its participants are food-secure, though this is not statistically significant. Most weaving-based households rely on agriculture but have limited access to FTC and DA services, with 19.14% and 22.44% respectively.

Table 7: MFI index Descriptive statistics (Dummy and Categorical Variables)

Variables	Category	Level of Multidimensional food insecurity										X^2-Value
		Food Secure (n=16)		Mildly Food Insecure (n=56)		Moderately Food Insecure (n=31)		Severely Food Insecure (n=200)		Total (303)		
		N	%	N	%	N	%	N	%	N	%	
Sex	Male	160	5.28	53	17.49	30	9.9	179	59.07	278	59.06	0.219
	Female	0	0	3	0.99	1	0.33	21	6.93	25	8.25	
Access to education	Literate	13	4.29	47	15.51	18	5.94	139	45.87	217	71.62	8.148[a]***
	Illiterate	3	0.99	9	2.97	13	4.29	61	20.13	86	28.38	
Food consumption Score	Acceptable	16	5.28	50	16.50	22	7.26	157	51.82	245	80.86	10.710[a]
	Borderline	0	0	6	1.98	6	1.98	30	9.9	42	13.86	
	Poor	0	0	0	0	3	0.99	13	4.29	16	5.28	
PSNP Membership	Non-member	16	5.28	54	17.82	26	8.58	166	54.79	262	86.47	11.196[a]
	Food for Work	0	0	2	0.66	5	1.65	27	8.91	34	11.22	
	Free Aid	0	0	0	0	0	0	7	2.31	7	2.31	
Access to credit	Yes	8	2.64	7	2.31	3	0.99	28	9.24	46	15.18	16.323[a]
	No	8	2.64	49	16.17	28	9.24	172	56.77	257	84.81	
FTC services	Yes	4	1.32	7	2.31	4	1.32	43	14.19	58	19.14	3.449
	No	12	3.96	49	16.17	27	8.91	157	51.81	245	80.86	
Access to DA Services	Yes	9	8.98	15	4.95	8	2.64	37	12.21	69	22.77	12.947[a]***
	No	7	2.31	41	13.53	23	7.59	163	53.8	234	77.23	
HH resilience level	Non-resilient	4	1.32	24	7.92	17	5.61	134	44.22	179	59.07	26.978[a***]
	Moderately resi.	5	1.65	21	6.93	7	2.31	43	14.19	76	25.08	
	Resilient	5	1.65	6	1.98	6	1.98	16	5.28	33	10.89	
	Highly resil.	2	0.66	5	1.65	1	0.33	7	2.31	15	4.95	
Access To mobile	No	0	0	18	5.94	11	3.63	111	36.63	140	46.20	26.583a***
	Yes	16	5.28	38	12.54	20	6.6	89	29.37	163	53.79	
Disability	No	16	5.28	55	18.15	23	7.59	183	60.39	277	91.42	16.525[a***]
	Yes	0	0	1	0.33	8	2.64	17	5.61	26	8.58	
Ill-member	Yes	2	0.66	14	4.62	6	1.98	43	14.19	65	21.45	1.260
	No	14	4.62	42	13.86	25	8.25	157	51.81	238	78.54	
Access To salary	No	14	4.62	50	16.50	25	8.25	191	63.04	280	92.4	10.168[a**]
	Yes	2	0.66	6	1.98	6	1.98	9	2.97	23	7.59	
Access To support	No	2	0.66	5	1.65	13	4.29	58	19.14	78	25.74	15.112***
	Yes	14	4.62	51	16.83	18	5.94	142	46.86	225	74.25	
Kebeles	Doko Danbo	4	1.32	14	4.62	8	2.64	70	23.10	96	31.68	24.189[a]***
	Doko Losha	7	2.31	24	7.92	12	3.96	33	10.98	76	25.08	
	Setena Boricha	3	0.99	8	2.64	4	1.32	48	15.84	63	20.79	
	Lakana Maldo	2	0.66	10	3.3	7	2.31	49	16.17	68	22.44	
Agro-ecology	Midland	1	0.33	1	0.33	0	0	25	8.25	27	8.91	9.849[a]**
	Highland	15	4.95	55	18.15	31	10.23	175	57.75	276	91.09	

Age category	15-24	2	0.66	6	1.98	1	0.33	14	4.62	23	7.59	4.170
	25-54	10	3.3	29	9.57	20	6.6	115	37.95	174	57.43	
	55-64	1	0.33	11	3.63	5	1.65	36	11.88	53	17.49	
	>65	3	0.99	10	3.3	5	1.65	35	11.55	53	17.49	
Marital status	Single	1	0.33	1	0.33	2	0.66	14	4.62	18	5.94	11.377[a]
	Married	15	4.95	54	17.82	28	9.24	163	53.79	260	85.80	
	Divorced	0	0	0	0	0	0	7	2.31	7	2.31	
	Widowed	0	0	1	0.33	1	0.33	16	5.28	18	5.94	
Main Occupation	Farming	4	1.32	25	8.25	8	2.64	121	39.93	158	52.15	58.943[a]***
	Weaving	5	1.65	24	7.92	19	6.27	69	22.7	117	38.61	
	Petty trading	0	0	0	0	0	0	3	0.99	3	0.99	
	Trade	2	0.66	2	0.66	0	0	2	0.66	6	1.98	
	Unemployed	1	0.33	1	0.33	2	0.66	2	0.66	6	1.98	
	Formal (Civil)	3	0.99	2	0.66	2	0.66	1	0.33	8	2.64	
	Others	1	0.33	0	0	0	0	2	0.66	5	1.65	
Education Level	No education	3	0.99	9	2.97	13	4.29	63	20.79	88	29.04	28.290[a]**
	Grades 1-6	1	0.33	25	8.25	8	2.64	66	21.78	100	33	
	Grades 7-10	7	2.31	9	2.97	3	0.99	41	13.53	60	19.8	
	Grades 11-12	1	0.33	4	1.32	4	1.32	17	5.61	26	8.58	
	College & abov)	4	1.32	9	2.97	3	0.33	13	4.29	29	9.57	
Livelihood Choices	On-farm	0	0	5	1.65	1	0.33	11	3.63	17	5.61	21.717
	Off-farm	0	0	0	0	0	0.33	1	0.33	1	0.33	
	Non-farm	1	0.33	6	1.98	5	1.65	33	10.89	45	14.85	
	ON+OF	1	0.33	2	0.66	0	0	0	0	3	0.99	
	ON+NON	11	3.63	35	11.55	22	7.26	111	36.63	179	59	
	OF+NON	0	0	2	0.66	0	0	4	1.32	6	1.98	
	ON+OF+NON	3	0.99	6	1.98	3	0.99	40	13.20	52	17.16	

Source: Own compilation from the survey, 2022

The Chi-square test revealed that 75% of multidimensional food-secure households are resilient to food insecurity, while 25% lack resilience. The test showed a significant difference in household resilience index between food secure, mildly, moderately, and severely food-secure households ($p<1\%$).

The study found significant differences in access to cell phone ownership, disability, formal employment, support services, kebele, and agro-ecology between MFI food insecurity categories at less than 1 and 5 percent. Of the 16 multidimensional food-secure families, all have access to mobile phones. However, 43.75% of food-secure households were from Doko Loosha Kebele. Nonetheless, the highland agro-ecology of the research area is home to the vast majority of 93.75% of the food-secure households.

There are statistically meaningful differences at $p<1\%$ in terms of main livelihood sources, with weaving and subsistence farming, accounting for 62.5% of food-secure households, having larger multidimensional food security family proportions than other livelihood activities, indicating their significant role in household food security.

The Chi-square test found a significant difference in multidimensional food security categories at $p<0.05$ level in terms of educational attainment, with 75% of food-secure households having completed secondary and tertiary education. This implies that a better food security is more likely to be possessed by people who have finished more years of formal schooling.

Additionally, 68.75% of households combine "on-farm and non-farm" livelihood strategies, resulting in 87.5% of multifaceted, food-secure households with greater food security. The study indicates that individuals who engage in various farming, off-farm, and non-farm activities tend to have better food security than those who did not.

4.4.3.2. *Socio-economic and Demographic Differences among MFI Categories*

This study examines the socioeconomic characteristics of households across various food insecurity categories using a one-way ANOVA, revealing significant disparities within various categories due to differences in various demographic and socio-economic attributes (continuous) (Table 8). As illustrated in Table 31, one-way ANOVA results show significant socio-economic

differences in households across food security categories, with p-values less than 0.05 for variables like total livestock holding, weaving income, total household income, family size, social safety net index, and resilience index.

The study found that food-secure and slightly food-insecure households have a lower mean age of household heads compared to moderately and severely food-insecure groups, and the difference is significant at $p<1$ percent. Thus, younger households are more likely to achieve better food security. Food-secure households also have higher educational attainment, while severe food-insecure households have higher years of schooling. Food-secure households have a larger mean productive labor size than mild and moderately food-insecure categories, with a statistically significant difference among MFIs at $p<0.05$ implying that an increased number of productive laborers enhances the food security status of households.

Table 8: Socio-economic Factors across Multidimensional Food Insecurity Status (Continuous Variables)

Covariates	MFI status of households				
	Food secure (n=16)	Mildly Food Insecure (n=56)	Moderately Food Insecure (n=31)	Severely Food Insecure (n=200)	Total (n=303)
Age of the respondents					*F=0.456***
Mean	42.19	46.07	48.13	46.69	46.49
Std. Dev.	16.359	15.715	18.749	17.176	16.997
Household head formal education (Years)					*F=0.743***
Mean	8.94	6.41	4.94	5.12	5.54
Std. Dev.	5.579	5.761	5.465	4.750	5.131
Total family size					*F=0.885***
Mean	6.62	6.23	7.13	6.94	6.81
Std. Dev.	1.784	2.960	3.973	3.089	3.114
Productive labor					*F=1.693***
Mean	3.81	3.54	3.13	3.95	3.78
Standard Dev.	1.834	1.991	1.910	2.166	2.101
Children's size in HH					*F=0.300****
Mean	2.50	2.07	2.10	2.17	2.16
Std. Dev.	0.966	1.725	1.513	1.671	1.632
An. Agr'al expenditure					*F=1.616*
Mean	3031.25	2549.29	1516.29	1940.16	2066.98
Std Dev.	2704.248	4489.680	1871.713	2430.139	2899.630
Annual food Expense					F=1.027
Mean	31675.00	26506.79	17742.39	25658.07	25322.80
Std Dev.	17673.879	20314.284	10737.080	32833.307	28650.440
Total Livestock holding					F=0.091
Mean	2.88	2.80	2.81	3.02	2.95
Std Dev.	2.941	2.604	3.027	3.374	3.175
Total Weaving Income					*F=5.470***
Mean	62745.00	35410.16	23145.16	29100.	31433.60
Std Dev.	74001.055	45315.838	27744.992	26750.03	35489.38
Total household income					*F=5.352****
Mean	142503.75	108724.64	63653.84	72582.80	82041.16
Std Dev.	141621.79	149526.11	61443.00	59992.42	90743.005
FCS					*F=4.651****
Mean	74.6250	63.3125	50.2581	56.1800	57.8663
Std Dev.	22.46524	22.46524	21.56265	25.86722	25.15162
Dependency Ratio					*F=0.750*
Mean	0.45863	0.39743	0.41971	0.38251	0.39309
Std Dev.	0.178164	0.270261	0.205644	0.217429	0.224965
Household resilience Index					F=7.093***
Mean	0.44148618 1	0.137166039	-0.0226947	-0.07020769	0.00000000
Std Dev.	0.46069985 91	0.571179197	.53905185	0.464048823	0.507791510
Income & Food Access Index					*F=11.44****
Mean	0.36410842 5	0.134972384	0.1963857	0.03648115	0.00000003
Std Dev.	0.21231288	0.321328009	0.2161633	0.403094248	0.384700993
	5				

Non-agr'al Asset Index					*F=14.95***
Mean	0.5493543	0.211682248	-.00593735	-.1022991	-0.00000004
Std Dev.	0.45658669 1	0.59641785	0.4711124	0.410487071	0.489334151
Social Safety Net Index					*F=2.938***
Mean	0.15130137 5	0.079436525	-.02027449	-.031203784	0.000000005
Std. Dev.	0.17913586 51	0.282855537	0.2856149	0.34819711	0.327458327

Source: Own survey, 2022

The study found that total weaving income in ETB significantly varies across different MFI categories (food secure, mildly food insecure, moderately food insecure, and severely food insecure) (F3, 299 = 5.470, p<0.001). The mean weaving income of food-secure households was significantly higher than that in other food security categories. Post-hoc comparisons indicated that the mean weaving income of food-secure households (M = 62745.00 SD = 74001.055) differed significantly from mildly food-insecure households (M = 35410.16 SD = 45315.16), moderately food-insecure households (M = 23145.16 SD = 27744.99), and severely food-insecure households (M = 29100.00 SD = 26750.03). However, no significant differences were detected among the mildly food insecure, moderately food insecure, and severely food insecure groups. This suggests that increasing revenue from weaving as a vocation can enhance multifaceted food security, suggesting that enhancing weaving income could be beneficial.

A one-way ANOVA test result (F3, 299=4.651, p<0.003) revealed statistically significant mean FCS differences within MFI levels. The Tukey test revealed significant differences in the mean food security score (FCS) between food-secure (M = 74.6250, SD = 22.46524) and moderately (M = 50.2581, SD = 21.56265) and severely food insecure (M = 56.1800, SD = 25.8663) households, but no significant difference was found between food-secure and mildly food-insecure households.

The one-way ANOVA test showed significant differences in the mean total household income from all sources of multidimensional food security groups (F3, 299=5.352, p<0.001). Tukey post-hoc test revealed that there is significant within group difference between food secure (M = 142503.75, SD = 141621.788) and moderately food insecure households (M = 63653.84, SD = 61443.00) at p=0.22 and severely food-insecure households (M = 72582.8, SD = 59992.415) at the p=0.014 significance level. Whereas mildly food insecure groups (M = 108724.64, SD =

149526.11) differ from severely food insecure groups (M = 72582, SD = 59992.42) at p=0.038. Food-secure households have higher mean total income compared to mildly and moderately food-insecure households, indicating improved multidimensional food security.

The hypotheses that mean household resilience scores vary across multidimensional food security categories are examined adopting one-way ANOVA. The ANOVA test revealed significant differences between MFI groups (F3, 299 = 6.050, P<0.001). The intra-category test using Tukey post-hoc test shown that the household resilience score in the food secure group (M= 0.4415, SD = 0.4607) meaningfully differs from moderately food insecure households (M = -0.0223, SD = 0.5391) at P = 0.013 and severely food insecure households (M = -0.07020769, SD = 0.4640) at p = 0.000. The study found a significant difference in household resilience scores between mildly (M = 0.1372, SD = 0.5712) and severely (M = -0.0702, SD = 0.4640) food-insecure households, with a p-value of 0.029. However, there was no statistically significant difference in mean resilience scores between food-secure and mildly food-insecure households. The lack of significant difference in food security status between mildly food insecure and food secure groups could be attributed to this.

Furthermore, a one-way ANOVA test shown that there is significant mean income and food access score (IFA) among MFI groups (F 2, 299 = 11.443, p<0.0001). Moreover, food-secure households (M = 0.3641, SD = 0.2123) differ significantly from severely food-insecure households (M = -0.0365, SD = 0.4031) at p = 0.000 and from moderately food-insecure households (M = -0.1964, SD = 0.2162) at p = 0.000 in terms of resilience score, according to a post-hoc test. The data indicates that there is a significant difference (p < 0.011) between the mean income and food access index (IFA) of households classified as mildly food insecure (M = 0.1349, SD = 0.3213), moderately food insecure (M = -0.1964, SD =0.2162), and severely food insecure (M = -0.0365, SD = 0.4031).

Similarly, the mean difference between MFI categories was examined using a one-way ANOVA, with the non-agricultural asset index and Social Safety Net serving as aspects of measuring household resistance to food insecurity. The findings demonstrated a significant difference in the mean scores for access to social safety net (F3, 299=2.938, p<0.034) and non- agricultural asset access (F3, 299=14.950, p=0.000) among MFI categories. This suggests that access to social safety nets and ownership of non-agricultural assets varies throughout households (Table

8).

4.5. Conclusion and Recommendations

4.5.1. Conclusion

The study used the multidimensional food security index (MFI) to assess households' food security status, categorizing them into four statuses: food secure, mildly insecure, moderately insecure, and severely insecure. The study found that only 5.3% of households are multidimensional food secure, with 76.2% experiencing moderate to severe food insecurity. Qualitative interviews and focus group discussions attest a 3-6 month food shortage annually.

The MFI indicator measures food security issues such as; anxiety, uncertainty, insufficient quality, diversity of food consumption, household hunger, coping strategies, and self-assessed food security status. Regarding anxiety or worry about food supply, majority of households (84.8%) in the area are anxious and uncertain about their food supply, indicating a significant concern about food insecurity. In terms of compromising quality and preferences of food consumed, 57.75% of households eat food they do not want to eat, 79.86% consume a limited food range, and 78.54% of households cannot afford desired food.

Based on type of food consumed, MFI shows 78.87% of households regularly consume grains-based food, while 21.45% rarely or frequently consume pulses. However, only 15.84% consume high-value foods like milk and milk products, meat, eggs, fish, fruits, and vegetables. In response to threatening food scarcity, around 78.21% of households are reducing the frequency of their daily meals from often to sometimes as a coping strategy. More painful strategies adopted include skipping entire days without eating (7.26%), consuming seed stock held for next season (65.67%), relying on wild food and immature crops (50.49%), and borrowing food or relying on help from relatives (17.82%).

The self-assessed food security situation revealed that 15.18% of respondents were food secure, while 84.82% were found to be food insecure at mild, moderate, and severe levels. About 11.55%, 18.81%, 20.46%, 7.26%, 1.32%, and 4.95% households have experienced the first six (1-6) most severe food insecurity conditions, often more than 10 times or sometimes 3-10 times, within a four-week recall period.

The study found significant variations in households' food security across various factors such as access to education, cell phone use, disability availability, livelihood sources and combinations, and resilience categories. The study found significant mean differences in household attributes across MFI categories, including family size, livestock holding size, head age, weaving income, total household income, food access index, social safety net index, and household resilience index.

4.5.2. Recommendation

The MFI analysis reveals a severe food insecurity issue due to fragmented land, population pressure, small livestock, low credit use, lack of job for youth (female), drought, and inadequate transport facilities. The study indicates that achieving multidimensional food security is influenced by the availability and accessibility of essential social, economic, and demographic factors. Households with higher education, access to mobile services, formal employment, use weaving and farming, and non-farm livelihood activities show improved multidimensional food security.

Increased livestock holding, weaving income, total household income, family size, resilience index, and social safety net index, and income and food access is found to improve multidimensional food security status. As a result, this study suggests essential policy recommendations for the concerned bodies. Hence, enhancing and achieving multidimensional food security status needs investing, improving access to quality education, and improving crop diversity and productivity through the adoption of agricultural technologies. Due to the small landholding size, livelihood diversification out of farming, along with other farming activities like weaving, trade, and formal employment, is strongly recommendable. Regarding farming activity, in the case of a very fragmented landholding size, well-managed, technology-supported, and demand-driven livestock production intensification was found to be very effective in the foreseen future. Considering its undesirable impact as a lasting solution for food insecurity problem, the role of the productive safety net program, which addressed the majority of the district Kebeles, needs to get recognition. However, still improving inclusion, exclusion, graduation, and the implementation scope can have a significant role in combating persistent food shortages in the area.

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CHAPTER FIVE: LIVELIHOOD DIVERSIFICATION STRATEGIES AND FOOD SECURITY IN THE WEAVING-BASED LIVELIHOOD SYSTEM OF GAMO ZONE, SOUTHERN ETHIOPIA

Abstract

Background: Livelihood diversification refers to the process by which households earn their living through a variety of economic endeavors, including non-farm revenue-generating businesses, entrepreneurship, and off-farm jobs. It serves to improve livelihood sustainability, increase household resilience, share risks, generate employment opportunities in the non-farm sector, and lessen issues of poverty and food insecurity. However, little research has been done on the relationship, status, and influencing factors on food security and livelihood diversification. In this regard, this study aims to investigate livelihood diversity, determinants and its linkage with household food security in the Chencha district of Southern Ethiopia.

Methods: Quantitative and qualitative data were collected from 303 randomly selected households using surveys, key informant interviews, focus group discussions, and observation. Data was analyzed by using descriptive statistics and the Herfindahl-Hirschman Index. The link between livelihood diversification and food security status of households was determined by pearson‘s correlation coefficient.

Results: the result revealed that subsistence farming (52.1%) and weaving (38.6%) activities were reported as the primary and secondary main income sources of households. A majority of households (90.7%) diversified their livelihood income sources. Based on income share, non-farm, on-farm, and off-farm income sources contributed, 72.96%, 25.3%, and 1.74% of total household income, respectively. Formal employment, weaving, barber/hairdresser, cattle production and sale, cereal production, and vegetable production (Potato) were highly paying livelihood activities in order. Households who combined on-farm, off-farm, and non-farm have gained far larger mean income followed by on-farm and non-farm strategies. Ordered Probit model results showed that landholding size, livestock holding size, and access to farmer training center (FTC) have positively affected the extent of livelihood diversification. Positive association was found between livelihood diversification and the food security status of households.

Conclusion: Thus, the majority of weaving-based livelihood groups diversify their livelihood

activities to on-farm, off-farm, and non-farm activities. Hence, supporting the weaving activity and motivating females‘ participation, increasing other livelihood options, and modernizing the system with appropriate training, education, and market linkage seems inevitable.

Keywords: Chencha Zuriya district, Food security, Herfindahl-Hirschman Index (HHI), livelihood diversification, weaving.

5.1. Introduction

While income diversification and migration play important roles in the poor's livelihoods, policymakers have ignored the off-farm and non-farm sectors in favor of agriculture (Carswell, 2000). Even though rural households' livelihoods in most developing countries are inextricably linked to the agricultural sector, agriculture has failed to become the primary source of livelihood for rural households in Sub-Saharan Africa (SSA) countries (Babatunde, R. O., 2013). This is due to increased vulnerability to poverty and food insecurity as a result of rapid population growth and associated decline in landholding size (Adugna, 2005). According to Jirsttrom *et al*. (2011), agriculture in SSA countries is rain-fed, with decreasing land size, low output per farm, and is subsistence-based. Reynolds et al, (2007), overdependence and overexploitation of nature result in environmental degradation, declining production, and food insecurity, forcing households to seek alternative livelihoods. Conventionally it is believed that the livelihood system in rural areas is purely agricultural; with crop and livestock production (Niehof A. (2004). Nevertheless, off-farm and non-farm activities play an important role in the economy, poverty reduction, and food security (Lanjouw *et al*; 2013). In rural Africa, off-farm income accounts for 40 to 45% of average household income and is positively related to well- being (Barrett et al., 2006). However, its role is not supported by policy focus.

