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Status and Determinants of Rural Households Livelihoods, Poverty, and Access to Agricultural Extension Services in Jimma Geneti Woreda, Ethiopia

Tariku Kassa Ambaye

A Dissertation Submitted to the Center for Rural development

Presented in Fulfillment of the Requirements for the Degree of Doctor of Philosophy (Development Studies/Rural Development)

Addis Ababa University
Addis Ababa, Ethiopia
June 2021

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Addis Ababa University
School of Graduate Studies

This is to certify that the thesis prepared by Tariku Kassa, entitled: *Status and Determinants of Rural Households Livelihoods, Poverty, and Access to Agricultural Extension Services in Jimma Geneti Woreda, Ethiopia*, and submitted in fulfillment of the requirements for the Degree of Doctor of Philosophy (Development of Studies/Rural Development) complies with the regulation of the University and meets the standards concerning originality and quality.

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Chair of the center or Graduate Program Coordinator

Declaration

I, the undersigned, declare that this is my original work, has never been presented in this or any other University, and that all the related literature has been fully acknowledged.

Name……

Signature……..

Date…….

Place……

Date of Submission……

This dissertation has been submitted for examination with my approval as University supervisor.

Supervisor name…….

Signature…….

Date…….

Co-supervisor name…….

Signature……..

Date…….

Abstract

Status and Determinants of Rural Households Livelihoods, Poverty, and Access to Agricultural Extension Services in Jimma Geneti Woreda, Ethiopia.

Tariku Kassa

Addis Ababa University, 2021

The general objective of this study was to analyze the status and determinants of rural households' livelihoods, poverty, and access to agricultural extension services in Jimma Geneti woreda, Ethiopia. A mixed-research design was employed. The subjects of the study were 387 surveys and 90 qualitative study participants. Multi-stage sampling techniques were used to include samples in this study. Both primary and secondary data sources were used to collect and establish the dataset of this study. Survey questionnaires, in-depth interviews, non-participatory observation, and focus group discussion tools were used to collect primary data. To analyze the data, both quantitative and qualitative data analysis techniques were employed. Both the specific and general livelihood indices of the study area show a low/depleted state of livelihood sources. Enhancing rural households' information, financial, social, natural, physical, and human capital should not be circumvented. The extent of sample heads' livelihood diversification (measured by Simpson Index Diversity) was found low (0.27). That is, sample heads of the study area remained in low-return non-farm livelihood activities only (61.26%). Having a relative risk ratio (greater than 50%), multinomial regression analysis shows that households' place of residence, sex, education, marital status, and membership in cooperatives are found significant determinants of rural livelihood's choice of livelihood strategies at a 5% significant level. Hence, encouraging rural households to engage in remunerative livelihood strategies (non-farm, off-farm, and/or a combination of activities) requires action-oriented policies. Furthermore, the composite multidimensional livelihood security of samples was found 2.406. Ordered Logit model results show rural heads' Sex, Marital Status, member of cooperatives, Age, F_size, Dependency Ratio, and landholding significantly impacted their state of multidimensional livelihood security. Hence, wider considerations of rural households' multidimensional livelihood security analysis should be in place than narrow analysis of food and/or nutritional security alone. Results of descriptive statistics show that sample heads' state of multidimensional poverty was found higher (53.1%) than other developing countries like Indonesia, Sierra Leone, and Nigeria but less than the national average. Results of the ordered logistic regression analysis revealed that kebele, marital status, literacy status, landholding, and membership in cooperatives of the household heads were among the determinants. Hence, policies and programs aiming to reduce rural heads' multidimensional poverty in the most deprived multidimensional poverty index indicators like school attendance and years of schooling should be a priority area. Attentions to decompose rural poverty into different categories enable planners to comprehensively understand it and reduce rural poverty. Alongside multidimensional poverty analysis, the involvement of the poor in poverty analysis shouldn't be overlooked. Sample heads access to agricultural extension services was found low. Weak links between agricultural research and farmers' extension problems, lack of coordination and communication between agricultural sectors and higher learning institutions, and lower salary level and fewer resources for field agricultural extension agents are found the major potential reasons/challenges that make sample households' non-accessed. Furthermore, the Logit model result shows that Kebele/"ganda" of the household head, access to agricultural extension training, access to credit service, irrigation use, and rural households' having a telephone were found the major determinant factors. Thus, agro-ecology and need-based, participatory, and pluralistic agricultural extension policy is needed.

Keywords: Livelihoods, poverty, agricultural extension services, rural households, Jimma Geenti Woreda

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Acronyms

AAU	Addis Ababa University
ADLI	Agricultural Development-Led Industrialization Strategy
AES	Agricultural Extension Services
ANOVA	Analysis of Variance
a.s.l	Above sea level
CARE	Cooperative for Assistance and Relief Everywhere, formerly Cooperative for American Remittances to Europe is a major international humanitarian agency delivering emergency relief and long-term international development projects
CPI	Community Participation Security
COVID-19	Coronavirus Disease 2019
CRD/CDS	Center for Rural Development/College of Development Studies
CSA	Central Statistical Authority
DFID	Department for International Development
DoI	Diffusion of Information
DR	Dependency Ratio
EEI	Economic Efficiency Index
EmSI	Empowerment security index
EnSI	Environmental security index
ESI	Ecological Security Index
EPI	Exocrine Pancreatic Insufficiency
FAO	Food and Agricultural Organization
FGD	Focus Group Discussion
FGT	Foster Greer and Thorbecke
FTCs	Farmers' Training Centers
FSI	Food Security Index
GADA	Generation in Action Development Association
GAI	General Asset Index (GAI)
GDP	Gross Domestic Product
GFRAS	Global Forum for Rural Advisory Services
GIS	Geographic Information System
GTMs	Grounded Theory Methods
GTP	Growth and Transformation Plan
HDRs	Human Development Reports
HHs	Household Heads
HPI	Human Poverty Index
HSI	Habitat Security Index
ICT	Information Communication Technology
IFAD	International Fund for Agricultural Development
IIA	Independence of Irrelevant Alternatives Assumption
IGNU	Inderia Ghandi National University
LAMP	Literacy Assessment and Monitoring Programme
LHD	Livelihood Diversification
LHS	Livelihood Security
LHSI	Livelihood Security Index
MA	Master of Art
MCA	Multiple Correspondence Analysis
MoA	Ministry of Agriculture
MLHS	Multidimensional Livelihood Security

MLHSI	Multidimensional Livelihood Security Index
MDP	Multidimensional Poverty
MPI	Multidimensional Poverty Index
Msc	Master of Science
MSSRF	MS Swaminathan Research Foundation
NBS	National Bureau of Statistics
NGOs	Non-Governmental Organizations
NPC	National Planning Commission
OSI	Occupational Security Index
OANR	Office of Agriculture and Natural Resource
OFED	Oromia Finance and Economic Development
OLS	Ordinary Least Square
OPHI	Oxford University Poverty and Human Initiative
OPHDI	Oxford University Poverty and Human Development Initiative
PPA	Participatory Poverty Analysis
PPI	Participatory Poverty Index
PRA	Participatory Rural Appraisal
PASDEP	Plan for Accelerated and Sustained Development to End Poverty
PLA	Participatory Learning and Action
PRS	Poverty Reduction Strategies
ROC	Receiver Operating Characteristics
RRA	Rapid Rural Appraisal
SAI	Separate Asset Index
SAPs	Structural Adjustment Programs
SDGs	Sustainable Development Goals
SDPRP	Sustainable Development and Poverty Reduction Plan
SEM	Structural Equation Modeling
SID	Simpson Index Diversity
SLFs	Sustainable Livelihood Frameworks
SLHSI	Sustainable Livelihood Security Index
SLSI	Sustainable Household Livelihood Security
SLM	Sustainable Land Management
SPSS	Statistical Packages for Social Science
SNNP	South Nations and Nationalities People
SSA	Sub-Saharan Africa
SEI	Social Equality Index
STATA	Statistical Software Package
TFA	Totally Fuzzy Approach
TLU	Tropical Livestock Unit
UNCED	United Nations Commission on Environment and Development
UNDP	United Nations Development Programmes
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNICEF	United Nations Children's Fund
UN SDGs	United Nations Sustainable Development Goals
WDR	World Development Report
WFP	World Food program
WHO	World Health Organization

CHAPTER ONE: GENERAL INTRODUCTION

1.1. Background and Justifications of the Study

Backgrounds of the study: Fragile and/or depleted livelihoods, poverty, and lack of need-based and pluralistic agricultural extension services have been the major challenges of rural households in the developing world. Each has its measurement techniques, definition, and theory/approach. For example, rural household livelihood analysis is the first thematic area. When conceptualized, it comprises a complex structure mostly agriculture, capabilities, asset capitals, and activities (mostly on-farm or agriculture) required for a means of living (Champers & Conway, 1992; Scoones, 1998). Besides, different authors like Champers & Conway (1992), Scoones (1998), Carney et al.(1999), and Ellis (2000b) state that rural livelihood is sustainable when it contends with and recuperate from stress and, thereby, didn't compromise the future of the next generation. As stated above, rural livelihood comprises mostly agriculture (Haggblade *et al*., 2007; World Bank, 2008).

There are two contrasting views on the debate about the role of agriculture alone as a source of livelihood for rural households. For instance, agriculture 'optimist' views as claimed by the World Bank (2008) state that Agriculture is the foundation of rural livelihoods that it speeds growth, reduces poverty, and ensures food security. Besides, agriculture is the largest source of employment, income, and raw materials (Haggblade *et al*., 2007). Moreover, a rural non-farm economy is more active when and where the local agricultural/farm economy is prosperous (Davis, 2004). Thus, agriculture is a strong foundation on which other activities like non-farm activities can develop (Gordon & Craig, 2001) and serves as the primary means of rural households' livelihood. For instance, the Federal Ministry of Agriculture of Ethiopia (2010) reported that Agriculture in Ethiopia has been a significant contributor to national GDP, unemployment reduction, and earning foreign currencies.

On contrary, agriculture 'skeptic' views claim that because the agricultural sector is highly characterized by small fragmented land size/decreasing farm sizes, low levels of output per farm, and a high degree of subsistence farming in most SSA countries (Jirstrom *et al*., 2011) and backward production technologies, irregular rainfalls, increasing soil erosion, land degradation, aridity in some regions and pervasive tropical diseases in Ethiopia, too (Arega, *et al*., 2013) relying upon agricultural-based rural livelihood alone couldn't guarantee enough rural

livelihoods for most of the rural people in rural SSA. Similarly, Babatunde (2013) states that farming/Agriculture as a primary source of income has become failed to guarantee sufficient livelihood for most farming households in SSA countries. Also, Ellis (2005) argues utilizing agriculture as the main vehicle for poverty reduction needs a reality check in SSA. Furthermore, only agriculture-based rural livelihood couldn't guarantee enough and sustainable means of living for most rural people (Jirstrom *et al*., 2011 & Arega, *et al*., 2013). In the case of Ethiopia, as mentioned by Fikiru (2008), the number of poor people in rural areas exceeds the capacity of agriculture to provide sustainable livelihood opportunities.

Hence, due to pressure from a population explosion (Barrett *et al*., 2001; Davies, 1993; Ellis, 1998; Bryceson, 1999a; 1999b) not in isolations but parallel with agriculture itself, there is a need for rural households' livelihood diversification to other non-agricultural livelihood options (Emanuel, 2011; Bryceson, 1993; Deverux, 2000; Hussien and Nelson, 1999; Reta and Ali, 2012; Timmer, 2009; Yizengaw, *et al*., 2015; IFAD, 2016). As part of a broader process of structural transformation (Timmer, 2009), rural households' livelihood diversification is defined as a sectorial shift of rural activities away from on-farm to non-farm activities (Start, 2001) and it is a continuous adaptation of a highly diverse portfolio of livelihood activities undertaken by individual and/or household members, thereby, improve their social status and standard of living, obtain necessities in life: food, water, shelter and clothing, secure survival and improve the standard of living (Ellis, 1996; 1998; 2000b). But, livelihood strategies are a combination of activities that people choose to undertake to achieve their livelihood goals (Ellis & Allison, 2004). With effective rural households' livelihood diversifications, rural people no longer remain confined to crop production, fishing, forest management, or livestock-rearing but combine a range of occupations to construct a diverse portfolio of activities (Dercon & Krishanan, 1996; Ellis, 2000a; Unni, 1996).

Furthermore, three strategic shifts that are the availability dimension, the accessibility dimension, and from material perspective to the social perspective in development thinking led to the adoption of the livelihood security framework. This implies that apart from the narrow consideration of food and nutrition aspects, the approach focused on a participatory, rapid, and holistic analysis of the livelihood systems of a given area, identify constraints to rural people, and design effective programs to overcome it (CARE Kenya, 1996a; 1996b; CARE India, 1997; CARE Sri Lanka, 1997; Drinkwater, 1998; Lendenberg, 2002). It helps to determine the

livelihood strategy portfolios that different households pursue and the factors determining them (Baby, 2005). Added to this other scholars like Swaminathan (1991a; 1991b), Frankenberger (1996), and Baby (2005) further clarify the approach comprises food, potable water, health facilities, educational opportunities, housing, and time for community participation and social integration. Furthermore, methodologically estimated by a series of procedures and finally develop aggregate livelihood security index (Lendenberg, 2002; Baby, 2005; Akter, 2012; Rahman & Akter, 2012; Rahman &Akter, 2014; Barela, *et al*., 2018). For example, previous studies like CARE India (1997), Lendernberg (2002), Baby (2005), Sing & Hiremathe (2010), and Barela *et al*. (2018) used the method.

Poverty analysis is the second thematic area**.** Based on Haughton & Khandker (2009) who put two major reasons for measuring poverty: to keep the poor on the agenda (i.e, not to forget them) and to identify the poor from non-poor, thereby, reduce or alleviate poverty, it seems indispensable to measure the status and determinants of rural poverty in the current study area. Thus, concerning the measurements of rural households' poverty, the monetary approach has been used for several decades. It identifies the poor from the non-poor using the poverty line (Nunes, 2008: Rahman & Titmir, 2013; Noglo, 2014; Laderchi, 2015; Suppa, 2016). It defines poverty as a lack of income. The approach has been guided by utility theory. Hence, it has dominated rural poverty measurement literature for a long time. Nevertheless, due to its internal weakness (identifying the poor from non-poor using controversial poverty line), an Indian Professor of economics Nobel Laureate Amartya Sen (1981) introduced capability theory in the literature of rural households' poverty estimations. Since then, it has got the attention of development agents, development economists, policymakers, and rural poverty researchers (individuals and organizations).

To identify the poor from non-poor, alternative axiomatic multidimensional deprivation indices to monetary approach (poverty line) were introduced in the poverty literature. That is, the basic idea of the multidimensional poverty index (M_0) approach is that an aggregation of shortfalls of all individuals where the shortfall concerning a given need reflects the fact that the individual does not have even minimum functioning vectors (Deutsch & Silber, 2005; Chakravarty, 2006; Alkire & Foster, 2008; 2011; Rolf & Eugenio, 2012; Rolf & Andrea, 2014; Dhongde & Haveman, 2015; Bérenger, 2016; Alkire & Jahan, 2018). The overall multidimensional poverty

index is obtained by the product of headcount ratio (H) and intensity poverty gap (A) (Alkire & Jahan, 2018).

The MPI approach implies that its results have been computed based on three dimensions and ten indicators proposed from top to down. That is, as MPI methodology is a quantitative and top-down approach, the voice of the rural MPI poor households has been overlooked. In other words, poverty dimensions and indicators were that of experts but not that of poor people who experienced it. As a result, the participatory poverty approach (bottom-up, qualitative, and poor voice focused) was introduced by development practitioners (Chambers, 1994a; 1994b) and since then used by participatory poverty researchers like Norton (2001), Duraiappah *et al*. (2005), Zaid *et al*. (2006), Hinds (2013), Leavy & Haward (2013). The approach is about understanding, gathering, and analysis of rural poverty from the perspective of those who experience it. Thereby, plan and formulate implementation strategies to reduce it by themselves (Norton, 2001). Cognizant of this, Word Bank cited in Narayan *et al*. (1999) mentions that who is better to inform poverty assessments than the poor themselves who are the true experts of poverty assessment. For example, when asked to characterize poverty, rather than income, the poor conceptualize poverty as multidimensional realities: lack of food, housing, and land to meet their basic survival needs (Narayan, *et al*., 1999; Zaid *et al*., 2006; Alemeseged, 2016; Melaku, 2016). In Jimma Geneti woreda, while conceptualizing poverty, a concept mapping matrix was used to progressively differentiate unadulterated voices of the poor. To identify the poor from non-poor, participatory poverty analysis(PPA) employs social mapping, seasonal calendars, transect walks, problem tree, semi-structured interviews (Chambers & Conway, 1992; Chambers, 1994a; 1994b; Leavy & Howard, 2013; Hinds, 2013), wealth ranking that categorizes rural households into different wealth categories: better off/richer, rich, poor, and poorest of the poor categories (Zaid *et al*., 2006) and participatory poverty index (PPI) that measures rural households' perceived poverty from bottom to up (Shen *et al*.,2011).

Analysis of rural households' access to agricultural extension services is the third thematic area of the current study. Rogers's (1995) diffusion of information (DoI) theory and Dercon & Douglas's (2014) high payoff input model have guided the analysis of the state of rural households' access to agricultural extension services and its determinants. Because the World population is increasing at an alarming rate from 6.7 to 9.1 billion by 2050 (UN, 2019) and rural households' poverty is wide spreading its scholarly investigation matters most. GFRAS (2012)

conceptualized agricultural extension services like supply of agricultural technologies/inputs, provisions of useful technical information/advice to the farmers, thereby, improve agricultural production and productivity, ensure food security, reduce rural poverty, and contributes to sustainable rural households' multidimensional livelihood security. For example, a couple of empirical studies by different scholars (Baby, 2005; Oladele, 2005; Oladle *et al*., 2004; Word Bank, 2015; Tata & Nenamare, 2016; Ijatuyi *et al*., 2017) show that there exists a significant relationship between the use of fertilizer and poverty reduction through yield increment in crop production. As an illustration World Bank (2015) found that under the right conditions, a 10% increase in fertilizer use would reduce poverty by 0.4%. All these background studies call for effective, participatory & need-based agricultural extension services. However, different socio-economic independent determinant factors affect rural households' access to agricultural extension and services like agro-ecology, sex, age, family size, marital status, education, distance to the nearest market, and others, *ceteris paribus* (Yurttaș & Atsan, 2006; Catherine *et al*., 2012; Arias *et al*., 2016; Abdallah &Abdul-Rahaman, 2016; Umeh & Ekwengene, 2017).

In synthesis, there are twelve rural kebeles and two small towns (Woreda finance and economic development office, 2017; 2018). Most of the rural population is engaged in traditional subsistence agriculture and rural households' access to effective, participatory, and need-based agricultural extension is not as it ought to be (Woreda agriculture and natural resource conservation office, 2017; 2018). The livelihoods security of rural households has been depleting (Woreda health office, 2017; 2018; Education office, 2017; 2018; Water, mineral and energy office, 2017; 2018; Land administration office, 2017; Animal health office, 2017; 2018; Livestock office, 2017; 2018; Irrigation office, 2018). Besides, to the extent of the knowledge of the researcher, analysis of micro-level cross-sectional data on rural households' multidimensional livelihoods, multidimensional poverty, and access to agricultural extension services were found insufficiently established both in policy documents and academic literature at the national level in general and study area in particular. All these instigated the researcher to undertake a study on the status and determinants of rural households' livelihoods, poverty, and access to agricultural extension services in the case of Jimma Geneti Woreda, Ethiopia.

Justification of the study: Analysis of the status and determinants of rural households' choices of livelihood strategies is the first thematic area of the current study. So far, substantial studies by different researchers (Dai *et al*., 2020; Khatun *et al*.,2012; Lio *et al*., 2015; Chuong *et al*.,

2015; Ahmed *et al*.,2016; Misganaw *et al*.,2019) have been done. From the synthesis of these related reviews, it is possible to deduce that agriculture has been failing to guarantee sufficiently the livelihood for most farming households and calls for their livelihood alternative options. Nevertheless, Ellis (1999) note that diverse non-farm activities have rarely been persuaded. Also, Arega *et al*. (2013) mention that in Ethiopia majority of smallholders have been cultivating mostly basic staples for the subsistence of their households on less than 0.5hec of on-farmland. Reviews show that livelihood diversification is not as it ought to be. Several determinate factors could affect rural households' choices of lucrative livelihood strategies in Ethiopia (Wagayehu, 2004; Yizengaw *et al*., 2015; Adugna, 2008; Fikiru, 2008; Kebede *et al*.,2014; Amare & Belaynesh, 2012; Emanuel, 2011; Yisehak, *et al*., 2014).

The narrowly studied rural *households' food insecurity* as one of the undesired outcomes of sustainable livelihood frameworks has sufficiently dominated the rural households' livelihood analysis. Regardless of these enormous food insecurity studies, worldwide, FAO (2017a) revealed that the state of the rural households' food insecurity has increased to 925 million people in 2016 (900 million in developing countries and about 70% in rural areas) and chronically undernourished people in the world is estimated to have increased from 777 million in 2015 to 815 million in 2016. Besides, worldwide, the number of undernourished people has increased to 821 million people- when decomposed stunting (nearly 151 million children under five or over), wasting (over 50 million children under five), and overweight (over 38 million children under five) and the trend and prevalence of undernourishment of the world was 14.5% (2005), 11.8%(2010), 11.3%(2012), 10.7%(2014), 10.8%(2016), and 10.9%(2017) were undernourished (FAO, IFAD, WFP, WHO, & UNICEF, 2018). The state of African trend and prevalence of chronically undernourishment was reported as 24.3% (2005), 21.7% (2010), 21.0% (2012), 20.7% (2014), 22.3% (2016), and 23.2% (2017) and for the Eastern African peoples results show that it was 34.3% (2005), 31.3% (2010), 30.9% (2012), 30.2% (2014), 31.6 %(2016), and 31.4 %(2017) (FAO *et al*., 2018).

Regardless of the dramatic increase in the number of rural household's food insecurity and nutritional insecurity (Abduselam, 2017; Federal Disaster and Risk Management Commission, 2018), well-established studies (chronologically arranged studies before 2008 by Degefa, 1996; 2002; 2005, Million, 2007, Messay, 2008, and Tsegaye, 2008; between (2008-2012) by Asfaw *et*

al. (2005), Aurino & Cafiero (2012), Carletto *et al*.(2012), Arega (2012), and post- 2012(2013-2017) studies by Cintron *et al*.(2016), Souza &Jolffiee (2016) and by Alemeseged (2016)) on rural households' food security and insecurity did and documented in Ethiopia. However, compared to multidimensional livelihood security issues of rural people those studies are considered narrow.

Poverty analysis is the second thematic area. That is, traditionally poverty has been measured using a one-dimensional monetary approach. Given the importance of other dimensions of rural poverty, previous studies like World Bank (2014), OPHI (2014a; 2014b; 2014c), Amao *et al*. (2017), OPHI (2017;2018), and UNDP (2019) underscore the importance of non-monetary measures of poverty analysis. Old results of the multidimensional poverty approach show that 85% of the world's multidimensional poor live in rural areas (OPHI, 2014a). In 2017, a total of 26.5% of people from 103 countries of the world are multidimensional poor (OPHI, 2017). Based on the newly revised globally 2018 MPI indicators, high but a declining trend the MPI poor for 105 countries was reported as 23.3% people lives in acute multidimensional poverty (OPHI, 2018). Decomposition result shows that 1.1 billion/84% rural people live in intense MPI poor greater than that of 0.2 billion urban MPI poor) (OPHI, 2018).

Furthermore, in 2019 across 101 countries, 1.3 billion people (23.1%) are multidimensional poor: 2/3rds live in middle-income countries (OPHI, 2019) - largest suffering populations (559,594 million) live in SSA: When decomposed, Nigeria (29.4%), Ghana (13.2%), Niger (59.1%), 23% (South Africa) (OPHI, 2018). In Sierra Leone, the incidence of rural poverty was 86.3%, the intensity of poverty was 60.3% and aggregate of poverty was 52% and urban incidence of poverty was 37.6%, the intensity of poverty was 50.9% and aggregate of poverty was 19.1% in 2017(UNDP, 2019) implying that multidimensional rural poverty indices were highest in a rural setting than urban area of the country. Likewise, rural-urban decomposition of multidimensional poverty results shows higher rural poverty in other SSA countries: 66.1% in 2010 (NBS Poverty Profile Report, 2010) and 29.4% 2018 (OPHI, 2018) in Nigeria, 94% (rural), and 43 %(urban) in Burkina Faso and 96% (rural) and 56 %(urban) in Niger (National Bureau of Statistics/NBS, 2005). However, in the Horn of Africa, when MDP is decomposed into rural-urban, for example, in Uganda, the national multidimensional poverty rate (55.1%) in 2019 was similar to the SSA average (57.5%)(OPHI,2019), in Somalia, rural poverty is wider than urban

poverty: 96% of rural households and 54% of urban households were MPI poor in the country (NBS, 2005).

Despite series of pro-poor development plans, policies, and strategies[2] multidimensional poverty is high, deep-rooted, and pervasive in Ethiopia (Alkire & Roche, 2013). For example, out of 102 million inhabitants of Ethiopia, 85.5% are multidimensionally poor in 2019- when decomposed into MPI indices results show that incidence of poverty was 88.4%, the intensity of poverty was 61.6% and the composite index of the country was 54.5% in 2011 and it was 83.5%, 58.5% and 48.9% in 2016, respectively and decompositions in term of rural areas show that 93.3% of multidimensionally poor people lives in rural areas of the country (OPHI, 2019). Regional decomposition of MPI poor in Ethiopia revealed that in Oromia (home of the largest number of multidimensionally poor people) the incidence of poverty fell from 91.7% in 2011 to 87.2% in 2016, but there was no significant reduction in the intensity of poverty, 91.9% for Somali, 44% in 2011 and 15.5% in 2016 for Addis Ababa city administration, Amhara significantly reduced intensity of poverty between 2011 to 2016, the reduction in MPI value in both Tigray, from 52% in 2011 to 45% and SNNP from 56.7% in 2011 to 48.2% in 2016 (OPHI, 2019). Using the Alkire & Santos (2013) method Alemeseged (2016) has conducted a household multidimensional poverty analysis and results show that 70.3% of the sample households were MPI poor in Werie Leke Woreda of Tigray regional state. Concerning the determinants of rural households multidimensional poverty, several determinants factors were identified by different scholars(Pasanen,2017; Sabire *et al*., 2006; Hashmi *et al*., 2008; Ballon &Apablaza, 2012; Sekhampu, 2013; Ibrahim &Umer, 2008; Adepoju, 2018; Apata *et al*., 2010; Amao *et al*., 2017; Bahta & Haile, 2013; Bogale *et al*., 2005; Bogale, 2011; Alemeseged, 2016; Teka *et al*., 2018; Girma &Temesgen, 2018; Desawi,2019).

Participatory poverty analysis (PPA) is a qualitative approach to identify the poor from the non-poor (Chambers, 1994a; 1994b). When rural poverty is assessed using such approach in SSA (e.g. the poor in Cameroon) distinguished the poor from the non-poor different ways: the presence of hunger, fewer meals a day and nutritionally inadequate diets, meager and irregular income spent on food, non-existent or low sources of cash income, feeling powerlessness and

[2] Series of Ethiopia' pro-poor development plans: PRS (2000/01),MoFED (2002), MDGs (2015), MoFED (2006), MoFED (2010), and MoFED (2016)

inability to make themselves heard (Citro & Robert, 1995). Similarly, Melaku (2016) identified the poor from non-poor as " a poor person is the one who has low or no land to cultivate, small house, disability or ill for a long period, the chance of being unsuccessful and poor working habit"(p:77-78). Concerning the perceived determinants of participatory poverty, poor people identified multiple determinant/ explanatory variables such as family size, age, gender, and residence (Majeed & Malik, 2014) and land ownership, livestock holding, access to irrigation, and others (Melaku, 2016).

Melaku (2016) and Alemeseged (2016) employed a *combination of two poverty measurements*. For example, while Melaku (2016) employed participatory poverty and monetary poverty measurement approaches, Alemeseged (2016) employed a combination of participatory poverty and multidimensional poverty study. In terms of data collection tools, Melaku (2016) used focus group discussion and well-being ranking. Alemeseged (2016) used FGD and in-depth interviews. Simple percentage by Melaku (2016) and transcribing, coding, and categorization methods by Alemeseged (2016) were used as qualitative data analysis techniques. Results by Melaku 2016) show that out of 42 samples, 14 PPA participants categorized themselves under the poor status of poverty. Besides, results of the participatory scoring matrix indicate that the community has provided the highest score for landholding (3.81%) and less importance to access to agricultural extension service (0.52). A comparison result of poverty measurement by PPA revealed a closer result (33.33%) to survey-based /monetary consumption expenditure approach result (35.12%). In contrast, Alemeseged's (2016) key informants' results revealed that households deprived of having money, something to eat or to sell, land, cloth to wear are considered poor. However, results in the average MPI score of the study area were computed as 41% greater than the MPI cutoff (33.33%). According to Alemeseged (2016), both approaches show that poverty is multidimensional in the study area.

Rural households' access to participatory agricultural extension services a fundamental role in rural household's poverty reduction and their livelihood security enhancement (Jonh, 2014; World Bank, 2015; Abdallah & Abdula-Rahman, 2016; Ijatuyui *et al*., 2017; Tigabu & Girma, 2018). In Sub-Saharan Africa, rural households' access to participatory agricultural extension services is influenced by their age, gender, marital status, family size, land ownership, rearing experience, farming experience, and extension visits in South Africa (Ijatuyi *et al*., 2017).

Abdallah & Abdul-Rahman (2016) have conducted on the determinants of rural women access to agricultural extension and advisory services in Ghana and t-value results showed that factors such as level of education, farming experience, farm size, income, extension contact, marital status, household size, and farming status had a significant positive relationship with the utilization of agricultural extension packages in the country. In Ethiopia, gender, education, landholding, livestock holding, and store distance have determinant factors on household access to agricultural extension and advisory services (Catherine *et al*., 2012). Multiple secondary data sources from woreda government offices revealed that no scientific analysis of the status and determinants of sample households' poverty, livelihoods, and their access to agricultural extension services.

All the above previous studies lead to identifying the similarities and gaps between the previous studies and the current study at hand. Hence, to describe the extent of rural households' livelihood diversification, the study used Simpson Index Diversity/SID approach used by Ahmed *et al*. (2018). Multinomial logit regression used to detect determinants of rural households' choices of livelihood strategies was similarly used to that of Yizengaw *et al*.'s (2015) study. In constructing rural households' multidimensional livelihood security index while the study followed that of Baby (2005), Singh & Hiremath (2010), Rahman & Akter (2012; 2014), and Barela *et al*. (2018), however, differ in the type and number of dimensions and indicators. OLS and Logit model was differently used to Tobit regression analysis of the determinants of multidimensional livelihood security analysis used by Rahman & Akter (2014).

There are no differences in the theoretical foundation (capability theory) and methodological approach (axiomatic deprivation) to identify the MPI poor from non-poor between the previous studies and the current study. Both studies also used similar types and the same numbers of MDP dimensions (health, education, and living standard dimensions). Moreover, the participatory scoring matrix used by Melaku (2016) and the current study is also the same in identifying the perceived determinants of rural poverty. General and separate asset index construction followed similar with Desawi's (2019) procedures but different in the number of asset capitals and household asset structure. Logit model application to the determinants of rural households' access to agricultural extension service was similarly used to that of Abdallah & Abdul-Rahman

(2016). One-way ANOVA was used similar to Alemeseged (2016) to establish nexus between dependent variables. Other critical differences lie on the following major points:

- ***First,*** *re-visiting rural households' new livelihood asset capitals and construction of new asset structure:* Thanks to Odero (2006). Previous livelihood studies ignored information capital as one part of the SLFs. They also failed to construct the asset "Hexagon". Thus, this study is unique for re-integrations of information capital in the SLF and constructed new rural households' asset endowment structure. As a result, it contributes to rural livelihood literature for future research and decision makings.

- ***Second,*** *less emphasis to consider legal out-migration as an alternative source of rural livelihood options:* On-farm, non-farm, off-farm, and/or a combination of these livelihood activities dominated the previous work of livelihood diversification studies. In the study area during lean periods (June, July, August, September, and October), households in the study area are highly food insecure, unable to meet the annual family food requirements, and unable to cope up with natural disasters (frequent water waves) and disease breakups (water-borne diseases) (GADA, 2014). Some households consider legal out-migration as an alternative source of their livelihoods. This study also focused on this option.

- ***Third,*** *narrow consideration of rural households' livelihood security issues:* Rural households' state of food security and/or nutritional security analysis sufficiently dominated the livelihood security analysis. However, the majority of them failed to investigate rural households' livelihood security issues from a wider and multidimensional perspective. Therefore, the current study has devoted itself to fill such gaps by contributing/enriching multidimensional livelihood security theory, methodologies, and empirical findings. For example, in terms of the study approach/framework, the current study was guided by CARE's (2004) livelihood security framework. Thematically, based on the seven livelihood dimensions and key indicators, the current study has undertaken the analysis of the rural household's multidimensional livelihood security of the study area.
- ***Fourth,*** *type and number of MPI indicators:* to identify the poor from non-poor, previous studies have employed deprivation indicators of Alkire & Santos (2010b; 2013) and that of Alkire & Foster (2008; 2011), this study used the newly global revised 2018 MPI indicators suggested by Alkire & Jahan (2018).

- ***Fifth,*** *deprivation cutoffs and decomposability of MPI poor:* For ten MPI indicators, the previous studies have computed their respective old MPIs based on deprivation cutoff point of 1/3(33.3%). However, because the numbers of MPI indicators were eleven, this study re-calculated K and used it as 0.366. Besides, to the extent of the knowledge of the researcher, all the previous multidimensional poverty researchers failed to decompose their respective MPIs into different MPI categories rather than dummy (MPI poor/MPI non-poor). MPI decompositions as near MPI poor, vulnerable MPI, and severe MPI poor by Batana (2008), Alemeseged (2016), and OPHI (2017) are exceptional but based on old MPI results. However, based on the new global 2018 MPI cutoff points, the current study filled the gap and contributes to rural household multidimensional poverty studies by decomposing the MPI poor into four/ordered multivariate categories like MPI non-poor, if K (0.366) less than 0.20, MPI vulnerable, if $0.20 \leq K < 0.36$, MPI poor, if $0.36 < K \leq 0.50$ and MPI sever if $K > 0.50$.
- ***Six,*** the *econometric analysis used to investigate determinants of rural households MDP:* to determine the factors contributing to MDP, except Melaku (2016) who used a scoring matrix method, because of the outcome an independent variable is a dummy variable (1 if MPI poor and 0 otherwise), the previous researchers have used binary logistic econometric regression analysis. However, because the expected outcome is measured with a polychotomous variable (there are four possible outcomes such as MPI non-poor, MPI vulnerable, MPI poor, and severe MPI poor) following Adepoju (2018), the current study employed Ordered logit model regression analysis. Such decomposition of rural poverty will help policymakers and planners to comprehensively identify who are poor and who are not, thereby, reduce the extent and severity of MDP,

- ***Seventh,*** *participatory poverty index (PPI):* Building on the fabulous dissertation work of Alemeseged (2016), the current study has employed a combination of multidimensional poverty approach and participatory poverty approach. Nevertheless, apart from spatial differences, there exist quite similarities and several major methodological differences with his study. For example, with the participatory poverty approach, Alemeseged (2016) has collected qualitative data using FGD and in-depth interviews. Because the design of the participatory poverty section of the current study was a qualitative case study research design, similar data collection tools were employed. Alemeseged (2016) has analyzed the qualitative data by

coding and categorizing [looks like, individual case analysis] of the interview results. However, based on the results of the concept mapping, the current study has analyzed the qualitative data by employing a cross-case analysis technique and developed the study area participatory poverty index (PPI). Then, the PPI result was used to compare the results of rural households' poverty when captured by the multidimensional poverty approach and when captured by the participatory poverty approach. In doing so, the study built the existing knowledge of poverty situations and contributes to the existing participatory poverty literature. A straightforward methodological difference with Alemeseged (2016),

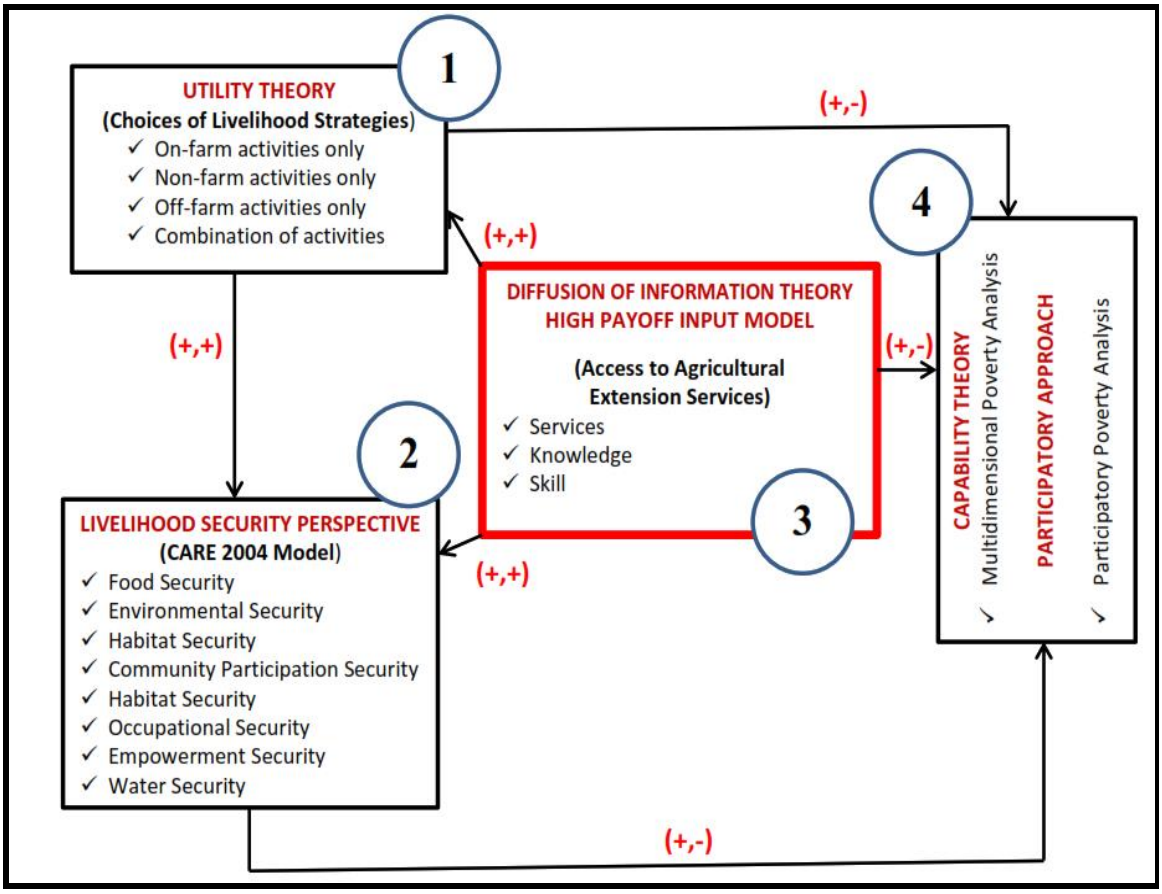
- ***Eighth,*** *need to re-investigate the causes of the low status of rural households' access to agricultural extension services.* In Ethiopia, despite considerable growth of households' participation in extension services, it remained low (Abrham, 2013). Because rural households' access to participatory and need-based agricultural extension services has a profound effect in enhancing their livelihood security and reduce poverty, the current study has investigated both the status and determinants of rural households' access to agricultural extension services, thereby, established the association among dependent variables in the study area. The synthesis of the above review of related literature and gap analysis shows us that the status and determinants of rural households' livelihoods, poverty, and access to agricultural extension services are crucial issues in ecologically fragile Jimma Geneti woreda, thereby, inform policies and interventions for poverty reduction, livelihood enhancement, and effective mechanisms of accessing rural households to agricultural extension services.

1.2. Overall Theoretical Framework of the Research

The current theoretical framework of the research represents how to study variables and concepts that are related to each other (model) that explains these variables and concepts are associated with each other (theory). Accordingly, the theoretical and conceptual framework explains the path of research and grounds it firmly in theoretical constructs. While the theoretical framework of the study is presented under Figure 1.1, the conceptual frameworks of the study are presented under chapters two, three, four, five, and six, respectively.

As shown in figure 1.1(**BOX1**), utility theory underpins the analysis of rural households' choices of livelihood strategies. The main reason is that the utility *function* underpins household choice of livelihood diversification activities.

Figure 1.1: Theoretical Framework of the Research



Source: Own construction (2021)

According to Yizengaw *et al*. (2015), the assumption is that in a given period at the disposal of its asset endowment, a rational household head chooses among the four mutually exclusive livelihood strategies that could offer the maximum utility. It is modeled as shown under equation (2.3) of chapter two. The current result shows that the current SID value of the sample households was 0.25 (low SID value) implying that the majority of the sample households of the study area (237/61.24%) remained in low-return non-farm livelihood activities only (crop production and animal rearing). By inserting in the multinomial logit model, the study investigated the statistical association between variable access to agricultural extension service (independent variable) and choices of livelihood strategies (dependent variable). Results show a positive and insignificant relationship between on-farm activities and off-farm activities. However, the negative and insignificant result was found with its association to a combination of on-farm and non-farm livelihood activities only. Furthermore, as evidenced by the result of One-Way ANOVA, contrary to the hypothesis, insignificant statistical association between choices of

livelihood strategies and rural households' multidimensional livelihood security was detected. The same result was found with its association to poverty.

BOX 2 shows the modeling of multidimensional livelihood security analysis in Jimma Geneti Woreda. As CARE's (2004) livelihood security model constitutes many livelihood security outcomes similar to the current study, it guides the study. Such analysis was modeled as shown under equation (3.4) and equation (3.12) of chapter three. Results show unequal livelihood security state of the rural households in Jimma Geneti Woreda. The overall livelihood security index of the current study area was 2.4 (low and fragile state of the livelihood security equilibrium). As evidenced by previous scholars like Ekwenegne (2017), Tigabu & Gebeyehu (2018), and Girma & Temesgen (2018), Box 2, above also shows the inverse relationship between rural households' multidimensional livelihood security vis-à-vis poverty (proposed future research).

Furthermore, the outward arrows of **BOX 3** show rural households' access to agricultural extension services positioned at the center of the theoretical framework implying that it plays a vital role in rural households' livelihood diversification and well protected multidimensional livelihood security (Farrington et al., 2002; Abdallah and Abdul-Rahman, 2016), and escape from the trap of poverty (John, 2014; Umeh & Ekwenegne, 2017). In this study, analysis of rural households' access to agricultural extension services was guided by Diffusion of Information theory (Dercon & Douglas, 2014) and High Payoff Input Model (Rogers, 1995) because both underscore the importance of modern agriculture vis-à-vis traditional agriculture currently prevails in Jimma Geneti Woreda. It is modeled as shown under equation (5.11) of chapter five. Results show that out of the total 387 samples 113(30.21%) of them were not access to agricultural extension training and 107(28.69%) were not accessed to full packages of agricultural extension services implying that rural households' access to agricultural extension services was not as it ought to be in the study woreda. To investigate the effect of access to agricultural extension services (independent variable) on rural households' multidimensional poverty (dependent variable), the study inserted the variable in the ordered logit model. Results of chapter two revealed a negative and statistically insignificant relationship between access to agricultural extension services and poverty. Besides, model presented under equation (6.8) of

chapter six, the results of One-Way ANOVA described in the sixth chapter show an insignificant relationship between rural households' access to agricultural extension service and poverty.

Last but not least, **BOX 4** represents the theoretical frameworks of rural households' poverty analysis in Jimma Geneti Woreda. Sen's (1981) capability theory and participatory approaches proposed by Champers (1994a; 2004) and Hindu (2013) guide the chapter on rural poverty analysis. While the ordered logit model is presented under equation (4.9), the participatory scoring matrix of PPA is presented as shown in equation (4.17). Results show rural poverty in Jimma Geneti Woreda found wide, deep-rooted, and severe. Besides, the study investigated the statistical association between variable access to agricultural extension service (independent variable) and poverty (dependent variable) and found an insignificant association.

1.3. Overall Philosophy and Methodology of the Research

Philosophical worldview: This dissertation adhered itself to the pragmatist philosophical worldview (a combination of quantitative and qualitative methods) described by Cresswell (2009).

Research Designs: Also, the study used several research designs. For example, temporally, cross-sectional research design takes place at a single point in time (Kothari, 2003; Trochin, 2005; Tariku, 2012). In this regard, primary data was collected at a single point in time in November (2019). Thus, the research design of this study is a household /micro-level cross-sectional design. Also, because the current study employs an "in-depth study" (Verma & Bead, 1981; Tariku, 2012) than a breadth study, the research design is also a qualitative case study design. Furthermore, because using descriptive statistics the study established the "descriptive profile" (Verma & Beard, 1981; Trochin, 2005; Tariku, 2012) of the study area, the descriptive research design is the other research design of this study. The study also analyzed the determinants of rural households' livelihoods, poverty, and access to agricultural extension services. "Cause-effect relationships" (IGNU2; 2005; Tariku, 2012) were established between independent variables and dependent variables. Different inferential statistics and econometric models were used. All of these entail that explanatory or causal research design is the other research design of this study. These imply that combinations of research designs were used. Such combinations of different research designs enabled the researcher to capture a comprehensive picture of study area rural households' multidimensional poverty, choices of livelihood

strategies, multidimensional livelihood security, their agricultural extension services, and determinants.