Agriculture, as in other Sub-Saharan African countries, is the mainstay of the Ethiopian economy (World Bank, 2008). It contributes 41.4% of the country's GDP, 83.9% of total exports and employs 80% of labour force in the country (Matousa et al., 2017 as cited in Ahmed, 2024).However, 95% of it is done on a small scale, on less than 0.5 hectares, with the majority used for home consumption (Fikremarkos, M. B., 2012). Arega *et al*. (2013). It is rain-fed, vulnerable to recurrent drought that occurs every three years, crop and animal pests and disease, land degradation, and seasonal fluctuation (FAO, 2015; CSA, 2020). This has resulted in a 10% decrease in agricultural production and a 10% increase in food insecurity (UNICEF, 2014). As a result, achieving food security and coping with recurring risks will be impossible unless the livelihood system is diversified to include off- farm and non-farm activities (Emanuel E., 2011). Increasing household capacity to withstand livelihood shocks and stresses improve livelihood sustainability and food security (Ayalneh, B., 2002; Farrington; Farrington et al., 2002; Dai *et al*., 2020).

Ethiopia has a diverse topography and agro-ecology, making it suitable for a wide range of animal and crop adaptations. However, Ethiopia is one of the poorest agrarian countries in the world, with the majority of its population residing in the highlands (Woldeamlak B., 2007). The country is one of the poorest in Sub-Saharan Africa (UNDP, 2007), owing to rapid population growth (Degefa T., 2005; Abera U., 2014). Food insecurity is a problem in Ethiopia's highlands, where population growth has resulted in smaller landholdings Abera U. (2014). Rural livelihood diversification is the process of constructing a diverse portfolio of activities and social support capabilities to maintain or improve living and managing risk, (Carswell et al., 2000; Start, D. and Johnson, C., 2004). It can also be articulated as an act of expanding the rural households‘ income activities to different sectors (Loison, S. A., & Loison S. A., 2016; Saha, B., & Bahal, R., 2012). Categorization of diversification can differ per different scholars as; on-farm, off-farm, and on-farm sources (Ellis, 1998); agricultural intensification, livelihood diversification, and migration by Barrett *et al.* (2001); and farm or non-farm by sector, wage employment or self- employment by function, on-farm or off-farm using the location of activity by (Loison, S. A., & Loison, S. A., 2016; Saha, B., & Bahal, R., 2010).

However, farm households diversify their income sources for various reasons like; pull (voluntary) and push factors (involuntary). In the former case, households diversify for asset accumulation, increasing income, and using available economic advantages. In the latter case, the purpose is risk management, reducing vulnerability, and enhancing resilience to shocks (Abdul-Malek M, Usami K., 2011; Abdul-Hakim R, Che-Mat SH., 2011)). In rural Ethiopia, the poor need to diversify their livelihood activity to off-farm and non-farm activities both to mitigate risks of rain-fed agriculture and to improve livelihood conditions (World Bank, 2005). Thus, diversification is indicated as the main way to fill the gap in the agricultural sector (Demisse, D., & Workneh, N., 2004; Gebreyesus, B., 2016).

In the Southern Nation Nationalities People‘s Regional (SNNPR) state of Ethiopia, a large proportion of the people about 90 percent located in the highland agro-ecology holds 66 percent of the farmland (Belete L, 2018). Our study area, Gamo Highland in Broad and Chencha

area particularly is one of the erosion-affected areas in the SNNPR. Chencha *Woreda3* Agricultural and Rural Development Office (CWARDO) report indicates that 38 percent of the total area is affected by soil erosion and more than 65% of agricultural land is prone to sheet, rill, and gully erosion due to continuous cultivation for centuries (CWARDO, 2014). As a panacea for soil erosion, the government-led and donor agencies supported agricultural intensification, and livelihood diversification through agricultural technology adoption plays an important role. For instance; the adoption of a newly introduced new potato variety achieved a relatively higher yield of 80 Quintals per hectare than other crop yields in the Chencha area (Bekele S., 2017) which reaches in food deficit season of June to August. However, it is below the expected potential due to possible reasons for declining soil fertility due to soil erosion, lack of training, and high vulnerability to disease.

Highland areas in southern Ethiopia in general and Chencha district in particular encounter both seasonal and chronic food shortages due to small land holding size and high population density. A strong food shortage occurs in the *Belg4* season (from April to May*)* and September to mid-November (Tadesse *et al.,* 2019). As a result, people are forced to adopt diverse activities like; intensification through technology utilization, Ensete production, trade, weaving, and out-migration (Engdawork Asefa, 2012). Chencha is one of the highland areas of the Gamo zone which is the origin of year-round flowing rivers like; Kulffo, Hare, and Baso, but they do not provide any economic value in the highlands except washing away the fertile soil (Bekele, S., 2017).

In the Gamo highlands including the Chencha area, land is transferred from parents to sons; which causes exponentially declining landholding shares for the coming generations (Abera *et al*, 2014). Accordingly, this forces households to face food shortages to feed year- round and practice undesirable livelihood diversification and rural-urban migration. In history, Gamo highlands had not been threatened by extreme famines and food insecurity problems the country had passed through (Desalegn, R., 1996). The area has been safeguarded from such serious food shortage problems for centuries due to the availability of multifaceted economic and

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3 *Woreda* is a smaller admin unit next to Kebele (ward) and below zone in Ethiopia since 1991.

4 *Belg* refers to a spring season which includes months March, April & May.

ecological root crops of Enset (*Ensete Ventricosum*) and Qoltso (*Arisaema schimperianum*). Currently, cultivation of these crops declining from time to time and they are replaced by other crop types like; cereals, fruit trees (Apple), and newly intervened potato crops (Abera U., 2014).

As a result, recently people in the area facing food shortages due to high vulnerability to climate change-related challenges like; drought, crop pests and disease, rainfall fluctuation, livestock death, and so on. For this reason, the majority of food-insecure people are supported by the government-launched Productive Safety Net Program (PSNP) to sustain life. As a result, running multiple livelihood options both within agriculture and outside of agriculture is expected to be the way out of food insecurity and poverty thereby building household resilience to food insecurity. For this reason, this study is designed to examine the availability of livelihood options, the level of diversification, and its effect on the food security status of households.

5.2. Materials and Methods

5.2.1. Study area and sampling Techniques

The study has been conducted in Chencha District, Gamo zone, Southern Ethiopia. Chencha is one of the ten woredas found in the Gamo zone of Southern Ethiopia. The livelihood system of the people mainly depends on small-scale but intensive subsistence farming and; is supported with some off-farm and non-farm livelihood strategies; like weaving, wage labour, formal employment, out-migration to town areas for the search for a better life, trade, and so on. As a result, this study is designed to examine the extent of livelihood diversity in the area and its effects on household income and food security status of households.

A multistage sampling procedure was employed to select the study district and the sample households. In the first stage, Chencha woreda was selected purposively where weaving activity is most dominantly practiced in the zone. Besides this, so far livelihood diversification, food security status, and determinants have not been studied in the area. In the second stage, four kebeles were selected purposively based on preliminary information considering the dominancy of weaving practices in the area; namely, Doko Danbo, Doko

Loosha, Lakana Maldo, and Setena Borcha. In the third stage, the sample respondents were been selected by using systematic random sampling techniques. Finally, the sample size of the

respondents was determined by using the formula suggested by (Yemane (1967) as follows;

$$n = \frac{(N)}{2+(e)^2} \quad \text{..... Equ [1]}$$

Where **N** refers to total population size, ***n*** refers to sample size and *e*-refers to the level of precision. In this study, N=2485 and e=0.05 n=303. Then, a representative sample respondent was identified based on probability proportion to a population from four kebeles using a systematic random sampling method per each 8-household interval.

5.2.2. Data Collection

The study applied mixed data collection techniques which combined both quantitative and qualitative data collection techniques. Data used for this study were both primary and secondary which are quantitative and qualitative. To this end, Key informant Interviews (KII), Focused Group Discussion (FGD), household surveys, field observations, and secondary sources analysis were employed.

Key Informant Interview: 20 in-depth Key Informant Interviews (KII) were held with household heads, kebele leaders, experts of agricultural extension, Natural Resource Management experts, health extension, food security and early warning, water supply and job creation and enterprise at kebele, woreda, and zone level. The KII has raised diverse issues for individuals and profession- specific questions for different offices. The issues elaborated include; livelihood income sources in the area, food supply and adequacy, shocks and risks, Vulnerability contexts, access and availability of basic livelihood options and services, and challenges.

Focused Group Discussion (FGD): To support the data gathered through the household survey 4 Focus Group Discussions (FGD) one in each kebele have been carried out from March 10-20 2022. It has included 6-10 members who know well about the livelihood conditions and associated challenges in the area. The members included in the group discussion were elders, women, and youth considering the heterogeneity of the group and managing the participation of all members. In that, the FGD has addressed the issues related to livelihood options, challenges, and food security conditions in the area.

Questionnaire survey: A household survey has been conducted using semi-structured

questionnaires. It has addressed the demographic, socio-economic, livelihood strategies, food security-related issues, and challenges that affect the livelihood conditions of the sample households. The survey process has been managed by using trained enumerators under close follow-up of the researchers.

Field Observations: Field observations have been made by transect walk throughout the research areas to observe the livelihood patterns of the people and the prevailing opportunities and challenges. Secondary data were collected through analysis of various published and unpublished secondary documents. Researchers and trained enumerators administrated the household survey.

5.2.3. Data Analysis

Data collected through a combination of different techniques were analyzed using appropriate data analysis methods as per the nature of the data. Descriptive statistics such as mean, standard deviation, percentage, ratio, and range were used to examine the socioeconomic status of respondents. Qualitative data collected through KII, FGD, and field observation were qualitatively analyzed using content analysis and narrating. Livelihood income diversification was determined by using the Herfindahl-Herschman Index (HHI) (Admasu et al., 2022). On the other hand, the association between socio-economic characteristics and the food security status of households was examined by adopting the bivariate Pearson correlation analysis technique. Data analysis and management were carried out using SPSS (Statistical Software Package for Social Science version 20). Whereas; determinants of household livelihood diversification status were identified by applying the ordered *Probit* model. The details of analysis techniques were briefed as follows;

5.2.3.1 Herfindahl–Hirschman Index

Authors use a variety of indices and measures to determine the livelihood diversification status of households such as counting the number of household income sources, Simpson‘s Diversity Index, Herfindahl–Hirschman Index, Ogive index, Entropy index, Modified Entropy index, and Composite Entropy index (Kariyasa, K., & Dewi, Y., 2011). Hence, this study used the Herfindahl–Hirschman Index (HHI) to examine the income diversification status of households for its common use and suitability to apply in household livelihood diversification analysis (Roy, A., & Basu, S., 2020; R. Sharma and G. Singh (2019)). [42,43]. HHI is calculated by taking the sum squares of each household income share _Yi‘ in the total household income ‘Y’.

Household livelihood diversification is determined by using the inverse of income diversification (Herfindahl-Hirschman Index). Thus, the Herfindahl-Hirschman Index which is independently developed by two authors (Hirschman, A., 1945; Herfindahl, O. C., 1950) expressed as follows;

$$Si^2 = HHI = \sum_{j=1} \left(\frac{Y}{Yj}\right)^2 \quad \text{Equation (2)}$$

Ji = 1, 2, 3, ……..……..n

Where Si refers to the income share of economic activity i in the total household income, Yi is the household income from specific activity i, and Y means the total household income from all livelihood activities for the household i. However, the level of livelihood diversification is determined by computing the inverse of the squared sum of the proportion of household income (HHI) from each economic activity to the total household income i.e. the inverse of income diversification (Olubunmi et al, 2017). It is expressed as;

$$D = 1/\sum_{=1}^{F} \left(\frac{2}{F}\right) \quad \text{Equation (3)}$$

The value of livelihood diversification (D=1) is equal to 1 when there is a complete specialization or no livelihood diversification, moderately diversified (1<*D*<2), and highly Diversified (*D*≥2) (Admasu et al., 2022).

5.2.3.2 Determinants of Household Livelihood Diversification Status

This part deals with identifying the determinant factors affecting household livelihood diversification. In this case, our dependent variable used is household livelihood diversification status having three ordered outcome alternatives; i.e., Low diversified', Moderately Diversified', and Highly Diversified'.

Based on the experiences of previous studies (Roy, A., & Basu, S., 2020; Admasu et al., 2022), the households are classified into three classes of diversification levels namely; _Low diversified', _Moderately Diversified', and _Highly Diversified'. Since, the dependent variable has more than two outcomes, and three ordered outcomes, the ordered *probit* regression model was the most commonly recommended technique used to examine the determinant factors affecting the probability of the household either into a higher or lower category. Then, the differences across these categories can be affected by different explanatory variables at different levels.

$$Y^*_j = X_j^1 \beta + U_{ij} \quad \text{..... Equation (4)}$$

$$Y=1 \text{ if } Y^*=1$$

$$Y=2 \text{ if } 1<Y^*<2$$

$$Y=3 \text{ if } Y^* \geq 2.0$$

Where Y refers to the level of livelihood diversification with ordered outcomes of Y1= No Diversification, Y2= Moderately Diversified, and Y3= Highly Diversified. The X_{ij} are the explanatory variables that are hypothesized to determine the Income diversification status of households. The explanatory variables used in this model consist of dummy and continuous forms in their nature. And, β represents the parameters estimated and U_{ij} is the disturbance term. The dependent and independent variables used in this model are described as follows.

5.2.3.3 Definition of variables and hypotheses

Following the clear discussion of analytical techniques used for investigating the determinants of household livelihood diversification status, it is imperative to describe the dependent variable (ordinary) and the potential explanatory variables used in the model. To this end, the identification of the dependent variable and its potential explanatory variables was done based on previous literature and author's experiences regarding livelihood diversification analysis. The descriptions of dependent and explanatory variables are shown in the table 9 below.

Table 9: Description of dependent and explanatory variables

Variable name	Description	Expected effect
Livelihood Diversification status	Y=1 No diversification, Y=2 Moderately diversification, Y=3‖ Highly diversified	(+, Positive, -, Negative)
Age of the household head	A continuous variable measured in years	+
Family size of the households	The number of families in the household	+
Landholding size	The landholding size of the household in hectares	+
Total livestock holding	Total number of livestock owned in Tropical Livestock Unit (TLU)	+
Access to Nearest local market	Access to the nearest local market within walking hours	-
Dependency Ratio	The ratio of dependent household members to total household members	_
Sex of the Household Head	Sex of household head (1=Male, 2=Female)	+/-
Access to Farmer Training Center (FTC)	Access to FTC services (0=No,1=Yes)	+
Access to Mobile services	Access to mobile services (0=No, 1=Yes)	+
Access to Safe water	Access to safe water (0=No, 1=Yes)	+
Household Head Read and Write	The ability of HH Read and Write (0=No, 1=Yes)	+
Access to formal employment	If the household member/s formal employed or not (0=No, 1=Yes)	+
Access to Transfers	If a household has got transfers (0=No, 1=Yes)	+
Access to Credit	If the household has used credit (0=No, 1=Yes)	+
Non-farm participation	If the household participated in a non-farm activity or not (0=No, 1=Yes)	+
On-farm participation	If the household participated in on-farm activity or not (0=No, 1=Yes)	+
Off-farm participation	If the household participated in an off-farm activity or not (0=No, 1=Yes)	+

Source: Own articulation, 2022

5.3. Results and Discussion

5.3.1. Socio-demographic characteristics of respondents

Table 10 presents household's socio-economic characteristics. The sample respondents have an average age of 46.49 years and the majorities about 91.7% of the household heads were

Male-headed. About 85.9% were married, and 71.6% of the respondents had access to formal education having 5.54 years of schooling.

Table 10: Demographic characteristics of the respondents

Item	Characteristics	Frequency	Percent
Agro-ecology	Highland	276	91.1
	Midland	27	8.9
Sex of the HH	Male	278	91.7
	Female	25	8.3
Marital status of the head	Single	18	5.9
	Married	260	85.9
	Divorced	7	2.3
	Widowed	18	5.9
Attended formal Education	Yes	217	70.96
	No	88	29.04
Educational category	No formal education	88	29.04
	Primary education (1-6)	100	33
	Secondary education (7-10)	60	19.8
	Higher Secondary (11-12)	26	8.6
	Tertiary (College and Above)	29	9.57
Age category in years[5]	Early working age (15-24)	23	7.59
	Prime working age (25-54)	174	57.43
	Mature working age (55-64)	53	17.49
	Elderly (65 and above)	53	17.49
PSNP Membership	Member on food for work	34	11.2
	Member on free access to food	7	2.3
	Not member	262	86.5

Source: Own Survey, 2022

Access to quality education and productive assets like land and livestock are major potential determinant factors affecting household livelihood diversification. Accordingly, the sample households have highly fragmented or minimal average landing holding size of 1.11 hectares and average livestock holding of 2.95 in TLU. Due to the small per capita landholding size and resulting very low agricultural production, the households in Chencha district practice off-farm and non-farm livelihood diversification. As a result, 47.9% of the respondent households reported out-of-farm livelihood activities as their main livelihood income sources. However, only 52.1% of the households responded that they used subsistence farming as the main source of their living. The households in the area faced the problem of food shortage for 3-

6 months. About 13.5% of randomly selected respondents were beneficiaries of Productive Safety Net (PSNP) support in the form of members on food for work and free access to aid.

Table 11: Demographic Characteristics of Respondents (Continuous Variables)

Demographic characteristics	Mean
Age of the respondents	46.49
Family size	6.81
Productive labour size	3.78
Dependency Ratio	0.223
Years of formal education	5.54
Total Landholding size	1.11
Livestock size in TLU	2.95
Number of income sources adopted	4.53
Mean annual income	82,041
Mean HHI	2.68

Source: Own survey, 2022

About 82.5% of the respondents were within the productive age category (15-64 years) with maximum age ranges of 17 and 107 years which is in line with Dersseh et al. (2016). The majority of weaving-based households about 90.75% have participated in more than one economic activity as their household income source and the remaining 8.25% have specialized only in one livelihood income source. The study result indicated that the respondent households have adopted an average of 4.53 number of income sources. Regarding the dependency ratio, the study revealed a 0.223 or 22.3 percent dependency ratio in the family.

5.3.2. Characteristics of Livelihood Diversification and Annual Income Shares

This part provides evidence of the diversity of income sources used in the area with the respective total participation, mean income, total income, and their share of the overall income of the whole household. In this case, mean income has been computed as the total income gained by several households participating in the corresponding income activity. Due to challenges of declining landholding size, diminishing farm productivity, and decreasing capacity of agriculture; rural households diversify their productive labour both into non-farm and off-farm sectors to get

their livelihood needs (Asmah, E. E., 2011; Martin, S. M., & Lorenzen, K. A. I., 2016). More particularly, the average per capita landholding size of the study area was one of the lowest; 1.11 hectares as per the current survey, which is slightly greater than the national and regional (SNNPR) averages of 0.84 and 0.52 hectares per household (CSA, 2011). According to the CSA report, about 84% of the households in the area have 0.5 hectares and below landholding size (CSA, 2003). As a result, people in the district are forced and opt to derive their household income from diverse sources.

Table 12: Diverse Income Sources and Shares in Total Annual Household Income

Income sources	No. of participants (%)	Mean income	Total income	% share in the total income
i) On-farm related activities				
Cereal crop production	52.14	5,738.18	906,634	6.73
Vegetable production (potato, cabbage)	61.72	4,512	843,760	6.26
Fruit production	21.12	1,374	87,950	0.65
Livestock production	17.83	3,774	203,800	1.51
Leasing out land	2.31	1,728.57	12,100	0.09
Cattle sale	27.72	6,950	583,800	4.33
Goat and sheep production and sale	26.73	4,400	356,419	2.64
Donkey/Mule/Horse sale	2.64	4,037.5	32,300	0.24
Poultry production	19.80	1,802	108,120	0.80
Milk and milk products	17.16	2,495.2	129,750	0.96
Skin and hide	1.65	518	2590	0.02
Bee and hives	2.97	451	4,060	0.03
Planting trees and sale	11.88	3,832	137950	1.02
Total on-farm income		**41,612.35**	**3,409,233**	**25.3**
ii) Off-farm income activities				
Wage labor	7.26	4,690.90	103,200	0.76
Firewood or charcoal sale	0.66	1,500.00	3000	0.02
Animal feed collection and sale	1.98	3,458.33	20,750	0.15
Grain trading	1.98	5,650.00	33,900	0.25
Livestock and product trade	2.31	2,642.85	18,500	0.14
Petty trade	4.95	3,706.66	55,600	0.41
Farm tool production and sale	0.66	500.00	1000	0.01
Furniture and woodwork	0.30	1000.00	1000	0.01
Total off-farm income		**23,148.74**	**234,450**	**1.74%**
iii) Non-farm income				
Formal employment	10.89	75,025.66	2,475,846	25.18
Weaving and spinning	81.18	38,162.00	9,387,880	69.66
Cash transfer	5.28	3,799.00	60785	0.45
Military service	4.95	3,561.66	53,425	0.39
Pension	3.63	3,856.36	42420	0.31
Metalwork	0.66	200.00	400	0.003
Begging	1.32	230.00	920	0.01
Remittance	17.49	2,352.83	124,700	0.93
Blacksmith	0.30	2000.00	2000	0.015
Traditional healer	0.30	0.00	0	0
Barber or hairdresser	1.32	24,500.00	98,000	0.73
House Rent	6.93	2,933.33	61,600	0.46
Total non-farm income		**156,620.84**	**9,832,130**	**72.96%**

Source: Author‘s compilation based on field survey, 2022.

The study result indicated that about 93.39%, 81.85 %, and 21.13% of respondents have

participated in non-farm, on-farm, and off-farm activities, respectively. Like other rural areas, the economy of Chencha district is dominantly characterized by subsistence farming. However, the non-farm income accounts for 72.96% of the total overall income of households which is 47.67% by far advance than the on-farm income share. The income shares of on-farm income sources accounts for only 25.29% of the overall income of the respondents. This result is in line with the study conducted in the Himalayas (Rahut, D. B., & Micevska Scharf, M., 2012).

Specifically, vegetable production (mainly Potato) was 61.72%, cereal production was 52.14%, cattle sales was 27.72%, sheep and goat production and sale were 26.73%, and fruit production 21.12% activities had relatively higher household participation recorded among on-farm activities. But, cattle sales (6,950 ETB), Cereal production (5,738.18 ETB), and vegetable production (4512 ETB) have relatively higher average annual income. While; cereal production, vegetable production (Potato and Cabbage), and cattle sales have 6.73%, 6.26%, and 4.33% shares on the overall income of the respondents, respectively.

However, off-farm income source has relatively lower levels of household participation and lower income contribution to the total household income. This could be due to high population density, very minimal landholding size, and the subsistence nature of agriculture in the area. This may limit off-farm livelihood options as an alternative employment sector for needy groups of society. Among off-farm income sources, annual income from grain trade (5650 ETB), Wage labor (4690.9 ETB), and petty trade (3706.6 ETB) has higher mean income. However, off-farm activity has an overall income share of only 1.74% of the annual income of the whole respondents. This result indicates the shortage of off-farm livelihood alternatives and low repaying capacity in the area (Table 12).