Population and Sampling Procedures: The unit of analysis[3] of this study is a rural household residing in the study woreda. It works both for population and samples. Thus, according to Jimma Geneti Woreda Office of Agriculture and Natural Resource (OANR, 2013/14), there are (N=11,021) rural households (Male headed=9,403 households and Female headed=1,618 households) living in Jimma Geneti Woreda. To compute samples study, there are different sample size determination formulae. These include Yemane (1967), Cochran (1977), Kothari (2004), and Krejcie & Morgan (1970) formulae. The latter is used in this study because the ever-increasing demand for research has created a need for an efficient method of determining the representative sample size of a given population. Their sample size (s) formula is equal to:

$$s = \frac{X2NP(1-P)}{d2(N-1)+X2P(1-P)} \quad \ldots\ldots\ldots\

livelihood sources, the study Woreda was classified into three strata using the farming system: High land stratum, mainly, farming barley, wheat, bean, and others, Plain area stratum, farming Maize, Teff, and others, and Coastal area stratum, mainly, farming fish, oils, vegetables, and others and such classification was made based on households types of farming system (Table 1.1). *Thirdly*, the availability sampling technique was used to sample all the twelve rural kebeles of the study area by excluding the two towns (*Hareto* and *Kidame Gebeya*). *Fourth*, once the twelve kebeles were sampled using the availability sampling technique, a proportional sample technique was used to determine the number of sample sizes from each kebele and the allocation of samples to each kebele was fairly represented. In this case, the proportionate stratified sampling formula was used. The proportional sampling formula used was presented as follows:

$$St = (\frac{Ni}{N})n \ldots\ldots\ldots\

Methods of Data Collection and Procedures: For quantitative data, a survey questionnaire (closed-ended and open-ended) was developed. Research protocols, the language of the interview guide & questionnaire were originally in English and then carefully translated to Oromiffaa. However, for qualitative data, key informant interview (structured & unstructured), focus group discussions, and non-participatory observation of sample heads' housing condition, FTC status in Hagaya kebele and avocado plant in Gamo Negoro and Balbala Sorgo kebeles were developed to collect the primary data from PPA participants. Before actual data collection, content validity and reliability of the quantitative survey tool were made. The content validity was analyzed using expert judgment. After the validity assessment of the survey instrument, the researcher attempted to get a recommendation letter from AAU, a rural development center and secured it on 22 October 2019 Ref.NO CRD/CDS/AAU/136/2019. Data for pilot-testing **(**from 2 November 2019 to 15 November 2019) was collected from 54 rural households of Charo Gobeno Kebele's (exclusively around a *Gotes* named as Ilikee, Hogonoba, Warra Wancha, and Tusha only). These *Gotes* are located on the asphalt road of Bako-Shambu town 1.5Km away from Hareto town that is easily accessible and later on excluded from the full data collection period of the current study. Then, reliability analysis was done using Cronbach alpha coefficient (α). The formula for Cronbach alpha is shown as follows:

$$\alpha = \frac{N \cdot \bar{c}}{\bar{v} + (N-1) \cdot \bar{c}} \quad \textbf{……..(1.3)}$$

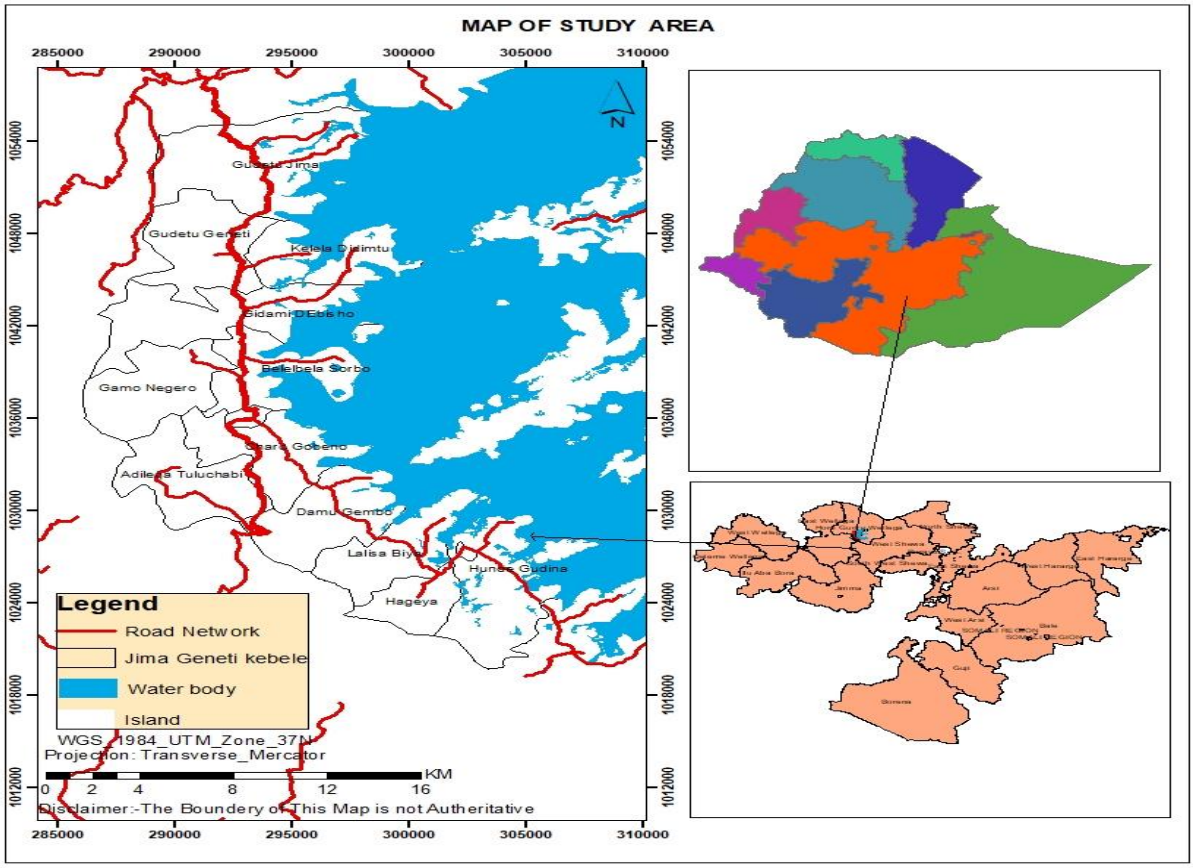
Where, α = *Cronbach alpha, N= Number of items, C= Average inter-item covariance among the items, V= Average variance.* **Note:** Cronbach alpha value ranges between 0 and 1, meaning, $\alpha \geq 0.9$ is excellent internal consistency, $0.9 > \alpha \geq 0.8$ is good internal consistency, $0.8 > \alpha \geq 0.7$ is acceptable internal consistency, $0.7 > \alpha \geq 0.6$ is questionable internal consistency, $0.6 > \alpha \geq 0.5$ is poor internal consistency and $0.5 > \alpha$ is unacceptable internal consistency ((Tavakol & Dennik, 2011). Accordingly, the overall Cronbach alpha coefficient (α) for the total 282 items was 0.77 suggesting that all the items have relatively high internal consistency. Meaning, under similar condition, all the 282 items have a chance of repeating similar results consistently. However, during the pilot-testing, there were some items complained by the respondents and enumerator that became difficult to understand and respond accordingly. Revisions were made for such items.

With the support of a total of 36 enumerators (34 development agents and extension workers of Jimma Geneti Woreda Agriculture and Natural Resource Office and two school teachers of Adileka Tulu Chala Kebele), quantitative data collection was carried out from 1st to 15 December 2019. Out of 408 total respondents, a total of 387 (94.9%) of the copies were returned from the survey participants. Only 21 (5.10%) copies were not returned. One of the main reasons for the non-return of items was due to one development agent on maternity leave supposed to collect the data. After the return of the 387 survey questionnaires, the researcher has recruited one data encoder and one STATA, expert. The data encoder has made an entry of the data from 17- 19 December 2019. The expert on STATA has made data clearance from 20-21 December 2019.

1.4.Context of the Study Area

The study woreda is divided into twelve rural and two urban kebeles (Woreda finance and economic development office, 2017; 2018) (Map 1.1, below).

Map 1.1: Map of the study area by sample kebeles



Source: Ethiopia Mapping Agency, expert assisted map (2021)

Indeed, Ethiopia is a land-locked country (Teklu & Turay, 2008). With an annual population growth rate of more than 2%, Ethiopia's population will be more than 120 million people by 2030 (FDRE, 2011). The country is divided into nine regional states of which Oromia is the one. In turn, divided into eighteen administrative zones of which Horro Guduru Wellega Zone is one. It has a total population of 570,040 (male=285,515) and female=284,525)(CSA,2007) and including Jimma Geneti (the study woreda), the zone is divided into nine Woredas. There are three major reasons why the Woreda was selected by the searcher: the interest of the researcher, rural poverty, livelihood depletions ("Chittu" island), and lack of effective pluralistic agricultural extension services in the study woreda and no previous study has been conducted.

Furthermore, according to the woreda finance and economic development office (2017), the study woreda is located at 287Km away from Addis Ababa on the way to Nekemte asphalt road and 27Km away from Horro Guduru Wollega Zone capital town shambu.The total population for Jimma Geneti Woreda was 64,158(while males constitute 31,756, females were 32,402, and while rural population was 57,192/89.14%, urban population constituted only 10.86% (6,966) (CSA, 2007). Data on the trend of population dynamics show that ascending trend (64,158 in 2007 GC and 88,850 in 2016/2017 (OFED, 2017:8). The total area of Jimma Geneti Woreda is 410.068 $km^{2/}$41,006.8 hectares (Woreda Finance and Economic Development office, 2017). In terms of land use, 193.12 km^2/19, 312 hectares was cultivable land, 11.205 $km^{2/}$11,205 hectares was forest land, 39.655 km^2 /39,655 hectares was grazing land, and 166.0268 $km^{2/}$16,602.7 hectares were other lands in 2017 EC (Woreda land administration office, 2017). Contrary to the Federal Democratic Republic of Ethiopia Ministry of Agriculture's (2000) traditional climatic agro-ecological zonations (*Dega, Woynadega,* and *Qolla*), the topography/relief of the study area is classified as highland and mid highland, implying that the study Woreda is neither lowland nor desert. Hence, for the current study, the researcher has categorized the woreda as *Highland* (where there is no Teff & Maize production in the kebele), *Plain area* (there is Teff & Maize production in the kebele), and *Coastal area* of Fincha'a Lake (there are Teff, Maize & fishing production in the kebele/island).

1.5. General Objective of the Research

The general objective of this study is to analyze the status and determinants of rural household livelihoods, poverty, and access to agricultural extension services in Jimma Geneti Woreda,

Ethiopia. However, the specific objectives and corresponding basic research questions of the study are presented under respective articles.

1.6. Significances of the Study

This study assumed has several significances. These are:-

First, widen human understandings/knowledge. For example, the study is significant in giving due emphasis to rural households' diversification of their livelihood sources than merely depending on on-farm activities. Besides, poverty has been conceptualized as a lack of income. However, this study is most significant that poverty is a multidimensional phenomenon. Also, it is significant in identifying pluralistic areas of agricultural extension services to rural households rather than delivering fertilizer and improved seeds alone.

Second, helps to understand the entirety of livelihood security. That is, several previous studies have focused on food and nutritional security as a fundamental issue of rural households. However, this study contributed that rural households' livelihood security is multidimensional requiring multidimensional study like the present one.

Third, it is also significant by contributing to the previous gaps in methodologies. For example, most rural poverty researchers have employed a monetary approach to poverty analysis. They also employed food and nutritional security analysis techniques. Even though employing such methodologies are not wrong, this study claims insufficient and contributed to multidimensional poverty analysis, participatory poverty analysis, and multidimensional livelihood security methodologies.

Forth, by availing household-level micro-data, the study is most significant for policy formulations related to livelihood improvements, poverty alleviation, and meeting the major goals of agricultural extension.

Fifth, above all the study, have significant contributions to local practices/woreda level) attempt to diversify livelihood sources, reduce poverty, and implement effective, need-based, and pluralistic agricultural extension services. *Sixth*, it also helps those who want to pursue further study on similar topics.

1.7. Scope and Delimitation of the Study

Thematically, the current study was focused on three major thematic areas such as analysis of rural households' livelihoods, poverty, and access to agricultural extension services and

determinants of each. According to Scoones (1998), sustainable livelihood framework analysis has different elements. However, the scope of this study excludes the mediating institutions and processes and examined the other elements. SID was used to analyze the extent of rural households' livelihood diversification. Indeed, the separate and general asset index was used to describe the state of rural households' asset profile.

Concerning the methodological scope of this study, multidimensional and participatory poverty analyses were used. Besides, the study employed PPI for qualitative poverty analysis. Furthermore, multinomial logit, OLS, ordered logit, participatory scoring matrix, and logit models were employed to analyze the determinants of choices of livelihood strategies, multidimensional livelihood security, multidimensional poverty, perceived poverty, and access to agricultural extension services, respectively. Spatially/geographically, this study was purposively delimited to Jimma Geneti Woreda. Added to the interest and familiarity of the researcher to the study area and due to lack of the previous study on a similar topic, the researcher purposively delimited to Jimma Geneti Woreda and twelve rural kebeles of the Woreda. Last but not least, as the study design is cross-sectional, the temporal/time scope of this study was done at a given point in time (i.e., November 2019).

1.8. Organization of the Dissertation

This dissertation consists of seven chapters.

- ✓ The first chapter is about the general introduction.
- ✓ The second chapter is devoted to analyzing rural households' choices of livelihood strategies.
- ✓ The third chapter is devoted to the analysis of the status and determinants of rural households' wider perspective of livelihood security.
- ✓ The fourth chapter focused on rural households' poverty analysis.
- ✓ Rural households' access to agricultural extension services was covered under chapter five of this dissertation paper.
- ✓ Results of one-way ANOVA established nexus between dependent variables under chapter six.
- ✓ Finally, the overall summary, conclusions, and recommendations are the emphasis of the last chapter.

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CHAPTER TWO
ANALYSIS OF THE CHOICES OF RURAL LIVELIHOOD STRATEGIES IN JIMMA GENETI WOREDA

Abstract: *Worldwide, significant numbers of rural populations are engaged in rural agriculture. For example, agriculture serves the majority of Ethiopians as a major source of livelihood. However, the role of agriculture alone as a source of livelihood is debatable. Choices of alternatives become essential. Thus, the major objective of the current study is to analyze the status and determinants of rural households' livelihood asset portfolios and choices of livelihood strategies and determinants. A mixed-methods approach is used. Primary data are collected from 387 random sample heads using survey questionnaires. Descriptive, inferential, and multinomial logistic regression is used to analyze data. Results of the descriptive analysis show that sample households faced multiple shocks (s) resulting in depletion of asset ownership. Out of the six livelihood asset, information capital was found to be the lowest livelihood asset index. This was further confirmed by the unequal line of the rural livelihood asset Hexagon that describes the ideal condition households have optimal access to the varied type of livelihood assets. Measured by Simpson Index Diversity, the extent of diversification equals 0.27 (extremely lower than other rural households in other developing countries). Households' kebele, sex, education level, marital status, and membership in cooperative are found significant determinants of rural livelihood's choice of livelihood diversification strategies at 5% significant level. The relative risk ratios (rrr) for each significant determinant are high (greater than 50%). Thus, based on multiple results of this study, it is possible to conclude that agriculture alone couldn't guarantee rural households' sustainable livelihood sources in the study area. Parallel with agriculture, pro-active and need-based rural development policies and strategies that promote the alternative, most lucrative, and complementary source of rural livelihoods [non-farm, off-farm, on-farm, and non-farm and legal foreign migration] required; an issue that shouldn't be circumvented.*

Keywords: Rural households, livelihoods portfolios, choice of livelihood strategies, mlogit, Jimma Geneti woreda (Ethiopia)

2.1.Introduction

There are three competent approaches to analyzing rural households' livelihood diversification. *First*, the household economic model (1970s- 1980s) aimed to combat rural poverty, famine, and food insecurity in developing countries (Becker, 1965; Singh *et al*., 1986; Ellis, 1993; Ashley & Carney, 1999; Taylor & Adelman, 2003; Yaro, 2006; Houweling, 2009; Sarah *et al*., 2015). However, the model has been criticized because it fails to capture survival strategies of livelihoods under stress (Ellis, 2000a, 2000b). It also fails to consider the social relationships between household members (Ellis, 1998). Furthermore, households are frequently exposed to incomplete or imperfect markets that limit their choices (Ellis, 1993). In this regard, the model is criticized for its perfect market functioning assumption,

Second, structural adjustment programs/SAPs (mid-1980's-early 1990s) was emerged concurrently with an economic model (Houweling, 2009) due to all these criticisms against a household economic model. It is based on the concept of economic liberalization (government several spending cuts and removal of subsidies (Bryceson, 1999b), nevertheless, plugged rural people into uncertainty and insecurity. That is, SAPs failed to meet its stated objective [poverty reduction, rather, enhanced rural poverty in developing countries (Houweling, 2009; Havnevik *et*

al., 2006), and *third*, shift from material perspective (food security) to a livelihood perspective (between mid-1980's-early 1990s) emerged in response to the failures of both macro-economic theories and SAPs (Chambers & Conway, 1992). Aimed to find local solutions to poverty (Houweling, 2009; Sarah *et al*., 2015) and given a general name sustainable livelihood framework analysis (SLFs) (Scoones, 1998; Ellis, 2000a; 2000b). A series of growing literature, for instance, Krantz (2001) framed different SLFs like CARE (1994) household livelihood security, Scoones(1998) sustainable livelihood framework, DFID (1997 & 2002) sustainable livelihood framework, UNDP (1997) approach to promote sustainable livelihoods(sustainable human development), Modified Sustainable Livelihood Framework (SLF), and Ellis(2000) Lihood framework (SLF).

Hence, out of the above three approaches to rural livelihood analysis, a sustainable livelihood framework (SLF) was chosen. Because its analysis of rural households' choices of livelihood strategies through an interaction of rural people's vulnerability context, asset capitals, and livelihood strategies (on-farm, non-farm, off-farm, a combination of either of these activities and migration, too). As a general livelihood analysis framework used by different studies, SLF has six boxes: vulnerability contexts, livelihood asset capitals, mediating processes, livelihood diversification strategies and activities, migration, and livelihood security. This study focused only on livelihood asset capitals, livelihood strategies, and migration as potential livelihood sources.

Analysis of the status and determinants of rural households' choices of livelihood strategies is another thematic area of the current study. So far, based on sustainable livelihood framework analysis (SLF) different researchers (Dai *et al*., 2020; Khatun *et al*.,2012; Lio *et al*., 2015; Chuong *et al*., 2015; Ahmed *et al*.,2016; Misganaw *et al*.,2019) conducted livelihood analysis. Some of them have conceptualized livelihood asset capitals and livelihood strategies. Some of them have identified approaches that could guide rural households' choices of livelihood strategies. For example, livelihood asset capitals mean living for an individual's life and are resources used to build livelihood (Bebbington, 1999). They are linked to vulnerability contexts and livelihood strategies (Ellis, 2000b; Houweling, 2009). This implies that the more assets people have the less vulnerable they are, otherwise, greater insecurity (Moser, 1998). Similarly, households with better asset ownership can achieve their livelihood objectives by improving their income, whereas, poor households do not (Desawi, 2019). Hence, the description of assets

is both as resources that people use in building livelihood (Bebbington, 1999) and as more holistic (Houweling, 2009) because assets are the building blocks for rural households' livelihoods (Sen, 1981). In the literature, having different assessment indicators, there are five common types of livelihood asset capitals identified by previous scholars (Champers & Conway, 1992; Scoones, 1998; DFID, 1999; Ellis, 1999) and remained and used for several decades as general sustainable livelihood frameworks. These are:

Human asset capital assessment indicators include education dimension (literacy-reading, writing, and doing simple arithmetic; educational status- abilities/habits, knowledge, skill/talent, experience, exposure to vocational skill pieces of training, social behavior and personality, labor, family size, and traits- gender, age, ethnicity, and experience of a household head (Ellis, 1996; 1999; Houweling, 2009; Yizengaw *et al*., 2015; Desawi, 2019). Besides, the health dimension has assessment indicators like chronic diseases, specific diseases, and epidemic diseases (Ellis, 1996; 2000b; Scoones, 1998; Houweling, 2009; Desawi, 2019). The human capital dimensions and indicators imply that a well-educated and healthy household follows diversified livelihood strategies as compared to those uneducated & unhealthy.

Physical asset capital assessment indicators, in turn, include agricultural physical assets owned like tractor, combiner, and generator for irrigation use, affordable transport and secure, affordable energy, durable consumer goods (are purchased and expected to last for considerable periods, Deswi, 2019) owned that includes tent and chairs, public infrastructures owned that includes primary school, health posts, and water schemes, sewing machine, blacksmithing tools, machines, roads, communication systems, and land improvements like terraces or irrigation. Note that households to operate these machines require a human capital skill that implies households having these physical assets diversify their livelihood options than those not owned (Ellis, 1999; De Hanna, 2000; Rakodi & Tony, 2002; Ellis, 2000b; DFID, 2000; Desawi, 2019),

Social asset capital assessment indicators include being a member of any social group in the kebele, level of participation in a social group, kind of support gained from a social group, and member of cooperatives that denotes a household head being a member of a social group could get quick information and able to diversify his/her livelihood than those not (Ellis, 1996; 1999; 2000b; Houweling, 2009; Megyesi *et al*., 2010; Habtu, 2012; Garedew, 2017; Desawi, 2019).

Financial asset capital assessment indicators comprise rural households' livestock holding, financial income, saving, access to loan and remittances(Toulmin, 1992; Ellis, 1999; 200b; DFID, 1999; De Hanna, 2000; Adugna, 2008; Houweling, 2009; Amare & Belaineh,2012; Yisehak *et al*.,2014; Seble, 2014; Yizengaw *et al*.,2015; Garedew, 2017; Ahmed *et al*.,2018) and

Natural asset capital assessment indicators include agricultural employment status, agricultural farmland ownership (Ellis, 1996; 1999; 2000b; DFID, 1999; Houweling, 2009; Garedew, 2017; Yizengaw *et al*., 2015; Desawi, 2019). Some of these scholars on rural households' livelihood assets constructed their respective asset Pentagon. But all failed to revise and integrate other asset capital. However, Adero (2006) revised and integrated *information capital* as part and parcel of the long-standing SLF as the sixth element. Its assessment indicators include radio, farm-book, telephone, internet, ICT-based extension services, agricultural knowledge, information and technologies, knowledge and information on agricultural risk management (Lasley *et al*., 2001; Odero, 2006; Munyua *et al*., 2009; FAO 2009; World Bank, 2011; Strong *et al*., 2014; Yizengaw *et al*., 2015; Tata & Mcnamera, 2016; Desawi, 2019). Now, the livelihoods asset structure moves from asset "Pentagon" to asset "Hexagon". It helps to visually observe households' strengths and interrelations among the six livelihood assets described above. In turn, according to Ellis and Allison (2004), rural livelihood strategies are an amalgamation of different rural livelihood sources persuaded by them for their survival that include on-farm, non-farm, off-farm, and/or a combination of these activities (Table 2.1, below).

Table 2.1: Classification of the components of rural livelihood diversification

Classification	Category	Definition
By sector: a standard national system	1. Farm (agricultural)	Production of unprocessed crops, livestock, forest, or fish products from natural resources. This category also includes farm wage labor, sale of farm output, and consumption-in-kind of own farm output.
	2. Non-farm (non-agricultural)	Includes all income-generating activities other than the production of primary agricultural commodities. Examples include mining, manufacturing, utilities, construction, commerce, transport, government services, among others. It also includes agro-processing, transport, or trading of unprocessed crops, livestock, forest, and fish products.
By function: Depends on how labor is compensated	3. Wage employment	Involves an employer-employee relationship, where the employee sells labor services to the employer in exchange for a wage or salary.
	4. Self-employment	Involves the sale of labor services to oneself, rather than working for an employer that pays a wage or salary. Income is earned through activities operated directly by the owner.
By location: Depends on where the activity takes place	5. On-farm	Income activity takes place on the farm, for example, crop and livestock production, hunting, fishing, or gathering from natural resources.
	6. Off-farm	Income activity takes place away from the farm (rural or urban, local or foreign). Typically includes all in the nonfarm category. Also refers to wage or exchange labor on other farms, and labor payments in kind such as harvest sharing and other non-wage labor contracts.

Source: (Ellis, 1998; Barrett *et al*., 2001; Haggblade *et al*., 2007; Fikiru, 2008; Losch *et al*., 2012; Yizengaw,*et al*.,2015; Sarah *et al*., 2015)

From the synthesis of these related reviews, it is possible to deduce that agriculture has been failing to guarantee sufficiently the livelihood for most farming households and calls for their livelihood alternative options. Nevertheless, Ellis (1999) note that diverse non-farm activities have rarely been persuaded. Also, Arega *et al*. (2013) mention that in Ethiopia majority of smallholders have been cultivating mostly basic staples for the subsistence of their households on less than 0.5hec of on-farmland. Reviews show that livelihood diversification is not as it ought to be. Several determinate factors could affect rural households' choices of lucrative livelihood strategies in Ethiopia (Wagayehu, 2004; Yizengaw *et al*., 2015; Adugna, 2008; Fikiru, 2008; Kebede *et al*.,2014; Amare & Belaynesh, 2012; Emanuel, 2011; Yisehak, *et al*., 2014). The other sections include section 2.2 review the results of the previous studies. Section 2.3 presents the specific objectives and corresponding basic questions of the study. However, section 2.4 presents the methods used to analyze rural households' choices of livelihood strategies. Section 2.5 presents the results and discussions. Finally, section 2.6 concludes and recommends.

2.2.Empirical Review

Several empirical studies have been conducted on the analysis of rural households' choices of livelihood strategies. Based on their objectives they employed different methodologies. For example, there are two major measurement approaches used to draw livelihood diversification (LHD) bio-diversity indicators. First, a one-dimensional index is determined by counting the number of income-generating activities (Martin & Lorenzen, 2016). The second one is two-dimensional approach that consider the number of income-generating activities and the proportion of each income (e.g.Simpson index of Diversity). It is used to explore the extent of livelihood diversification. Because of its computational simplicity, robustness and wider applicability previous scholars (Shiyani &Pandya, 1998; Chuong *et al*., 2015; Ahmed *et al*., 2016; Misganaw *et al*., 2019; Dai *et al*., 2020) employed Simpson Index Diversity. Concerning the analysis of the determinants affecting livelihood diversification, there are different econometric models in the literature. For example, to determine determinant variables that affected the extent of livelihood diversification in West Bengal (India), Khatun & Roy (2012) used multiple regression analysis. However, Ahmed *et al*. (2018) employed Tobit multiplicative heteroscedasticity regression, model in Bangladesh. Furthermore, to investigate the determinant factors influencing the households' choice of livelihood strategies, Seble (2014) and Yizengaw *et al*. (2015) have applied the Multinomial logit model of the econometric analysis. In

turn, Misganaw *et al*. (2019) to estimate the probability of choosing simultaneous livelihood strategies used a multivariate probit model, and an ordered probit model was estimated to examine the effect of livelihood diversification on the adoption intensity of sustainable land management /SLM practices in the upper Blue Nile Basin. In Oromia regional state, Doyo *et al*. (2018) analyze the determinants of alternative household activity-mix strategies because it is widely used for polytomous response categorical variables. Diagnoses of the assumptions of the multinomial logit model were made. According to Doyo *et al*. (2018), while the IIA assumption was tested using the Housman test, the degree of multicollinearity and association among discrete and dummy explanatory variables were tested using contingency coefficients. Nevertheless, the variance inflation factor was used for continuous explanatory variables.