Non-farm activity plays a significant role in the livelihood system of the rural households in the area. Based on non-farm income activity participation, weaving, and spinning activity account for 81.18%, remittance 17.49%, and formal employment (governmental or non-governmental) accounts for 10.89%. However, based on the average annual income return for the corresponding participants; formal employment,

weaving, and Barber or hairdresser service have higher repayment capacities of (75,025.66 ETB), (38,162 ETB) and (24,500 ETB), respectively. This result is similar to the study by Israr et al. (2014) and Gautam and Andersen (2016) which reported a larger income contribution of non-farm activity and formal employment to total household income and general well-being than on-farm activities. Also, the findings of Yizengaw *et al*. (2015) revealed similar results in which non-farm income contributed 60 percent to household income in Debre Elias woreda East Gojjam zone, Ethiopia. The study by IFAD also supports that households in developing countries drive more than 50 percent of their household income from non-farm livelihood activities (IFAD, 2011). Hence, giving due attention to education and strengthening non-farm livelihood diversification is inevitable in the area.

5.3.3. Livelihood Diversification Strategies

Based on the survey result, 90.76% of the households got their income from more than one livelihood source with an average of 4.53 livelihood options. Similarly, people in highly populated and fragmented landholding conditions; diversify their sources of household income (Gebru et al., 2018).

Despite the most frequent adoption of on-farm, off-farm, and non-farm concepts in the livelihood classification, many argue for inextricability and difficulty in putting clear demarcation among this classification. However, this study has adopted the conceptualization provided by Kristin Lambert (2019). Accordingly, on-farm activities consist of farming and agricultural production-related activities that include; all activities of farming (crop production and livestock rearing) carried out on the farm of the household or occur at the beginning of the value chain. On the other hand, off-farm income encompasses all agriculture-related activities that occur beyond the farm or in the ―middle‖ and ―end‖ of the process which include; processing, packaging, storage, transporting, and retail sale. So, off-farm activities include all processes carried outside own farm up to final consumption. Whereas; non-farm activity refers to sectors that exist outside of agricultural market systems like; construction, healthcare, hospitality, formal employment, education, mining, tourism, and artisans.

Table 13: Choice of livelihood strategies adopted by respondent households

Livelihood strategies adopted	Frequency	Percent	Average Income
On-farm only	17	5.61	15,379
Off-farm only	1	0.33	1,000
Non-farm only	45	14.85	26,782
On-farm and off-farm	3	0.99	30, 067
On-farm and non-farm	179	59.08	50,288
Off-farm and non-farm	6	1.98	22,150
On-farm, off-farm, and non-farm	52	17.16	55,366
Total	**303**	**100**	

Source: Author‘s compilation from field survey, 2022

Based on the livelihood activity participation of the households, livelihood activities identified in the area were categorized into seven livelihood strategies;

- Group 1: Only on-farm livelihood activities
- Group 2: Only off-farm livelihood activities
- Group 3: Only non-farm livelihood activities
- Group 4: On-farm and off-farm combination of livelihood activities
- Group 5: On-farm and non-farm livelihood activities
- Group 6: Off-farm and non-farm livelihood activities
- Group 7: On-farm and off-farm and non-farm livelihood activities

Different authors; (Gebreyesus, B., 2016; R. Sharma and G. Singh, 2019; Admasu *et al*., 2022) classify households based on the use of on-farm, off-farm, non- farm, and a combination of one or more of them as their livelihood income source. Based on these experiences, the respondent households were categorized into seven (7) livelihood groups (Table 5). Accordingly, the majority of the respondents 179(59.08%) and 52(17.16%) were getting their livelihood means from on-farm and non-farm‘, and on-farm, off-farm, and non-farm economic activities, respectively. Following the two, non-farm only ‘employed 45 (14.85%) of the households (Table 13).

Based on average annual income per participant; households who combined the three livelihood sources on-farm, off-farm, and non-farm activities‘ have the highest average annual income of 55,366 ETB, followed by _on-farm and non-farm‘, _on-farm and off-farm‘, and non-farm only‘ income sources. The least remunerative livelihood group is

the only off-farm ‘activity. This implies that households who combine different income sources will get higher annual income and thereby minimize risk and enhance their capacity to withstand natural and economic uncertainties.

5.3.4. Extent of Livelihood Diversification in the Area

People diversify their livelihood income sources to increase household income and thereby improve the well-being and food security status of their household members. Accordingly, this study attempted to determine the status of livelihood diversification and its association with the food security status of households following the experiences of precedents (R. Sharma and G. Singh, 2019; Roy, A., & Basu, S., 2020; Admasu *et al*., 2022).

Table 14: Livelihood Diversification Status of Households

LD status	Herfindahl-Hirschman Index	
	No. of respondents	Percentage
No Diversification (D=1)	44	14.52
Moderately Diversified (1<D<2)	158	52.15
Highly Diversified (D≥2)	101	33.33
Total	303	100
Mean HHI		2.68

Source: Authors‘ compilation from survey, 2022

Table 14 presents the extent of household livelihood diversification using (HHI) techniques. Based on the thorough analysis of income distribution of households using HHI results, 14.52% of the respondents specialized only on one income source, or adopted _No livelihood diversification ‘whereas, 52.15% practiced Moderate level‘of livelihood diversification status. Surprisingly, 33.33 percent of the respondent’s highly diversified ‘their livelihood income sources. The mean HHI score is 2.68 which indicates highly diversified ‘livelihood sources result across all households. Using similar techniques, other researchers have also shown similar results (Roy, A., & Basu, S., 2020), 27% and 37% of the respondents in the Coastal Community of Bangladesh have poor ‘and medium‘levels of livelihood diversification, respectively.

5.3.5. Determinants of Household Livelihood Diversification

Table 15 presents determinants of livelihood diversification. The ordered Probit model was used

to detect the determinants of the livelihood diversification status. Here it is mainly focused on carrying out the data analysis and identifying explanatory factors (continuous and discrete) that affect livelihood diversification status. Before running the data analysis, the existence of bad correlation (multi-Collinearity) among potential explanatory variables was tested using Variance Inflation Factor (VIF) and Contingency coefficient (CC) values for continuous and discrete variables, respectively. Then, the test result revealed that there is no strong correlation among independent variables. Accordingly, the VIF values for all continuous variables were found to be small (VIF<10) which is below the cutting threshold value of 10. In the same way, the multi-Collinearity test result for discrete explanatory variables revealed a contingency coefficient value of less than 0.75 which confirmed the existence of no strong association.

Ordered probit model was used to examine the determinants of household livelihood diversification status with 95 CI value. The model fitting information shows that the model has high predictive power with Nagelkerke pseudo-R-square value 0.562 which indicates the model fits the data well with 56.2% of the variance in the dependent variable (i.e., livelihood diversification status) explained by the modeled explanatory variables. Whereas; the difference between the two log-likelihoods the chi- square has shown a significance level of less than 0.001.

Table 15: Determinants of household livelihood diversification status

Variables	Estimates	Std. Error	Wald	Sig.
HHI= 1	-0.863	0.0.547	2.483	0.115
HHI=2	0.991	0.548	3.268	0.071
Age	0.005	0.005	1.261	0.261
Family size	-0.068	0.031	4.633	0.031**
Landholding size	0.225	0.095	5.587	0.018**
Total livestock holding size (TLU)	0.178	0.040	19.215	0.000***
Access to Nearest local market (walking hours)	0.199	0.130	2.364	0.124
Dependency Ratio	0.400	0.336	1.422	0.233
Sex of the household Head (Yes=1)	-0.240	0.284	0.714	0.398
Access to FTC services (Yes=1)	0.388	0.212	3.368	0.066*
Access to Mobile (0=No)	-0.283	0.171	2.120	0.145
Access to Safe Water (0=No)	-0.090	0.165	0.299	0.585
Household Head Read and Write (0=No)	-0.022	0.161	0.018	0.893
Formal employment (0=No)	0.427	0.299	2.042	0.153
Access to Transfers (0=No)	-0.586	0.276	4.514	0.034**
Access to Credit (1=Yes)	0.046	0.226	0.042	0.837
Non-farm participation (0=No)	-0.188	0.304	0.381	0.537
On-farm participation (0=No)	-2.207	0.257	73.603	0.000***
Off-farm participation (0=N0)	-0.392	0.195	4.037	0.045**

LR $\chi 2$ (32)	596.093
Chi-Square	200.330
Number of observations	303
Prob>$\chi 2$	0.001
Pseudo R^2	0.562

***, ** and * stands for significant at less than 1%, 5% and 10% probability levels, respectively.

Source: Own survey, 2022.

Parameter Estimates

In the following part, the parameter results with significant influence on the household livelihood diversification status were interpreted. Among 17 explanatory variables, 7 variables were found to significantly determine the likelihood of household livelihood diversification from lower to higher or vice versa.

Family size of the household: the sample respondents have a relatively larger average family of 6.81 which is even greater than the regional average of 5.47 members in the Southern Nations Nationalities people‘s region of Ethiopia (CSA, 2020). It is expected that an increased family size can increase the likelihood of increasing livelihood income sources. However, the model

result revealed that family size has negatively and significantly affected the probability of household livelihood diversification at 5% significant level; and in contrast with this the multinomial logit based analysis found that household size positively contributed for likelihood of households' adoption of on-farm activity with off-farm and non-farm alternatives in Chewaka district of Ethiopia (Abera et al., 2021). Accordingly, a unit increase in the family size decreases the likelihood of income diversification to a higher level by 0.0681 units when other factors are kept constant. This may imply that an extended family member may become a burden in the rural contexts where there is a shortage of land resources and other off-farm and non-farm job opportunities.

Landholding size: Here, livelihood diversification is expected to be happening both within the agricultural sector and outside of the agricultural sector, in turn, could have a positive impact on household general well-being and food security (Onunka et al., 2017). In this regard, as expected land holding size has positively influenced the likelihood of household livelihood diversification at 5% significant level. A unit increase in the landholding size of a household increases the likelihood of attaining a higher livelihood diversification category by 0.225 units if other factors were kept constant. Consequently, increased landholding size gives opportunities to expand income sources into growing several crops and vegetables, and rearing large species and size of livestock. Therefore, it is advisable to improve mechanisms of accessing land for rural households to enhance household food self-sufficiency and productivity through livelihood diversification.

Total Livestock holding size: Although a minimal average livestock holding size (2.95 Tropical Livestock units) is reported in the study, income gained from livestock and livestock products is confirmed as the top-ranked among on-farm income sources. As expected, the model result indicated that the size of total livestock holding became one of the important determinant livelihood diversification factors that positively affected at less than a 1% significance level.

A unit increase in livestock holding size in TLU increases the likelihood of households achieving higher diversification levels by 0.178 times when other factors are kept constant. This may be explained as increased diversity and size of livestock holding could mean expanded sources of food and income for households in the form of livestock and livestock products. Thus, in the highly fragmented landholding areas like; the Chencha district; rearing diversified

livestock in an intensive and home-managed way with necessary expertise and support services seems more recommendable.

Access to Farmer Training Center (FTC) services: Access to agricultural production-improving technologies and services like Farmer training services is one of the important factors that are expected to enrich farmers with the necessary knowledge and skills to increase production and productivity through adopting diverse income activities. As expected, access to FTC services was found to positively determine the likelihood of household livelihood diversification. Accordingly, a household that had access to FTC services has an increased likelihood of falling into the higher livelihood diversification category by 0.388 units more than non-users at less than 10% significance status. Increased access to FTC enhances livelihood diversifications of households by exposing them to new experiences, knowledge, and skills to practice in their livelihood system. Thus, strengthening FTC service provision in the area would have a desirable effect on livelihood diversification and the food security status of rural households.

Access to Transfers of Payment: In the study, households use a variety of cash and kind transfers of support to sustain their living. Alternative transfers reported include; remittances from their family members from urban centers of the country and abroad the country, PSNP support, food insecurity relief aids during food deficit seasons, and so on. As expected, *ceteris paribus*, lack of access to transfers of payment significantly decreases the probability of households falling into the higher livelihood diversification category by 0.586 units at less than a 5% significant level.

On-farm participation: In rural areas, on-farm income sources are the most important livelihood diversification sources, in the form of livestock and crop production. The probit model result indicated that participation in on-farm activity highly contributed to the livelihood diversification status of the respondent households at a 1% significant level. Keeping other factors constant, those who did not participate in on-farm activity have a 2.207 units lower likelihood of falling into a higher (moderate or highly diversified) income category than those who have participated in on-farm income activity. This implies that participation in various on-farm activities enhances improved livelihood diversification status and in turn, improves food

security and household resilience to food insecurity.

Off-farm participation: This study has revealed options for off-farm livelihood sources such as; wage labour, firewood collection and charcoal production and sale, animal feed collection and sale, grain and livestock trades, petty trade, furniture and woodwork, and farm tool production and sale. In the econometric model analysis, access and participation in off-farm activities significantly influenced the livelihood diversification status of households at less than a 5% significant level. Considering other factors constant, households who had not participated in or accessed incomes from off-farm activity have decreased probability of attaining higher livelihood by 0.392 units than those who had access to off-farm income participation.

5.3.6. Socio-Economic Characteristics and their Associations with Food Security Status

Livelihood diversification is a common practice followed by rural farming households in Africa which involves increasing economic activities within and out of farming activities as a means to escape from the effects of poverty and food insecurity problems (John Afodu *et al*., 2020). As can be in Table 9, the associations between different socioeconomic variables and the food security status of weaving-based households were observed using Pearson Correlation Analysis (Roy, A., & Basu, S., 2020). Accordingly, age of the respondent (AGE), educational status in years (EDU), family size (FAMSZ), number of productive labour (*PROLABR*), total landholding size (*LAND*), livestock holding size, total income from all sources (*TOTINCOM*), Livelihood diversification status using HHI (*LD*), food security status (*FCS*) and Dependency Ratio (*DEPNDC*) were used.

Table 16: Socio-economic Variables and Food Security Associations

	AGE	EDU	FAMSZ	PRLABR	LAND	TLU	TOINCM	LD	FCS	DEPNDR
AGE	1									
EDU	-.199**	1								
FAMSZ	.224**	.129*	1							
PROLABR	.221**	.068	.668**	1						
LAND	.067	.272**	.333**	.306**	1					
TLU	.189**	.214**	.535**	.401**	.468**	1				
TOTINCM	-.007	.222**	.278**	.193**	.158**	.101	1			
LD	-.057	.060	.061	-.039	.173**	.047	.057	1		
FCS	-.018	.322**	.176**	.054	.197**	.204**	.151**	0.720**	1	
DEPNDC	.107	-.032	.107	-.313**	.011	.017	.093	.110	.152**	1

**Correlation is significant at the 0.01 level (2-tailed) * Correlation is significant at the 0.05 level (2-tailed)

Source: Own Survey, 2022

The result revealed that Pearson product correlation of household age and Food security status (FCS) was found to be very low negative and statistically significant ($r=0.199$, $p<0.01$). The result is in line with the work of Ortega-velez et al., (2024) which revealed that the likelihood of aged households to fall at accepted FCS level decreased than younger counter parts. This shows that an increase in household head age leads to a decreased Food Consumption Score in the household. Educational status of the household head (EDU) and Food Consumption Score (FCS) were found low positive and significantly correlated ($r=0.322$, $p<0.01$). This implies that increased educational attainment leads to enhanced food security status. The association of other variables like; family size, landholding size, total livestock holding size, and total household income have a very low positive and significant correlation at $p<0.01$ with the Food security of households. However, the Pearson correlation of livelihood diversification status (HHI) has a high positive ($r=0.720$, $p<0.05$) and significantly correlated with food security status (FCS) (Table 16).

This implies that an increase in household livelihood diversification has a positive association with the improved food security status of the households. This result is similar to the research output of (Dersseh et al., 2016; Onunka *et al*.; 2017) who found a positive association between increased livelihood diversification and improved food

security status among households of Udi local government area, Enugu state, Nigeria. Another study by (Echebiri, R. et al., 2017) has also found a positive effect of livelihood diversification on the food security status of farming households. Therefore, expanding and creating necessary opportunities for weaving-based households to diversify their income sources within and out of farming activities is advisable to improve the well-being and food security status of their households.

5.4. Conclusion and Recommendations

5.4.1. Conclusions

Subsistence farming (crop and livestock production), weaving and spinning, formal employment, and trade are the main livelihood income sources used in Chencha district of South Ethiopia. Agriculture and weaving are the primary and secondary income sources of employment and income source, respectively. Small landholding size, high population density, out-migration, weaving, and Enset-based livelihood system characterize the study area. The major livelihood challenges in the area include; fragmented landholding and associated food shortage, soil erosion, lack of infrastructure (road), and resulting poor market linkage and food shortage. Most people in the area diversified in _farm only‘, _non-farm only‘, _on-farm and off-farm‘, _on-farm and non-farm‘, _off-farm and Non-farm‘, _on-farm, off-farm, and non-farm‘ livelihood strategies. Even though subsistence farming was reported as the primary income source by about 72.3% of the respondents, non-farm income contributed 72.96% share of the total household income. On- farm and off-farm income sources accounted for 25.3% and 1.74% of total income, respectively. However, based on mean per capita income from each economic activity for respective participants, formal employment, Weaving and Spinning, Barber/Hairdresser activity, cattle production and sale, cereal production, and vegetable (Potato) are identified as the most remunerating economic activities reported. Majority of the respondent households diversified their livelihood activities to more than one activity.

The livelihood strategy specific close examination revealed that, households who combined _on-farm, off-farm and non-farm‘ gained far larger mean income followed by _on-farm and non-farm‘, _on-farm and off-farm‘, and _non-farm only‘ livelihood strategies. Analysis of household livelihood diversification status indicated that the majority of the households in the study area have *_moderately diversified"*, *„low diversified",* and *_highly diversified"* in their respective

order. Landholding size, TLU, and frequency of FTC services received positively contributed to the likelihood of household livelihood diversification to the higher levels.

However, family size, lack of access to transfers, on-farm income participation, and lack of off-farm participation have negatively affected the household‘s likelihood of attaining higher livelihood diversification. Besides this, education status, family size, land holding size, livestock holding size, total income, and livelihood diversification status have positive associations with the food security status of respondents. On the other hand, age and food security status have been found negative associations.

5.4.2. Recommendation

Based on the findings of the study, the following suggestions were forwarded to the concerned stakeholders. Diversifying the income activity both within and outside of farming activities has been found highly economical in terms of increasing household income and contributing to food security. So, the district government and other development agents should support households by creating awareness, providing skill training, and accessing financial sources. Besides efforts made to improve agricultural production and productivity, zonal government bodies should give due focus to support the available non-farm and off-farm economic sectors in the area like; weaving, trade, beauty salon, quality education, and formal employment to counterbalance challenges of climate change and shortage of landholding. Creating job opportunities for youth by accessing credit and providing skill training to establish small-scale enterprises should be given due attention. Weaving and spinning activity in the area is reported as the second most important livelihood activity adopted by youth and productive adults next to agriculture. However, it is threatened by a lack of modernization, market linkage, and unfair price allocation from traders.

Thus, the government should give recognition for its economic role, make reasonable interventions to adopt technology-based production, create market linkages, and help and organize youth to add value to the weaving products. Adopting intensive agricultural practices (technology and irrigation substantiated) like; potato, fruit, and livestock could be suggested for the area. Furthermore, improving access to quality education, and training services and creating job opportunities for youth and college graduates should be rethought. The increasing trend of youth female participation should be motivated and institutionally supported.

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CHAPTER SIX: HOUSEHOLD RESILIENCE TO FOOD INSECURITY: THE CASE OF CHENCHA ZURIYA DISTRICT, SOUTHERN ETHIOPIA

ABSTRACT

Background: Fragmented landholding, recurring drought, food price inflation increased incidences of food insecurity shocks in the highland areas of Ethiopia. This study investigated food insecurity shocks and major sources of household resilience in southern Ethiopia.

Method: Using a resilience approach, the study used a cross-sectional design that included a household survey of 303 rural households in the wake of COVID-19 and related shocks, corroborated with focus group discussions and key informant interviews. Descriptive statistics and multivariate analytical methods, such as principal component analysis, were used to analyze the data.

Result: Food insecurity in the area is caused by factors like inflation, family illness, low farm production, and drought. A resilience analysis reveals six dimensions significantly contribute to household resilience, with access to Social Safety Net, basic services, and non-agricultural assets being crucial. All but stability dimensions positive and significantly contributed to resilience. The Multivariate analysis revealed that 59.7% of households were non-resilient, while 40.3% were resilient at various levels. Based on factor loading and Beta coefficient access to Social Safety Net, basic services, and non-agricultural assets are crucial for promoting household resilience against food insecurity.

Conclusion: The study suggests strengthen and improve the social safety net services and creating conducive opportunities for accessing basic productive assets like land for landless and marginalized groups, increase access to basic public services, and support agricultural intensification to enhance household to food insecurity. Furthermore, community members and concerning development stakeholders should also prioritize the strengthening of key resilience dimensions and address frequently encountered shocks and stresses to enhance household resilience in the area.

KEYWORDS: Chencha; food insecurity; household resilience; livelihood; shock; stress

6.1. BACKGROUND

Food security, a global concern, originated in the 1970s during the global food crisis (FAO, 1996). It has evolved over time, with over 200 definitions (Maxwell et al., 2013). It is defined as having access to adequate food for all people, at all times, for an active and healthy life (FAO, 1996; El Bilali *et al.*, 2019). However, hunger and undernourishment remain pressing issues, with 820 million hungry people worldwide and an estimated 670 million still hungry by 2030, putting the Sustainable Development Goal 2030 (SDG) agenda of eliminating poverty and malnutrition at risk (Boliko, 2019; WFP, 2022).

When everyone has physical, social, and economic access to enough, safe, and nourishing food that satisfies their dietary needs and food choices for an active and healthy life, there is food security. When this requirement is not met, food insecurity results (Camire, 2021). Food insecurity is disproportionately distributed, with Africa comprising 28.05% of food insecure in the world, Sub-Saharan Africa (SSA) and Asia alone account 95% of global food insecure populations (Zereyesus *et al*., 2022). Climate change, COVID-19, and wars have exacerbated this issue in Sub-Saharan Africa (Baptista *et al.*, 2022). Conflict, climate change, and global market failure are major contributors to hunger and malnutrition (Degefa, 2015; Caroline & Kristina, 2022), with 70% of food insecurity live in conflict areas.

Ethiopia is grappling with humanitarian emergencies and food insecurity due to conflict, every 3-5 years recurring droughts, rain-fed agriculture, population pressure, limited infrastructure, irregular rainfall, and seasonal fluctuations (Devereux, 2000; MoARD, 2009; Meskerem & Degefa, 2015; Anantharam *et al*., 2021). The major causes of food shortage in Ethiopia associated with its traditional backward farm practices (lack of adopting improved seed and animal breeds, low adoption of chemical fertilizers, lack of adopting farming technology adoption), rain-fed dependence, lack of large-scale irrigation practices (Mulugeta, 2009). Recent review reveals that despite a decrease in food insecurity in Ethiopia, 32.7% of the population still suffers from food insecurity and food gap is higher than other African countries due to several factors (Ayele, 2020). In Ethiopia, food insecurity is primarily caused by factors such as recurring drought risk, environmental degradation, demographic pressure, rural-urban migration, and conflict.