Empirically, Ellis (1999) found that 60% of rural household income is from non-farm sources in South Asia. Due to land fertility and other issues of farming rural households are forced to look towards alternative sources of income (Hiremath, 2007). For example, nearly 40% of farmers take up livelihood activities other than farming in India (Kumar et al., 20011). Furthermore, to examine the extent of diversification Khatun & Roy (2012) and Ahmed et al. (2018) conducted a study in India and Bangladesh, respectively. Both researchers used a similar methodology (Simpson Index Diversity). But found different SID results. For instance, Khatun & Roy (2012) found a salaried group (SID 0.61/highest livelihood diversification group) followed by agriculture and allied activities group SID value 0.5768, causal labor group (smallest SID value 0.1326). However, Ahmed et al. (2018) found 4.2% of households' with SID range (>0.760) had "very high", 38.4% of households with SID range (0.510-0.750) had "high", 31.4% of households with SID range (0.260-0.500) had "medium", and 19.6% households with SID range (0.01-0.250) had "low", and 6% households with SID range (<.01) had "no" level of diversified livelihood activities.

In Sub-Saharan Africa (SSA), Ellis (2000b) and Sarah (2015) have studied the status of rural livelihood diversification in SSA. Results revealed that relatively better-off smallholders achieved successful livelihood diversification. Furthermore, Mensah (2014) has assessed the livelihood opportunities/strategies of rural poor households in Ghana and found that major traditional livelihood option for households appears to be food crop farming (76%), petty trading (16%), livestock rearing (4%) and salary work (2%). Oluwatayo (2009) states that

agriculture alone does not provide sufficient livelihood opportunities in rural Nigeria, hence, diversification is indispensable in the country. Besides, in South Africa, Ellis (1999) found that a range of 80–90 percent reliance on non-farm income sources is common.

In East Africa (Ethiopia) rural households combine a broad array of livelihood activities (natural resources and subsistence farming) (Tasow, 2002; Sarah, 2015). Another study by Meaza (2014) shows that construction, manufacturing, hand tools, and services are the most important non-farm activities of the sample households in Enderta woreda (Tigray regional state). In the same regional state, Desawi (2019) constructed the asset pentagon from five livelihood asset capitals like physical capital (0.78), social capital (0.38), human capital (0.16), natural capital (0.04), and financial capital (0.01). Further study by Yizengaw et al. (2015) revealed that households engaged in rearing/livestock (92.25%) and 63.1% did not participate in off-farm activities in Debre Ellias woreda (East Gojjam of Amhara regional state). Besides, Misganaw et al. (2019) found that mixed cropping and livestock production, the production of emerging cash crops (e.g., khat) dominated the overall income generation of the majority of farmers in Gozamen woreda (Amhara regional state). In turn, Seble (2014) found that agriculture alone and agriculture plus migration were the two most pertinent livelihood strategies in Artuma Fursi woreda (Oromia special zone, Amhara regional state) (Ethiopia). She also considered migration as an alternative source of rural households' livelihood. Doyo et al. (2018) also found that majority of the sample households allocated all their labor force to pastoral and farming activities alone (48.3%) in Oromia regional state (Yabello Woreda). The overall extensive review of descriptive results on rural livelihood diversification shows that rural households' choices of livelihood diversification strategies were not as they ought to be.

Multiple determinant factors are contributed to it. For example, Khatun & Roy (2012) and Ahmed et al. (2018) found a positive and statistically significant relationship between livelihood diversification and regional dummy. According to Chuong et al. (2015) who state that older household heads (experienced persons) tend to decide to diversify their income sources entails us the age of the household head is another determinant variable. Moreover, Khatun & Roy (2012), Seble (2014), Yizengaw et al. (2015), and Ahmed et al. (2018) also revealed that the sex of the household head is among the determinant factors of rural households' choices of livelihood strategies. Khatun & Roy (2012) also found that family size was found to be positively related to the level of livelihood diversification but the coefficient was not

statistically significant. Consistently, Ahmed et al. (2018) found a positive contribution to the extent of livelihood diversification with a family size that is, having more members in a household means more scope to access different income sources and earn a higher amount of income.

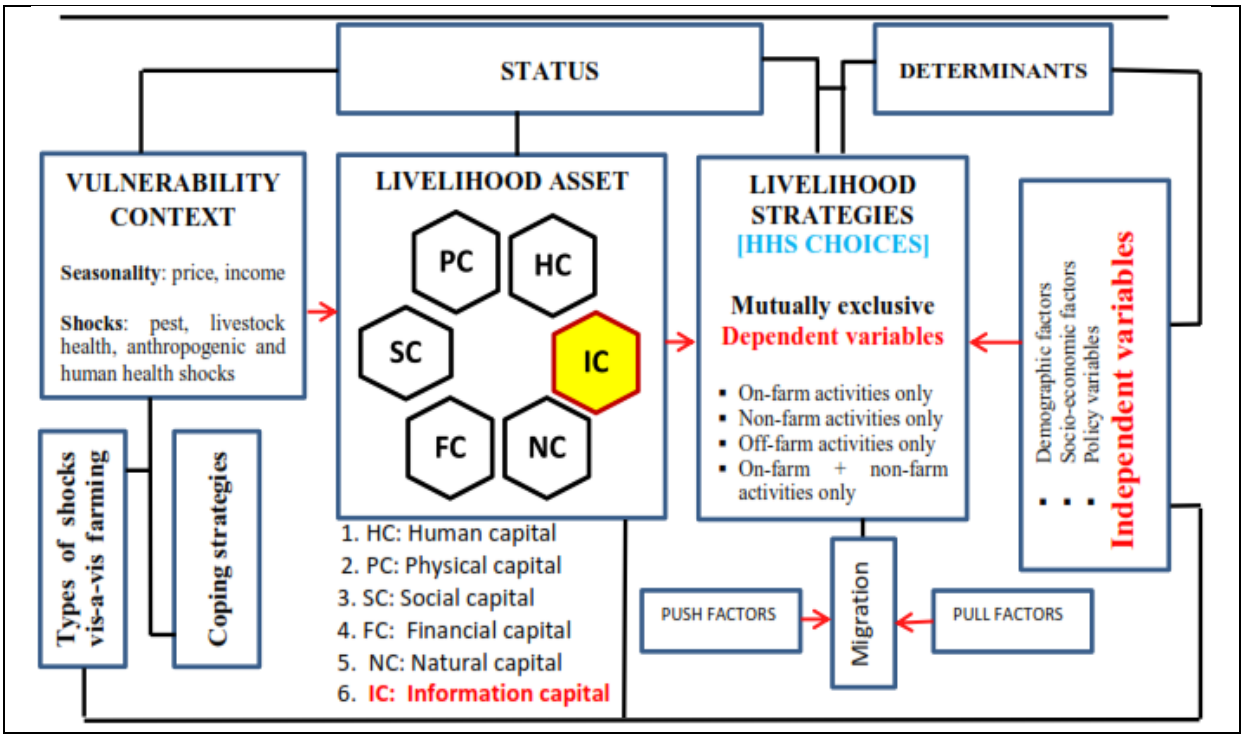
Moreover, other factors are constant; Khatun & Roy (2012), Seble (2014), and Ahmed et al. (2018) reported that the level of education of the household head was found as another determinant factor. For instance, Ahmed et al. (2018) reported that the higher level of education among the household heads had a negative and significant (1% level of significance) effect on livelihood diversification in the study areas of rural Bangladesh. A livestock holding in TLU of rural households' is also found as the determinant factor of their choices of livelihood diversification strategies (Reardon et al., 1992; Adugna, 2008; Amare & Belaineh, 2012; Seble, 2014; Yisehak et al., 2014); Yizengaw et al., 2015). Khatun & Roy (2012) found a positive and statistically significant relationship between livelihood diversification and membership of a cooperative society. Ahmed et al. (2018) also reported that the dummy variable of participating in some development program was found significant at a 1% level significance and had a positive impact on the level of livelihood diversification, the marginal effect showed that, if a household is a member of any developmental program then the likelihood of livelihood diversification increases by 10.5% compared to the household that is not involved in some development programs. Also, Ahmed et al. (2018) reported that the amount of savings had a negative and highly significant (at 1% level of significance) effect on livelihood diversification.

Previous studies such as Adugna (2008), Fikru (2008), Seble (2014), Kebede et al. (2014), Yizengaw et al. (2015), and Ahmed et al. (2018) also reported landholding size as a determinant factor of rural households' choices of livelihood diversification strategies. Amare & Belayneh (2012), Seble (2014), and Yizengaw et al. (2015) stated market distance and non/off-farm diversification had a positive and significant relationship. Similarly, Seble (2014) found that distance from the nearest market has positive rewards for household livelihood strategy diversification. Khatun & Roy (2012) reported a relationship between livelihood diversification and training was found positive and statistically significant.

The current study is unique for its four mutually exclusive polytomous response categorical dependent variables. Furthermore, there are also some gaps in the previous studies detected yet and contributed more to this study. For example, in the sustainable livelihood framework, the

five livelihood capital dominated the livelihood literature for several decades since its inception. Being influenced by the long-standing history of SLF, most previous livelihood literature failed to consider other new livelihood capital, repeatedly considered the five livelihood capitals. They also insignificantly considered legal migration as one major livelihood strategy for rural households whose livelihood is entirely dependent on agriculture alone. However, based on different literature (Lasley et al., 2001; Odero, 2006; Munyua et al., 2009; FAO 2009; World Bank, 2011; Strong et al., 2014; Yizengaw et al., 2015; Tata & Mcnamera, 2016) in the 21st-century information is becoming power by itself in general and influencing others [the five livelihood capitals] in particular. The current study is significant by considered information capital as the sixth but complementary element of households' livelihood capital ownership. It is also indispensable by widening the livelihood literature through advocating legal migration as another source of rural livelihood source. The study is also found important in widening knowledge on rural households' sustainable livelihoods and serves those scholars who want to study similar topics in another rural context. The current study is also vital in modifying the historically yet unmodified sustainable livelihood framework (Figure. 2.1).

Figure 2.1: Modified sustainable livelihood and conceptual frameworks



Note: Detail explanations, relationships, and hypotheses of each independent variable are found under section 2.3

Source: Own modified sustainable livelihood and conceptual frameworks (2019) adapted from Scoones (1998)

2.3. Specific Objectives and Basic Questions

The specific objectives and corresponding basic questions include:

To describes the status of rural households' choices of livelihood strategies in the study area.

a. Based on the six types of livelihood asset capitals, what is the livelihood asset profile of sample households? Separate asset indices? General asset index? What about their asset capital structure?
b. Which livelihood strategy/ies mostly persuaded by sample households?
c. When computed using SID approach, what is the extent of rural households' livelihood diversification?

To examines the statistically significant determinants of rural households' choices of livelihood strategies in the study area.

d. Are the significant determinants of explanatory variables affecting rural households' choices of livelihood strategies?

Based on the review of theoretical, methodological, and empirical reviews, the researcher adapted and established the following modified sustainable livelihood framework that guides the study.

2.4. Methods

In the study area, the status and types of livelihood diversification strategies were analyzed using descriptive statistics. Besides, because of its computational simplicity, robustness, and wider applicability by previous researchers such as Chuong *et al*., 2015; Ahmed *et al*. (2016), and Misganaw *et al*. (2019), Simpson Index Diversity/SID) was used to compute the extent/level of livelihood diversification by sample heads. That is, major livelihood activities (on-farm activities, non-farm activities, off-farm activities, on-farm + non-farm, and migration) of the households were first identified. Then, compute Simpson Index Diversity of the study area. The formula for Simpson Index was given below as:

$$SID = 1 - \sum_{i=1}^{n} p_i^2 \quad \text{..... (2.1)}$$

Where, *SID= Simpson Index Diversity, n=Total number of livelihood/income sources, in this study n was livelihood sources (n=14), and P_i=Livelihood/ income proportion of i^{th} source, in this study households proportion in each livelihood source.*

Furthermore, the assumption of economic theory tells us that in a given period at the disposal of its asset endowment, a rational household head chooses among the four mutually exclusive

livelihood strategies (on-farm activities only, non-farm activities only, off-farm activities only, and on-farm plus non-farm activities only) that could offer the maximum utility. Thus, the appropriate model for such assumption, i.e. multinomial logit(mlogit) model is used to investigate determinants of sample households' choices of livelihood strategies, because the dependent variables (choice of livelihood strategies) are more than two or polytomous variables and easy computation of mlogit (Adugna, 2008; Seble, 2014; Yizengaw *et al*., 2015). Previous scholars (Seble, 2014; Yizengaw *et al*., 2015) mostly used the model. Before estimating the data using the mlogit model, the two assumptions of the model are tested:

First, a test for consistency of independence of Irrelevant Alternatives (IIA) assumption was made using two methods. Hausman specification test (Hausman & McFadden, 1984; STATA,13) whether the IIA assumption is violated or not: The null hypothesis (H0:X=0)choices are independent; The alternative(Ha:X≠0)choices are not independent. Hausman statistics distributed as χ^2(chi-square).

Let, *β_C =the coefficient vector from the consistent estimator, β_e=the coefficient vector from the efficient estimator$_C$=the covariance matrix of the consistent estimator, and V_e=the covariance matrix of the efficient estimator.*

It is computed using the formula below:

$$H=(\beta c-\beta e)0(Vc-Ve)^{-1}(\beta c-\beta e)\ldots\ldots\ldots

If the respondent makes choice j, then U_{ij} is the maximum among the j utilities. So, the statistical model is derived by the probability that choice j is made, which is:

$$prob(U_{ij}>U_{ik})\ for\ all\ others\ K \neq i$$ ..... (2.4), *Probability choice J*

Where; *U_{ij} =is the utility to the i^{th} respondent from livelihood strategy j, and U_{ik} =is the utility to the i^{th} respondent from livelihood strategy k.*

Thus, the i^{th} household's decision can be modeled as maximizing the expected utility by choosing the j^{th} livelihood strategy among J discrete livelihood strategies, that is:

$$Max_i = E(U_i)=f_j(x_i)+\varepsilon_i, j=0,\ldots J$$ ..... (2.5), *i^{th} household decision*

In general, for an outcome variable with J categories, let the j^{th} livelihood strategy that the i^{th} household chooses to maximize its utility could take the value 1 if the i^{th} household chooses j^{th} livelihood strategy and 0 otherwise. The probability that a household with characteristics x chooses livelihood strategy j, P_{ij} is modeled as:

$$Pi = \frac{\exp(X'i\beta j)}{\sum j=0\ \exp((X'i\beta j)}, J=0$$ ..... (2.6), probability HH chooses livelihood strategy j

With the requirement that: $\sum_{j=0}^{J} Pij = 1 for\ any\ i$

Where *P_{ij}= probability representing the i^{th} respondent's chance of falling into category j; X_i= Predictors of response probabilities; and β_j= Covariate effects specific to j^{th} response category with the first category as the reference.*

A convenient normalization that removes indeterminacy in the model is to assume that $\beta_1 = 0$ (Green, 2003). So that *exp ($X_i\beta_j$)* = 1, implying that the generalized equation (5.6) is equivalent to:

$$P_r(y_i = j/x_i)=p_i=\frac{\exp(x_{i\beta_j})}{1+\sum j=1\ \exp((X'i\beta j)}, \text{ for } j=0,1,\ldots,J$$

$$P_r(y_i = j/x_i)=p_i=\frac{1}{1+\sum j=1\ \exp((X'i\beta j)}$$ ... ...……..…… (2.7)

Where; *y = A polychromous outcome variable with categories coded from 0…… J.* The probability of P_{i1} is derived from the constraint that the J probabilities sum to 1. That is, *P_i=1-* $\sum$ pij. So, like the binary logit model, it implies that we can compute J log-odds ratios which are specified as:

$$\ln[\frac{pij}{piJ}]=X'(\beta_j-\beta_J)=X'\beta_J, \text{ if } J=0$$ ..... (2.8), J log-odds ratios

Overall, the polytomous dependent variables [livelihood/income sources] for the multinomial logit model used in this study are rural households' livelihood strategy choices (on-farm

activities, non-farm activities, off-farm activities, and a combination of on-farm + non-farm) that were defined as depicted in Table 2.2, below:

- Y=0, if the choice lays in on-farm only [base category because of STATA default and widely practiced in Jimma Geneti woreda.
- Y=1, if the choice lays in non-farm only,
- Y=2, if the choice lays in off-farm only, and
- Y=4, if the choice lays in on-farm + non-farm only

The independent variables that are expected to affect/determine rural households' choice of livelihood strategies are shown in (Annex 2.1). The study described the variables and proposed the following hypothesis:

X1: Place of residence/ kebele: Khatun & Roy (2012) and Ahmed *et al*. (2018) found a positive and statistically significant relationship between livelihood diversification and regional dummy. In the current study, the incentives to diversify may vary due to sample households' place of residence/ kebele. To capture the effect of differences in twelve places of residence/ kebele of sample households of the study area on livelihood diversification it was hypothesized that the relationship between livelihood diversification and households place of residence/ kebele to be a positive sign of estimated coefficients and statistical significance with on-farm activities, non-farm activities, off-farm activities, and on-farm + non-farm activities, meaning, greater livelihood diversification, too. Meaning, sample households located in a kebele where there exist better livelihood asset diversify their livelihood sources as compared to that kebele with poor livelihood asset base exhibiting negative sign, *ceteris paribus*.

X2: Sex-HUMAN CAPITAL: Seble (2014) found female households invest more time in domestic roles (childcare, gathering firewood, fetching water, and cooking), being female household head was found to be negatively (β=-4.43) and significantly (p-value= 0.06) influence the choices of agricultural plus off-farm livelihood strategy, implying that the likelihood(marginal effect=-0.381) of female-headed households to choose agriculture plus off-farm livelihood strategy decreases by 38.1% at less than 10% probability level as compared to the base category (agriculture plus migration livelihood strategy). A similar study by Yizengaw *et al*. (2015) found sex has a negative (β=-2.610) and significant relationship to on-farm plus non-farm livelihood diversification strategy choice at 5% significance, due to the gender

division of labor (males depend on on-farm activities than females), the negative coefficient indicates that male-headed households are more probably engaged in on-farm only livelihood strategy and less probably engaged in non-farm livelihood diversification strategy, the marginal effect (-.547) implies the likelihood of adopting an on-farm plus non-farm strategy in favor of male households decreases by 54.7%.

Ahmed *et al*. (2018) found the gender of the household head has a significant contribution in determining livelihood diversification in rural areas of Bangladesh. The results showed that man headed households had a positive and significant effect on the extent of livelihood diversification among the rural households (at a 1% level of significance). This is probably because in the rural areas of Bangladesh a man has more access and social acceptance to have more employment opportunities both inside and outside of the house than a woman. On the other hand, women have less access to work outside of the home and thus less scope to diversify their sources of income. The marginal effect of gender explains that if the household is headed by a man then the extent of livelihood diversification is likely to increase by 13.7%. Thus, based on the previous findings of Seble (2014), Yizengaw *et al*. (2015), Ahmed *et al*. (2018), and Chuong *et al*., (2015), keeping other variables constant, it was expected that due to gender division of labor in rural areas male-headed households of the study area mostly engaged on on-farm activities than female-headed households and less probably engaged in non-farm livelihood diversification strategy, implying that there exist positive (male-headed) and negative (female-headed) and significant influence of sample household's sex on their livelihood diversification.

X3: Age-HUMAN CAPITAL**:** Since in a rural society livelihood decisions are mostly taken by a household-head, the researcher has considered the age of household-head was hypothesized as that the household with a younger head was expected to have higher desire and access to non-farm activities and have a positive sign and significant influence. It was also expected to have a negative sign and significant influence. The latter hypothesis was determined based on a similar study by Khatun & Roy (2012) who found that age has a significant and positive influence on farmers' livelihood diversification options. It was old based on the finding of Chuong *et al*. (2015) found that older household heads tend to decide to diversify their income sources, the multiplicity of activities increases with advancing age: experience increases with age and experienced persons have more prospects of getting jobs in the non-farm sector

X4: Family size-HUMAN CAPITAL: The family size of the household head is another demographic determinant factor of rural households' livelihood diversification shown in the conceptual framework of the study. That is, family size is an important factor for livelihood diversification. Reardon (1997) had observed that family size affects the ability of a household to supply labor to the farm; in a large family, some members could remain engaged in traditional farming while others could opt for non-farm activities.

Khatun & Roy (2012) found that family size was found to be positively related to the level of livelihood diversification but the coefficient was not statistically significant. In turn, Ahmed *et al*. (2018) found that household size was also found significant in determining livelihood diversification. It had a positive contribution to the extent of livelihood diversification and was found highly significant at a 1% level of significance; the positive contribution of household size is as expected because having more members in a household means more scope to access different income sources and earn higher amount of income. Thus, it was expected that the family size of the sample households has both positive/negative signs and a significant influence on their choices of livelihood strategies. That is, according to the arrow of the conceptual framework of the study, *ceteris paribus*, the bigger the household head family size, it hypothesized increased probability of the household with increased probability of the household venture into as many ways as possible to gain required resources to diversify their livelihoods because the availability of family labor means, more members bring more resource to the households, otherwise has negative and significant influence.

X5: Education level-HUMAN CAPITAL: To capture the effect of education, the education level of the household head was considered. The relationship between livelihood diversification and education was hypothesized to be positive/negative signs and significant. This hypothesis was made based on previous findings. For example, Seble (2014) found that other factors constant, the higher level of education of the household, the lesser would be the participation in agricultural alone livelihood strategy, marginal effect implies that a one year (unit) increase of household head educational level, the households decreases the involvement in agriculture alone livelihood strategy by 15%, the contrary result is true for agriculture plus non-farm and agriculture plus off-farm livelihood strategies, the possible reason is educated people mostly have better exposure to create a social network and helps to have chance to engage in different

livelihood strategies and leave better life by diversifying their income by working on off-farm and non-farm and other better remunerative occupations.

Khatun & Roy (2012) also found that highly educated persons diversify their livelihood options through opting for salaried jobs, self-employment activities, etc., whereas low-educated and illiterate persons engage themselves in wage-earning. Therefore, investing in education and increasing access to higher education will help the rural households in getting alternative income. Improvement in the educational level will increase the probability of engagement in rural non-farm activities and livelihood diversification.

Newman & Sudharshan (2000) found that education level has a positive effect on participation in non-farm activities. Nevertheless, Ahmed *et al.* (2018) also show that the higher level of education among the household heads had a negative and significant (1% level of significance) effect on livelihood diversification in the study areas of rural Bangladesh. This is probably because school education increases the human capital level and provides necessary skills to an individual to get a decent and more permanent type of work which leads him or her to get income from a single source. Moreover, educated persons also hardly look for farm and non-farm employment types of job. The marginal effect of education of household head implies that the level of livelihood diversification is likely to be decreased by 0.7% for every additional year of schooling of the household head. Finally, in China, Dai *et al*. (2020) found that a higher education level increases the probability of diversification into non-agricultural livelihood activities.

X6: Livestock holding (TLU)-FINANCIAL CAPITAL: In Africa, household livestock holdings are often found to enable diversification (Toulmin, 1992). Hence, Amare & Belaineh (2012) found that livestock holding significantly and positively influences participation in wage activities at a 5% level of significance. Households with more livestock holding do have the capacity to participate in lucrative non/off-farm employment activities than those households with no or small size livestock holding (Amare & Belaineh, 2012). Looking at livelihood diversification across three different agro-climatic zones in Burkina Faso, Reardon *et al.*(1992) found that in all zones greater livestock holdings meant greater diversification, although the same correlation was not found with landholding. Seble (2014) found that, due to the good number of livestock size (TLU) that enable households to obtain more income from the sale of different

cattle stock, thereby, used by such households in the time of adverse condition, parameter estimates show that household livestock holding had significant influence to participate/engage more in agriculture alone livelihood strategy at less than 10% probability level, marginal effect implies that a unit increase in livestock will increase the choice of households by about 6.7% to engage more in agriculture alone livelihood strategy as compared to agriculture plus migration strategy pursuers.

On the contrary to these results, Yizengaw *et al*. (2015) found that livestock holding in TLU is negatively and significantly related to on-farm plus off-farm plus non-farm livelihood diversification strategy at 1% level of significance, marginal effect implies that as the livestock numbers in TLU increases by one unit, the likelihood of smallholder rural farm households' choice of combining on-farm, off-farm, and non-farm livelihood diversification strategies decreases by 4.2%; a unit TLU increase in livestock increases the rural farm households adoption of on-farm only livelihood strategy; when the livestock size increase by one TLU the probability of households' choice of on-farm plus non-farm, and on-farm plus off-farm livelihood strategies decrease by 3.3 and 0.5% respectively, provided that the other factors remain constant. Similarly, Adugna (2008) and Yisehak *et al*. (2014) found livestock holding has a negative and significant relation with non/off-farm livelihood diversification strategies. Therefore, in the study area livestock is a core and liquid asset (source of cash income) for the improvement of livelihood strategies. The large livestock holding creates a better opportunity to earn more income from livestock production. Therefore, households who obtained the required amount of cash from livestock may not need to involve in non/off-farm activities for additional income whereas farmers with lower livestock holding may be obliged to diversify livelihoods into off-farm and non-farm activities to fulfill household needs. It was expected that livestock holding has positive/negative signs and significant influence on sample household's choice of livelihood options.