Chencha Zuria district in Gamo zone, with 82% highland ecology, experiences 3-6 months of food insecurity particularly in April to May and September to November (Hassen, 2019; Tadesse *et al*., 2021); due to fragmented landholding and seasonal food shortages. To cope, people use risk management measures like livelihood diversification, drought-resistant crops (Enset and Qoltso), weaving, and outmigration, however, empirical evidence on household resilience remains limited.

Food insecurity remains a significant challenge for many individuals necessitating ongoing research. Food security analysis has long aimed to enhance analysis techniques for predictions of vulnerability of food insecurity (Løvendahl *et al.*, 2004). However, resilience, a cohesive academic and policy concept, encourages collaboration among various disciplines, policymakers, and practitioners to address food insecurity issues (Alinovi *et al*., 2008; Schipper & Langston, 2015). It measures a system's ability to handle the negative effects of unpredictable shocks, rather than predicting a crisis. According to Bahadur *et al*. (2015) and Winderl (2014) resilience indicators are used as a measure of program success. Hence, resilience refers to a system's ability to maintain a specific standard of living, such as food security, despite shocks and stresses, based on available means of subsistence and risk- taking. However, resilience and vulnerability share two common elements; the shocks and stresses, and the adaptive capacity (Alinovi *et al*, 2010). It concerns with examining, investing on and taking actions on existing capacities as a new-normal towards attaining food security (Frankenberger and Nelson, 2013). The conventional risk management approach is disjointed, while resilience promotes cooperation in analysis, planning, and implementation (Constas and Barrett, 2013), linking short-term humanitarian efforts with long-term development activities for better outcomes (Fan *et al*., 2014). It provides a fresh perspective on the factors and dynamics of resilience to food insecurity, enabling individuals to utilize their existing strengths (Adane, 2018).

Resilience is context-specific (FAO, 2014), but food security studies in general are rare in Chencha (Eshetu, & Mekonnen, 2016; Tadesse, Y. *et al.*, 2019), however, there are no research on resilience subject. Study by Eshetu and Mekonnen's (2016) found off-farm participation reduces household poverty, while Essa's (2019) study revealed significant differences in food security status between adopters and non-adopters of soil and water conservation practices.

Yenenesh *et al.* (2019) discovered that improved potato varieties enhance households' livelihoods, but no studies have explored resilience to food insecurity. The resilience approach is a long-term development strategy that analyzes shocks and stresses, plans, and evaluates food security programs to achieve sustained progress (Constas *et al.*, 2014).

The analysis of resilience studies in Ethiopia are limited number and broad in their focus, considering diverse livelihood contexts in Ethiopia (Girmay, 2019; Adane, 2018 and Fikiru, 2016). However, this study aims to narrow the focus on weaving-based households, focusing on the multidimensional nature of household resilience sources and factors determining capacity to withstand, recover, and respond to food insecurity. The literature suggests that integrated assessment approaches at national, local, and household levels are necessary for context-specific vulnerability and resilience studies to address specific geographic problems (Adane, 2018; Shibru *et al*., 2024).

It is against this background that the study aims to assess rural households' resilience to food insecurity shocks in Chencha Zuriya district, Gamo zone, identifying sources, magnitudes and determinants. Then, the findings can guide policymakers in determining effective investments in resilience.

6.2. METHODOLOGY

6.2.1. Data Sources and Sampling Techniques

This study utilized both qualitative and quantitative data to understand livelihood conditions, food security, external shocks, and household resilience to food insecurity. Primary data sources were households, KII, and FGD, while secondary data was collected from national statistical reports, documents and literatures. To get representative and reliable information and to draw sound conclusions, multistage sampling method is employed. In the first stage, the district of Chencha was selected because of the high concentration of weaving in the region and throughout the nation (Waktole, 2016 and Alyahat, 2018), with weaving being the primary source of income to supplement highly dispersed subsistence farming. Besides this, the livelihood system of the area is threatened by prolonged about more than half a year annual food deficit, ever declining landholding, soil erosion, population pressure, recurring drought, pest and disease (CWARDO, 2014; Tadesse et al., 2019; Abera et al, 2019). In contrast to this, the area is praised for high resistance to historical famine s and food insecurity the country has encountered without losing

any life (Desalegn, 1996). This is the main rationale for purposively selecting the area and the ideal place to conduct food security and resilience studies. Four kebeles with relatively dominant weaving households: Doko Danbo, Doko Loosha, Lakana Maldo, and Setena Borcha were purposively selected in the second stage based on preliminary survey, and key informant interviews. The sample respondents were chosen in the third stage using systematic random sampling techniques. Finally, the sample size of respondents was determined by using the following formula proposed by (Yemane, 1967);

$$n = \frac{(N)}{2+(e)^2} \quad \text{..... Equ [1]}$$

Where, N = the total population size, n = the sample size, and e the level of precision.

In this study, N=2485 and e=0.05 n=303. Then, the representative sample respondents were identified based on probability proportion to the population from four kebeles using a systematic random sampling technique per each 8-household interval.

The study utilized cross-sectional data collection methods, including quantitative and qualitative methods, including household surveys, FGD, KII, field observations, and secondary source analysis. Before conducting data collection activity, an official letter of consent and approval concerning ethical matters and the primary objective of the research was obtained from the institutional review board (IRB) of Addis Ababa University's College of Development Studies. Informed written consent was got from respondents for interviews, focused groups, and surveys. Ethical approval letter was obtained from Addis Ababa University's Academic Commission and the Institutional Review Board (approval number: 029/01/2023) on October 20, 2023.

6.2.2. Data Analysis

This study aimed to explore livelihood threatening shocks and stresses, household resilience sources to food insecurity in Chencha district. However, amid of resilience‘s emerging research and development use (Constas and Barrett, 2013), many things remain vague regarding how the concept can be measured (Vaitla *et al*., 2012); indicators to be used and how they can be combined lacks consensus (Maxwell *et al.,* 2013; Mulat and Negussie 2013;Mulugeta, 2014; Guyu and Muluneh, 2015; Adane, 2018; Gebrerufael, 2019; Debebe, 2021).

Resilience is a latent variable that cannot be directly observed. It is determined through adopting

the Resilience Index Measurement and Analysis-II (RIMA-II) approach (WFP, 2022), which consists of eight components: access to basic services (ABS), agricultural assets (AA), income and food access (IFA), non-agricultural assets (NAA), adaptive capacity (AC), social safety nets (SSN), and stability (S). The RIMA-II approach involves; theoretical concept development, variable identification, standardization, weighting and uncertainty metrics assessment (Dhraief et al., 2019; WFP, 2022). The mathematical model for measuring household resilience can be expressed as:

$$RI = f(AA, ABS, IFA, NA, ATP, AC, SC, S) \quad \text{Equ(2)}$$

where RI is the resilience index, IFA is income and food access, ABS is access to basic services, AA is agricultural asset possession, ABS is access to basic services, NA is non-agricultural assets, ATP is agricultural technological and practices adoption, AC is adaptive capacity, SC is social capital, and S refers to household exposure to shocks or stability.

The study determines RI using multivariate techniques (principal component analysis), considering the researchers' lack of consensus on it (Dhraief et al., 2019; Maxwell et al., 2013). Some studies employ qualitative techniques of measurement (Niemistö, 2011) and others use quantitative statistical methods. This study uses quantitative methods to estimate household resilience to food insecurity, transforming qualitative scales into standard ones using optimal scaling for easier principal component analysis. It follows two-stages a two-stage factor analysis strategy, first estimating each component individually using PCA. The second stage uses interacting components as covariates, and the resilience index is a weighted sum of factors using Bartlett's scoring method (Bartlett, 1937), and the weights are the proportions of variance explained by each factor as follows:

$$RI_n = W_{j1}F_{i1} + W_{j2}Fj_2 + W_{j3}F_{j3} + \ldots\ldots W_{jn}F_{jn} \quad \text{Equ (3)}$$

Where RI-Resilience index of the n^{th} household, *Wj*-is the variance explained by factor *j*, and F_n is the factor retained based on eigenvalue greater than 1.

Data compatibility for PCA analysis of singularity and sampling adequacy were checked using Bartlett's Sphericity test and Kaiser-Meyer-Olkin criteria of sampling adequacy (Field, 2005). Cutting points for household resilience levels vary, but Bartlett‘s test of Sphericity generally less

than 0.05, and Kaiser-Meyer-Olkin (KMO) tests of sampling adequacy should be above the recommended cutting point of 0.5. However, cutting points to categorize households into different resilience levels differ from one another.

The resilience index score ranges from negative to positive, however, there is a lack of consensus among the resilience literature on using cutting points. For instance, some categorize households into two groups: resilient (RI>0.00) and non-resilient (RI<0) (Cheber, 2021a; Gebrerufael, 2019); others level them into four groups: non-resilient, moderately resilient, resilient, and highly resilient (Adane, 2018; Beyene, 2016; Dhraief et al., 2019). Rather than making a rough division into two groups, this study is inclined to use a more descriptive four categories: non-resilient (RI<0), moderately resilient (0<RI≤0.50), resilient (0.50<RI≤1.0), and highly resilient (R>1.0) (Adane, 2018; Beyene, 2016).

Whereas determination of final household resilience index has employed co-variate directly observed variables to determine different pillars of household resilience index such as household food insecurity access scale (HFIAS) and Food consumption score (FCS). Each of these variables was derived through employing different data analysis techniques. HFIAS a food security analysis tool used to measure the access component of household food insecurity developed between 2001 and 2006 by the USAID-funded Food and Nutrition Technical Assistance (FANTA) project. The data collected through nine occurrences and nine frequencies of occurrence questions that capture behavioral and psychological experiences of households regarding food access over the past 30 days (Coates, *et al*., 2007). Whereas food consumption score (FCS) used in PCA analysis is a composite measure used to assess household food security by evaluating dietary diversity, food frequency, and the nutritional importance of different food groups. The FCS is calculated based on the frequency of consumption of various food groups over the past seven days. Each food group is assigned a weight reflecting its nutritional value. For example, foods high in energy and protein receive higher weights. The total score is derived by summing the weighted frequencies of consumption across all food groups (Coates *et al*., 2007). Then, the scores of these indicators were used as directly observed variables to determine pillars of resilience, particularly IFA (Income and Food Access).

6.3. Results and Discussion

6.3.1. Descriptive Statistics

Chencha households face a significant food deficit, both chronic and seasonal due to low agricultural production on fragmented landholdings (Abera *et al.,* 2019). The current study found very small average land (1.1 ha) and livestock (2.95 TLU) holdings. They rely on weaving as an essential income source, with 90.75% using diverse income sources with an average annual income of 44,474.63 ETB[6]. Formal employment (75,025.66 ETB), weaving (38,162 ETB), and barber services (24,500 ETB) have higher average annual income returns. However, external shocks threaten livelihoods. Government-designed PSNP support helps address the food shortage, providing food for work and free aid access.

Rural households in developing countries face challenges from environmental, socio- economic, and ecological shocks (Tefera & Kayitakire, 2015), requiring resilience to recover from food insecurity (Folke, 2006; Walker et al., 2004). Understanding food system capacity is crucial for humanitarian development planning intervention (Holling, 1973; Diamond & Morlino, 2004).

The household survey, KII and FGD concomitantly identified climate, demographic, and market-related stressors as the primary causes of food insecurity in the study area in the last 5 years since 2022. Factors such as population pressure, food price inflation, COVID-19, drought, crop pests, and livestock deaths contribute to the issue. Health extension services have reduced health problems, but poor individuals still face health issues. Long-term threats include low technology adoption, soil erosion, and over-reliance on rain-fed agriculture (Figure 2).

As to 2022 Early warning office report of Chencha Zuria district experiences 3-6 months of food shortages annually, primarily in April, May, June, September, and October. Coping strategies include transitory food aid, PSNP, soil and water conservations, and weaving activities.

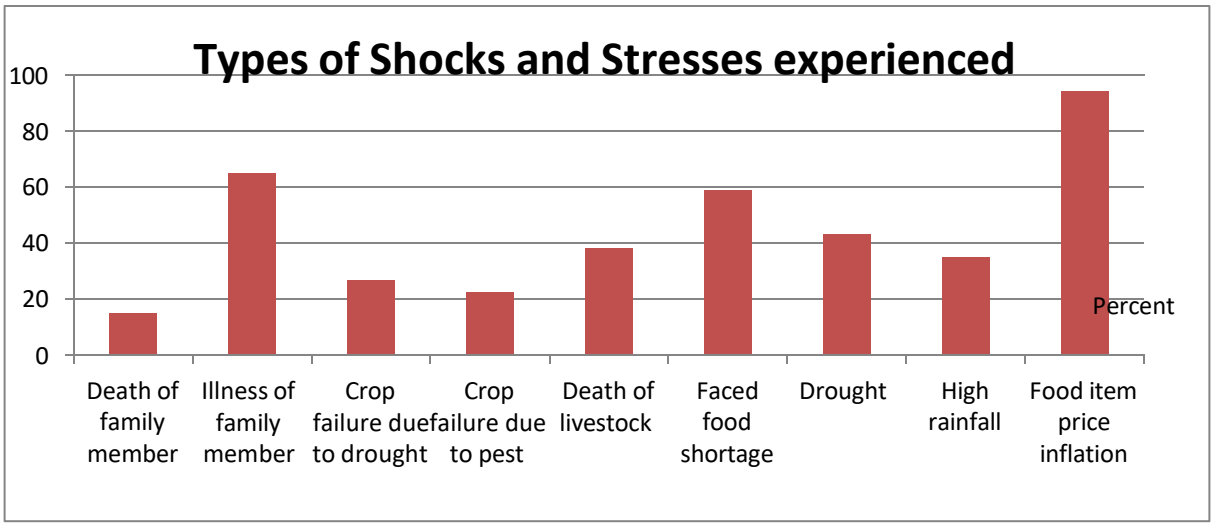

Figure 6: Major Shock Challenges Faced by the Surveyed Households

70% of respondents believe their current food consumption cannot be maintained during a drought, highlighting the need for identifying resilience sources and determinant factors in development planning and intervention.

6.3.2. Estimation of the Latent Indicators

This section examines household resilience to food insecurity using principal component analysis method. Eight resilience building blocks are identified and latent variables are computed using multivariate analysis (Alinovi et al., 2009), factor loadings, eigenvalue criteria, and KMO statistics (Field, 2005). The final aggregate resilience index is computed.

6.3.3. Income and Food Access (IFA)

Income and food access (IFA) are crucial for a household's resilience against external livelihood shocks and food insecurity, which is computed from 9 variables (Table 17). PCA analysis retained four factors based on eigenvalue criteria greater than 1.0. Factor 1 is determined by the FCS, the HFIAS, and household food worry. Factor 2 is defined by household food expenditure and food consumed from own production, while factor 3 defined by food consumed from credit and assistance. And factor 4 is determined by the contribution of annual per capita household income and the percentage of total household income spent on food for consumption.

Table 17: Component Factor Loading for Income and Food Access (IFA)

Variables	Comp1	Comp2	Comp3	Comp4
FCS	0.5493			
HFIAS	-0.6369			
Worried to feed family	0.5278			
Food Expenditure		0.6498		
Food consumed from neighbor		0.6749		
Food from credit			0.6897	
Food from Gift			0.6812	
Per capita income				0.8366
Income spent on food (%)				-0.4351
Eigenvalues	1.83104	1.40214	1.19751	1.01052
Variances	0.2034	0.1558	0.1331	0.1123
Cumulative variance	0.2034	0.3592	0.4923	0.6046

Variance (%) =60.46%
KMO test of sampling adequacy=0.559
Determinant of correlation matrix Det=0.485
Bartlett‘s test of Sphericity is significant at p=0.0001; chi-square=215.785
Degree of freedom=26
Extraction method: Principal Component Analysis

Source: Own survey, 2022

Based on the factor loading and Beta coefficient size; the IFA index is primarily influenced by household per capita income, with negative correlations with HFIAS score and income spent on food consumption. The KMO test of sampling adequacy (0.559) and Bartlett's test of Sphericity ($p<0.0001$, chi-square=215.785) and the variance defined are 60.46%, which showed significant variance contributions from four factors, indicating the principal component analysis technique is suitable for dimension reduction.

IFA= 0.3364*factor1 + 0.25769 *factor 2 + 0.2202*Factor 3 + 0.1857 *Factor 4……. Equ(4)

6.3.4. Social Safety Net or Social capital (SSN)

The Social Safety Net (SSN) is a crucial resource for the poor (WFP, 2016), providing access to assistance from both formal and informal sources (Ciani & Romano, 2014; Guyu & Muluneh, 2015). It is often the last resort for that facing food insecurity, with ten variables used for the index determination (Table 18) and insignificant variables were dropped out. Variables in dummy and categorical forms are converted into standard forms using optimal scaling for easier principal component analysis.

The data set meets KMO and Bartlett's tests for sampling adequacy and Sphericity

(Table3), and the index for the Social Safety Net variable is estimated as follows;

SSN= (0.1678*Factor1 + 0.1589*Factor2 + 0.1177*Factor3 + 0.1065*Factor4 …… Equ(5)

The PCA approach identified four latent variables (factors 1, 2, 3, and 4) that accounted for 55.09% of the variance in the estimation of the latent variable SSN.

Table 18: Principal Component factor loadings of Social Safety Nets (SSN)

Variables	Components			
	Comp1	Comp2	Comp3	Comp 4
Supportiveness of people	-0.4812			
Safety net Gov't	0.5567			
Other supports NGO	0.6202			
No. Close friends		0.5828		
Neighbors to feed children		0.5758		
Edir membership			0.6175	
Church membership			0.7501	
No. individuals lend 100 birr				-0.5999
Supportive neighbor				0.6892
Eigenvalues	1.67755	1.58876	1.17745	1.06496
Variances	0.1678	0.1589	0.1177	0.1065
Cumulative variance	0.1678	0.3266	0.4444	0.5509

Variance (%) =55.09%
KMO test of sampling adequacy=0.554
Bartlett's test of Sphericity is significant at p=0.0001; chi-square=194.638
Degree of freedom=45
Extraction method: Principal Component Analysis

Source: Own survey, 2022

The study uses factor rotation to identify important variables for retaining loading values larger than 0.4 (James, 2002). Most variables are positively correlated with the social safety net (SSN), except community supportiveness and lending (Table 18). Support from safety nets and other organizations are more crucial than other forms in determining Factor 1. Membership in religious associations, social support from neighbors, and non-governmental organizations are important variables.

6.3.5. Access to agricultural Assets (AA)

Access to agricultural assets (AA), including land, livestock, and labor, is crucial for rural households to diversify income sources, withstand food shortages, and build resilience to food insecurity. This study estimated the index for AA using eight (8) observable variables. As shown in the Table 19 below, the principal component analysis (PCA) test results show good suitability, with three factors retained defining 66.18% of variation in AAI, based on the KMO criterion of eigenvalues greater than 1 (Field, 2005).

Table 19: Principal Component factor loadings for Access to Agricultural Asset

Variables	Comp1	Comp2	Comp3
Land holding size in hectare	0.5224		
Livestock holding in TLU	0.5283		
Number of matured Enset			0.7519
Number of Years to feed the family			0.5520
Expected crop harvest in ETB		0.5149	
Monetary value of mature Eucalyptus tree		0.4627	
Mature fruit ready for harvest in ETB		0.6473	
Productive family labour (>15 and <65)	0.5974		
Eigenvalues	2.62675	1.2579	1.03642
Variances	0.3283	0.1572	0.1296
Cumulative variance	0.3283	0.4855	0.6151

Variance (%) =61.51%
KMO test of sampling adequacy=0.728
Bartlett's test of Sphericity is significant at p=0.0001; chi-square=423.813
Det =0.242
Degree of freedom=28
Extraction method: Principal Component Analysis

Source: Own survey, 2022

Landholding, TLU, and productive labor sizes correlated with factor 1; Factor 2 was determined by cash income from crop harvest, matured Eucalyptus trees, and fruit harvest; while factor 3 was influenced by mature Enset crops ready to harvest and their expected years of feeding (James, 2002). Mature Enset, expected fruit harvest, and productive family labor being the most crucial agricultural assets for household resilience to food insecurity and AA index defined as;

AGRI = 0.2446* Factor 1 + 0.2158* Factor 2 + 0.1547* Factor 3….....Equ(6)

6.3.6. Agricultural Input and Technology Adoption (AITA)

Applying improved agricultural methods and technologies to rural household farms is critical to increasing agricultural productivity thereby to fulfill the food shortfall and improving household resilience to food insecurity in a growing population and dwindling land yield (Adane, 2018). For this end, AITA index is estimated using (5) agricultural technology-related variables were used (Table 20). The PCA model's compatibility test yielded positive results, with three factors retained explaining 89.53% of the variance in the AITA index determination.

Table 20: Principal Component factor lodging for Agricultural Technology Adoption (ATA)

Variables	Comp1	Comp2	Comp3
FTC service	0.5889		
DA contact	0.5316		
Veterinary services	0.5944		
Improved seed use		0.8215	
Pesticide use		0.4314	
Chemical fertilizer use			0.7112
Herbicides			0.6907
Eigenvalues	2.26868	1.20849	1.05298
Variances	0.3241	0.1726	0.1504
Cumulative variance	0.3241	0.4967	0.6472

Variance (%) =64.72%
KMO test of sampling adequacy=0.692
Bartlett's test of Sphericity is significant at p=0.0001; chi-square=461.133
Degree of freedom=21
Factor Extraction method: Principal Component Analysis

Source: Own survey, 2022

The PCA analysis revealed all variables have a positive correlation with the AITA index: access to farmer trainings, DA contacts, and veterinary services positively correlated with factor 1; use of improved seeds and pesticides influenced factor 2; and access to chemical fertilizer and herbicides have determined factor 3. The study highlights improved seed access and chemical fertilizer use as crucial agricultural technologies, with a higher factor loading value determining the AITA latent variable index. The survey results are consistent with the information gathered from KII, FGD, and researcher field observations, and the latent variable index for AITA is determined using the following method:

AGRTECHAI = 0.2964* Factor1 +0.1786* Factor2 +0.1721* Factor3.....Equ(7)

6.3.7. Non-agricultural or Physical Assets (NAA)

In rural areas, ownership of non-agricultural assets is a sign of wealth status (Dhraief et al., 2019) and an important source of livelihood risk management. Based on literatures and researcher's experience, 11 variables were used all measured in current economic value in ETB; suitable for principal component analysis (Table 21). PCA analysis retained four components explaining 57.52% variance in the NNA latent variable index by (Field, 2005; Kaiser, 1964).

The PCA analysis revealed all variables have a positive correlation with the AITA index: access to farmer trainings, DA, and veterinary services positively correlated with factor 1; use of improved seeds and pesticides

influenced factor 2; and access to chemical fertilizer and herbicides was determined by factor 3. The study highlights improved seed access and chemical fertilizer use as crucial agricultural technologies, with a higher factor loading value determining the AITA latent variable index.