X7: Dependency ratio (DR): Increase in dependency ratio of the household head (ratio of the population of dependent age less than 15 and above 64 to the population of productive age 15 to 64 years) was expected the lesser diversification (negative and significant influence) of livelihood sources by sample households of the study area, otherwise, its decrease means the high extent of diversification (positive sign and significant inference).

X8: Marital status: the hypothesis that marital status of the rural households was expected to positively and significantly influence their participation in non-farm livelihood option

X9: Member of cooperative-SOCIAL CAPITAL: Khatun & Roy (2012) found the relationship between livelihood diversification and membership of a cooperative society was found positive and statistically significant. Ahmed *et al*. (2018) also reported that the dummy variable of participating in some development program was found significant at a 1% level significance and had a positive impact on the level of livelihood diversification, the marginal effect showed that, if a household is a member of any developmental program then the likelihood of livelihood diversification increases by 10.5% compared to the household that is not involved in some development programs. These two previous studies imply that membership of a formal social organization like Idir, Equib, Mahiber, Debo, 1 to 5, Self-help Group (SHG)/co-operative/, village committee, etc. is an important social capital in determining livelihood diversification. Membership of an SHG elevates his/her social status and increases access to common property resources as well as different government/NGO schemes. Therefore, it was hypothesized a positive relationship between livelihood diversification and membership of the social organization. Because being a member or beneficiary of some developmental projects or programs they can have more access to information and scope to intensify their income sources.

X10: Saving-FINANCIAL CAPITAL: Ahmed *et al*. (2018) reported that the amount of savings had a negative and highly significant (at 1% level of significance) effects on livelihood diversification, implying that households having some saving money are likely to be less diversified in their livelihood activities because; more savings means less investment which eventually results in less income as well as less number of income source. In contrary to Ahmed *et al*.(2018) the current study hypothesized that more saving of sample households followed by investment in the remunerative business enables them to diversify their livelihood source and hence positively and significantly influence diversification otherwise more saving with either no or less investment was expected to have a negative and statistically significant effect on diversification.

X11: Landholding size (hectare)-NATURAL CAPITAL: Previous studies reported that landholding size having a positive/negative and statistically significant effect on rural

household's choices of livelihood diversification strategies. For instance, Seble (2014) found that more land size can obtain more income from the sale of different agricultural products, landholding size of the household head had a significant positive relationship to influence farmers decision to participate in agriculture alone livelihood strategy, marginal effect implies that a unit increase in landholding size increased the probability of using agriculture livelihood strategy by 70.2% at less than 5% significance level as compared to the base category (agriculture plus migration) livelihood strategy pursuers, and similarly a unit increase in landholding size decrease the probability to engage in agriculture plus non-farm activities by 2.3% at less than 10% probability level. Kebede *et al. (*2014) found that the total cultivated land size has a positive and significant influence on off-farm participation perhaps households with better holding opted for additional income in casual laborer works to smoothen their farm operations. Adugna (2008) and Fikru (2008) stated that farmers with smaller land sizes are involved in off-farm diversification activities because of a shortage of land to support their livelihood.

In contrary, Yizengaw *et al*. (2015) found that land size is significantly and negatively related to on-farm plus non-farm, on-farm plus off-farm, and on-farm plus non-farm plus off-farm livelihood diversification strategies equally at less than 1% level of significance with respect to on-farm only (reference category), the negative coefficients indicated that the households with large land size are participated less in non/off-farm livelihood diversification strategies and participated more on on-farm only livelihood strategy, marginal effect implies that the probability of smallholder farm households livelihood diversification into non-farm, off-farm, and combined off-farm and non-farm activities other than agriculture decrease by 21.9, 15.3 and 19% respectively as the land size increases by one hectare, due to a smaller amount of cultivated land is not enough to the households to make a sufficient living from farm production alone, causing them to look for supplementary non/off-farm income-generating activities.

All together Ahmed *et al.* (2018) reported that all three land classification dummy variables were found significant at a 5% level of significance. The functionally landless households had a negative coefficient while the small and medium landholding households had a positive coefficient compared to the large landholding households. This means that functionally landless

households are likely to be less diversified in their livelihoods compared to large landholding households. On the other hand, small and medium landholding households are likely to be more diversified in their livelihoods compared to large landholding households. Thus, it was hypothesized that rural households in the study area who owned larger farm size (landholding measured in hectare) were less diversified, whereas because of the shortage of land to support their families survival means households with smaller land size hypothesized that participating more in rural livelihood diversification strategies. Therefore land size has either positive/ negative signs or statistically significant.

X12: Distance to the market-PHYSICAL CAPITAL: Amare & Belayneh (2012) stated that market distance and non/off-farm diversification had a positive and significant relationship because residing nearer to the market enables farm households to engage in non-farm activities (like petty trading and shopkeeping). Seble (2014) found that distance from the nearest market has positive rewards for household's livelihood strategy diversification, the choice to decide to participate in agriculture plus non-farm activities increases by about 13.74% at less than 10% probability level, as distance to market places decreases by one Km as compared to the base category, this implies that nearness to market center motivates rural households to engage in agriculture plus non-farm. Similarly, Yizengaw *et al*. (2015) found that market distance is positively and significantly related to on-farm plus off-farm, and a combination of on-farm, non-farm and off-farm livelihood diversification strategies equally at 5% probability level, marginal effect implies that as the market distance increases by 1 km, the likelihood of the farm households participation into on-farm plus off-farm, and a combination of on-farm, non-farm, and off-farm livelihood diversification strategies increase with 6.4 and 4.6% respectively, and decrease for on-farm only strategy provided that the other factor remains constant, due to the closer to the market center reduce the transaction costs of acquiring agricultural inputs and profitably selling outputs and hence, good profits may attract them to depend on agriculture only and due to as the farm households located far from the market center the probability of farm households' engagement into agricultural daily wage activities are higher to resolve liquidity problems. Furthermore, the closer to the market center may expose rural non-farm participants to high competition from factory-made substitutes sold in rural market centers which may lessen rural households' non/off-farm livelihood diversifications.

Based on the findings of Amare & Belayneh (2012), Seble (2014), and Yizengaw *et al*. (2015) geographic variables (for example, distance to the market) are also important determinants of livelihood diversification. The proximity of sample households in the study area to market or town has a significant influence on livelihood diversification and increases the prospects of non-farm employment for the rural households. That is, as distance to the market places increases the agriculture group disincentives to go out of their area for selling of their agricultural production, whereas the households are closer to the market center, it was expected that it enhances rural households' participation in non-farm activities like petty trades. Thus, the relationship between livelihood diversification and distance to the nearest town was hypothesized to be a positive/negative and significant relationship.

X13: Shocks: Jimma Geneti woreda sample households are found in the different farming systems such as highland, plains, and coastal areas. As a result, households' may face different shocks that affect their means of survival strategies. Hence, any shock encountered by sample households was hypothesized to have depleted their livelihood as a response to it in the form of coping strategies, i.e. selling of assets. This, in turn, discouraging sample households from different livelihood activities, and hence there exist a negative and significant relationship between shocks and livelihood divarication.

X14: Access to agricultural extension technologies/services or training: Most of the non-farm activities being extension services or skill training based, such services/training increase the possibility of getting non-farm jobs. Therefore, a positive relationship was assumed between livelihood diversification and extension services/training otherwise negative and statistically significant. This was consistent with the finding of Khatun & Roy (2012) the relationship between livelihood diversification and training was found positive and statistically significant.

2.5. Results and Discussions

2.5.1. The Six Livelihoods Asset Capitals

In the current study, multiple correspondence analyses (MCA) technique was used to describe the types and key indicators of livelihood assets owned by sample households, then, separate asset and general asset indices of the sample heads, and structure of the six asset capitals constructed as follows:

Key Asset Variables & Categories

This study identifies a total of 81 livelihood asset variables and 191 modalities/ categories for each livelihood asset from the literature. They have ordinal, binary, and categorical modalities. These 81 variables are too many and difficult for analysis. Therefore, STATA MCA results and weights (first and second MCAs) reduced them to key livelihood asset variables[5] and made the data ready for the construction of general asset index, separate asset indices, and the stricture of the asset profile of the sample heads. Hence, to observe the preliminary association patterns with the principal axis the 81 asset indicators were inserted in the MCA model. STATA version 13.0 was used to run the MCA using the *mca command*. Then following Asselin (2009), Ezzarari & Verme (2012), and Desawi (2019) the MCA analysis was carried out in two steps:

Step 1: First MCA results and weights

Here, all the 81 asset variables were listed in the first MCA, and then by analyzing results and weights, while less relevant removed, more relevant variables were inserted in the second MCA (Table 2.2).

Table 2.2: First Multiple Correspondence Analysis Results (preliminary MCA)

- Total inertia (sum of all principal inertia of dimensions of latent variable) = .0275465
- Number of axis = 2

Dimension (used to explain latent variable)	Principal inertia: (Relative importance of each dimension)	Percent	Cumul. percent
Dimension1	.0062135	22.56	22.56
Dimension 2	.0056893	20.65	43.21
Dimension 3	.0028297	10.27	53.48
Dimension 4	.0014325	5.20	58.68
Dimension 5	.0012052	4.38	63.06
…	…	…	…
Dimension 36	3.41e-08	0.00	81.19
Total	.0275465	100.00	

Source: Own computation from field survey (2019)

As shown in Table 2.2, the first MCA results illustrate the preliminary MCA where the table of eigenvalue highlights the distinction between the first factorial axis and the following axes (labeled as dimensions in the table). It also revealed the breakdown of the total inertia into 36 principal dimensions showing all the principal inertias of dimensions or total inertia equals

[5] **Key livelihood asset variables:** *are the best candidates to represent all the variables considered in the rural livelihood analysis using MCA approach (see, Asselin, 2009; Ezzarari & Verme, 2012; Casta et al., 2013; Dawit et al., 2014; Desawi, 2019).*

.0275465. The percentage contributions of each 36 principal dimensions were in decreasing order starting from dimension one that scored the highest amount of explained principal inertia (22.56%) implying that the first axis alone captures and explains 22.56% of the total inertia. However, the second-dimensional principal inertia captures and explains 20.65% of the total inertia. The first two principal dimensions (first dimensional 22.56% and second dimensional 20.65%) together explain a total of 43.21% of the total inertia. While the third contributed 10.27%, the fourth contributed 5.20%. Other dimensions insignificantly explain the dependent variable. Hence, to identify the weights attached to each asset variable and category by MCA, dimension 1 (first axis) could be taken.

The first MCA weights show that households increased ownership of sufficient asset base provides a store of wealth to engage in multiple activities and hence is positively associated with livelihood diversification, however, negatively associated with poverty because in the latter case lack of sufficient asset base perpetuates rural households' poverty status. For example, the status of multidimensional poverty of sample households' is described by modalities with negative scores implying that variable modalities that are negatively associated with dimension one or first axis increase household poverty. In other words, because of the negative correlation between the variables of the six livelihoods asset and weights of dimension 1 are negatively correlated, households who had very low possession and low access to the six livelihood asset indicators were identified as poor.

Furthermore, it can be more clarified as one critically reviews the six livelihood assets first MCA weights [signs and scores] vs two properties of MCA[6]. To improve the MCA model in a way that satisfies these basic properties, the researcher looked at the inertia of each variable and modality on the first axis (dimension 1) that was the latent multidimensional measure of poverty indicators because the state of well-being captured by indicators positively correlated to the first axis/ dimension 1 and where the state of poverty was described by those indicators negatively correlated to the first axis/ dimension 1. A review of the most negatively correlated variables to the first axis/ dimension 1 allowed the researcher to identify poor households with very low

[6] **Two properties of MCA:** *First, satisfying the property of FAOC-there must be an ordinal consistency between ordering of categories and ordering of weights across categories either in increasing or decreasing order and Second, final value of indicators or second MCA results and weights (Asselin, 2002;2009).*

access to human, physical, social, financial, natural, and information capital indicators regardless of the place of residence.

Following Asselin (2002; 2009), Dawit *et al*. (2014), and Desawi (2019), the inclusion or exclusion of such asset variables were made by critically reviewing each indicator of the six livelihood assets (weights). For example, in terms of human capital 8 variables were inserted in the MCA model where all of them found satisfied the FAOC property and included in the final MCA results and weights. This implies that a low level of welfare is characterized by a low literacy rate of the households or a small proportion of them who cannot read and write in the households reduce welfare status and less/no livelihood diversification that could increase their state of multidimensional poverty. Poor households are also characterized by a lack of special skill training (handcraft making, local veterinary skills, and local health skills). In the field of health, the MCA shows that sample household with serious health reduce their welfare status and no/less livelihood diversification, thereby, increase their state of multidimensional poverty, too.

This is so because poor households do not have access to health care for illness, injury and have no medical coverage, have no toilets at home and are not connected to the potable water supply even to a public fountain, fail to meet their basic nutrition needs to the extent that their expenditure on food is below the food poverty line and also poor households have children under the age of five suffering from malnutrition and stunted growth. In contrast, wealthy households are generally characterized by a high literacy rate, equip with different skills, and better health status that improves their welfare and diversifies their livelihood sources, thereby, decreases multidimensional poverty status, implying that they are well connected to the welfare dimension axis (dimension 1).

Similarly, 8 variables in physical capital were included. That means, in both human and physical capital asset indicators all the 16 variables were found more relevant and maintained for the second MCA. However, in social capital one variable [involvement in social group improve livelihoods/ s4_q61] was found less relevant and excluded from the second MCA [17/18 variables maintained]. In financial capital, the 24/24 variables were maintained by MCA. In natural capital, one variable [major constraints on farmland in the last 12 months/s4_q77]

was reduced from the final MCA (15 out of 16 maintained). The groups of sample households also lack agricultural physical assets like tractors, combiners, and generators for irrigation uses. They also lack durable consumer goods like a tent and lacks public infrastructures.

In Information capital out of 7 variables in the first MCA, only 4 of them were maintained for the final MCA where 3 [poor utilization of ICT/S4_Q165_2_2, limited access to agricultural information /s4_q165_2_3, and limited access to risk management/s4_q165_2_10)] of them found less relevant in the second MCA. Meaning, in terms of communication, poor households do not have assets like radio, television, cell phone, farm-book, and internet access. Overall, the researcher safely argued that dimension one (first axis) described a situation of the sample households asset ownership and welfare and this ownership status also described the multidimensional poverty status of the sample households in the current study area. Hence, after a critical review of 81 asset variables and 191 categories while some variables were eliminated (had counter-intuitive sign) and a total of 76 asset variables and 165 modalities/categories that satisfy FAOC property were maintained for the final MCA results (Table 2.4) and weights.

Step 2: Second/final MCA results and weights

Here, to improve the MCA model, all the 76 asset variables and 165 categories were inserted in the second/final MCA model (Table 2.3). The output of the second MCA exercise suggests that the variables increase in the explanatory power of the first factor (dimension one).

Table 2.3: Second Multiple Correspondence Analysis Results

- Total inertia (sum of all principal inertia of dimensions of latent variable) = .02144086
- Number of axis = 2

Dimension (used to explain latent variable)	Principal inertia: (Relative importance of each dimension)	Percent	Cumul. percent
Dimension1	.0060423	28.18	28.18
Dimension 2	.0038399	17.91	46.09
Dimension 3	.0021609	10.08	56.17
Dimension 4	.0013376	6.24	62.41
Dimension 5	.0007338	3.42	65.83
..	..		
Dimension 29	3.90e-08	0.00	80.42
Total	.0214409		100

Source: Own computation from field survey (2019)

Table 2.3, above revealed the breakdown of the total inertia into 29 principal dimensions showing all the principal inertias of dimensions or total inertia equals .02144086. The

percentage contributions of each 29 principal dimensions were in decreasing order starting from dimension one that scored the highest amount of explained principal inertia (28.182%) implying that the first axis alone captures and explains 28.18% of the total inertia of the latent variable (choices of livelihood diversification strategies), suggesting that household score generated by MCA on the first axis is a consistent indicator that can be used for ordering purposes to measure general and separate livelihood asset indices based on sample households types of asset ownership. The table also revealed that the second/final MCA raised the explanatory power of dimension one that enlarges the descriptive power of its principal inertia from 22.56% (First MCA result) to 28.18% (Second MCA results). It also revealed that the increment of the first MCA result's cumulative inertia contribution of dimension one (43.21%) to the second MCA result's cumulative inertia contribution of dimension one (46.09%). Hence, dimension 1 denominated sample household's choices of livelihood diversification strategies (dependent variable) axis as it has large principal inertia to explain it. Based on Asselin's (2009) study, to include in the asset index score, the key/major asset variables were identified using average *egen-value* was used as a cutoff point. That is, the direction of the variables (negative or positive correlation with the latent variable- choices of livelihood strategies) was used as a mechanism of critical review to identify key variables to be used on the construction of households' asset indices.

Furthermore, it was also instructive to look at the size of the weights. That is, to see the relative contribution of each asset indicator [singular values[7]], final MCA weights, the numerical value/size of weights were critically observed. However, to identify major /key asset variables to be included in the construction of household's asset index in the study area which singular value can use as a cutoff point was a debate in the literature. For example, while Asselin (2009) used the average of the egen values **(0.22)** of each multidimensional poverty indicator as a cutoff point, Ezzrari & Verme (2012) used a singular value greater than **2** as a cutoff point, Dawit *et al* (2014) used singular values greater than **0.2**, and Desawi (2019) used asset indicators greater than **2.5** weighting values and computed each rural household's composite asset index score. After a slight modification, this study adopted the approach of Asselin (2009) and identified a total of 81 key asset index indicators and 109 corresponding

[7] **Singular values:** *indicate the relative contribution of each dimension to an explanation of the inertia or proportion of variation in the participant and variable profile (Dawit et al.,2014:1039)*

modalities/categories (Annex 2.2). In terms of the breakdown of each six types of asset capitals that were included in the construction of composite or general asset indicator score ($GAIS_i$).

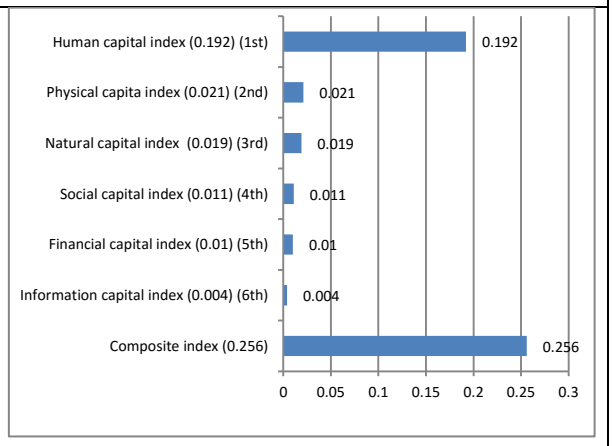
Separate Livelihood Assets Indices

Based on the list of key variables this section has constructed and analyzed the separate asset indices of the six asset capitals, respectively (Table 2.4 and Figure 2.2).

Table 2.4 Separate asset indices of sample heads

Asset capital	Mean index	Rank
Human capital index	0.192	1st
Physical capita index	0.021	2nd
Natural capital index	0.019	3rd
Social capital index	0.011	4th
Financial capital index	0.01	5th
Information capital index	0.004	6th
Composite index	0.256	

Figure2.2 Separate asset indices of samples



Source: computed from survey data (2019)

Table 2.4 and Figure 2.2 show, the *human capital index (HCI)* was constructed from 8 key indicators and 21 corresponding categories. Results show that the mean human capital index of the sample households was (0.192). That is, the majority (225/72.82%) of the sample households were able to read, write and do simple arithmetic, 242(62.53%) access to vocational skill training, and their average health status (180/46.51%) significantly contributed to the highest mean human capital index of sample households as compared to their remaining mean asset indices.

The *physical capital index (PCI)* was developed from 3 key indicators and 21 corresponding categories. Results show that the mean physical capital index of the sample households was (0.021). The second position of the mean physical capital index was potentially due to the largest percentage of rural households' ownership of durable consumer goods Chair (326/84.24%).

In turn, the *social capital index (SCI)* was developed from 7 key social capital indicators and 17 corresponding categories were used to compute the social capital indices of the sample

households. Results show that the mean social capital indices of the sample households were (0.011). This shows us that the mean social capital index of the sample households was ranked in fourth place. This was potentially due to low participation of sample households to social groups like Equip (290/74.94%), Self-Help Groups (155/40.05%), and 1 to 5 (126/32.56%).

However, the *financial capital index (FCI)* developed from 13 key financial capital indicators and 26 corresponding categories were used to compute the financial capital indices of the sample households. Results show that the mean financial capital index of the sample households was (0.0107). This shows us that the mean financial capital asset index of sample households ranked fifth. The potential reasons include sample households lack of livestock like Goat (289/74.68%), Horse (268(69.25%), Sheep (229/59.11%), Donkey (287(74.16%), and Bull (310/80.105) and their lack of financial income from daily wage (337/87.08%), Sell of livestock like oxen, sheep, goat, and hen (157/40.57%), and lack of financial saving (150/38.74%).

The *natural capital index (NCI)* constructed from 8 key natural capital indicators and 16 corresponding categories were used to compute the natural capital indices of the sample households. Results show that the mean natural capital indices of the sample households were (0.019). The mean natural asset index of the sample households ranked in third place, after their mean physical capital index. It was found potentially contributed due to their land management practices like fallowing (157/40.57%) and manure (209/54.01%) and coupled with their soil conservation practices like terracing (183/47.29%), tree planting (184/47.55%), soil or stone band application (124/32.04%), and counter plow (277/71.58%).

Last and least, the *information capital index (ICI)* was developed from 4 key information capital indicators and 8 corresponding categories were used to compute the information capital indices of the sample households. Results show that the mean information capital indices of the sample households were (0.004), implying that the lowest mean asset index due to the majority of them lack of information sources like radio (166/42.89%), farm-book (336/86.82%), telephone (332/93.52%), and internet access in the field (324/87.10%). In contrast, Desawi (2019) computed mean human capital index as (0.16) less than, mean physical capital index as (0.76) greater than mean social capital index as (0.38) also greater than, mean financial capital index as (0.01) also less than, and mean natural capital index as (0.04) also greater than that of the current study area but failed to consider and compute the mean information capital index of his

study area suggested by Odero (2006) as the sixth rural households' asset capital. This entails us that to the extent of the knowledge of the researcher no previous scholar including Deswi (2019) has computed the mean information capital index like the one computed for the current study area.

General Asset Index (Woreda Level)

A total of 43 key variables having 109 different categories and corresponding weights were inserted in STATA using *gen command*, where the positive and negative signs of each weight of each category were also considered (i.e., adding if positive and subtracting if negative weight). The new variable named General Asset Index Score (GAISi) was created. To obtain the general asset index or mean asset index score (Table 2.6), the STATA command *summarizes GIASi* was run.