Table 21: Component loadings of variables to estimate (NNA) component of resilience

Variables	Component			
	Comp1	Comp 2	Comp3	Comp4
Bed	0.4866			
Stove owned	0.4193			-0.4591
Jewelry		0.6934		
Watch		0.6790		
Mobile phone			0.5498	
Bicycle			0.7119	
Radio				0.8121
Eigenvalues	2.86857	1.28787	1.11104	1.06
Variances	0.2608	0.1171	0.1010	0.0964
Cumulative variance	0.2608	0.3779	0.4789	0.5752

Variance (%) =57.52%
KMO test of sampling adequacy=0.696
Bartlett's test of Sphericity is significant at p=0.0001; chi-square=513.121
Determinant of the correlation matrix Det = 0.178
Degree of freedom=55
Extraction method: Principal Component Analysis

Source: Own computation from survey, 2022

The NAA index is calculated as follows;

NNAi = 0.2516*Factor 1 + 0.1166*Factor 2 + 0.1041*Factor 3 + 0.1029*Factor 4..... Equ (8)

6.3.8. Adaptive capacity (AC)

Adaptive capacity is a crucial aspect of household resilience, allowing households to absorb, adapt, or react to shocks (Alinovi et al., 2009; Alinovi et al., 2010). Literature treats adaptive capacity differently from resilience analysis, with some treating it as a separate component (Walker et al., 2004) and others as part of resilience analysis (Pisano, 2012; Frankenberger *et al*., 2014; Abebe, 2018; Debessa, 2018). This study treats adaptive capacity as a determinant component for household resilience to food insecurity, following previous works *(*Alinovi *et al., 2009;* Alinovi *et al., 2010)* and (Guyu & Muluneh, 2015; Debessa, 2018).

For ease of PCA analysis, optimal scaling (mean = 0 and variance = 1) was carried for dummy and categorical variables. Statistical requirements are checked and found suitable, and seven components

were retained that explain 58.81% of variance in adaptive capacity (AC) determination using PCA analysis (Table 22).

Table 22: Component loadings of variables to estimate Adaptive Capacity

Variables	Component						
	Comp 1	Comp 2	Comp 3	Comp 4	Comp 5	Comp 6	Comp 7
HH ability to read/write	0.7090						
HH Years of schooling	0.6010						
Ill members		-0.5079					
Number of disable		0.5780					
Income sources			0.4907				
Agri income source			0.5110				
Number of crops grown			0.5162				
Single and Earning				0.5426			
Salary/wage				0.6075			
Spiritual education attn.					0.6776		
Transfers					0.4479		
Family business						0.6332	
Cash deposit							0.6460
Eigenvalues	2.82781	1.82181	1.57836	1.43022	1.34778	1.11136	1.05599
Variances	0.0931	0.0888	0.0884	0.0877	0.0847	0.0777	0.0676
Cumulative variance	0.1488	0.2447	0.3278	0.4031	0.4740	0.5325	0.5881

Variance (%) =58.81%
KMO test of sampling adequacy=0.604
Bartlett's test of Sphericity is significant at p=0.0001; chi-square=866.269
Degree of freedom=171
Extraction method: Principal Component Analysis

Source: Own survey, 2022

Except for the number of ill members in the household, the study found that household adaptive ability, particularly reading and writing capacity, spiritual education, and monetary deposits, have positively and higher correlates with the AC index, implying for resilience to food insecurity.

AC= 0.0931*Factor 1 + 0.0888*Factor 2 + 0.0884*Factor 3 + 0.0877*Factor 4 + 0.0847*Factor 5 + 0.0777*Factor 6 + 0.0676*Factor 7..... Equ(9)

6.3.9. Access to Basic Services (ABS)

Access to basic services (ABS) or public services delivered by national governments and supporting organizations, enhance households' resilience to external shocks by providing in-kind and in-service supports, improving their overall quality of life (Alinovi et al., 2010). Dummy and categorical variables were changed to continuous form using optimal scaling for convenience of PCA analysis

and retaining four components, explaining 68.18% of the variance in ABS index estimation (Table 23).

ABSI=0.1609* Factor 1+0.1168* Factor 2+0.1163* Factor 3+0.1097* Factor 4+0.0960* Factor 5

….....Equ(10)

Table 23: Component loadings of variables to estimate (ABS) component of resilience

Variables	Comp1	Comp2	Comp3	Comp4	Comp5
Primary school	0.6530				
Secondary school	0.6602				
preparatory school		-0.5761			
Access to mobile phone		0.5869			
Access to main road			0.5149		
Access to microfinance			0.5858		
Access to water for domestic use				0.7479	
Access to market				0.4560	
Access to Electricity					0.8349
Access to potable water					0.4377
Eigenvalues	1.93116	1.40125	1.39586	1.31583	1.1524
Variances	0.1609	0.1168	0.1163	0.1097	0.0960
Cumulative variance	0.1609	0.2777	0.3940	0.5037	0.5997

Variance (%) =59.97%
KMO test of sampling adequacy=0.6240
Bartlett‘s test of Sphericity is significant at p=0.0001; chi-square=523.174
Det =0.171
Degree of freedom=66
Extraction method: Principal Component Analysis: Principal Component Analysis

Source: Own survey, 2022

The study reveals that access to primary and secondary schools is highly correlated with factor 1. Attaining preparatory school and mobile access have negative and positive correlations with factor 2. The correlation of access to the main road and microfinance services to component 3 is highly positive, indicating a strong connection between these variables. Access to domestic water and markets have a positive correlation with component 4. Component 5 is determined by the positive correlation between _Access to Electricity‘ and 'Access to Potable Water'. The most crucial public services in the area are access to electricity, domestic water, and secondary school, as determined by factor loadings (Table 23).

6.3.10. Stability

Stability, a cross-sectional dimension of resilience to food insecurity, refers to the stability of the food

supply and socio-economic factors in face of different adverse external shocks and stresses (Alinovi et al., 2010). Following similar previous studies and taking into account particular study area context; this study has used human health issues like frequency of visits to clinics due to illness, death of family member, climatic shocks like drought, high rainfall, death of livestock, crop failure due to disease and pest, and socio-economic changes such as food item price inflation and perceived capacity of household head to keep current level of consumption if drought occur in the coming production season. Some variables in dummy and categorical forms were transformed into continuous forms using optimal scaling (mean = 0 and variance = 1). PCA analysis showed compatibility of the data set (Table 24), with three components retained explaining 69.15% of variances in stability (S) estimation.

All variables except family member illness were significant i.e. an absolute value of loadings greater than 0.4 (Stevens, 2002), affecting household resilience capacity negatively. However, as expected the capacity to maintain current food consumption if a drought occurs is negatively correlated with the S latent variable, indicating a potential drought-related impact.

Table 24: Component Loadings of variables to Estimate Stability (S) Component

Variables	Comp1	Comp2	Comp3
Drought	0.5401		
High rainfall	0.5388		
Crop failure due to drought	0.5424		
Family member death		0.5793	
Livestock death		0.7483	
Food item price rise			0.7599
Able to keep current food consumption?			-4602
Eigenvalues	3.1377	1.34678	1.04759
Variances	0.3922	0.1683	0.1309
Cumulative variance	0.3922	0.5606	0.6915

Variance (%) =69.15%
KMO test of sampling adequacy=0.762
Det = 0.093
Bartlett's test of Sphericity is significant at p=0.0001; chi-square=791.088
Degree of freedom=28
Extraction method: Principal Component Analysis

Source: Own survey, 2022

Stability Index= 0.3922*Factor1 + 0.1683*Factor2 + 0.1309*Factor3……. Equ(11)

The results showed that factor 1 was positively correlated with drought, heavy rainfall, and crop loss caused by drought; factor 2 was positively correlated with family members and livestock deaths; and

factor 3 was positively correlated with the effect of rising commodity prices and negatively correlated with households' ability to continue their current level of consumption into the future. Depending on the degree of factor loading of variables, rising food prices and animal deaths are important stability factors or shocks to families.

6.4. Household Resilience to Food Insecurity

Two steps were involved in determining household resilience: first, indices for each of the eight constituent pillars (IFA, SSN, AA, AITA, NAA, AC, ABS, and S) were computed; second, the household resilience index was determined by using the pillars that were defined in the first stage as covariates in PCA analysis.

RI= 0.2712* Factor 1 + 0.1565* Factor 2+0.1423* Factor 3……. Equ(12)

Field's PCA data compatibility recommendation yielded promising results (Field, 2005) (Table 25), with six out of eight variables significantly contributing to three retained components with loading values greater than 0.4 (Stevens, 2002). However, households' access to Agricultural Technology Innovation and Adaptive Capacity showed weak access and need for strengthening.

Table 25: Component Loadings of Variables to Estimate Household Resilience (RCI)

Variables	Comp1	Comp2	Comp3
Agricultural Assets	0.4542		
Access to Non-agricultural Assets	0.5523		
Income and Food Access	0.4631		
Social Safety Nets		0.8283	
Access to Basic Services			0.7808
Stability			-0.5301
Eigenvalues	2.16977	1.25211	1.1386
Variances	0.2712	0.1565	0.1423
Cumulative variance	0.2712	0.4277	0.5701

Variance (%) =57.01%
KMO test of sampling adequacy=0.691
Bartlett's test of Sphericity is significant at p=0.0001; chi-square=295.986, Det. R-Matrix=0.371
Degree of freedom=28
Extraction method: Principal Component Analysis

Source: Own survey, 2022

Factor loadings can be utilized as a correlation coefficient or a regression coefficient, which analyzes PCA assumptions using orthogonal rotation (Field, 2005). The PCA result shown that access to AA, IFA and NAA are positively correlated with Factor 1; access to SSN positively determined factor 2; ABS and S positively and negatively correlated with or determined factor 3, respectively. As in other studies by Adane (2018), Alinovi *et al.* (2009), Alinovi *et al.* (2010), Beyene, (2016), and Debebe (2021), the size of the beta coefficient is used to establish the relative importance of pillars to household resilience to food insecurity. In this regard, access to SSN (0.8283), ABS (0.7808), and NNA (0.5523) is the factor that contributes most strongly to household resilience to food insecurity in the study area, according to the size of the beta coefficient of loadings. KII and FGD results also support the quantitative result with informal social support systems in the case social, economic or environmental shocks responses.

The findings of PCA analysis finally categorized households into status of resilience levels. The study found that 179(59.06%) of respondents were non-resilient and 124(40.94%) were resilient at different levels, with an average resilience score of -3.30033E-10, indicating a non-resilient mean resilience score (Table 26).

Table 26: Level of Household Resilience to Food Insecurity

Resilience index	Resilience status				
	Non-resilient (RI≤0.00)	Moderately resilient (0.00<RI≤0.50)	Resilient (0.50<RI≤1.00)	Highly resilient (RI≥1.00)	Total
No. respondents	179	76	33	15	303
Percent	59.74%	24.42%	10.89%	4.95%	100
Minimum	-1.1014280	0.0147597	0.5030434	1.0250580	-59.9659144
Maximum	-0.0000952	0.4913051	0.9766411	1.8484960	18.1485606
Mean	-0.335005108	0.238796850	0.675617052	1.301466067	22.2953627
Std. Dev.	0.2374532536	0.1506310020	0.1295782057	0.2240763545	19.5219910

Source: Own survey, 2022

6.5. Conclusion and Recommendation

The study highlights food insecurity in a district as a significant development challenge due to livelihood shock and stress factors such as small landholding size, food item price rise, drought, family illness, crop pests, and disease. It examined household resilience, threatening shocks using one-time cross-sectional data; however, it lacks considering temporal and geographical dynamics. It provides insights for policymakers to plan and implement lasting development policies in changing socio-economic conditions.

The study reveals that social safety net, basic services, and non-agricultural assets are key factors in enhancing household resilience to food insecurity, while agricultural technology and adaptive capacity are less influential. Finally, PCA shows most households (59.76%) were non-resilient to food insecurity shocks.

The study highlights areas for enhancing households' resilience to food insecurity in the district and proposes the following policy suggestions for long-term strategies to address these challenges;

- Resilience studies reveal access to social safety nets, basic services, and non-agricultural assets as key resilience sources. Strengthening non-agricultural asset ownership and refining policies to expand social safety net and basic services can enhance household resilience against food insecurity.
- Household resilience is largely influenced by their adaptability and access to agricultural technology, however found to be least contributed in the study. A well-designed agricultural

extension program can enhance resilience by focusing on education, income generation, health services, and social and technical skills for responding environmental and socio-economic changes.

- FGD, KII and PCA result highlights the issue of fragmented landholding and restricted agricultural ownership due to population pressure, leading to food production shortfalls. It suggests policymakers should increase off-farm activities for young people and households with working age, and explores small-farmland-based agricultural techniques as solution for food insecurity.

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CHAPTER SEVEN: DETERMINANTS OF HOUSEHOLD RESILIENCE TO FOOD INSECURITY FOR COMPARISON: THE CASE OF CHENCHA DISTRICT, SOUTHERN ETHIOPIA

Abstract

Background

Food insecurity is a historical global human challenge, but has yet remained a burning development agenda. The capacity to withstand and recover from food insecurity shocks and stresses refereed as resilience, which is determined by a strand of factors. This paper deals with measuring and; identifying major determinants of household resilience to food insecurity among weaving-based livelihood system in Chencha district.

Methods

Multi-stage sampling technique was employed to generate data from 303 sample households through household survey, focus group discussion, and key informant interviews. The collected data were analyzed by using descriptive statistics, household resilience index, chi-square test, one-way ANOVA and econometric model (probit regression).

Results

The household survey revealed that 59.04% households were non-resilient, 24.42% were moderately resilient, 10.89% resilient and 4.95% highly resilient. The Chi-square and one-way ANOVA tests have shown a meaningful and statistically significant difference among resilience categories. Finally, probit model analysis indicated that access to credit, average years of family education, crop diversity, income diversity, landholding size, TLU, expected crop harvest, expected cash income from fruit trees, frequency of extension contact, FCS, annual food expenditure, ownerships of Radio, Jewelry, furnished bed, membership in local associations, and distance to local market have positively influenced the likelihood of attaining higher household resilience at CI 95% or P<1%, 5% and 10%. Whereas; lack of access to mobile phone, inability to read and write, family business, formal employment, and transfers of payment have decreased likelihood of households to achieve higher resilience level.

Conclusions

Therefore, improving household access to credit, education, income diversification, livestock and land, agricultural extension services, membership to local associations, mobile service, and income diversification would enhance household income and food security, which could in turn improve household resilience to food insecurity.

Key words: Household, Resilience, Determinants of resilience, Food Insecurity, Shock, Stress

7.1. Background of the study

Food security is a multidimensional concept that is currently the political, economic, and social agenda of development. Its emergence dates back to some 50 years ago, in the 1970s, during the World Food Conference Summit (2003). Currently, it is claimed that it has more than 200 definitions and many indicators of measurement (Maxwell and Smith, 1992). Definitions and conceptualizations of food security have undergone a series of modifications. However, food security is commonly understood as a condition where all people at all times have physical, economic, and social access to sufficient, safe, and nutritious food that helps to lead an active and healthy life (FAO, 1996). Basically, it can be conceptualized and examined at multiple levels (Anon, 2015).

Food insecurity and undernourishment remained a burning development agenda in an ever uncertain world. A significant proportion of the world population is suffering from increasing hunger. In the year 2019, more than 820 million people were suffering from hunger (SOFI, 2019). Its severity increasing over time, 828 million people were hunger in the year 2021, 924 million people were food insecure. Even an expected 670 million people will still be suffering hunger in the 2030 (FAO, 2022). Among 795 million food insecure people in 2015 worldwide, Africa comprises 28.05%, however, Sub-Saharan Africa constitute 95% of food insecure people in the whole Africa (USDA, 2022). Increasing climate change and resulting drought, successive shocks due to COVID-19 pandemic and war between Ukraine and Russia raised food insecure people to 123 million in 2022 (Baptista *et al*., 2022) take attributes for increased food insecurity problem in SSA.

Food insecurity is a historical human challenge in Ethiopia since 1970s (Devereux, 2000; Kaluski *et al*, 2001; FAO, 2010). However, food insecurity and malnutrition are still a primary concern of Ethiopia. Currently, an estimated 20.1 million people need humanitarian food support, 7.4 million children and women were undernourished, malnutrition 41 percent of children between 6-59 months undernourished (WFP, 2023). For this, conflict during 2020-2022 in the northern part and associated displacement and historic drought in years 2020-2023 in the south and southeast part of the country has attributed to growing food insecurity (WFP,

2023;.FWS NET, 2023). Hunger and malnutrition mainly caused by a combination of conflict and drought. Globally, conflict takes biggest driver of malnutrition where 70% of world hunger and food insecure people are found in areas affected by war and violence like; conflict of Ukraine and Russia, and conflicts in the northern part of Ethiopia (WFP, 2023). Climate change induced shocks (drought) are another important contributor next to conflict that destroy lives (human, crop and livestock), and decline people‘s ability to feed them. Global market failure also caused raise to fertilizer price and declined food production and resulted in food price inflation. In Africa, population pressure, diminishing landholding size and farm productivity, limited adoption of technology, recurring droughts, conflict, rising food prices, and epidemics affecting humans and cattle considered as factors that attributed for food insecurity problem in Africa (FAO, 2015; Meskerem and Degefa, 2015). On the other hand, Ethiopia's food insecurity issue is linked to the country's increased reliance on rain-fed agriculture, drought, population pressure, and irregular rainfall (MoARD, 2009). Particularly, southern parts of Ethiopia are also encountering food insecurity in the form of chronic and seasonal forms despite its suitable and diverse agro-ecology. The area is highly exposed to soil erosion due to its mountainous topography. Particularly, the study area Chencha district is highly threatened by different forms of soil erosion (sheet, rill and gully) (CWARDO, 2014). The area is highly vulnerable to long-term seasonal food insecurity that lasts from April to May, and September to November (Tadesse *et al*, 2019, Abera *et al*, 2019). Declining landholding size, population pressure, drought, crop disease and pests, livestock and human disease, seasonal fluctuation, and resulting erratic rainfall are major causes of food and livelihood insecurity in the area (Engdawork, 2012; Shambel, 2017). To withstand this challenge, people practice income diversification, cultivating endogenous drought-resistant crops (Enset and Qoltso), weaving, and rural-urban migration (Abera, 2014; Abera *et al*., 2019). But it lacks empirical studies conducted on the status and determinant factors affecting household capacity to withstand food insecurity shocks and stresses (resilience).

Resilience is an important development discourse which has emerged as a novel and quickly expanding development topic in the past few decades (Bahadur *et al*, 2015; Winderl, 2014). It is defined as the capacity of a system to resist, absorb, accommodate to and recover from the effect of the livelihood shocks and stresses without being incurring irreversible damage on the structure and functions of a system (Geneva, 2009; Olamide Bisi- Amosun & Lafayette, 2019). Resilience is a multidisciplinary concept, but, for the first time the work of Alinovi *et al.* (2009) has applied

the concept in the context of food security analysis. However, its application depends on unit of analysis, type of shock, answering the question of resilience of what and resilience to what (Alinovi *et al.,* 2009). Resilience of households to food insecurity depends on livelihood options available (assets, activities, services) to the household and its ability to manage. Unlike vulnerability, resilience analysis focus on measuring capacity of households to withstand and recover from expected shocks and stresses (USAID, 2013).

However, resilience concept in food security study is newly emerging (Alinovi *et al*, 2009) and conceptualized as ability of household to maintain certain level of wellbeing (food security) in face of shocks and stresses. Basically, resilience analysis employs two data types; time series longitudinal data (longitudinal dynamics) and cross-sectional data (a static or current time) or a point in time data (Alinovi *et al*, 2009, Alinovi *et al*, 2010, Ciani & Romano, 2013, Adane, 2018 and Gebrerufael, 2019). However, analyzing longitudinal dynamics of resilience faces challenges of availability and access of time series data. As a result, very insignificant studies have used longitudinal data for resilience analysis (Alinovi *et al*., 2008; Alinovi *et al*., 2010; Mulat and Negussie, 2010). However, majority of resilience studies employ cross-sectional one time data (static data) (Carter *et al*., 2006; Keil *et al*., 2008, Adane Atara, 2018 and, Gebrerufael, 2019, Debebe, 2021). Using four building blocks, Alinovi et al. (2010) found that households' resilience to food insecurity varied among different sub-regions. Another study at Kenya using longitudinal from 2005-06 years data found large-holders are most resilient while pastoralist livelihood groups were found least resilient (Alinovi *et al*., 2010). While Ciani & Romano (2013) found smallholders and agricultural wage workers were less resilient than other livelihood groups in Nicaragua. The resilience study at Boricha woreda Sidama region found 61% of respondents as non-resilient and inter-livelihood zone variation (Adane Atara, 2018).Whereas Gebrerufael (2019) confirmed that half of the households in Ahferom woreda in the Tigray region were resilient, and the remaining half were non-resilient to food insecurity.

In a comprehensive evaluation of relevant empirical literature, the majority of studies focused on the ability of agriculture-based livelihood systems. This study, however, concentrated on assessing the resilience capacity of households that employ traditional weaving and spinning as a source of income for their livelihood. Though it is the most well-known alternative livelihood option in the country after agriculture, little research has been done on the benefits of weaving or its drawbacks. In Chencha district, the designated research area, the current study is novel

because resilience studies there are the first of their sort. The current study examines the determinant factors of weaving-based households' resilience to food insecurity in the Chencha District using the revised version of the Alinovi (2010) resilience paradigm. Conceptualizing and analyzing household resistance to food insecurity within the context of sustainable livelihood thinking has also been shown to be an interesting approach. It differs from previous empirical research, though, in that it (1) examines how livelihood diversification affects household resilience and (2) concentrates on looking at weaving as a means of enhancing household resilience against food insecurity.

7.2. Method

7.2.1. Data Types and Data Sources

Both qualitative and quantitative data were employed in this investigation. To better understand the nature of livelihood conditions, food security, external shocks and pressures, and household resilience to food insecurity, quantitative and qualitative data from primary and secondary sources were acquired. Households, key informants, and focus group discussants were among the primary data sources used. Secondary data were gathered from national statistical reports, annual office reports, published and unpublished documents on livelihood conditions, food security status, food insecurity causing shocks and stresses, coping strategies, and potential sources of household resilience to food insecurity and its determinants in the area.

7.2.2. Sampling Techniques and Sample Distribution

Chencha district is one of the food insecurity stressed areas found in southern Ethiopia in general and Gamo zone in particular. Food insecurity is exacerbated by fragmented and small landholdings, deteriorating soil fertility owing to protracted repeated agriculture, high population density, recurrent drought, irregular rainfall, and other factors. As a result, chronic and seasonal food insecurity is a critical development challenge in the area. However, the area has long been praised for its ability to endure the country's historical food crisis shocks without resulting in life losses (Desalegn, 1996. Abera et al, 2019). However, the causes and key sources of its ability to endure food instability and famine have yet to be empirically supported. In the Chencha district, weaving and spinning considered as the second most important livelihood activity following small-scale agriculture which complement the food and income shortage households encounter

due to very low agricultural production. Weaving and spinning are regarded as the second most significant livelihood activity in the area, behind small-scale agriculture, and help to supplement the food and income shortfalls that households face due to low agricultural production. As a result, this study was designed to investigate household resilience to food insecurity, with weaving-based households as a target group assuming weaving as an important livelihood income alternative and household resilience to food insecurity.