Table 2.5: Mean of the composite/general asset index score (GIAS) of sample households (N=309)

Variable	Obs	Mean	Std.Dev.	Min.	Max.
GAIS2	277	0.2563173	.0630784	.0579	.3986

Source: Own computation from field survey (2019)

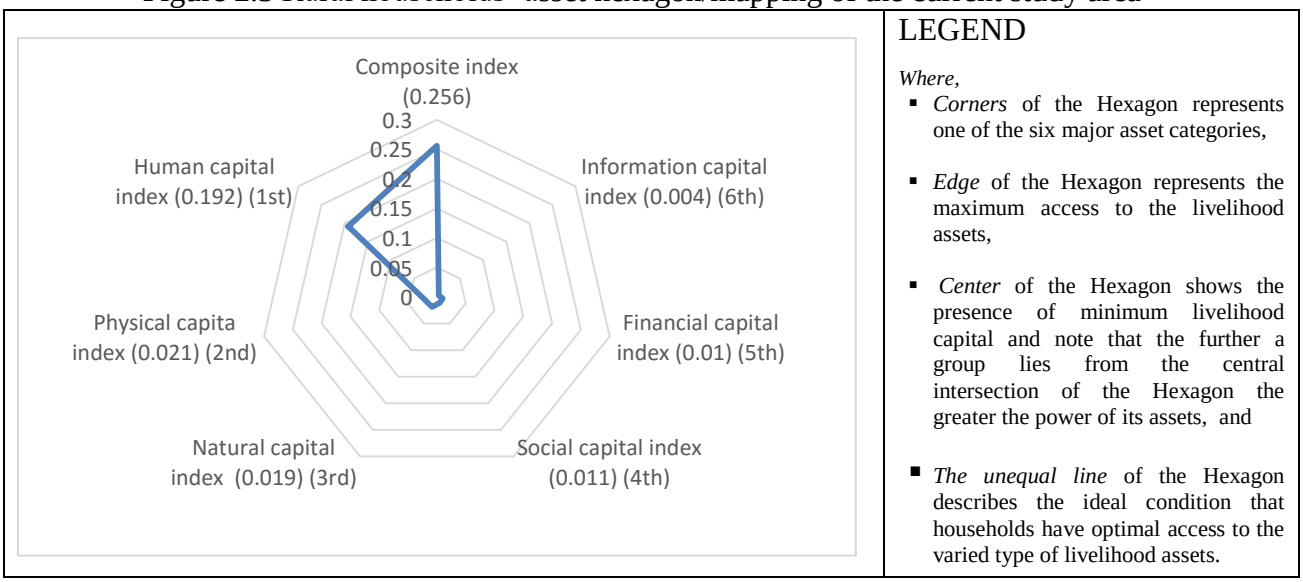
The general asset indicator generated after the data set has all values 0<general asset index score <1 (positive), implying that it doesn't need adjusting by creating a new variable (adjusted only if all values are negative. Thus, summary statistics show that the mean asset index scores of the sampled households were found as 0.256 with the standard derivation of 0.63. It has a minimum value of 0.0579 and a maximum value of .399. Previous studies like Odero (2006), Houweling (2009), Meaza (2014), and Desawi (2019) analyzed the livelihood indices of their study area and none of them have computed the composite general mean asset index score that makes it difficult for comparing and contrasting the current general asset index score (0.256) of the study with these previous studies. Even, if they did it is still difficult to make comparisons because while those previous studies analyze rural heads asset index based on five asset capitals, the current study has done it based on six asset capitals (above results and discussions).

Livelihood Asset Endowment Structure/Asset Hexagon

Figure 2.3, below presented the result of the asset endowment structure/livelihood asset Hexagon of the current study area. Developed by Radar from Excel 2013, Hexagon was used to visually observe rural households' strength and interrelations among the six rural livelihood capitals (human, physical, natural, social, financial, and information capital assets). In other

words, the shape of the Hexagon depicted rural households' access to different asset capitals, differently, implying the current state of rural households' asset capitals: The human capital index of the rural households was highest and their information capital index was the lowest (LEGEND, Figure 2.3, below).

Figure 2.3 Rural households' asset hexagon/mapping of the current study area

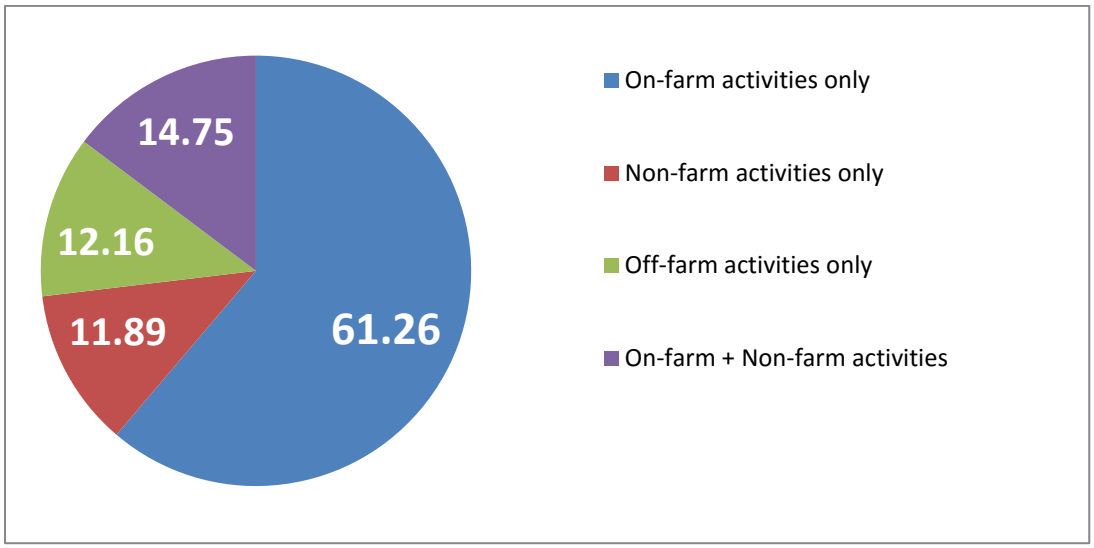


Source: Own computation from field survey (2019)

2.5.2. Choices Of Livelihood Diversification Strategies

To describe the current status of samples choices of livelihood diversification options, self-assessment of the response of households were presented in Figure 2.4, below:

Figure 2.4: Choices of livelihood diversification strategies & their contributions to households' livelihood sources



Source: Own computation from field survey (2019)

On-farm activities only were among the livelihood strategies mostly persuaded. It focused on crop production (Teff, Maize, Wheat, Nouge, Bean & Barley), animal husbandry (Cattle, sheep & goats, donkey, horse, fish, and poultry), livestock by-product (skimmed milk, butter, yogurt, whey, and cheese), forests, and farm wage labor, sale of farm outputs, and consumption-in-kind of own farm outputs (Barrett *et al*., 2001; Ellis, 1998; Haggblade *et al*., 2007; Yizengaw, *et al*.,2015; and Fikiru, 2008). Based on the survey result of figure 5.4, above, the majority of the sample households (313/61.26 %%) were engaged in on-farm only livelihood primary occupation. In response to the specific types of on-farm livelihood activities sample households engage on it in the last 12 months, it was found that 146(40.22%) engaged in crop production like teff, maize, wheat, nouge, bean and barely; 6 (1.65%) on animal husbandries like cattle, sheep, and goat; 8 (2.20%) on livestock products (skimmed milk, butter, and cheese); 12(3.31%) on poultry production ; 3(0.83%) on modern beekeeping; 70 (19.28%) on crop production and animal husbandry; 40 (11.02%) on crop production, animal husbandry, and livestock products; and 78(21.49%) on all livelihood activities except modern beekeeping. The results imply that crop production followed by a combination of livelihood activities like animal husbandry, livestock products, and poultry production activities were found the major primary occupation and livelihood sources of sample households. In terms of the proportional contribution of the different livelihood sources, crop production was found highest.

The above result was consistent with agriculture 'optimist' views. That is, based on agriculture 'optimist' views of Gordon & Craig (2001), Haggblade *et al*. (2005), and Davis (2004) and organizations like World Bank (2008) and Ethiopia's Federal MOA (2010) rural households; livelihood is a complex structure comprising of mostly agriculture where agriculture is an important sector and predominant activity for the majority of the rural populations' livelihood. Besides, several studies were done by Gordon & Craig (2001), Haggblade *et al*. (2005), Davis (2004), World Bank (2008), and MOA (2010) show that agriculture has multiple roles of which it enhances economic growth, reduces poverty, and could ensure food security and above all, it is the largest employer of rural areas, income generator & source of raw materials. By implication, agriculture is the primary means of rural households' livelihood in other parts of Ethiopia in general and by the current focus area of the current, it is also the primary means of rural households' livelihood in the current study area in particular.

Nevertheless, on-farm/agriculture-related activities have no guarantee to continue as rural households' sustainable livelihood source. In other words, according to agriculture 'skeptic' views of Fikiru (2008), Jirstrom *et al*. (2011), Arega, *et al*., (2013), and Babatunde (2013) agricultural sector in the sub-Saharan African countries [Ethiopia included] is highly characterized by decreasing farm sizes/ small fragmented land size, low levels of output per farm, a high degree of subsistence farming, backward production technologies, irregular rainfalls, increasing soil erosion, land degradation, aridity in some regions, and pervasive tropical diseases and hence, relying upon only agricultural-based rural livelihood couldn't guarantee enough rural livelihoods for most of the rural people in rural SSA. That means farming/Agriculture as a primary source of income for rural households has become failed to guarantee sufficient livelihood for most farming households in SSA countries. Its contribution to rural poverty reduction has been questioned. In the case of Ethiopia, the number of poor people in rural areas of Ethiopia exceeds the capacity of agriculture to provide sustainable livelihood opportunities (Fikiru, 2008).

Thus, to attain a sustainable livelihood to get a better income for their households, thereby, achieve the goals of rural development: the process of change in the life of rural societies and choices of livelihood strategies for rural households become a matter of necessity. Several studies in the past (Emanuel, 2011; Bryceson, 1993; Deverux, 2000; Hussien and Nelson, 1999; Reta and Ali, 2012; Timmer, 2009; Yizengaw, *et al*., 2015) have emphasized the importance of diversification of agriculture to non-agricultural activities and other livelihood options.

Non-farm activities only were among the eight livelihood strategies. It refers to multi-dimensional and heterogeneous activities that take place outside the agricultural sector (Barrett *et al*.,2001; Ellis, 1998; Haggblade*et al*.,2007; Yizengaw, *et al*.,2015; Fikiru, 2008). Regarding the composition of non-farm activities, Haggblade, *et al*.(2007) stated as, "the composition of the non-farm activity considerably differs" (p.13) that includes " rural economic activities outside agriculture and takes place at home or in factories (p.19). Also, according to various documents, non-farm activities include mining, manufacturing, utilities, construction, commerce, transport, government services, agro-processing, transport or trading of unprocessed crops, livestock, and forest and fish products. handcraft activities such as weaving, spinning, carpentry, house mudding, poet making, remittance, etc; petty trade such as grain trade, fruits &

vegetables trade), selling of local drinks, trading of small ruminants and cattle, and remittance transfers within and across nations (Barrett *et al*.,2001; Ellis,1998); Haggblade *et al*.,2007; Losch*et al*.,2012, Yizengaw, *et al*.,2015; Fikiru, 2008).

Based on the survey result of figure 5.4, above, out of the total 387 sample households, concerning types of livelihood activities only 11(11.89%) engaged in non-farm activities only type of livelihood sources, implying that in the last 12 months before this study, less number of sample households were engaged on non-farm livelihood activities like non-agricultural activities (trade) (49/47.57%), handcraft activities (weaving, carpentry, and house mudding)(26/25.24%), trading like grain, local drinks, soft drinks and small ruminants (28/27.18%), suggesting that less diversification of livelihood sources was another cause of the highest number of sample households in MPI severely poor (226) constituted from sample households engaged on on-farm activities only.

Off-farm activities were among the eight livelihood options presented to the sample households. It focused on either wage or self-employment activities. While wage employment activities involve an employer-employee relationship, where the employee sells labor services to an employer in exchange for a wage or salary (Barrett *et al*., 2001; Ellis, 1998); Haggblade *et al*., 2007; Yizengaw, *et al*., 2015; Fikiru, 2008), self-employment activity involves the sale of labor services to oneself, rather than working for an employer that pays a wage or salary. Income is earned through activities operated directly by the owner (Barrett *et al*., 2001; Ellis, 1998); Haggblade*et al*., 2007; Yizengaw, *et al*., 2015; Fikiru, 2008).

Based on the survey result of figure 2.4, above, concerning types of livelihood activities out of the total 387 sample households, 3(12.6%) were engaged in off-farm activities. However, on decomposed into the two types of off-farm activities, results show that 9(7.26%) sample households were wage employed (employee sells labor services to an employer in exchange for a wage or salary)and most of the households, i.e., 115(92.74) were self-employed (sale of own labor rather than working for an employer).

Migration (in the form of remittance from any member of household migrated aboard) being less recognized [compared to on-farm, non-farm, off-farm, or a combination] in the literature of livelihood sources was another source of rural livelihood source of rural people and is an

inherent component of the development process by either reducing or perpetuating poverty. For example, remittances from migrants have been used as a household strategy to overcome shocks they may have faced and reduce vulnerability to poverty (World Bank, 2007; 2014; 2015a). On contrary, skilled and unskilled labor migrants perpetuate poverty.

Given this, results show that out of the total 387 sample households only (47/12.18%) of them sent abroad their household member whereas the majority (339/87.825) was didn't. Those sample households' who sending migrants also reported their total remittance received in the last 12 months of this study. Results show that they received a mean minimum of ETB 1,080 and a maximum of ETB 40,000.00 with average remittance of ETB 17,684.29 and a standard deviation of 12,941.11. Out-migration was reported as reducing factor of poverty status of those households sending migrants as compared to those not sending by increasing their income, saving, and investment (Haberfeld *et al*.,1999; Kothari, 2002; Baby, 2005; Ghosh, 1993; Prakash, 1998; Retnaraji,1998; Losch *et al*., 2012; World Economic Forum, 2017; Ahmed *et al* .,2018)

The results also showed that the number of migrants had a negative and significant contribution to the level of livelihood diversification. The number of migrants is significant at a 1% level of significance. The households which have more migrant members both in-country and abroad are receiving a regular and higher amount of income as a remittance. Thus, these households do not seek alternative sources of income which results in a low level of livelihoods diversification. Malek &. Usami (2009) found the same in their study on non-farm income diversification in Bangladesh. They found the negatively significant coefficient of out-country migration capital on non-farm income diversification. The marginal effect of the number of migrants explains that for an additional out-migrant member from the household the level of diversification is likely to go down by 2.7%.

In the case of the current study area, Table 2.6 presented the cross-tabulation of households' sending and not sending migrants' Vis-Vis MPI categories. The Table revealed most sample households not sending any member of their household member were found in MPI severely poor (246), MPI poor (44), and MPI vulnerable (48). One sample household being a non-sending migrant and MPI non-poor may be due to other factors. Whereas, the same Table revealed that the small number of sample households who sent any member of their household

member abroad were found in MPI severely poor (31), MPI poor (10), and MPI vulnerable (6), other factors remain constant. In triangulation, the Likert scale result shows that 58 sample households strongly agreed that out-migration has the potential to reduce rural poverty and 46 sample households agreed on the same. On the contrary, while 51 sample households strongly disagree with the role of out-migration in rural poverty reduction, 36 sample households disagreed.

Table 2.6: Cross-tabulation of households' sending and not sending migrants Vis-Vis MPI categories

Migrant members sent abroad?	MPI poverty categories				Total
	MPI sever	MPI poor	MPI vulnerable	MPI non-poor	
No	246	44	48	1	239
Yes	31	10	6	0	47
Total	277	54	54	1	386

Source: Own computation from field survey (2019)

Distribution of Choices of Livelihood Strategies By Kebele

Table 2.7, below presented the distribution of sample households' choice of five livelihood diversification strategies by their respective kebeles. Accordingly, out of the total 387 sample households, most of them (237/61.24%) engaged in on-farm livelihood activities only as compared to the other livelihood options. Others 46 (11.89%), 47 (12.15%), 57(14.73%), and 47 (12.18%) secured their survival strategies from non-farm activities only, off-farm activities only, a combination of on-farm and non-farm activities, and remittance from migrants of family members respectively. In terms of sample households' kebele, 41 sample households from Gudetu Jimma kebele were participated in on-farm activities being followed by Gidami Dabsho.

The potential reason could be that both kebeles apart from the rainy season have access to irrigation facilities that motivated them to participate more in on-farm activities. They have also market access in their respective kebele that enables them to sell their agricultural products like crops, vegetables, and fruits from both the rainy season and irrigation facilities. Out of the twelve kebeles, sample households from Hunde Gudina were found to participate most in non-farm activities and off-farm activities as compared to other sample households from other kebeles. It was due to the large proportion of sample households from the kebele itself and its easy market access to nearby market opportunities from adjacent woredas like Bako Tibe woreda (West Showa zone) and Wayu woreda. Sample households from Dambu Genbo kebele (10) were found to most participated in the combination of non-farm and non-farm activities

most probably due to the availability of multiple market opportunities (Hamus Gebeya ,Facase Gebeya, and Kara Gebeya in the kebele itself and nearby market areas like Kidame Gebeya and Hareto Gebeya). Besides, except Balbala Sorgo kebele [highest deprivation score], all sample households from each kebele sent their family members abroad in the form of out-migration. For example, Gudetu Jimma kebele sample households were found most in sending their family members abroad followed by Gudetu Geneti that may be due to their high vulnerability to illegal brokers/human traffickers from nearby Shambu town (capital of Horro Guduru Wollega Zone).

Table 2.7: Distribution of choices of livelihood diversification strategies by kebele of sample HHs

S/N	Kebele of sample household heads	Choices of livelihood diversification strategies							
		On-farm	Non-farm	Off-farm	On-farm+ Non-farm	Total	Migration		Total
							Yes	No	
1	Gudetu Jimma	41	1	1	3	46	9	37	46
2	Kulala Didimtu	18	1	1	9	29	3	26	29
3	Gudetu Geneti	21	4	1	6	32	7	25	32
4	Gidami Dabsho	29	3	0	2	34	4	30	34
5	Balbalaa Sorgo	24	3	1	3	31	0	31	31
6	Gamo Nagaro	17	1	1	9	28	4	24	28
7	Adi Leka Tullu Chali	28	4	1	0	33	1	32	33
8	Charo Gabano	12	7	6	5	30	3	27	30
9	Damu Gembo	5	2	2	10	19	5	14	19
10	Lalisa Biya	9	8	11	5	33	5	27	32
11	Hagaya	14	2	0	1	17	2	15	17
12	Hunde Gudina	19	10	22	4	55	4	51	55
	Total	237	46	47	57	387	47	339	386

Source: Own computation from field survey (2019)

Extent or Level of Livelihood Diversification Strategies

The current status of the four livelihood diversification strategies of sample heads was analyzed. On-farm activities only have no guarantee for sustainable rural livelihoods. As a result, diversification to other livelihood options was found necessary. Hence, to measure the extent/level of livelihood diversification of livelihood sources by sample households' livelihood diversification index known as Simpson Index Diversity/SID was used. Both Choung *et al*. (2015) and Ahmed *et al*. (2018) described SID as having a value of range between 0 and 1, implying if SID is 0 sample households were participated on in one livelihood or income source and if SID is 1 sample households were participated on in all livelihood or income source (n) listed for analysis of the extent of livelihood diversification (Table 2.8).

Ahmed *et al*. (2018) defined different levels/extent of livelihood diversification using Simpson Index Diversity/SID. Accordingly, to describe the extent of livelihood diversification of the study area composite SID value of the study area was computed from 14 different livelihood sources. The results show that the SID value of the current study area was 0.27, meaning medium livelihood divarication when compared to the medium SID value = 0.46 reported by Chuongh *et al*., (2015) in Vietnam and high SID value reported by Ahmed *et al*. (2018) in Bangladesh. In other words, the majority of the sample households of the study area remained in low-return on-farm activities the only type of livelihood diversification strategies like crop production and animal rearing. An attempt was made to describe the constraints (lack of rural road network and transportation facilities, poor asset base, lack of credit service, and lack of awareness) of rural households and significant determinants (marital status, kebele, education, membership in cooperative & sex of the household heads) that compel them from remunerative livelihood activities under section (2.5.3).

Table 2.8: Extent of livelihood diversification and livelihood sources

List of livelihood source by strategies (n)=14	Obs.	Pi	Pi^2
On-farm activities only			
1. Crop production (Teff, Maize, Wheat, Nouge, Bean and Barely)	146/363	P_1=0.40	P_1^2=0.16
2. Animal husbandry (Cattle, Sheep, Goat, Donkey & Horse)	6/363	P_2=0.02	P_2^2=0.00
3. Livestock products (Skimmed milk, Butter, Cheese)	8/363	P_3=0.02	P_3^2=0.00
4. Poultry production	12/363	P_4=0.03	P_4^2=0.00
5. Modern beekeeping	3/363	P_5=0.01	P_5^2=0.00
6. Crop production and animal husbandry	70/363	P_6=0.19	P_6^2=0.04
7. Crop production, animal husbandry & livestock products	40/363	P_7=0.11	P_7^2=0.01
8. All except beekeeping	78/363	P_8=0.21	P_8^2=0.05
Non-farm activities only			
9. Non-agricultural activities (trading)	49/107	P_9=0.48	P_9^2=0.23
10. Handcraft activities (weaving, carpentry & house mudding)	26/107	P_{10}=0.25	P_{10}^2=0.06
11. Trading (grain, local drinking & small ruminants	28/107	P_{11}=0.27	$P11^2$=0.07
Off-farm activities only			
12. Wage employment (sell of labor to the employer in exchange for salary)	9/124	P_{12}=0.07	P_{12}^2=0.01
13. Self-employment (sell of labor service to oneself rather than working for an employer)	115/124	P_{13}=0.30	P_{12}^2=0.09
Migration			
14. Any household member migrated?	47/386	P_{14}=0.12	P_{14}^2=0.01
	Total	0.49	0.73
		SID=1-sum of Pi^2	0.27

Note: *n= Total number of livelihood sources, Pi= sample households livelihood proportion of i^{th} livelihood source, Pi^2 = Square of sample households livelihood proportion of i^{th} livelihood source and SID= Simpson Index Diversity= 1- the sum of Pi^2*

Source: Own computation from field survey (2019)

2.5.3. Determinants of Households Choices of Livelihood Diversification Strategies

Diagnosis Tests

Test for Consistence of Independence of Irrelevant Alternatives (IIA) assumption

To check whether the IIA assumption was violated or not, two methods were used. First, the Hausman test following Hausman and McFadden (1984) was performed. It was hypothesized as The null hypothesis (H0: X=0) choices are independent.

The alternative (Ha: X≠0) choices are not independent.

IIA assumption requires the probability of using one best livelihood strategy by a given household needs to be independent of the probability of choosing another livelihood strategy. This implies that unbiased and consistent parameter estimates of the MNL model require the assumption of IIA to hold or inviolate. Therefore, before the selection of the MNL model for the data, the researcher checked first whether this restrictive assumption of IIA was met or violated (Annex 2.3). It shows that the Hausman test for Independence of Irrelevant Alternatives (IIA) chi-square (28) value or (b-B)'[(V_b-V_B)^(-1)](b-B) of -12.42 indicate insignificant results for IIA assumption, hence fail to reject the null hypothesis (H0: X=0) choices are independent, i.e. The choices are independent in the sense that inclusion or exclusion of categories doesn't affect the relative risk associated with repressor in the remaining categories. In other words, the selected multinomial logit model used to analyze determinants of rural households' livelihood diversification strategy choices does not violate the IIA assumption and hence this critical finding allowed the researcher to proceed, run and interpret the results of the econometric multinomial logit model in the next paragraphs.

The second Test for Consistence of Independence of Irrelevant Alternatives (IIA) assumption was detected using Small and Hsiao (1985) test (Annex 2.4). Results of the Smhsiao IIA test show insignificant chisqaure test implying that IIA assumption detected not violated. For example, results revealed that smhsiao s4_q79new2 ,elim(1) : Test chi2(1) = 2.791, smhsiao s4_q79new2 ,elim(2) : Test chi2(1) = 4.222, smhsiao s4_q79new2 ,elim(3) : Test chi2(1) = 0.439, and smhsiao s4_q79new2 ,elim(4) : Test chi2(1) = 7.130 implying that all chisqaure test results are insignificant (0.05) meaning IIA not violated.

Test of no multicollinearity assumption

To detect the existence of multicollinearity problems among the nine dummy or discrete independent, pairwise correlation matrixes were generated and the coefficients were examined.

Accordingly, there was no value of 0.75 or above that indicates a stronger relationship between dummy or explanatory variables, therefore, hence no presence of serious multicollinearity problem among discrete independent variables was detected (Annex 2.5). However, to check whether there was a multicollinearity problem among continuous explanatory variables, Variance Inflation Factor (VIF) was used. That is, according to Gujarati (2003) VIF having a value greater than 10 implies the presence of a serious multicollinearity problem among continuous variables. Similarly, in the case of the current study, all values of VIF were found less than 10 showing no serious multicollinearity problems among continuous explanatory variables (Annex 2.6).

In both diagnoses tests of the multicollinearity assumption [degree of association between two discrete explanatory variables less than 0.75 and VIF for continuous explanatory variables less than 10] no existence of serious multicollinearity problem and hence it was possible to use multinomial logit model in determining factors that affect sample households of the study area choices of their livelihood diversification strategies/ multiple dependent variables such as Y_0= on-farm [default base category generated by STATA, however, changed to on-farm+ non-farm activities because significant p-values were found in on-farm+ non-farm activities only dependent variable], Y_1= non-farm activities only, Y_2= off-farm activities only, Y_3= on-farm + non-farm activities only livelihood strategies.

Determinants and Marginal Effects

Annex 2.7 revealed the determinant factors of sample household's choice of livelihood diversification strategies versus the base category. Concerning the coefficients (βs) of the mlogit, Chilot (2007) states that it neither stand for the actual size of change nor probabilities rather it only provides the direction of the effect of the independent variables on the dependent variable. However, the relative risk ratio (rrr) or sometimes referred to as odds (column C, F & I) entails the probability of choosing livelihood strategies over the probability of choosing the baseline category (on-farm activities only) for a unit change in the predictor variable. Indeed, the parameter estimates/coefficients (βs) and relative risk ratio (rrr) of the multinomial logit model are difficult to interpret because they are relative to the base outcome (on-farm activities only). As a result, another way to evaluate the effects of covariates is to examine the marginal effect of changing their values on the probability of observing an outcome (Green, 2003). Accordingly,

out of the total 14 explanatory variables entered into the MNL model only five explanatory variables such as place of residence/*kebele* of the household head, sex of the household head, education, marital status, and member in cooperative are found the significant determinants of rural livelihood's choice of livelihood diversification strategies at 5% significant level.

Place of residence/kebele of the household head: The incentives to diversify may vary due to sample households' variation in place of residence/kebele and their type of farming system. To capture the effect of differences in households' place of residence/kebele on livelihood diversification, the relationship between livelihood diversification and households' place of residence/kebele was hypothesized positive. Results of the sign of estimated coefficients for the place of residence/kebele of the household head is found positive (βs= .1971647,.5189864 & .0890475 for non-farm, off-farm & on-farm+ non-farm, respectively) livelihood strategies but statistically significant at 5 % level of significance for off-farm activities (p-value=0.001<0.05) and insignificant for the other two livelihood strategies which imply that ceteris paribus the households residing in the resource-rich kebeles (Lalisa Biya and Hunde Gudina) of the study area have more on-farm diversified livelihood strategies to off-farm activities livelihood strategy than those in the resource-poor kebeles (Balbala Sorgo *kebele*, highly swampy area) and it is because of difference in the location-specific agro-climatic and socio-economic factors.

However, the relative risk ratio (rrr) or sometimes referred to as odds (column C, F & I) show that a one-unit increase in the variable place of residence/*kebele* of the sample household for non-farm strategy is (1.217945(exp(0.1971647)), off-farm strategy (1.680324(exp(0.5189864)) and on-farm+ non-farm strategy (1.093135(exp(0.0890475)), suggests the expected risk of sample households in the study area staying in the on-farm activities only livelihood strategy increases by 19.7% for non-farm strategy, 51.9% for off-farm strategy and 8.9% for on-farm + non-farm strategy respectively, other factors remain constant. The marginal effect of the variable place of residence/*kebele* of the sample household for off-farm strategy increases by 1.1%, other factors remain constant. The above results are consistent with the findings of Khatun & Roy (2012) and Ahmed *et al* (2018)

Sex of the household head: Keeping other variables constant, it was expected that sex of the household head has a positive and significant relationship with rural households' livelihood diversification strategies, i.e., due to sex-role stereotypes or gender division of labor (male

depend on on-farm activities and less probably engaged in non-farm, off-farm and on-farm + non-farm livelihood diversification strategy than females). Results of the sign of estimated coefficients for sex of the household head are found positive (β=.6575456) and statistically insignificant (p-value=0.622>0.05) for non-farm strategy. The relative risk ratio (rrr) for non-farm livelihood strategy is found as (1.930049(exp(0..6575456)) shows that a one-unit increase in the variable sex of household head for non-farm strategy increases by 65.8%, other factors remain constant. Similarly, the sign of estimated coefficients (column E, Table 2.2) for sex of the household head is found positive (β=.2486019) and statistically insignificant (p-value=0.852>0.05) for off-farm strategy at a 5 percent level of significance. The relative risk ratio (rrr) for off-farm livelihood strategy is found as (1.282231(exp(0.2486019)) show that a one-unit increase in the variable sex of household head for off-farm strategy increases by 24.9%, other factors remain constant.

But contrary to the hypothesis sex of the household heads found negative (βs=-1.43518) and statistically significant (p-value=0.035< 0.05) relationship with on-farm+ non-farm strategy choice at 5 percent level of significance, where the negative coefficient imply that male-headed sample households of the study area are more probably engaged in on-farm livelihood strategy and less engaged in alternative livelihood strategy, in this case, on-farm+ non-farm strategy choice. The relative risk ratio (rrr) for on-farm+ non-farm livelihood strategy is found as (.2380724(exp(-1.43518)) show that a one-unit increase in the variable sex of household head for on-farm+ non-farm strategy decreases by 43.5%, other factors remain constant. The marginal effects show that the likelihood of adopting an on-farm+ non-farm strategy in favor of male households decreases by 25.5%, other factors remain constant. Yizengaw *et al.*(2015) and Seble (2014)found consistent results.

Education of the household head: To capture the effect of education, the education level of the household head was considered. The relationship between livelihood diversification and education was hypothesized to be positive. Results of the sign of estimated coefficients for the education level of the household head are found positive (β=.0185327) and but statistically insignificant (p-value=0.972>0.05) for non-farm strategy. The relative risk ratio (rrr) for non-farm livelihood strategy is found as (1.018705(exp(.0185327)) shows that a one-unit increase in the variable education level of the household head for non-farm strategy increases by 101.9%,

other factors remain constant. Similarly, the sign of estimated coefficients for the education level of the household head is found also positive (β=.1.716308), however, statistically significant (p-value=0.007<0.05) for off-farm strategy at 5 percent level of significance. The relative risk ratio (rrr) for off-farm livelihood strategy is found as (5.563948(exp(1.716308)) show that a one-unit increase in the variable education level of the household head for off-farm strategy increases by 171.6%, other factors remain constant. The marginal effect shows that if a household's education level increases by one more unit then the likelihood of livelihood diversification to off-farm strategy increases by 3.8%, other factors remain constant.

Furthermore, the sign of estimated coefficients for the education level of the household head is also found positive (β=.520515) and statistically insignificant (p-value=0.124>0.05) for on-farm+ non-farm strategy at a 5 percent level of significance. The relative risk ratio (rrr) for on-farm+ non-farm livelihood strategy is found as (1.682787(exp(.520515)) show that a one-unit increase in the variable education level of the household head for on-farm+ non-farm strategy increases by 52.1%, other factors remain constant. Educated people mostly have better exposure to create social networks and helps to have chance to engage in different livelihood strategies and leave better life by diversifying their income by working on on-farm and non-farm and other better remunerative occupations like for salaried jobs and self-employment activities, etc. This suggests that investing in education and increasing access to the higher education level of rural households help them in getting alternative income sources. The result is consistent with previous findings of Newman & Sudharshan (2000), Khatun & Roy (2012), Seble (2014), and Dai *et al*. (2020) who reported that education level has a positive effect on participation in non-farm/non-agricultural livelihood activities, however, inconsistent with the finding of Ahmed *et al*. (2018) who reported that higher level of education among the household heads had a negative and significant (1% level of significance) effect on livelihood diversification in the study areas of rural Bangladesh.

Marital status of the household head: The relationship between marital status and livelihood diversification was hypothesized to be positive. As expected results of the sign of estimated coefficients for the education level of the household head are found positive (β=.6343823) and statistically significant (p-value=0.045>0.05) for non-farm strategy. The relative risk ratio (rrr) for non-farm livelihood strategy is found as (1.885857(exp(.6343823)) show that a one-unit

increase in the variable marital status of the household head for non-farm strategy increases by 63.4%, other factors remain constant. The marginal effect shows that if a household is married then the likelihood of livelihood diversification to non-farm strategy increases by 2.7% as compared to on-farm strategy, other factors remain constant. Similarly, the sign of estimated coefficients for the marital status of the household head is found also positive (β=.4253949), however, statistically insignificant (p-value=0.229>0.05) for off-farm strategy at a 5 percent level of significance. The relative risk ratio (rrr) for off-farm livelihood strategy is found as (1.530195(exp(.4253949)) shows that a one-unit increase in the variable education level of the household head for off-farm strategy increases by 42.5%, other factors remain constant.

Furthermore, the sign of estimated coefficients for the marital status of the household head is also found positive (β=.7813568) and statistically significant (p-value=0.004<0.05) for on-farm+ non-farm strategy at a 5 percent level of significance. The relative risk ratio (rrr) for on-farm+ non-farm livelihood strategy is found as (2.184434(exp(.7813568)) show that a one-unit increase in the variable marital status of the household head for on-farm+ non-farm strategy increases by 78.1%, other factors remain constant. The marginal effect shows that if a household is married then the likelihood of livelihood diversification to on-farm+ non-farm strategy increases by 8.8%, other factors remain constant.

Member in cooperative of the household head: By increasing rural households' social status member in cooperative of the household head increases their access to common property resources, as well as different government/NGO schemes, thereby, it has an important role in determining their choices of livelihood diversification strategies. Therefore, it was hypothesized that sample rural household heads have a positive relationship with livelihood diversification strategies. As expected results of the sign of estimated coefficients (column B) for the member in cooperative of the household head are found positive (β=.9501161) but statistically insignificant (p-value=0.354>0.05) for non-farm strategy. The relative risk ratio (rrr) for non-farm livelihood strategy is found as (2.58601(exp(.9501161)) show that a one-unit increase in the variable member in cooperative of the household head for non-farm strategy increases by 95%, other factors remain constant.

In contrary to the expectation, the sign of estimated coefficients for the member in cooperative of the household head is found negative (β=-1.700449), however, statistically significant (p-

value=0.040<0.05) for off-farm strategy at 5 percent level of significance. The relative risk ratio (rrr) for off-farm livelihood strategy is found as (.1826016(exp(-1.700449)) shows that a one-unit increase in the variable member in cooperative of the household head for off-farm strategy decreases by 170% %, other factors remain constant. The marginal effect shows that if a household is a member of a cooperative then the likelihood of livelihood diversification to off-farm strategy decreases by 6.7%, other factors remain constant. Furthermore, the sign of estimated coefficients (column H) for members in cooperative of the household head is also found positive (β=.7813568) and statistically significant (p-value=0.004<0.05) for on-farm+ non-farm strategy at a 5 percent level of significance. The relative risk ratio (rrr) for on-farm+ non-farm livelihood strategy is found as (2.184434(exp(.7813568)) show that a one-unit increase in the variable member in cooperative of the household head for on-farm+ non-farm strategy increases by 78.1%, other factors remain constant. The positive relation between a variable member in cooperative of the household head and choices of livelihood diversification strategies (non-farm and on-farm + non-farm) result is consistent with the findings of Khatun & Roy (2012) and Ahmed *et al*. (2018)

2.6. Key Results, Conclusions, and Recommendations

2.6.1. Key Results

To conclude, the following key results are identified:

1. According to Harris (1982), rural development is a multi-sector approach. Apart from rural agriculture (on-farm, non-farm, off-farm, and /or a combination of these activities), it embraces natural resource conservation, rural marketing, rural transport, rural finance, rural manufacturing, rural mining, and rural infrastructures: roads, energy, and water, education, and health. Requiring scholarly investigations such as rural livelihood systems centered on the well-being of rural households. Accordingly, in terms of their six types of livelihood capitals (human, physical, social, financial, natural, and information capitals), the status of rural households was also analyzed. The general mean asset index of the sample households was computed as 0.256.

2. When the general asset index decomposed into separate asset indices of each livelihood capital, it was found that human capital asset index (0.192), physical capital index (0.021), natural capital index (0.019), social capital index (0.011), financial capital index (0.01), and

information capital index (0.004), implying that while the human capital index of the sample households was highest their information capital index was found lowest due to lack of information sources like radio (166/42.89%), farm-book (336/86.82%), telephone (332/93.52%), and internet access in the field (324/87.10%). Furthermore, concerning the choices of livelihood strategies, it was found that 237(61.24%) engaged in on-farm activities, 57(14.73%) engaged on on-farm plus non-farm activities, 47(12.14%) engaged in off-farm activities, 46(11.83%) were engaged on non-farm activities and out of 387 sample households it was also found that only (47/12.18%) of them sent their household member to abroad diversify their livelihood options.

3. The overall extent or level of rural households' livelihood diversification was estimated from 14 different livelihood sources using Simpson Index Diversity/SID. Results show that the current SID value of the sample households was 0.25 (low SID value) implying that the majority of the sample households of the study area (237/61.24%) remained in low-return non-farm livelihood activities only (crop production and animal rearing). Descriptive statistics show a lack of rural road network and transportation facilities, poor asset base, lack of credit service, and lack of awareness of rural households.
4. Multinomial logit model significant determinants like marital status, kebele, education, membership in cooperative & sex of the household heads were found compelled rural households of Jimma Geneti woreda not to participate in the choices of their remunerative livelihood strategies and activities.

2.6.2. Conclusions

Based on the above key results, the following two overall conclusions are drawn:

1. Livelihood assets have been unequally distributed among rural HHs' in the study area.
2. On-farm activities only livelihood source remains the most important source of livelihood for all households in Jimma Geneti Woreda.
3. The state of rural livelihood diversification is low. Given the challenges of climate change, it is possible to further conclude that sample households' of Jimma Geneti woreda dependence on on-farm activates only don't sustainably guarantee their future livelihood sources.

2.6.3. Recommendations

Based on the conclusions draw above the following recommendations are made:-

1. The general mean asset index of the sample households was computed as 0.256 and low. Besides, the separate asset index of the sample households shows a 0.192 human asset index. This was contributed by sample households with fewer literacy skills, lack of vocational skill training centers, and poor perceived health status. Thus, it is recommendable to establish rural adult literacy classes in the village. By doing so sample households could improve their reading, writing, doing simple arithmetic, and get acquired necessary vocational skills that could enhance their human capital, thereby, the overall asset index of the woreda.
2. The natural capital index was found as 0.019. Natural asset indicators such as Tractor, combiner, generator for irrigation use, tent, chair, primary school, health post, water scheme, and distance to the market were used to construct sample households' physical asset index. The majority of sample households reported that they lack such agricultural physical assets, durable consumer goods physical assets, and public infrastructural services physical assets. Thus, to enhance the current physical asset index of the sample households in the woreda due emphasis is required for accessing them to physical asset indicators like modern agricultural physical assets (tractor, combiner, and generator for irrigation), durable consumer goods physical assets (tent and chairs) and public infrastructural services physical assets (primary school, health post and water scheme primary school, health post and water scheme).

   Above all, to low asset indices such as the social capital (promote harmony and synergy among households and access them to rural cooperatives) and financial capital (improve the quantity and quality of livestock holding, promote saving by reducing huge expenditures on festivals, access subsistence farmers to credit services and encourage them to invest in both on-farming and non-farming livelihood strategies). For natural capital (by undertaking many proactive measures related to land/the 1995 constitution, entitle farmers land ownership and use rights than government land ownership, and in place effective policy measures that encourage households participation in conservation practices on their respective land) and information capital assets seek due considerations, too. This helps asset depletion of the sample rural household heads, thereby, reduce their vulnerability to simultaneous shocks and prevent them from severe multidimensional poverty status.

   The importance of intangible livelihood assets (information asset capital) makes unique the study that was overlooked by previous livelihood asset researchers. In the 21st century,

information capital asset is becoming a core element of the rural households' sustainable livelihood framework in general and asset capitals in particular. To understand how the impact of information asset capital and the way it interacts with the remaining five livelihood asset capitals of rural households there must be mechanisms to access households to information sources from radio, internet, and other farm-related sources of information to enhance the current lowest state of information capital index of the sample households in the woreda. This can be done by addressing outreach listening to radio and televisions through expanding rural electrification facilities in the woreda by concerned bodies. Moreover, ICT-based extension services could revise the current low status of sample households' information capital index. By improving the current low livelihood asset capitals of the sample households, information asset capital also enhances rural households' asset profile and reduces their deep-rooted multidimensional poverty. This does not mean that the newly created asset structure of the households (Hexagon) and the information capital asset stand alone. Rather, part and parcel of the five livelihood asset capitals and the whole sustainable rural livelihood framework analysis.

3. Furthermore, results show that on-farm activities were found the dominant livelihood activity of sample households. That is, it was found that the majority of sample households failed to diversify their livelihood strategies from on-farm activities to other different remunerative activities. Meaning, rural samples in Jimma Geneti woreda are engaged in low profitable, low return, and non-rewarding on-farm activities at the expense of alternative profitable, high return, and rewarding livelihood options. For example, results show that the current SID value of the sample households was 0.25 (low SID value) implying that the majority of the sample households of the study area (237/61.24%) remained in low-return non-farm livelihood activities only (crop production and animal rearing). Besides, on-farm activities, these results call for addressing sample households' pro-active participation in lucrative non-farm, off-farm, and/or a combination of on-farm +non-farm activities. In other words, the woreda Agriculture and Natural Resource Conservation, irrigation, and Trade offices are recommended to increase the awareness of rural households engaged in on-farm activities only to diversify their livelihood sources to non-farm, off-farm, and a combination of these livelihood activities.

4. Besides, the in-depth analysis of the sample households' status of livelihood strategies revealed the incoming of unrecognized alternative sources of rural households' livelihood (out-migration). Out-migration of members of sample households was mainly due to push and pull factors. Results revealed the presence of a few households (47/12.18%) sending their household members abroad for remittances, the majority (339/87.825) didn't. Migration as rural households' alternative source has been a controversial point (it reduces poverty by increasing their income or perpetuates poverty due to brain drain of skilled and unskilled labor in the rural community) among livelihood scholars. The result calls for legal migration to be an integral part of rural households' development initiatives in general and rural households' alternative source of livelihood in particular.
5. Results of the multinomial logit model revealed that several positive and negative significant factors contributed to it. Thus, because the diversification of agriculture alone-based livelihood has no guarantee and is necessary to improve it, effective government policies and programs must be crafted. Thereby, rural households' livelihoods diversification could be done through creating opportunities for rural households in terms of accessing them on more income-generating activities that combat their risk of income fluctuations, rural road network and transportation facilities, asset base diversification, access to rural credit service, and awareness creation of rural households on the significances of non-farm activities. Besides, policies and programs should also focus on significant factors such as education, access to rural cooperatives, & positive gender discrimination actions.

6. Overall, the government should craft and implement policies and programs to promote diversification of livelihoods through increasing and creating opportunities for more income-generating activities especially for the poor households to combat the risk of income fluctuation. The policies and programs should focus on factors that have a large impact on livelihood diversification. For example, through policy intervention mechanisms the smallholder farm households' participation in lucrative non-farm activities needs to be addressed. This could be happening by encouraging rural-urban linkages, expansion of electricity facilities and road networks in the study area.

CHAPTER THREE
RURAL HOUSEHOLDS' MULTIDIMENSIONAL LIVELIHOOD SECURITY ANALYSIS IN JIMMA GENETI WOREDA[8]

Abstract: *The purpose of this study was to describe the status and to investigate the determinants of rural households' multidimensional livelihood security in Jimma Geneti Woreda, Oromia Regional State (Ethiopia). The study applied quantitative research methodology. Data are collected through an open-ended and closed-ended household survey and secondary data sources. A sample of 387 was involved. Descriptive statistics and econometric models (ologit model) are used to analyze the data. Descriptive findings imply that inter-households' inequality in terms of the seven multidimensional livelihood security indices exists. Also, the composite multidimensional livelihood security of sample heads was found at the fragile end of the multidimensional livelihood security equilibrium ranges 0 to 5 scale. Ologit result show households' members of cooperative have negatively and significantly affected rural heads' multidimensional livelihood security. Theoretically, the study implies narrow considerations (household-level food and nutritional security studies alone) couldn't comprehensively understand their multidimensional issues. Hence, effective rural development policies and strategies aiming to ensure household-level well protected multidimensional livelihood security need to base on such study than mere considerations of food and nutritional securities alone. The former has the long-term benefit of household-level sustainable development in general and poverty reduction in particular.*

Keywords: Rural households, multidimensional livelihood security, multiple correspondence analyses, ologit model, Jimma Geneti Woreda (Ethiopia)

3.1.Introduction

Many of the definitions of the concept of multidimensional livelihood security derive from the work of Chambers & Conway (1992). However, this study adopts the definition given by Baby (2005) that it refers to rural households' adequate access to income, food, nutrition, health facilities, clean environment, habitat facilities, educational opportunities, community participation, and social integration, thereby; meet basic needs. However, this study denotes the seven multidimensional livelihood security domains operationalized under section (6.1).

Furthermore, the historical development of livelihood security is deep-rooted into the three strategic shifts in development thinking carried out from the 1970s to the 1990s. That is, during these periods according to different reviews (World Bank, 1989; UNICEF, 1990; Davies *et al*., 1991; Maxwell & Smith, 1992; Farrington *et al*., 1999) much conceptual progress has been made in an understanding of the processes that lead to household food insecurity and nutritional insecurity. These strategic shifts led to the emergence of the rural livelihood security approach. These are:- *Strategic shift* one/availability dimension (the 1970s -1974): In the 1970s food security was linked mostly to national and global food supplies (availability dimension of food security). The food crisis in Africa in the early 1970s stimulated a major concern on the part of the international donor community regarding supply shortfalls created by production failures due

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to drought and desert encroachment (Davies *et al*., 1991). This focus on food supplies as the primary cause of food insecurity was given credence at the 1974 World Food Conference conceptualized as a shift from regional and national food security to households and individual food security. *Strategic shift two* **(**1980s-early 1990s): Accessibility dimension (during 1980s) (Sen, 1981; Borton & Shoham, 1991) and utilization dimension (early 1990s) (World Bank, 1989; UNICEF, 1990) were the two most important strategic shifts of these periods. *Strategic shift 3* from material perspective to social perspective (Late 1980s-During 1990s): According to Maxwell (1996), the third shift focuses on the enhancement of people's capacities to secure their livelihoods (Maxwell, 1996; Maxwell & Smith, 1992). A shift that emerged into CARE's (2004) livelihood security model constituted from multidimensional livelihood security dimensions and assessment indicators. Overall, it was since the third strategic shift, the theoretical foundation of analyzing rural households' multidimensional livelihood security was integrated into the CARE (2004) livelihood security model that constitutes multidimensional livelihood security dimensions and assessment indicators of the current study. Hence, it guides this study because it is a participatory and rapid community assessment technique that helps to use the village profiles as baselines to learn about the lag between macro policy reforms, trickle-down benefits, and grassroots impacts.

There are twenty-one different methodologies of analyzing sustainable development (Drinkwater, 1998; Baby, 2005; Sing & Hiremath, 2010) of which sustainable livelihood security index (Parris & Kates, 2003; IISD, 2004; Bohringer & Jackem, 2007) was found the most relevant to this particular study. The sustainable livelihood security index was found relevant because it is simple to compute and flexible to include more livelihood security dimensions and corresponding indicators. Besides, sustainable household livelihood security (SLSI) is one of the most comprehensive yet simple indices for measuring long-term livelihood security in rural areas. Concerning its procedure, different scholars such as Saleth & Swaminathan (1993), Baby (2005), Rahman & Akter (2012), and Barela *et al*. (2018) have followed different steps/stages of developing livelihood security indices and a composite index (section 3.4). The remaining sections include section 3.2 review the results of previous studies. Section 3.3 presents the specific objectives and basic questions. Section 3.4 presents the methods used to analyze rural households' multidimensional livelihood security. Section 3.5 presents the results and discussions. Finally, section 6.6 concludes and recommends.

3.2.Empirical Review

Multidimensional livelihood security analysis requires some assessment indicators. For example, IFAD (2001) identified some of the food insecurity assessment indicators such as low consumption, low malnutrition, illiteracy, low life expectancy, insecurity, powerlessness, and low self-esteem. In Sri Lanka, Wickramasinghe (1999) introduces sets of criteria/indicators to measure the sustainability of livelihoods such as socio-cultural security related to food security, a secure place or dwelling for living and family functioning, services and secure status in the society, economic security/access to productive assets, stable production, income and employment, availability of public services and access to market outlets, environmental security/bio-diversity, the stability of the soil, water availability and physical space availability for crop production, and political security/ empowerment of local community in every aspect of life. In India, some of the other indicators of assessing sustainable livelihood security include food security/production and distribution, water security/source, supply, quality, use, habitat security/quality and location of housing, and occupational security/income, employment, assets production, productivity and working conditions(Twigg, 2001).