The study used a multistage sampling technique to choose the study district and sample households. In the first stage, the Chencha district was purposefully chosen where weaving is the most prevalent livelihood activity in the zone in particular and the country in general. In the second stage, four kebeles were selected where weaving is dominantly practiced by running scatter plot for all kebeles in terms of the numbers of households involved in weaving activity. In this regard, Doko Danbo, Doko Loosha, Lakana Maldo and Setena Borcha were selected as a sample kebeles. The sample respondents were chosen in the third stage using systematic random sampling techniques. Finally, the sample size of respondents was determined using the following formula proposed by Yemane (1967):

$$n = \frac{(N)}{2+(e)^2} \quad \text{..... Equ [1]}$$

Where,

N = the total population size,
n = the sample size and
e= the level of precision.

In this study, N=2485 and e=0.05 n=303. Then, the representative sample respondents were identified based on probability proportion to population from four kebeles using systematic random sampling technique per each 8 household interval. The study data were collected in 2022 from 303 sample rural households, 20 in-depth key informants, 6 focus group discussions, and substantiated by field observations and secondary document analysis.

7.2.3. Types and Methods of Data Collection

The study used cross-sectional data collection methods that included quantitative and qualitative data collection methods. This study relied on both primary and secondary data, which were quantitative and qualitative in character. As significant data gathering methodologies, household surveys, focused group discussions (FGD), key informant interviews, field observations, and secondary source analysis were used.

7.2.3.1. Key Informant Interview

Before conducting household surveys, intensive key informant interviews were employed with food security and early warning officers, health, education, social affairs, and natural resource management officers. Accordingly, 20 in-depth Key Informant Interviews (KII) were held with household heads, kebele leaders, experts in agricultural extension, natural resource management experts, health extension, food security and early warning, water supply, and job creation and enterprise at kebele, woreda, and zone levels. Basically, the issues elaborated include: livelihood income sources in the area; food supply and adequacy; shocks and risks; vulnerability contexts; access to and availability of basic livelihood options and services; and challenges.

7.2.3.2. Household Survey

Household survey has been conducted using semi-structured questionnaires. It has addressed the demographic, socio-economic, livelihood strategies, food security, household access to assets and basic services, livelihood shocks and stresses, challenges and household resilience sources that affect livelihood conditions of the sample households. The survey process has been managed by using trained enumerators under close follow up of the researchers. The household survey data collection was done on March and April, 2022 G.C from 303 weaving-based households.

7.2.3.3. Focused Group Discussion (FGD)

Six Focus Group Discussions were held on March 10-20, 2022, to supplement the data acquired from the household survey, two in Doko Danbo and two in Doko Loosha kebeles and one each in Setena Boricha and Lakana Maldo kebeles based on population size. It contains 6-10 people who have extensive knowledge in the area's livelihood conditions and accompanying difficulties. Members of the group discussion comprised elders, women, and teenagers, taking into account

the group's diversity and managing the participation of all members. The FGD addressed problems such as livelihood possibilities, constraints, food security conditions, livelihood shocks and stress, and potential sources of household resistance to food insecurity in the area.

7.2.3.4. Field Observations

Transect walks were conducted throughout the research locations to observe people's livelihood patterns as well as the current opportunities and difficulties. Secondary data were gathered by analyzing numerous published and unpublished secondary documents. The household survey was conducted by researchers and professional enumerators.

7.3. Data Analysis Techniques

Data collected through household survey, focus group discussion, key informant interview and secondary document analysis were analyzed using relevant data analysis techniques. The main subject of this study, the household resilience to food insecurity problem majorly addressed with quantitative data collected through household survey. Thus, household resilience is examined through resilience analysis technique following RIMA-II approach (FAO &WHO, 2022). For this end, the data were analyzed by adopting quantitative data analysis model using multivariate analysis model. Among different multivariate analysis techniques, particularly principal component analysis method is applied. Various socio-economic explanatory variables (dummy, categorical and continuous) were used to examine their effects across the categories of household resiliencies (Tables 2, 3 & 4). Chi-square test is used to examine whether there exists meaningful difference among meaningful significant difference exists in various categorical variables across resilience categories of (non-resilient, moderately resilient, resilient and highly resilient categories). On the other hand, the existence of significant mean variation of continuous variables throughout the resilience categories was determined by using one-way ANOVA techniques.

On the other hand, qualitative data types collected through FGD, KII and field observation were analyzed by narrative inquiry, content analysis and interpretation. However, the detail of quantitative data analysis model was described in the following parts.

7.3.1. Techniques of Determining Household Resilience to Food Insecurity

Household resilience conceptualized as the ability of a household to maintain a certain level of well-being (i.e., being food secure) by withstanding shocks and stresses and reorganizing while undergoing change so as to still retain essentially the same function, structure, and feedback (Alinovi et al., 2009; Daie & Woldtsadik, 2015). It can also be defined as a system's capacity to respond positively to surrounding changes, maintain, or improve function based on available options like assets, activities and services (Frankenberger, T., 2012). Household resilience is a complex system thinking that deals with vulnerability and changes considering households as basic components in a food system (Béné C.et al, 2016). In this regard, households are considered as main decision makers and main adaptive component having continuous interaction with its surrounding environment (Guyu & Muluneh, 2015; Dhraief *et al*., 2019). Regarding analytical techniques; resilience is a latent variable that cannot be directly observed. Hence, it is determined from covariate effects of hypothesized potential dimensions that are latent variables themselves (Alinovi *et al*., 2009). Following RIMA-II approach suggested by (FAO &WHO, 2022), household resilience to food insecurity was determined by covariates of eight components. These components include; access to Basic Services (ABS), Agricultural Assets (AA), Agricultural Technology and Practices (ATP), Income and Food Access (IFA), Non-agricultural asset (NA), Adaptive Capacity (AC), Social Safety Nets (SSN), and Stability (S). Final household resilience to food insecurity index was determined following a series of steps.
These include developing theoretical concept for understanding resilience, identifying and developing relevant variables, standardizing to allow comparison, weighting and aggregating the variables, and using uncertainty metrics to assess the robustness of the variables (Dhraief et al., 2019; FAO &WHO, 2022). The model for household resilience measurement can be expressed mathematically as:

$$RI = f(ABS, AA, IFA, NA, ATP, AC, SC, S) \quad (1)$$

Where RI is the resilience index, IFA is income and food access, ABS is access to basic services, AA is agricultural asset possession, NA is non-agricultural assets, ATP is agricultural technological and practices adoption, AC is adaptive capacity, SC is social capital, and S refers to household exposure to shocks or stability.

Despite resilience‘s multidimensional application and its dynamic nature, there is lack of consensus reached among scholars on how to measure it (Maxwell, et al., 2013, Dhraief *et al*., 2019). It can be measured employing quantitative or qualitative techniques (Nelli, N., 2011). However, the current study used quantitative methods through applying a series of multivariate techniques (principal component analysis and optimal scaling). Optimal scaling is used to transform dummy and categorical data to standard continuous forms for ease of principal component analysis.

Therefore, a two-stage factor analysis technique is used to determine the resilience index. First, an iterated principal component analysis (PCA) method is used to estimate an index for each component independently across a collection of observed variables. The interaction components that were calculated in the first stage are used as covariates in a PCA analysis to create the household resilience index in the second step. The components produced by Bartlett's (1937) scoring technique are then added up to form the resilience index, which is a weighted total. The weights correspond to the percentages of variation that each factor explains, as follows:

$$RI_n = W_{j1}F_{i1} + W_{j2}Fj_2 + W_{j3}F_{j3} + \ldots\ldots W_{jn}F_{jn} \quad (2)$$

Where RI-Resilience index of the n^{th} household, *Wj*-is the variance explained by factor *j*, and F_n is the factor retained based on eigenvalue greater than 1.

The compatibility of data for PCA analysis and sampling adequacy were checked by Bartlett‘s test of Sphericity and Kaiser-Meyer-Olkin (KMO) criteria (Field, 2005). Accordingly, Bartlett‘s test of Sphericity should be less than 0.05 (the cutting point), and Kaiser-Meyer-Olkin (KMO) tests of sampling adequacy should be equal to or above the recommended cutting point of 0.5. Resilience index scores range from negative to positive. However, there is a lack of consensus among the resilience literatures on using cutting points (Fikiru, 2016; Gebrerufael, 2019 & Debebe, 2021). In this regard, some categorize households into two; resilient (RI>0.000) and non-resilient (RI<0) (Gebrerufael, 2019; Debebe, 2021); others level them into four groups: non-resilience, moderately resilient, resilient, and highly resilient (Fikiru, 2016; Adane, 2018; Dhraief, M. Z. et al., 2019). This study categorized households into four groups following the suggestions by (Fikiru, 2016; Adane, 2018; Dhraief, M. Z. et al., 2019) namely; (1) non-resilient (RI≤0), (2) moderately resilient (0<RI≤0.50), (3) resilient (0.50<RI≤1.0), and (4) highly resilient

(R>1.0). This helps us to make more descriptive comparisons among resilience groups rather than rough categorization into two groups.

7.3.2. Determinants of Household Resilience to Food Insecurity

Household resilience to food insecurity refers to a household's ability to maintain food security despite shocks, stresses, and changes, ensuring its function, structure, identity, and feedback. The options accessible to the household and its capacity to withstand risks determine how resilient it is to food insecurity (Daie & Woldtsadik, 2015). Determinant factors must be identified in order to improve households' resilience to food insecurity. Therefore, it is critical to pinpoint the resilience-determining variables in order to implement programming and policy changes.

Here the resilience level was used as a dependent variable with a negative to positive values. Based on the experiences of previous studies (Fikiru, 2016; Adane, 2019), the households were classified into four classes of resilience namely; Non-resilient (RI≤0.00), moderately resilient (0.00<RI≤0.50), resilient (0.50<RI≤1.00), and highly-resilient (RI>1.00). Since, the dependent variable has more than two outcomes, in our case four ordered outcomes. In this case, ordered probit regression model was most commonly recommended technique used with ordered classifications. Then, the differences across these categories can be affected by different explanatory variables at different levels. And the model was specified as follows;

$$Y^*j = X_{j1}\,\beta + U_{1j} \quad \text{.....(1)}$$

$Y=1$ if $Y^* \leq 0$

$Y=2$ if $0 < Y^* \leq 0.50$

$Y=3$ if $0.50 < Y^* \leq 1.0$

$Y=4$ if $y>1.00$

Where Y refers to the level of household resilience to food insecurity with an ordered outcomes of Y_1=Non-resilient, Y_2=moderately resilient, Y_3=Resilient and Y_4=highly resilient. The X_{ij} are the explanatory variables that are hypothesized to determine the household resilience status. The explanatory variables used in this model consist of dummy, categorical and continuous forms in their nature. And, β represents the parameters estimated and U_{ij} is the disturbance term.

Before running the data analysis, the existence of bad correlation (multi-Collinearity) among potential explanatory variables should be tested using Variance Inflation Factor (VIF) for continuous variables and Contingency coefficient values for discrete variables. For acceptable multi-Collinearity test result, VIF should be less than 10. Similarly, in the case of discrete variables contingency coefficient value should be less than 0.75. The model fitness was also checked by using model fitting information (Nagelkerke pseudo R-square≥0.5 and significance of two log-likelihood chi-square). These confirm the existence of no strong association. The dependent and independent variables used in this model are described as follows.

Definition of variables and hypotheses

Following the clear discussion of analytical techniques used for investigating the determinants of household resilience status, it is imperative to describe the dependent variable and the potential explanatory variables used in the model. For this end, the identification of the dependent variable and its potential explanatory variables was done based on previous literature and the authors‘ experiences regarding resilience analysis. The descriptions of dependent and explanatory variables are shown in the Table 27 below.

Table 27: Description of Dependent and Explanatory Variables

Variable name	Description	Expected effect
Household Resilience Status	Y=1, Non resilient, Y=2, Moderately resilient, Y=3, Resilient, Y=4, Highly resilient	(+, Positive, -, Negative)
Age of the household head	A continuous variable measured in years	+
Family size of the households	The number of families in the household	+
Landholding size	Landholding size of the household in hectare	+
Total livestock holding	Total number of livestock owned in Tropical Livestock Unit (TLU)	+
Years of formal education	Household head education in years	+
Dependency Ratio	Ratio of dependent household members to total household members	–
Productive labour	Number of household members >15 and <65 years of age	+
Annual Agricultural expense	Total annual agricultural expense	+
Annual non-food expenditure	Amount of expense spent on non-food items	+
Annual food expense	Total food expense (ETB)	+
Annual income from weaving activity	Total annual weaving income (ETB)	+
Total annual income from all sources	Total annual income from all sources (ETB)	+

Food Consumption Score (FCS)	HH food consumption score	+
Access to formal education	Household head access to education (1=Yes, 2=No)	+/-
Access to formal credit use	Access to credit services (0=No,1=Yes)	+
Access to FTC services	HH access to farmer training services (0=No, 1=Yes)	+
Utilize DA services	HH access to Development agent services (0=No, 1=Yes)	
HHI diversification status	Household Diversification status (0=Low, 1=Medium, & 2=High diversified)	+
Food consumption score	Household food consumption score status (0=poor, 1=borderline, & 2=acceptable)	
Livelihood strategies	Combination of livelihood s used (0=on-farm, 1=off-farm, 2=Non-farm, 3=ON & OFF, 4=On & NON, 5=OFF & NON, 6=ON&OFF+NON)	+/_
On-farm participation	Household on-farm income participation (0=No, 1=Yes)	+
Off-farm participation	Household off-farm participation (0=No, 1=Yes)	+
Access to Mobile services	Access to mobile services (0=No, 1=Yes)	+
Disability	Availability of disability in household (0=No, 1=Yes)	-
Household Head Read and Write	Ability of HH Read and Write (0=No, 1=Yes)	+
Ill member in the household	Availability of severe ill member in the household (0=No, 1=Yes)	-
Access to formal employment	If the household member/s formal employed or not (0=No, 1=Yes)	+
Access to Transfers	If household has got transfers (0=No, 1=Yes)	+
If the community is supportive in illness	If the community is supportive or not in the case of family member illness (0=No, 1=Yes)	+
Edir membership	If the household is member in Edir (0=No, 1=Yes)	+
Faced crop failure	If the household has faced crop failure in the year (0=No, 1=Yes)	-

Source: Own survey, 2022

7.4. Results and Discussion

7.4.1. Household Resilience to Food Insecurity Across Demographic Characteristics

As can be depicted in the table 21 below, chi-square test is used to examine the statistical differences between household resilience across different socio-economic variables (dummy and categorical). Accordingly, the existence of statistical difference in terms of livelihood diversification categories was examined. In this regard, among non-diversified households only 15.9% were resilient to food insecurity at different levels. While 84.09% of the non-diversified

(specialized at one livelihood option) households are non-resilient to food insecurity shocks. While about 58.42% of highly diversified households were found to be resilient to food insecurity at different levels. This may be explained by the fact that better household resilience to food insecurity requires greater household income diversification, and that there are significant differences in household diversification status among resilience categories (p = 0.000).

Table 28: Socio-economic Factors Affecting Household Resilience Categories (Categorical Variables)

Explanatory Factors	Category	Household resilience to food insecurity						X^2-Value
		Non-resilient N=179	Moderately resilient N=31	Resilient N=56	Highly resilient N=200	Total N=303		
		%	%	%	%	%	N	
HHI diversification Status	Low	12.21	1.65	0.66	0	14.52	44	34.607***
	Medium	33	13.86	3.96	1.32	52.15	158	
	High	13.86	9.57	6.27	3.63	33.33	101	
Food Consumption Score	Poor	4.62	0.66	0	0	5.28	16	21.932***
	Borderline	11.55	2.31	0	0	13.86	42	
	Acceptable	42.9	22.11	10.89	4.95	80.86	245	
Livelihood Strategies	On-farm	2.64	1.65	1.32	0	5.61	17	69.193***
	Off-farm	0.33	0	0	0	0.33	1	
	Non-farm	14.52	0.33	0	0	14.85	45	
	ON+OFF	0.33	0	0.66	0	1	3	
	ON+NON	31.02	20.13	5.28	2.64	9.09	179	
	OFF+NON	1.98	0	0	0	1.98	6	
	ON+OF+NON	8.25	3.63	3.63	2.31	17.16	52	

Source: Own survey, 2022

A chi-square test is performed to determine whether household food consumption scores (FCS) vary throughout household resilience categories. According to the findings, 87.5% of poor (food-insecure) households are not resilient to food insecurity. About 46.93% of acceptable (food-secure) households were resilient to food insecurity to varying degrees. The results showed that there are significant differences in household food consumption scores between the categories of household resilience (p = 0.001). In similar ways, there is a significant difference across resilience categories in terms of livelihood strategy combinations (p = 0.000). More than 50% of households that combined on-farm, off-farm, and non-farm livelihood activities were resilient to food insecurity at different levels. Thus, adoption of diversified combination of livelihood activity is suggested for attaining more resilient livelihood.

As can be observed from Table 28, the chi-square test is used if there are meaningful differences across household resilience levels in terms of various dummy variables. The result revealed the existence of a significant and meaningful difference across household resilience in terms of access to basic services like education, credit, FTC, and utilizing Development Agent (DA) services in the area. For instance, in terms of access to education, a relatively large proportion of non-resilient households have no education at all compared to their resilient counterparts. In the cases of access to credit, only 15.18% of the total respondents have access to credit in different sizes and forms. However, the majority 65.2% of credit users were among the resilient categories of respondents. In a similar manner, there is less access to FTC and DA service utilization among non-resilient households than among the resilient categories of respondent households. Accordingly, only 3.96% and 5.61% non-resilient households have access to FTC and DA services, respectively. The differences across resilience categories are significant at p = 1%.

Table 29: Socio-economic factors Affecting Household Resilience Categories (Dummy Variables)

Explanatory Factors	Category	Level of resilience to food insecurity						
		Non-resilient (n=179)	Moderately resilient (n=76)	Resilient (n=33)	Highly resilient (n=15)	Total (303)		X^2-Value (Df=3)
		%	%	%	%	%	N	
Access to education	Literate	37.3	21.12	9.24	3.96	71.62	217	15.636***
	Illiterate	21.78	3.96	1.65	1	28.38	86	
Access to credit	Yes	5.28	5.61	2.64	1.65	15.18	46	14.409a**
	No	53.8	19.47	8.25	3.3	84.82	257	
Utilize FTC services	Yes	3.96	6.6	5.28	3.3	19.14	58	60.665**
	No	55.12	18.5	5.61	1.65	80.86	245	
Utilize DA services	Yes	5.61	5.94	6.93	4.3	22.77	69	84.128***
	No	53.47	19.14	3.96	0.66	77.23	234	
On-farm participation	Yes	41.91	24.1	10.23	4.95	81.85	248	35.384***
	No	17.16	0.33	0.66	0	18.15	55	
Off-farm participation	Yes	10.89	2.97	3.96	2.31	20.13	61	15.544***
	No	48.18	22.11	6.93	2.64	79.87	242	
Mobile use	Yes	36.30	18.15	8.91	3.96	53.8	163	41.861a***
	No	22.77	6.93	1.98	1	46.2	140	
Disability	No	56.77	21.45	8.25	4.95	91.42	277	20.068a***
	Yes	2.31	3.63	2.64	0	8.58	26	
Ill member in the family	Yes	9.24	8.25	2.97	1	21.45	65	10.173a**
	No	49.83	16.83	7.92	3.96	78.55	238	
HH Read and write	Yes	22.44	18.15	6.6	4.3	51.49	156	34.855***
	No	36.63	6.93	4.3	0.66	48.51	147	
Govern‘t salary or wage	Yes	1.32	2.31	1.98	1.98	7.59	23	35.343***
	No	57.75	22.77	8.91	2.97	92.41	280	
Transfers or assist	Yes	1.98	2.97	2.97	1.98	9.9	30	35.324***
	No	57.1	22.11	7.92	2.97	90.1	273	
Edir member	Yes	49.83	24.75	10.56	4.95	90.1	273	16.289***
	No	9.24	0.33	0.33	0	9.9	30	
Support in illness	Yes	40.26	20.79	9.57	3.63	74.26	225	9.661**
	No	18.81	4.29	1.32	1.32	25.74	78	
Crop failure due to Drought	Yes	13.20	6.93	5.61	1	26.73	81	12.485**
	No	45.87	18.15	5.28	3.96	73.27	222	

*** Significant at 1% and ** significant at 5%
Source: Own survey, 2022

In general, the chi-square test result shown that there is a significant differences among the resilience categories of households in respect to access to education, household head ability to read/write or not, access to credit, utilization of FTC services and DA services, access to mobile, livelihood diversification status, access to government salary/wage, food consumption scores, livelihood diversification choices, on-farm participation and off-farm participation, availability of physical disability and ill members in the family, access to financial transfers in kind/cash,

membership in *Edir*, whether the community was supportive or not in the cases of illness, and crop failure due to drought at probability of p<1 and p<0.05 (Table 29).

A one-way ANOVA was employed to examine mean differences of various socio-economic characteristics of households. With regard to years of formal education, non-resilient households (m=4.425) have relatively lower mean years of schooling than moderately resilient (m=6.289), resilient (m=7.970), and highly resilient (m=9.73) households. And, the difference is statistically significant at p=0.000. Similarly, households with relatively higher mean family size, household productive labour, land holding size, non-food expenditure, agricultural expense, food expense, weaving income, total household income, and food consumption score have relatively higher household resilience attainment and the differences were significant at 1% and 5% (Table 30).

Table 30: Socio-economic Factors Affecting Household Resilience (Continuous Variables)

Covariates	**Resilience status of households**				
	Non-resilient	**Moderately resilient**	**Resilient**	**Highly resilient**	**Total**
Years of education					***F*=9.984*** **
Mean	4.425	6.289	7.970	9.733	5.54
Std. Dev.	0.367	0.564	0.856	1.269	5.131
Total family size					***F*=12.070*** **
Mean	6.039	7.474	8.273	9.467	6.81
Std. Dev.	0.221	0.339	0.515	0.763	3.114
Productive labor					***F*=4.710*** **
Mean	3.603	3.8182	3.667	5.667	3.78
Standard Dev.	0.154	0.237	0.359	0.533	2.101
Landholding size					***F*=12.764*** **
Mean	0.879	1.280	1.535	2.070	1.109967
Std Dev.	0.068	0.104	0.158	0.234	0.9589455
Annual non-food expense					***F*=12.371*** **
Mean	3651.397	5766.776	9907.576	13118.333	5332.01
Std Dev.	564.948	867.018	1315.764	1951.593	7973.948
Annu Agri'ral Expend.					***F*=11.162*** **
Mean	1447.66	2305.07	4181.21	3600.00	2066.98
Std Dev.	1880.283	2096.271	6173.777	2736.786	2899.630
Annual food Expense					***F*=4.149*** **
Mean	20903.36	30520.95	36784.61	26508.80	25322.80
Std Dev.	16638.175	46650.707	23416.231	23824.524	28650.440
Total Livestock holding					***F*=10.176*** **
Mean	2.39	3.05	4.21	6.33	2.95
Std Dev.	2.368	3.028	3.257	7.257	3.175
Weaving total					***F*=3.560** **
Mean	27347.82	41153.95	25997.58	42900.00	31433.60
Std Dev.	25978.575	53248.758	25671.423	30909.569	35489.375
Total hh income					***F*=8.696*** **
Mean	65760.65	102156.18	83146.97	171972.93	82041.16
Std Dev.	56933.240	125785.492	66035.654	165625.38	90743.005

Food Consumption Score					*F*=56.649***
Mean	47.8911	61.3816	84.6818	100.100	57.8663
Std Dev.	18.43766	22.93714	23.38830	17.60195	25.15162
Dependency Ratio					***F*=4.231*** **
Mean	0.35597	0.45178	0.45032	0.41287	0.39309
Std Dev.	0.216204	0.226596	0.247094	0.195761	0.224965

*** stands for significant at less than 1% and ** significant at less than 5%
Source: Own survey, 2022

In addition to this, the post-hoc test is carried out to investigate if there are individual differences between groups. Accordingly, there exists group differences among non-resilient, moderately resilient, resilient and highly resilient groups in terms of years of household head years of formal education, total family size, number of working groups (Productive labour size), landholding size, annual non-food expenditure, annual agricultural expenditure, annual food expenditure, total livestock holding, weaving income, total household income from different sources, household diversification scores, food security status (using Food Consumption Score), and dependency ratio at probability of 5% and 1% levels. This result is in line with the study of Fikiru (2016) and Debebe (2021).

7.5. Determinants of Household Resilient to Food Insecurity

The ordered probit model was used to detect the determinants of household resilience to food insecurity. Here, the main focus is on carrying out the data analysis and identifying explanatory factors (continuous and discrete) that affect household resilience to food insecurity. Before running the data analysis, the existence of bad correlation (multi-Collinearity) among potential explanatory variables was tested using the variance inflation factor (VIF) and contingency coefficient values for continuous and discrete variables, respectively. Then, the test result revealed that there is no strong correlation among independent variables as shown in the extended data (appendix-1: https://doi.org/10.6084/m9.figshare.25952146.v4). Accordingly, the VIF values for all continuous variables were found to be small (i.e., VIF<10), with a mean value of 1.60744, which is far beyond the cutting threshold value of 10. In the same way, the multi-Collinearity test result for discrete explanatory variables revealed a contingency coefficient value of less than 0.75, which confirmed the existence of no strong association (Appendix-2: https://doi.org/10.6084/m9.figshare.25952146.v4).

As shown in the previous sections, the existence of a statistically significant relationship between the status of household resilience to food insecurity and the potential explanatory variables was tested using chi-square and one-way ANOVA tests. Thus, these variables were used for ordered probit analysis using a 95% confidence interval (CI) or $p<0.05$ value. The model fitting information shows that it has high predictive power with a Nagelkerke pseudo-R-square value of 0.877, which indicates the model fits the data well with 87.7% of the dependent variable (household resilience to food insecurity) being determined by the independent variables. Besides, the difference between the two log-likelihoods, the chi-square has shown a significance level of less than 0.001. The parameter test results are shown in Table 31 below.

Table 31: Determinants of Household Resilience to Food Insecurity

Variables		Estimates	EXP (Odds Ratio)	Std. Error	Wald	Sig.
RCI = 1		1.209		0.858	1.987	0.159
RCI = 2		3.745		0.903	17.192	0.000
RCI = 3		6.120		1.005	37.043	0.000
Use of Credit services (ETB)		0.215	1.2398619	0.064	11.285	0.001***
Average family education (Years)		0.054	1.0554846	0.028	3.585	0.058*
Number of crops grown		0.142	1.1525767	0.060	5.657	0.017**
Number of income sources		0.174	1.1900556	0.056	9.690	0.002***
Cash deposit (ETB)		0.000	1.0000062	0.000	0.650	0.420
Landholding size (Ha)		0.156	1.1688262	0.114	1.884	0.170
Livestock holding size (TLU)		0.018	1.0181630	0.047	0.147	0.701
Mature Enset (Years to feed family)		0.008	1.0080321	0.047	0.031	0.859
Expected crop harvest in cash (ETB)		0.000	1.0000280	0.000	3.927	0.048**
Mature Eucalyptus in cash (ETB)		0.000	1.0000299	0.000	0.781	0.377
Expected cash from fruit trees (ETB)		0.000	1.0000000	0.000	3.826	0.050**
Access to chemical fertilizer (KG)		0.000	1.0000000	0.000	1.023	0.312
Access to FTC services (Frequency)		0.107	1.1129343	0.076	1.975	0.160
Access to DA contact (Frequency)		0.136	1.1456829	0.058	5.488	0.019**
Access to Veterinary services (Frequency)		0.058	1.0597150	0.078	0.551	0.458
Food Consumption Score (FCS)		0.011	1.0110607	0.005	5.186	0.023**
Household food insecurity access scale (HFIAS)		-0.008	0.9920319	0.025	0.113	0.736
Annual Food Expenditure		0.000	1.0000000	0.000	3.706	0.054*
Any kind of Jewelry		0.000	1.0000000	0.000	6.254	0.012**
Radio Ownership (ETB)		0.000	1.0000000	0.000	4.054	0.044**
Television ownership (ETB)		0.000	1.0000876	0.000	2.705	0.100
Furnished Bed		0.000	1.0000000	0.000	19.037	0.000***
Membership in local groups		0.400	1.4918247	0.231	3.011	0.083*
Supports from safety Nets in cash		0.000	1.0000639	0.000	0.463	0.496
Distance to Nearby Market		0.601	1.8239419	0.175	11.743	0.001***
Total family size		0.052	1.0533757	0.040	1.642	0.200
Gender of household head	Male	0.53	0.0000000	0.460	0.013	0.908
	Female	0[a]	-	-	-	-
Access to Electricity	No	-0.013	0.9870841	0.303	0.002	0.965
	Yes	0[a]		-	-	-

Access to mobile phone	No	-1.105	0.3312109	0.273	16.334	0.000***
	Yes	0[a]		-	-	-
Access to Safe Water	No	-0.334	0.7160538	0.244	1.875	0.171
	Yes	0[a]	-	-	-	-
HH can read/write	No	-0.790	0.4538448	0.230	11.810	0.001***
	Yes	0[a]	-	-	-	-
Participation in business	No	-0.690	0.5015761	0.276	6.250	0.012**
	Yes	0[a]	-	-	-	-
Formal employment	No	-0.644	0.5251875	0.354	3.315	0.069*
	Yes	0[a]	-	-	-	-
Access to transfers	No	-2.154	0.1160192	0.365	34.768	0.000***
	Yes	0[a]		-	-	-
LR χ_2 (32)	635.155					0.000
Number of observations	303					
Prob>χ2	0.001					
Pseudo R^2	0.877					

***, ** and * stands for significant at less than 1%, 5% and 10% probability levels, respectively.

Source: Own survey, 2022.

Interpretation of model result

Based on the probit model result, the following explanatory variables, which have significantly influenced the status of household resilience to food insecurity, are briefly interpreted. Accordingly, some explanatory variables were found to positively and significantly influence the likelihood of attaining from lower to higher household resilience to food insecurity (table 24)..

Access to credit services: access to credit services is an important engine to combat poverty and food insecurity through buying agricultural inputs for the purpose of agricultural intensification and livelihood diversification. However, households fear the high interest rates, and it needs pre-conditions like savings and collateral to get the loan. Despite the availability of some credit and saving institutions like Omo Microfinance and Vision Fund Micro-finance institutions; households in the area were not interested in getting the services. Besides this, the result indicated that access to credit has a positive influence on the resilience to food insecurity $p<0.01$. This implies that a unit increase in credit use increases the probability of a household falling into the higher category of resilience by 0.215 units more when other factors are kept constant. The odds ratio result shows that the probability of a household falling into the higher resilience level is 1.2398619 times greater for increased access to credit in comparison to low credit utilization. Therefore, this study suggests increasing access to credit for smallholder farmers to increase

options, production and improve household resilience. This result is incongruent with (*Fikiru*, 2016) and (Tesso et al., 2012).

Access to Local Market: Access to markets was expected to have a positive influence on household resilience to food insecurity by enabling ease of access to necessary agricultural inputs, food items, and agricultural products. However, the result confirmed that distance from the local market increased the probability of households attaining higher household resilience to food insecurity by 0.601 at $p<0.01$. This could be explained as the closer the household is to the market area, the less likely they are to participate in diverse agricultural production activities, resulting in decreased household resilience to food insecurity due to limited access to farmland. However, this result is in contrast with Debebe C. (2021).

Access to education (Average years of family schooling): education is one of the key factors in building household capacity to cope with shocks and stresses that could enhance individuals‘ capacity to plan access, and utilize agricultural extension information, manage livelihood shocks, make better decisions on livelihood options, and more. The model result indicated that average educational attainment of the household positively and significantly affected resilience level at a 10% significant level. A positive sign with a household education coefficient of 0.054 would mean that with increasing education, there is a greater probability of falling into the higher resilience level. Regarding the odds ratio, the odds of improved resilience are 1.0554846 times greater for increased household education attainment than those with low educational status. This result is similar to the study conducted on the analysis of vulnerability and resilience to climate- induced shocks in North Shewa, Ethiopia (Tesso et al., 2012). Thus, the study advocates access to quality education considering intra-household equity.

Crop Diversity: Cultivating several crop species enables households to cope with the effects of both price and production risks, which can help them, ensure they have more food options and income alternatives. As a result, the sample households have grown a mean of 5.08 and a maximum of 11 types of crop species. The model result shows that a number of crop species cultivated in the area have positively and significantly affected household resilience, with a coefficient of 0.142 at $p<0.05$. Households with high crop diversity are more likely to fulfill improved dietary diversity and thereby attain a higher resilience level, with 1.19005557 times

more than those with a low crop diversity level. In agreement with this result, the study conducted in Malawi reported positive contribution of crop diversification to the food consumption status of households (Mango et al., 2018)(Adjimoti & Kwadzo, 2018).

Diversity of Income sources: Following diverse income sources is expected to have several livelihood implications, like enhancing household income sources, means of risk management, improving household wellbeing, and more. In this study, the number of income sources adopted by households has a positive influence on household resilience to food insecurity, with a coefficient of 0.174 at a significant level of $p<0.01$. This implies that households with diverse income sources will have a higher likelihood of falling into a higher resilience level at an odds ratio of 1.19005557 times greater than those with few income sources. This result is in agreement with Fikiru (2016).

Expected crop harvest in cash (ETB): Resilience is about the capacity of an individual, a household, a community, or a subject to withstand the effect of a foreseen shock or the ability to recover from past shocks and stress using available and potential sources of capability. The model result shows that the expected crop harvest in monetary value has positively influenced household resilience with a coefficient of 0.00002802 at $p<0.05$. The odds ratio of falling to a higher resilience level is 1.0000280 times higher in cases of an increased expected crop harvest than a low expected crop harvest.

Expected cash from fruit trees (ETB): Fruit production is an important cash crop in the study area and serves as a source of income to build household resilience. Study reports show that there are more than 60 varieties of apple fruit trees grown in the area, which serve as a basic income source in the form of seedlings and fruit products (Fetene et al., 2014). Apple fruit products reach during food deficit seasons of March, April, and May, which become food security buffering options. The probit result indicated that the amount of expected fruit income has a positive influence on household resilience and increases the likelihood of falling into higher resilience levels at $P<0.05$. The study report revealed that about 21.12 percent of respondents had incomes from apple fruit grown in their backyard. The FGD and KII results indicated the suitability of the area for apple cultivation and its high income-generating capacity, but theft due to its high economic value was stressed as the main threat.

Access to Development Agent Contact (DA contact): Access to development agent contact has a positive influence on household resilience to food insecurity by providing agricultural production information. Households with a higher frequency of DA contact are more likely to fall into the higher category of resilience at $p<0.05$. Keeping other factors constant, a unit increase in access to DA contact will increase the probability of households being at a higher resilience level by 0.136 units. This, in turn, improves household resilience to food insecurity.

Food Consumption Score (FCS): As expected, food consumption status in the form of FCS has a positive association with household resilience to food insecurity at $p<0.05$. This positive influence refers to the fact that the higher the food consumption status of the household, the greater its capacity to withstand food insecurity-related shocks. The model result indicated that a unit increase in FCS increases the likelihood of the household falling into the higher resilience category by 0.011 units, considering other factors constant.

Access to non-agricultural assets: In rural areas, ownership of non-agricultural assets is a sign of wealth status and is considered a means of livelihood risk management (Saputri, 2016). As expected, the model result shows that access to and ownership of physical assets like jewelry, radios, and furnished beds are positively associated with household resilience to food insecurity at probability of less than 0.05, 0.05, and 0.01. A household with increased ownership of the physical assets is more likely to fall into the better resilience category than its counterparts.

Access to formal employment: Access to formal employment (government or non-government employment) is one of the major non-farm income sources adopted in the area, having the highest average income that accounting for more than 18 percent of the total household income of the respondents. *Ceteris paribus*, as expected, the probability of a household falling into the higher resilience level decreases by 0.644 units if the household has no access to formal employment at $p<0.1$.

Access to transfers payment (Dummy): Access to transfers in different forms, formal or informal, in-kind or in-cash, is considered one of the major sources of social safety nets. These include; donor agencies based support services (PSNP), aid, and remittances. Thus, the probit result indicated that lack of access to cash transfers decreases the likelihood of achieving higher resilience level by 2.154 units if other things kept constant at $p<0.01$. Hence, transfers help

households in cases of food deficit seasons and help create assets, thereby enhancing household resilience to food insecurity.

Participation in family business activities: practicing non-farm livelihood diversification is believed to contribute to improved household food security and, in turn, strengthen household resilience to food insecurity. In the rural areas of Gamo zone in general and Chencha district in particular, weaving, trade, small-scale food item enterprises, hairdressers, and barber services were reported as the major out-of-farm business activities. Considering other things being constant household ability to attain higher resilience level decreases by 0.690 if the household has not participated in out-of-farm business activity $p<0.05$. Therefore, this study suggests creating a conducive environment for youth and able groups to enter into rural business activities is inevitable to create job opportunities for others, improve income, and thereby increase their resilience to food insecurity (*Fikiru*, 2016).

7.6. Conclusion and Recommendation

7.6.1. Conclusion

This work has aimed to examine the factors that determine household resilience status across different categories and understand the dynamics of household resilience across differing socio-economic characteristics. Hence, the result confirmed the proposed notion that household resilience depends on the resources and livelihood options available and the effects of external shocks and stresses. A thorough analysis of household resilience status has categorized households into four categories: non-resilient, moderately resilient, resilient, and highly resilient. Broadly, the study results show that the majority, about 59.76% of the households were non-resilient to the expected food insecurity shocks and stresses; the remaining 40.24% of the respondent households were found to be resilient at different levels.

A close examination of household resilience across different socio-economic and demographic characteristics of households using a chi-square test indicated significant differences. As a result, there is a significant and meaningful difference across household resilience categories in terms of access to education, credit use, access to FTC and DA services, livelihood diversification categories, food consumption score categories, livelihood diversification choices like;

participation in on-farm, off-farm, and non-farm options, access to mobile use, household head ability to read and write, disable household member availability, access to formal employment, access to transfers and assists, Edir membership, and whether encountered crop failure due to drought or not at 5% and 1% significant levels. The one-way ANOVA result revealed that there is a meaningful difference among household resilience categories in terms of years of education, total family size, productive labor, landholding size, annual non-food expense, annual agricultural expense, food expense, total livestock holding, weaving total income, total household income, and dependency ratio at less than 1%, 5%, and 10% significance levels.

The probit model confirmed that access to credit, average years of family education, diversity of crop types grown, number of income sources adopted, land holding size, livestock holding size, expected crop harvest, expected cash income from fruit trees, frequency of DA contact, FCS, annual food expenditure, radio ownership, jewelry ownership, ownership of a modern furnished bed, membership in local associations, and distance to a nearby local market have positively influenced the likelihood of attaining higher household resilience at 1%, 5%, and 10% significant levels. Whereas, lack of access to a mobile phone, inability of the household head to read or write, lack of family business, lack of formal employment, and lack of access to transfers of payment in the form of remittances and support have decreased the likelihood of households achieving a higher resilience level at 1%, 5%, and 10% significance levels.

7.6.2. Recommendation

Based on the result of household resilience to food insecurity using one-time cross-sectional data, it has pinpointed areas and factors to be stressed by concerned bodies to initiate, improve, and build household resilience to food insecurity. Accordingly, improving household resilience in the study area requires investing and improving access to available options and alternatives such as agricultural assets, non-agricultural assets, adaptive capacities, basic services, agricultural technologies and practices, social safety nets, and income and food access. Particularly, improved access to credit, education, livelihood diversification options, creating opportunities to get assets like land and livestock, and improved agricultural extension services will have a potentially positive impact on building household resilience in the area. Therefore, concerned bodies need to improve households‘ access to basic livelihood assets, livelihood

options, and services to enhance household capacity to withstand food insecurity-inducing shocks and stresses.

Ethical Clearance: Following an assessment of the proposal in compliance with academic norms at the university and research instruments. Informed written consent from respondents was obtained in order to conduct the data collection process for interviews, focused groups, and surveys. Confirming this, the Academic Commission of Addis Ababa University provided a written consent ethical clearance letter (No. 029/01/2023) on October 20, 2023. The Institutional Review Board (IRB) has three members: Amare Bantider (PhD), Adimasu Zerihun (PhD), and Teshome Tafese (PhD). The letter will be made available upon the request.

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CHAPTER EIGHT: SUMMARY, CONCLUSION AND POLICY IMPLICATIONS

8.1. Introduction

The research has addressed the objectives investigating livelihood options households adopted, multidimensional food insecurity situations and coping strategies adopted, and identified food insecurity inducing shocks and stresses, and analyzed household resilience level to food insecurity and its determining factors. The study has been organized eight different parts. The first part has presented the background and rationale of conducting the study. The second chapter encompassed about the results of thorough review of related conceptual and empirical reviews and conceptual frameworks. In the third chapter, description and justification of selecting the study area, research methodological issues of sample selection and appropriate data analysis methods used for addressing each research objectives were discussed. Then, the results of each research objective were analyzed through using appropriate data analysis were organized in four consecutive chapters from four to seven. Here, this chapter provides the summary of the findings, conclusions and policy recommendations, and theoretical contribution of the study.

8.2. Summary

The main intention of this study was to investigate household resilience to food insecurity. Household defined as the capacity to withstand, positively react, and recover from livelihood shocks and stresses that can potentially induce threatening household food insecurity depending on available options (assets, activities and services) (Alinovi *et al*., 2008). For this end, this study has addressed specific inter-related objectives of examining diversities, and income contribution of livelihood options and its association with household food security status, explored multidimensional food insecurity status and its determinants; investigated major sources, extents and determinants of household resilience to food insecurity. It has conceptualized the research objectives as an interdependent aspects; a household resilience as a combined outcome of different available unobserved latent variables namely; options, assets, activities and services following the previous literatures (Alinovi et al., 2008; Alinovi et al., 2010; Ciani and Romano, 2013; Adane Atara, 2018; and Gebrerufael, 2019). Accordingly, it has adopted the integration of sustainable livelihood and resilience frameworks. This recognizes household resilience as an outcome of access to livelihood assets, activities, transforming support services, livelihood alternatives and livelihood outcomes in the face of external shocks and stresses (Serrat, O., 2010

and Alinovi *et al*., 2010). For this, cross-sectional data collected from randomly selected 303 households substantiated with qualitative data were used. Multivariate (principal component analysis) model was used to determine household resilience that measures different components of household resilience separately following two stages. In the first stage, it estimates eight potential blocks (latent variables themselves) of resilience from different directly observed variables. In the second stage, final household resilience is determined by applying principal component analysis (PCA) from eight different components computed in the first stage as a covariate in the multivariate analysis. But, household income diversification status was determined by applying count index and Herfindahl–Hirschman index (HHI). Ordinary probit model was used to identify the various determinant factors of household livelihood diversification, and resilience to food insecurity. Food security status was determined by adopting multidimensional food insecurity approach (Mexwel et al., 2013). In addition to these, descriptive statistics, Chi-square-test, one-way ANOVA were used to analyze different quantitative data. Qualitative data were analyzed following narration and context analysis.

Household livelihood diversification analysis was carried out using different techniques such as; count Index, and Herfindahl–Hirschman index (HHI). Count index technique has shown that the households in this study have adopted an average of 4.53 income sources; 90.7% of households followed more than one income sources. In the study area, subsistence farming (52.1 percent) and weaving (38.6 percent) activities are reported as the main income sources of households. And households have combined diversity of livelihood strategies mainly; On-farm and Non-farm (59.08%), farm and Non-farm (17.16%), Non-farm only (14.85%), and Farm only (5.61%) strategies. Based on income share; non-farm, on-farm and off-farm income sources contributed, 72.96%, 25.3% and 1.74% of total household income, respectively. Households who combined On-farm, Off-farm and Non-farm activities together have gained far larger mean income followed by On-farm and Non-farm strategies. Considering an average income; Formal employment, weaving, barber/hairdresser, cattle production and sale, cereal production, and vegetable production (Potato) were highly paying livelihood activities in order. Furthermore, Herfindahl–Hirschman index (HHI) analysis revealed that 37.45%, 34.325% and 28.22% of

households diversified their income sources at ‗Moderate', ‗Low' and ‗High' status, respectively. The study also has found positive association between livelihood diversification and food security status of households. In addition this, the ordinary probit model analysis further has shown landholding size, livestock holding size, and access to FTC services have all been positively affected, and family size, lack of access to off-farm and on-farm income participation, and lack of access to cash transfers negatively affected the likelihood of households falling into a higher livelihood diversification level.

Similarly, a resilience approach was adopted to examine household resilience to food insecurity. A close examination of major sources of household resilience to food insecurity shocks and stresses was made using a multivariate (PCA) analysis model. It has used eight potential sources or determinants of household resilience to food insecurity shocks. As a result, the loadings of PCA indicate that six were found to significantly contribute to the resilience of households to food insecurity shocks. But adaptive capacity and access to agricultural technologies and practices were not significantly contributing to household resilience. Except stability (S), all seven dimensions have been positively determined and correlated with the household resilience to food insecurity index. Based on factor loading size and beta coefficients, access to the social safety net (SSN), access to basic services (ABS), and access to non-agricultural assets (NNA) were the most important sources of household resilience to food insecurity. Following these, income and food access (IFA) and agricultural assets (AA) are important dimensions of household resilience to food insecurity. Assessments on major food insecurity-inducing shocks and stresses indicated that food item price inflation, family member illness, food shortage, and drought were the most frequently reported shocks and stresses encountered by the respondents in the last five years. This result is in line with comparable previous studies (Alinovi et al., 2010; Adane Atara, 2018); their study indicated that IFA, ABS, AC, and ATP have significantly contributed to household resilience.

However, household resilience to food insecurity is determined by a strand of factors. The factors which influenced the resilience of households to food insecurity were analyzed using ordinary probit model, Chi-square test and One-way ANOVA. The Chi-square test result indicated significant and meaningful differences across household resilience levels in terms of access to education, credit, FTC, and DA contact. One-way ANOVA result has shown the

existence of significant mean differences among resilience categories in terms of years of education, family size, productive labour, landholding size, annual food, non-food and agricultural expenses, livestock holding, weaving income, household income, and dependency ratio. Finally, probit model analysis indicated that access to credit, average years of family education, crop diversity, income diversity, landholding size, livestock holding size, expected crop harvest, expected cash income from fruit trees, frequency of extension contact, Food Consumption Score, annual food expenditure, ownerships of Radio, Jewelry, furnished bed, membership in local associations, and distance to local market have positively influenced the likelihood of attaining higher household resilience at probability less than 1%, 5% and 10%. Whereas; lack of access to mobile phone, inability to read and write, family business, formal employment, and transfers of payment have decreased likelihood of households to achieve higher resilience level.

While food security is a multidimensional issue, most studies adopt a single indicator which addresses only specific aspects of it. The policies designed based on this result might also miss basic facets of food security. The MFI result shown that, only 5.28% households were multidimensional food secure. The remaining 94.72% households were food insecure; i.e. 18.48% mildly, 10.23% moderately and 66.01% severely food insecure. In line with this, Key informant interview and focus group discussion also confirmed strong food shortage of 3-6 months a year due to fragmented landholding, and population pressure. About 84.8% of households feel anxiety and uncertainty about food supply; 57.75% eat food they do not want; 79.86% eat monotonous food; and 78.54% of households cannot afford food they want at sometimes or often. Regarding type of food consumed; 78.87% eat food made from grains, and only 15.84% reported consumption of high-value food. Whereas an average of 13.3% households experienced six most severe food insecurity conditions at sometimes-often levels. In response to this, 78.21% reduced the number of meals consumed in a day, 7.26% skip entire days without eating; 65.67% consume seed stock held for next season; 50.49% rely on wild food and immature crops; and 17.82% borrow food or rely on help from relatives at often to sometimes. Besides, chi-square test indicated existence of significant difference among MFI categories in terms of access to education, mobile, formal employment, use weaving and subsistence farming as main income source, combination of _on-farm and non-farm‘ and _non-farm‘. A one-way ANOVA has shown statistically significant difference across MFI categories in terms of TLU,

weaving income, total income, and family size, SSI, IFA, and HRI across the MFI categories. Therefore, this study indicates that different stakeholders need to rethink and plan interventions to improve the food security status of households, considering the multidimensional aspects of the food security outcomes.

8.3. Conclusions and Recommendations

Understanding potential sources and causes of food security is an imperative for evidence-based sustainable food security policy design and intervention. This requires a clear knowledge of potential sources capacities to withstand current and expected food insecurity inducing shocks and stresses. These sources can differ from one geographical area to the other, hence, it needs geographical specific examination of major dimensions of household resilience to food insecurity shocks and stresses and food insecurity causing problems. As a result, this study has examined livelihood diversification, multidimensional food insecurity, household resilience to food insecurity, and their determining factors. The findings of this could hopefully contribute by empirical evidence on potential sources of building improved food security and household resilience to food insecurity shocks and stresses. Based on the findings of this study, the following policy implications are recommended to reduce food insecurity and thereby to improve household resilience to food insecurity.

Household livelihood diversification analysis indicated that the majority of households derive their livelihood income from diverse sources. However, the majority of households reported mixed-subsistence farming and weaving activities as primary and secondary income sources. Similarly, households diversified their livelihood strategies to on-farm, off-farm, and non-farm and combined them. Accordingly, households that choose a combination of on-farm, off-farm, and non-farm activities together have a larger average income, followed by households that combine on-farm and non-farm activities. Formal salary-based employment, weaving, barber/hairdresser, cattle production and sale, cereal production, and vegetable production (potato) were highly profitable livelihood activities. There is a positive correlation between household livelihood diversification scores (HHI) and food security scores (FCS). Based on this finding, general rural livelihood improvement interventions need to focus on improving production and productivity of highly employing livelihood income sources such as; mixed farming and indigenous weaving activities. For this end, agricultural intensification through

technology adoption, training, and market linkage for weaving could be suggested for improving household income. However, very minimal landholding size resulted in food supply shortage. Hence, off-farm, on-farm and non-farm diversification like; managed livestock (dairy, fattening, sheep and poultry) rearing, non-farm activities like; formal employment, barber/hairdresser services are found to be relevant to improve household income and thereby enhance household resilience to food insecurity. Besides this, the positive association between livelihood diversification and food security scores suggest income diversification to improved food security. Therefore, it becomes imperative to develop other means of subsistence and to support and modernize the weaving industry with relevant training, education, and market linkage services.

Understanding and strengthening household resilience through evidence-based intervention is believed to enhance household resilience to food insecurity. Unlike vulnerability analysis, resilience approach of food security analysis focus on identifying and strengthening existing potentials of households. With regard to resilience analysis result in Chencha district, access to the social safety net (SSN), access to basic services (ABS), and access to non-agricultural assets (NNA) were the most important sources of household resilience to food insecurity. Following these, income and food access (IFA) and agricultural assets (AA) are important dimensions of household resilience to food insecurity. In the study, access to adaptive capacity (AC) and agricultural technology and practices (ATP) were found non-significant contributors of resilience. This implies, the availability of very insignificant AC and ATP services in the study area though they are very crucial for improving food production and enhanced food security.

Therefore, strengthening and improving targeting system and quality of Social safety net services, access to basic services, increasing access and adoption of ATP services, and supporting agricultural intensification would be advisable to increase household resilience to food insecurity. Policy makers should focus on strengthening the most important dimensions of resilience and targeting on the frequently encountering shocks and stresses to improve household resilience in the area. Hence, improving household access to credit, education, livestock and land, agricultural extension services, membership to local associations, mobile service, and income diversification would enhance household income and food security, which could in turn improve household resilience to food insecurity.

A multidimensional-based household food security study showed that about 94.72% were food insecure at different levels; only 5.28% were multidimensionally food secure. Strong seasonal

and chronic food insecurity is a defining feature of the area, and it is threatened by population pressure, drought, and seasonal variations. Increasing agricultural production and productivity is still the primary solution to this problem. Therefore, it is recommended that small-scale livestock production (dairy, fattening, and poultry), improved access to agricultural productivity-enhancing technologies, and access to agricultural assets like land (through resettlement) be considered as viable alternatives. Similarly, the relevant government and non-government organizations should pay adequate attention to improving the Productive Safety Net Program's role in targeting and management systems to enhance its food security supporting and natural resource safeguarding roles.

8.4. Suggestion for Future Research

This study mainly analyzed household resilience to food insecurity at one point in time. It has addressed three interrelated issues of livelihood diversification, multidimensional food security status, household resilience to food insecurity, and their determinants using one-time cross-sectional data. However, each of the study themes is broad and needs in-depth and further studies. For instance, in the case of identifying and analyzing livelihood diversifications, the current study area is more uniform (more highland) in terms of agro-ecology. And the study only examined the income role of livelihood activities like agriculture and weaving without considering value-chain dimensions and challenges. Therefore, this study would like to recommend a more in-depth study of livelihood analysis, considering value chain analysis (agricultural and weaving products). It is more informative if the livelihood diversification and food security studies consider agro-ecological differences by targeting different agro-ecological categories. In fact, it is substantial to address multidimensional aspects of food security using one composite index. However, it needs further, more comprehensive study of each dimension of food security (availability, access, stability, and utilization). For instance, food insecurity aspects like utilization and the resulting outcomes need independent studies. Regarding resilience towards food insecurity problems, addressing geographical and temporal dynamics is reasonably recommended for future studies using panel data.

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APPENDICES

APPENDIX-1 QUESTINNAIRES FOR HOUSEHOLD DATA COLLECTION

Data collection tool

Addis Ababa University College of Development Studies Center for Food Security Studies
Data Collection Tool I: Questionnaire

PhD Research Project on "Household Resilience to Multidimensional Food Insecurity: the Case of Weaving- based Livelihood System in Chencha Woreda, Southern Ethiopia."

Dear interviewee; Desta Dereje is a PhD student at Addis Ababa University, College of Development Studies in the center for food security studies. He is now conducting a research project on ―Household resilience to food insecurity: the case of weaving-based livelihood system in Chencha woreda, Gamo zone, Southern Ethiopia‖. The main objective of this study is to analyze the household resilience to food insecurity especially in the case of weaving-based livelihood groups. By this study, it aims to identify major food insecurity causing stresses and shocks, sources of household resilience to food insecurity, examine household food security and household resilience status to food insecurity by using data collected from randomly selected households found in Chencha area, particularly those whose livelihood system depend on weaving livelihood activity. The information you provide him will be confidential and will not be used by government tax authorities or any other non-governmental organizations for other purpose different from aforementioned specific objectives. It will be used for research purpose only. The researcher (or interviewer) is therefore kindly asking you to provide him genuine information and honest answers to each question in this questionnaire. The researcher thanks you in advance for your kind cooperation.

I. Demographic Characteristics of the Households

1.1. Name of the household head: _____; Household ID No. _____
1.2.Village/Cluster:_____:Kebele_____
1.3. Agro-ecology: 1. Highland ☐ Midland ☐ nd ☐
1.4. Sex of the household head: 1. Male ☐ male ☐
1.5. Position of the respondent in the household: 1. Household head 2. Spouse 3.Son/daughter 4. Relative
1.6. Age of the household head (in years) _____(years)
1.7. Marital status of the head: 1. Single 2. Married 3. Divorced 4. Widowed
1.8. Main (primary) occupations of the household: 1) Unemployed 2) Subsistence farmer 3) Weaver 4) Trader 4=Petty trade 5=Formal employment
6= others (specify) _____
1.9. Are you literate? 1= yes 2= No
1.10. If literate, years of formal education: _____

1.11. Family size: Male _____ Female _____ Total: _____
1.12. Total number of household members of working age (>14 and <64 years old)
1.13. Number of dependent household members: Children (below 15 years): _____Adults (above 64) _____
1.14. PSNP membership: 1. Member on food for work 2. Member on free access to food 3. Non-member 4. Others (specify) _____
1.15. Land holding size _____(hectare)
1.16. Livestock holding size: Cattle _____Goat _____Horse _____Sheep _____. Other specify _____

Livelihood activities and strategies

2. Major livelihood activities		Sources of household income/food (Tick)	Rank based on their importance to your income/food
1.	Farming (crop and livestock production)		
2.	Fruit and horticulture production		
2.	Casual labor		
3.	Firewood or charcoal collection and sales		
4.	Employment (salary)		
5.	Weaving		
6.	Private business (trade)		
7.	Pension		
8.	Aid and transfer		
9.	Remittance		
10.	Gifts/inheritance		
11	Petty trade		
12	Other (specify)		

II. Household Income sources (in Birr)

Did you or any of your household members receive cash income from any of the following sources of income within the last year (last 12 months)?

Farm income Sources		Income (in Birr)	**Non-farm income sources**		Income (in Birr)	**Off-farm income Sources**		Income (in Birr)
	Cereal crops		1.	Salary		1.	Livestock and livestock products trading	
			2.	Weaving				
	Vegetables		3.	Wage labor		2.	Petty trading	
	Fruits		4.	Cash transfers (PSNP)		3.	Market brokering	
	Livestock Production		5.	Military Service		4.	Pottery making	
	Leasing out crop land							
	Cattle sale		21.	Pension		36.	Farm tools selling	
	Goat and Sheep		22.	Firewood or charcoal selling		37.	Metalwork	

	Donkey, mule and horse		23.	Animal feed (grass or fodder)		38.	Furniture (wood work)	
	Poultry and poultry Products		24.	Construction materials		39.	Begging	
	Milk and milk Products		25.	Weaving and spinning		40.	Remittance	
	Animal skins and hides		26.	Blacksmithing		41.	House rent/sell	
	Bee colonies or beehives		27.	Carpentry		42.	Others: (Specify): _____	
	Honey and Wax		28.	Barber or Hairdresser				
	Gesho		29.	Traditional healer				
	Others (specify)		30.	Grain trading				

III. Food and Non-food Expenditure (in Birr)

Please, indicate the monthly expenditure of your household in the following items

Did you or anyone in your household buy any one of the following items?					
Food expenditure (in the last one month)		**Expens (in e Birr)**	**Non-food expenditure (in the last one year)**		**Expens (in e Birr)**
1.	Wheat		1.	Firewood and charcoal	
2.	Barley		2.	Energy (fuel, solar or electricity)	
3.	Teff		2.	Paraffin or kerosene	
4.	Injera		3.	Candles and matches	
5.	Cabbage		4.	Transport	
6.	Potato		5.	Milling fees for grains	
7.	Fruit		6.	Donation (church, charity or beggars)	
8.	Bread		7.	Personal hygiene products	
9.	Millet		8.	Household utensils	
10.	Pasta and Macaroni		9.	Rent (house, oxen and land)	
11.	Sweet potato		10.	Maintenance (house, radios, watches, spare parts)	
12.	Kocho		11.	Batteries	
13.	Beans		12.	Household furniture	
14.	Onion and garlic		13.	Clothes (for children, husband, and wife)	
15.	Tomato		14.	Linen-towels, sheets, blankets	
16.	Green pepper		15.	Shoes	

17.	Meat		16.	Umbrella	
18.	Milk and milk products		17.	Gold, dowry for spouse (ceremonial expenses)	
19.	Eggs		18.	Traditional medicine and healers	
20	Potato		19.	Modern medical treatment and medicines	
21.	Banana		20.	Educational expenses (books, pens, pencils, uniform)	
22.	Papaya and orange		21.	Agricultural inputs expenditure	
23.	Sugar and coffee		22.	Rituals (religious and public) ceremony	
24.	Edible oil		23.	Marriage ceremony	

25.	Honey		24.	Mirage and funeral contribution	
26.	Tea/coffee		25.	Construction materials (bricks, cement, wood)	
27.	Soft drinks		26.	Farm tools	
28.	Fruit juice		27.	Government taxes and levies	
29.	Local liquor (Tella)		28.	Punitive Compensation and/or penalties	
30.	Salt/pepper		29.	Other expenses (specify)	
31.	Alcoholic beverages (beer or local Areqe)				
32.	Meal eaten at restaurant				
33.	Others (specify)				

IV. Food security related questions (MFI)

Question no.	Indicator	MFI indicator questions	Possible response options			
			Often	Sometimes	Rarely	Never
1.	HFIAS/HHS	How often did you or any HH member have to go a whole day without eating?				
2.	HFIAS/HHS	How often did you or any HH member go to sleep at night hungry?				
3.	HFIAS/HHS	How often was there ever no food in your HH?				
4.	CSI	How often has the HH had to skip entire days without eating?				
5.	CSI	How often has the HH had to send HH members to beg?				
6.	CSI	How often has the HH had to send HH members to eat elsewhere?				
7.	FCS/HDDS	How often has the HH eaten any pulses?				
8.	FCS/HDDS	How often has the HH eaten any food made from grain?				
9.	CSI	How often has the HH had to consume seed stock held for next season?				
10.	CSI	How often has the HH had to gather wild food, hunt, or harvest immature crops?				
11.	CSI	How often has the HH had to purchase food on credit?				
12.	CSI/rCSI	How often has the HH had to borrow food, or rely on help from a relative?				
13.	HFIAS	How often did you or any HH member have to eat foods you did not want to eat?				
14.	HFIAS	How often did you or any HH member have to eat a limited variety of foods?				
15.	HFIAS	How often were you/any HH member not able to eat the kinds of foods you preferred?				
16.	CSI/rCSI	How often has the HH had to reduce the number of meals eaten in a day?				
17.	CSI/rCSI	How often has the HH had to limit portion size at meal times?				

18.	CSI/rCSI	How often did you worry that your HH would not have enough food?				
19.	SAFS	Self-assessed food security during past 30 Days				
20.	FCS/HDDS	How often has the HH eaten any dairy products?				
21.	FCS/HDDS	How often has the HH eaten any eggs?				
22.	FCS/HDDS	How often has the HH eaten any meat, fish?				
23.	FCS/HDDS	How often has the HH eaten any fruits?				
24.	FCS/HDDS	How often has the HH eaten any vegetables?				

V. Coping Strategies

Has your household faced longer term food shortages in the last twelve months?
1. Yes 2. No
If yes, please indicate how you tried to cope with the food shortage?

S.no.	**Coping Strategies**	Frequencies (Tick)			
		Often	Sometimes	Rarely	Never
1.	Rely on less preferred and less expensive foods				
2.	Sell livestock to buy food/grain				
3.	Purchase food on credit				
4.	Depend on wild fruits and roots				
5.	Consume seed stock held for next season				
6.	Receive food/grain/money from neighbors/relatives/friends				
7.	Firewood and charcoal selling				
8.	Seasonal migration (wage labor)				
9.	Receive food aid from government and NGOs				
10.	Withdrawal of money from savings				
11.	Remittance				
12.	Permanent migration				
13.	Send children or an adult to eat with relatives and neighbors				
14.	Sell household assets (e.g., radio, bed)				
15.	Rent or sell productive assets (Water pump, Beehives)				
16.	Dropping of children out of school and send them to work for money (e.g., domestic service)				
17.	Participate in food-for-work or cash-for-work				
18.	Take out a loan from friends or relatives				
19.	Take out a loan from a money lender				
20.	Borrowing money from MFIs and Banks				
21.	Limit portion/size of meals				
22.	Reduce number of meals per day				
23.	Restrict food consumption of adults				
24.	Skip entire days without eating				
25.	Others (specify)				

(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	

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?		

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, number of times you employed it**
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?			

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 - Chencha wereda agriculture bureau officer/s

1. Would you describe your *woreda* in terms of:
- Area of the *woreda* 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),

VI. Household Resilience to food insecurity questionnaire

A short RIMA questionnaire allows at collecting the information needed for estimating the household resilience capacity through short interviews.

a) Access to Agricultural Assets (AAA)

1)	Do you own land?	Yes
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
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
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.	How much cash income do you expect from the upcoming harvest?	
5.	Do you have eucalyptus trees ready for cut?	Yes
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 have fruit bearing trees such as Apple, Avocado, and Banana etc…?	Yes
6.1	If yes, how much income do you expect from upcoming yield?	

b) Non-agricultural asset:

	Does your household have (own) the following assets?	**If yes, purchase price in Birr**
1.	Jewelries such as gold rings 1) Yes 2) No	

2.	A watch/clock 1) Yes 2) No	
3.	A radio 1) Yes 2) No	
4.	A tape recorder 1) Yes 2) No	
5.	A television 1) Yes 2) No	
6.	A mobile telephone apparatus 1) Yes 2) No	
7.	A table (s) 1) Yes 2) No	
8.	A chair(s) 1) Yes 2) No	
9.	A bed (s) with cotton/sponge/spring mattress 1) Yes 2) No	
10.	A bicycle (s) 1) Yes 2) No	
11.	A motorcycle (s) 1) Yes 2) No	
12.	Energy saving stove(s) 1) Yes 2) No	
13.	An animal-drawn cart? 1) Yes 2) No	

c) Agricultural technology adoption:

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

	Item	Yes	No	If yes;
	Use chemical fertilizer			Amount in KG _____
	Use improved seed			Amount in Kg _____
	Utilize pesticides			How many times _____
	Utilize FTC services			Number of times services have been Received_____
	Receive development agents (DA) Services			Number of times visited by DA_____

d) Access to Basic Services (ABS)

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.	Microfinance institutions		
5.	School		
	Primary school 1st cycle		
	Primary school 2nd cycle		
	Secondary school (9-10)		
	Preparatory school		
	Other Related questions		
6.	Are you the user of microfinance institutions' (MFIs) **services?**	Yes	No
6.1	If yes, how much savings do you have in MFIs at present?		
7.	Does your household have access to electricity?		
8.	Does any member of your household own mobile Yes No telephone?	Yes	No
9.	Do you think that a drinking water available for your Yes No household is safe?	Yes	No

e) 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. Excellent**	**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?			
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			
9.	**Can the head of the household read and write?**	**[1 = yes 0 = no]**		
10.	A. How many years has the household head attended formal school? b. How many years has the household head attended Koranic school?	**[in number]**		
11.	A. How many years has the household member with the highest level of education?	**[in number]**		
	b. How many years has the household member with the highest level of education attended **spiritual** school?	**[in number]**		
12.	How many years on average have the household members of working age (>14 and <64 years old) attended formal school?	**[in number]**		
13.	In the past 12 months, was [the below livelihood activity] a source of household income?	**[1 = yes 0 = no]**		
	• Agriculture, animal breeding, fishing			
	• Family business (other than agriculture)			

	• Government wage and salary	
	• Private sector wage and salary	
	• Transfers and social assistance	
	• Other (Specify)	
14.	What is considered as the main income source of the household?	[open answer]
15.	How many different crops have the household members grown during the last season?	**[in number]**

f) Social capital

1.	Are you a member of _Idir‘ in your village?	Yes	No
2.	Are you a member of church or other religious	Yes	No
	group?		
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	Yes
5.	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?		
6.	If you suddenly need 100 Br, how many people, other than your household members, do you think will lend for you?		
7.	If your household members suddenly face serious illness or death, do think that your neighbors provide you with the assistance your household needs?	Yes	Yes
8.	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?	Yes	Yes

g) Social safety nets:

1.	Has your household participated in the government social safety net Yes No program?	Yes	No
1.1	If yes, indicate the estimated value of benefits received (in Birr) in one year time.	Yes	No
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.		

h) Income and food access (IFA)

Two additional dimensions (stability and adaptive capacity) cut across the four pillars and account for households‘ capacity to respond and adapt to shocks.

i) Stability and

j) Adaptive capacity

h) Food security

Food security	
21. What is the amount spent on the food consumed by the household members during the past 7 days?	[monetary value in local currency]
22. What percentage of your income is used for buying food?	[%]
23. Can you quantify how much your household consumed in the past 7 days using credit (because of inability to cover the cost)?	[monetary value in local currency]
24. Can you quantify how much your household consumed in the past 7 days from its own production?	[monetary value in local currency]
25. Can you quantify how much your household consumed in the past 7 days from assistance/gifts?	[monetary value in local currency]
26. Over the past 7 days, have the household members consumed [FOOD GROUP]?	[1 = yes 0 = no]
• Cereals	
• White tubers and roots	
• Vitamin A rich vegetables and tubers	
• Dark green leafy vegetables	
• Other vegetables	
• Vitamin A rich fruits	
• Other fruits	
• Organ meat	
• Flesh meat	
• Eggs	
• Fish and seafood	
• Legumes, nuts and seeds	
• Milk and milk products	
• Oils, fats	
• Sweets	
• Spices, condiments, beverage	
27. During the last 7 days, have you been faced with a situation wherein you did not have enough food to feed the household?	[1 = yes 0 = no]
Shocks	
28. What are the most severe shocks faced by the household in the last 12 months?	(Open answer)
29. What did the household members do to cope with the shocks?	[open answer]