Furthermore, Singh & Hiremath (2010) identified livelihood security indicators such as ecological security indicators: forest cover, water quality unaffected habitations (i.e. habitations that are not affected by pollutants such as fluorides, nitrates, & brackishness), and groundwater recharge potential; economic efficiency indicators: total food grain yield, milk yield, and net sown area; social equity indicators: percent of the population above the poverty line, female literacy, maternal survival rate, per capita food grain production, and per capita milk production. In turn, to develop rural households' livelihood security index of some selected villages of India, Baby (2005) used multiple indicators like food security, occupational security, habitat security, health security, environmental security, educational security, and social security. Barela *et al*. (2018) have identified a list of seven components of livelihood security indicators such as food security**,** economic security, health security**,** educational security**,** social security**,** institutional security, and infrastructural security**.** Once, the list of livelihood security indicators is identified, the way of constructing a composite index and separate indices of each component of the rural households are becoming indispensable, meaning, methodological approach to livelihood security assessment.

Based on the above multidimensional livelihood security assessment indicators, there are different studies conducted yet. For example, worldwide, FAO (2017a) revealed that the state of the rural households' food insecurity has increased to 925 million people in 2016 (900 million in developing countries and about 70% in rural areas) and chronically undernourished people in the world is estimated to have increased from 777 million in 2015 to 815 million in 2016. Besides, worldwide, the number of undernourished people has increased to 821 million people-when decomposed stunting (nearly 151 million children under five or over), wasting (over 50 million children under five), and overweight (over 38 million children under five) and the trend and prevalence of undernourishment of the world was 14.5% (2005), 11.8%(2010), 11.3%(2012), 10.7%(2014), 10.8%(2016), and 10.9%(2017) were undernourished (FAO, IFAD, WFP, WHO, & UNICEF, 2018).

Moreover, the study conducted for the analysis of household livelihood security in 15 villages of Bastar (India) by CARE India (1997) shows that the village is on the fragile end of the household livelihood security index (i.e., 2.3 fragile equilibrium and 5 well-protected livelihood security), hence, overall livelihood security index of the study was found serious threats having 1.9 livelihood security, less than the average. Another study on the livelihood security of the rural community in India was conducted by Baby (2005). Her results show that household food security emerged as the most important dimension (highest index) compared to the rest of the remaining six livelihoods security dimensions. Singh & Hiremath (2010) conducted similar research on the sustainable livelihood index in India/Gujarat district. Results show that the eastern districts dominated by scheduled tribes' have a high ecological security index/ESI but a very low economic efficiency index/EEI and social equality index/SEI. In turn, Barela *et al*. (2018) assessed the livelihood security of tribal farmers (Madhya Pradesh, India). They developed the index result from seven livelihood security dimensions (e.g., food security, economic security, health security, social security, infrastructural security, educational security, institutional security). The Overall livelihood security status revealed that 48.33% of the respondents come under the low category (Barela *et al*., 2018). In Bangladesh, Rahman & Akter (2012; 2014) have studied the livelihood security in poor urban settlements in Jessore and Tongi, too.

The above descriptive results generated by CARE India (1997), Baby (2005), Singh & Hiremath (2010), Akter (2012), Rahman & Akter (2012; 2014), and Barela *et al*. (2018) revealed that rural households'' multidimensional livelihood security was low. Several determinants contributed. For example, Akter (2012) reported an insignificant effect of age and sex on multidimensional livelihood security. Rahman & Akter (2014) reported that family size has positively and significantly increased the probability of being food secure and empowered. The family size of the household head is another demographic determinant factor of rural households' multidimensional livelihood security, *ceteris paribus.* More family size means more labor that can produce more food. On the contrary, Akter (2012) reported that family size reduces the probability of rural households' multidimensional livelihood security because the larger the family size the more they are demand basic needs, thereby, affect it negatively.

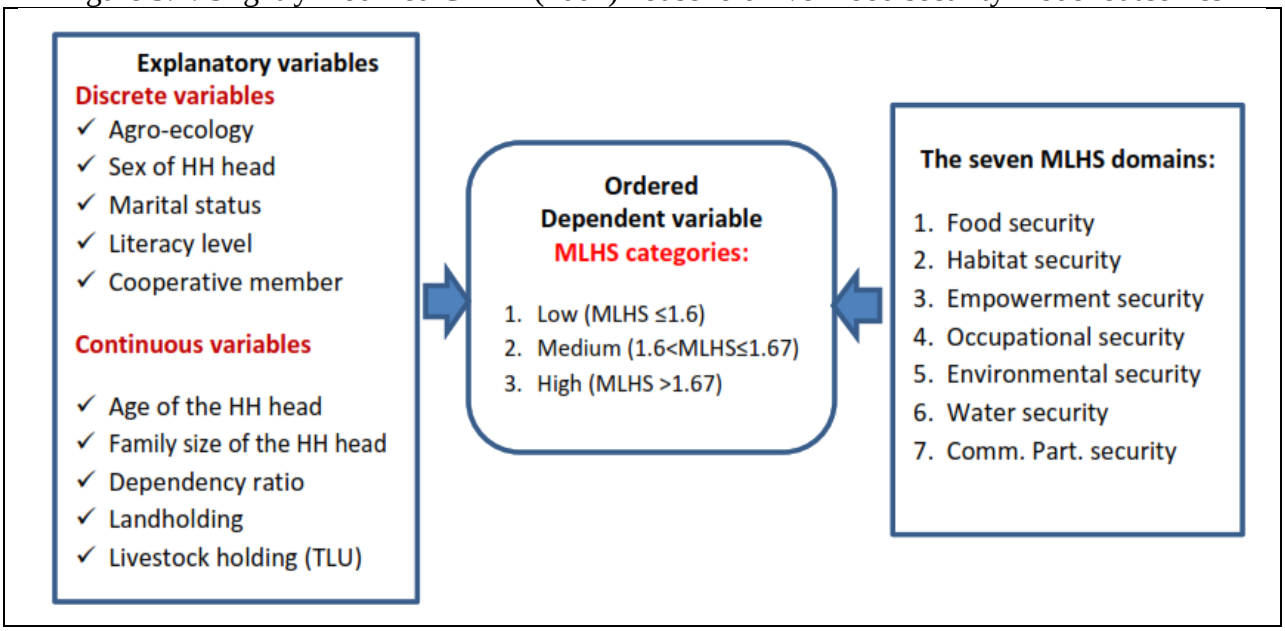
Akter (2012) reported an insignificant effect of marital status dependency ratio variable negatively affected rural households' composite livelihood security because the more the dependents the more their demand for basic needs. Besides, Rahman & Akter (2012; 2014) reported a consistent finding that the dependence burden has a significant negative effect on rural households' state of multidimensional livelihood security. Concerning the influence of the household heads' landholding, Akter (2012) found a positive and significant effect of landholding on rural households' composite livelihood security. Moreover, results show that all livelihood security indices (economic, food, health, education, and empowerment) are significant determinants of overall household livelihood security (Rahman & Aakter, 2012; 2014).

The state of African trend and prevalence of chronically undernourishment was reported as 24.3% (2005), 21.7% (2010), 21.0% (2012), 20.7% (2014), 22.3% (2016), and 23.2% (2017) and for the Eastern African peoples results show that it was 34.3% (2005), 31.3% (2010), 30.9% (2012), 30.2% (2014), 31.6 %(2016), and 31.4 %(2017) (FAO *et al*., 2018). Regardless of the dramatic increase in the number of rural household's food insecurity and nutritional insecurity (Abduselam, 2017; Federal Disaster and Risk Management Commission, 2018), well-established studies (chronologically arranged studies before 2008 by Degefa, 1996; 2002; 2005, Million, 2007, Messay, 2008, and Tsegaye, 2008; between (2008-2012) by Asfaw *et al*. (2005), Aurino & Cafiero (2012), Carletto *et al*.(2012), Arega (2012), and post- 2012(2013-2017) studies by Cintron *et al*.(2016), Souza &Jolffiee (2016) and by Alemeseged (2016)) on rural households'

food security and insecurity did and documented in Ethiopia. However, compared to multidimensional livelihood security issues of rural people those studies are considered narrow.

In synthesis, one of the prime gaps of the previous studies was the methodological gap. For example, Barela *et al*. (2018) assessed the livelihood security of rural households using a simple percentage. However, this study computed both the separate livelihood security indices of seven livelihood security dimensions and the overall/composite livelihood security index of the woreda. While Akter (2012) used two estimation techniques (two stages- least square/2SLS & three stages- least square/3SLS), Rahman & Akter used Tobit model, this study is unique because it employs the OLS and Logit model for the analysis of the determinants of multidimensional livelihood security. As justifications were made under section 3.1 above, the current study adopted CARE (2004) livelihood security model outcomes (Figure 3.1).

Figure 3.1: Slightly modified CARE (2004) household livelihood security model outcomes



Source: Slightly modified CARE (2004)

Furthermore, in the study area, the overall livelihood securities of the households have been threatened by the rise in the water level of the artificial Fincha'a Lake constructed for hydroelectric power during the Imperial period. For example, vast areas of land farms are converted to swampy areas. Grazing lands are covered by water bodies. Rural-urban migration is increasing. As a result, food, habitat, empowerment, occupational, environmental, water, and community participation securities are under threat unless otherwise scientifically study the state and determinants of households' multidimensional security issues than merely focusing on their

food and nutritional security issues in the case of rural households in Jimma Geneti woreda, Oromia Regional State.

3.3.Specific Objectives and Basic Questions

The specific objectives and basic questions include:
To describes the current multidimensional livelihood security status of the study area.

a. When rural households' livelihood security is analyzed multidimensional way, what is the current status of their multidimensional livelihood security?
b. In which MLHSI categories sample households are mostly distributed?

To examines the determinants of the rural households' multidimensional livelihood security in the study area.

c. Are there any significant determinant variables determining rural households' current overall livelihood security? If yes, what are they?

This study is significant from the empirical, knowledge, and literature wise contributions, it has also merit in terms of methodological contribution, too. Furthermore, this paper will bridge the existing gap in the current literature on multidimensional livelihood security.

3.4.Procedures and Methods

Both descriptive and econometric analyses were used to analyze rural heads' multidimensional livelihood security. Most previous scholars like Saleth & Swaminthan (1993), Baby (2005), Rhman & Akter (2012), and Barela *et al*. (2018) used the multidimensional livelihood security index. To compute the study area's index, this study adopted the same procedures and methodologies. These include:

Step one, selection/characterization of livelihood security dimensions, indicators, and modalities/categories: This selection of dimensions and indicators step is similar to the first step of rural poverty analysis approaches (chapter two). Hence, a meticulous review of related literature on multidimensional livelihood security and consulting experts in rural development enabled the researcher to first identify a total of ten livelihood security dimensions and corresponding indicators and modalities/categories[9]. However, to avoid redundancy of rural heads data analysis dimensions and indicators of nutrition, health, and education were omitted and the remaining seven dimensions and their corresponding 92 indicators and 224

[9] **Modalities/categories***: a set number of* ***categories*** *a participant can select from, and each* ***category*** *is distinct from others.*

modalities/categories were identified to achieve the third specific objective of this study and were operationalized. Multiple correspondence analysis techniques were used to identify key multidimensional livelihood security indicators and their categories (Annex 3.1).

Step two, determination of scale value/weighting livelihood security dimensions using the formula: Under step one, seven livelihood security dimensions were identified. But relative weights are not attached to them. Recall that in multidimensional poverty analysis weights of each dimension were adopted from Alkire & Jahan (2018). However, in participatory poverty analysis, an equal weighting approach was used. Unlike these approaches, following Guilford's (1954) normalized rank order method; non-arbitrary specific weights were determined and attached to seven rural multidimensional livelihood security dimensions). Such a method was employed because the method can be used with any number of variables, doesn't require a large number of judges and was used by different scholars (Mathew, 1989; Baby, 2005; Letha *et al*., 2016; Niketha *et al*., 2017). Guilford's (1954) method has a series of sub-steps (Annex 3.2).

Step three, non-arbitrary attachments of weights to each indicator and their corresponding categories: While step one identifies livelihood security dimensions, indicators, and categories, step two above attached respective weights to each livelihood security dimension. So far, relative weights to each livelihood security indicator and their categories are not attached. Step three solved the issue. There are different methods of attaching weights to indicators. For examples, normalized rank order method (Guilford, 1954), equal weighting approach (Filmer & Pritchart, 2001), human development index/HDI and human poverty index/HPI(Asselin, 2002), and MCA approaches (Asselin, 2002; 2009; Husson *et al*., 2010) are some of the methods used in attaching weights to indicators used to construct the index.

While Filmer & Pritchart (2001) justified the equal weighting approach as arbitrary, and theoretically not supported, Asselin (2002; 2009) and Husson *et al*. (2010) claimed that the equal weighting approach is wrong because the weighting of all indicators equally doesn't influence sample households. Asselin (2002) states human development index/HDI and the Human poverty index/HPI are criticized for their being identified as an arbitrary set of poverty indicators and their corresponding weights in the aggregating composite index. Hence, an alternative approach known as multiple correspondence analysis/MCA has to be used to assign non-arbitrary weight to every indicator and category, maintain the useful and highest amount of

variance of each indicator, thereby, reduce data dimensionally and a large number of categorical variables that are most important. The current study adopted Asselin (2002; 2009) and Husson *et al*.(2010) non-arbitrary assignment of weights to each indicator and category. Following Asselin (2002; 2009) and Desawi (2019), a multiple correspondence analysis/MCA or homogeneity analysis approach was used to non-arbitrarily attach weights to categorical data indicators and their corresponding categories. The major reason was what Assellin (2002) writes as the MCA approach is an optimal tool to determine non-arbitrary unequal weights to the categories of the same indicator.

Step four, computing the overall multidimensional livelihood security index: at this step, it was possible to compute the overall multidimensional livelihood security index of the study area. It followed the following sub-steps such as standardization, averaging, and computing composite index:

- *Converting/standardization of each livelihood security dimension to unit score (U_{ij}):* Each livelihood security dimension consisted of a different number of items/indicators. As a result, their range of scores differs. Hence, converting or standardizing the scores of all the seven livelihood security dimensions into the unit score is required. This can be done by simple range and variance using the equation:

$$Uij = \frac{Yij - Min.Yi}{Max.Yj - Min.Yj} \quad \text{.....3.1}$$

i.e, standardization of the 7 LHS dimensions

Where,U_{ij}= Unit score of the i^{th} respondent on j^{th} LHS dimension, Y_{ij}= Value of the i^{th} respondent on the j^{th} livelihood security dimension, Min Y_i= Minimum score on the j^{th} livelihood security dimension, Max Y_i= Maximum score on the j^{th} livelihood security dimension

Note: Yij is obtained, Min Yi and Max Yi values of are obtained by summarizing statistics (mean, standard deviation, minimum and maximum

Thus, the score of each component ranged from 0 to 1 i.e. when Y_{ij} is minimum, the score is 0 and when Y_{ij} is maximum the score is 1.

- *Calculating livelihood security index of each household ($HLSI_i$):* Livelihood security dimensions and corresponding indicators will contribute to the livelihood security index of each sample household. Hence, first, sum the unit score of each household and sum it up. To get the livelihood security index of each household find the average of the standardized

livelihood security dimensions (step 1) and divide it by some livelihood security dimensions (n=7). That is, the livelihood security index (HSIi) of each sample household is computed.

$$HLSIi = \frac{\sum Uij}{n} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\text{averaging the unit score (3.2)}$$

Where, HLSIi= Livelihood security index of i^{th} household, i= 1-387, J=1-7, Uij=Unit score of the i^{th} respondent on j^{th} dimension, n= Number of livelihood security dimension (n=7)

- ***C****omputing the overall multidimensional livelihood security index (MLHSI) of the woreda:* After standardization of the livelihood security indicators and computation of each household's livelihood security index, the computation of the overall multidimensional livelihood security index was made. That is a composite set of MHLS indices at the household- level was developed by utilizing a set of seven dimensions and 92 livelihood security indicators. This is so because livelihood security dimensions and corresponding indicators could contribute to the overall LHSI of the woreda. It is obtained by multiplying the unit score (Uij) of each respondent by respective scale values of livelihood security and summed up. Then, the scores obtained are divided by total scale value and multiplied by 100. Below was the formula used to compute the composite livelihood security index (LS).

$$HLSIi = \frac{\sum Uij * Rc}{Total\ scale\ value(RC)} * 100\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\text{(3.3) overall composite index}$$

Where, HLSi= Livelihood security index of i household, i= 1-387, J=1-7, U_{ij}=Unit score of the i^{th} respondent on j^{th} dimension, Rc= Scale value/weight of the ith respondent on jth dimension. For the analysis of the determinants of rural multidimensional livelihood security ordered logit model was used because the dependent variable of this study is ordinal variables inherently ordered categories/ polynomious outcomes. For example, the current study has categorized sample households into three MLHSI categories: low (MLHS ≤ 1.6), Medium 1.6< MLHSI≤1.67), and high (MLHS > 1.67). Hence, it is specified as follows:

$$Y_i^* = \beta' X_i + e_j \quad -\infty < Y_i^* < -\infty \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\

and high), the relation between latent variable Y_i^* and observable Y_i is obtained from ordered logit model as follows:

$Y_i=1$ if $-\infty \leq Y^*_I < \mu_1$, i=1,…,n,
$Y_i=2$ if $\mu_1 \leq Y^*_I < \mu_2$, i=1,…,n,
$Y_i=3$ if $\mu_2 \leq Y^*_I < \mu_3$, i=1,…,n,
… … … ….
$Y_i=J$ if $\mu_{J-1} \leq Y^*_I < +\infty$, i=1,…,n, ……(3.5)

Where, n= value of the sample size, μ and ∞ = Thresholds that define observed discrete answers and should be estimated.

The probability of Yi=j was calculated by the following relation

$$Pr(Y_1=J)=Pr(Y_1 \geq \mu_{J-1})=Pr(\varepsilon_1 \geq \mu_{n-1}-\beta X_1)=F(\beta X_1-\mu_{J-1}) \quad (3.6)$$

In cumulative probability expression, the ordered logit model estimates the likelihood of household "I" to be at 'J^{th}' level or less (1…, j-1). It should be noted that the answer groups in the ordered logit model are ordered. The ordered logit model was expressed as follows:

$$log\left[\frac{\gamma_j(x_i)}{1-\gamma_j(x_i)}\right] = \mu_j - [\beta_1 x_{1i} + \beta_2 x_{2i} + \cdots + \beta_k x_{ki}] \quad (3.7)$$

J= 1…, J; i= 1,…,n

In which, 'Y_j' cumulative probability was as following:

$$\gamma_j(x_i) = \gamma\left(\mu_{j-\beta' x_i}\right) = P(Y_i \leq j|x_i) \quad (3.8)$$

Where,B_i =column vector and of parameters(β_1, β_1,…,β_k),X_i = column vector of explanatory variables (X1,X2,…X11),μ_j = only dependent on the probability of predicting category and is not dependent on explanatory variables,The crisp part, i.e,

$$\beta_1 x_{1i} + \beta_2 x_{2i} + \ldots + \beta_k x_{ki} \quad (3.9) = \textit{dependent part of the category}$$

χ^2 statistics in parallel regression test was calculated as follows:

$$x^2 = -2logLikelihood_{Cm} - (-2logLikelihood_{Cm}) \quad (3.10)$$

Where, Cm = current model, Gm = General model, if the calculated χ^2 is more than χ^2 in the table, it will indicate the rejection of the null hypothesis which means the current model is estimated correctly.

Parameters were estimated by the maximum likelihood estimation method, which maximizes the probability of categorization.

$$L(Y|\beta; \mu_1, \mu_2, \ldots, \mu_{J-1}) = \coprod_{i=j}^{n} \coprod_{i=0}^{J} [\gamma(\mu_{j-\beta' x_i}) - \gamma\left(\mu_{j-1} - \beta' x_i\right)]^{-zij} \quad (3.11)$$

Where,'z_{ij}' = *Binary variable. It equals 1 when the observed group for person 'i' is 'j', and if they are not equal, it equals zero.Newton-Raphson algorithm was used in the maximizing process.*

Besides, annex 3.3, the study described the variables and proposed the following hypothesis:

X1: Agroecology/farming system: agroecology/farming type of sample heads was assumed to have a positive and significant effect on their multidimensional livelihood security status.

X2: Age/proxy of the overall experience of the household head was expected to significantly increase the probability of the respondents being health and educationally secure and empowered, thereby, well-protected multidimensional livelihood security. Akter (2012) reported an insignificant effect of age on multidimensional livelihood security.

X3: The sex of the household heads was expected to have a positive and significant effect on the multidimensional livelihood security of rural households. This was so because in rural areas of the study area man has more access to seven multidimensional livelihood security domains than a woman. Akter (2012) reported an insignificant effect of sex on multidimensional livelihood security.

X4: The family size of the household head. Rahman & Akter (2014) reported that family size has positively and significantly increased the probability of being food secure and empowered. On contrary, Akter (2012) reported that family size reduces the probability of rural households' multidimensional livelihood security because the larger the family size the more they are demand basic needs, thereby, affect it negatively. However, this study assumed that family size has a positive and significant effect because the bigger availability of family labor means, more members bring more resources to the households; for example, produce more food due to the availability of family labor.

X5: Marital status of the household head was expected to improve the probability of the rural households' multidimensional livelihood security than single or unmarried heads. The potential reason may be the more the household head gets married there is high the probability of couples' participation in different multidimensional livelihood security domains. Akter (2012) reported an insignificant effect of marital status on multidimensional livelihood security.

X6: Literacy status was expected to improve the probability of the rural households' multidimensional livelihood security than illiterate.

X7: Dependency ratio of household heads variable was assumed to negatively affected rural households' composite livelihood security because the more the dependents the more their demand for basic needs. This assumption was consistent with Akter (2012) and Rahman & Akter (2012; 2014).

X8: Landholding (hectare). Consistent with Akter (2012) it was assumed that the landholding variable was assumed positive and significant effect on rural households' composite livelihood security. The potential reason is that land is the main source of the wealth of rural households (i.e. food security).

X9: Livestock holding (TLU) was expected to have a positive and significant effect on rural households' multidimensional livelihood security than those household heads with a fewer number of livestock holdings.

X10: Credit services were assumed to have a positive and significant effect on sample heads' composite livelihood security.

X11: Member of cooperatives was also expected to have a positive and significant effect on rural households' state of multidimensional livelihood security. The potential reason may be being a member of cooperatives; household heads get the opportunity to work jointly with other heads. This could enable to improve his/her state of food security and occupational security, thereby, significantly enhances the probability of rural households' well-protected multidimensional livelihood security.

3.5.Results and Discussions

3.5.1.Rural Livelihood Security Dimensions And Key Indicators

Livelihood Security Dimensions

As per Guilford (1954) Normalized Rank Order Method the seven livelihood security dimensions were ranked by 30 judges who are the experts in the field of social science, food security, agricultural extension, environment, women and children affairs/gender, economics, cooperatives, rural development, and related fields. A format (Annex 3.4) containing the seven livelihood security dimensions was handed over personally to them for ranking (1 to 7) dimensions according to their relevance to rural households. Then, rankings were tabulated, frequency distribution (f_{ji}) worked out, mean of each livelihood dimension computed, and finally, scale value/weights of each dimension computed and attached (Table 3.1/row/16).

Table 3.1: Frequencies, p-values, C values, mean (Rj), and scale values/weights (Rc) of each livelihood security dimensions

(A)	(B)	Product of frequencies and C values of the seven Dimensions of sample households Multidimensional LHSAI							(J)	(K)	(L)
r_i	Ri	(C)	(D)	(E)	*(F)*	(G)	(H	(I)	∑f ji	Proportion (P values)	C value Correct rank
		FoSD	***HaSD***	***EmSD***	***OcSD***	***EnSD***	***WaSD***	***CoPD***			
1	7	11x8=88	0x8=0	7x8=56	12x8=96	0x8=0	0x8=0	0x8=0	30	92.86	8
2	6	8x7=56	3x7=21	6x7=42	7x7=49	2x7=14	0x7=0	4x7=28	30	78.57	7
3	5	7x6=42	5x6=30	3x6=18	6x6=36	2x6=12	3x6=18	4x6=24	30	64.29	6
4	4	3x6=18	3x6=18	5x6=30	4x6=24	2x6=12	3x6=18	10x6=6	30	50.00	6
5	3	1x5=5	6x5=30	7x5=35	0x5=0	5x5=25	4x5=20	7x5=35	30	35.71	5
6	2	0x5=0	1x5=5	2x5=10	1x5=5	10x5=50	14x5=7	2x5=10	30	21.43	5
7	1	0x4=0	12x4=48	0x4=0	0x4=0	9x4=36	6x4=24	3x4=12	30	7.14	4
	∑fji	30	30	30	30	30	30	30	21	350	41
	P-values	92.286	78.57	64.29	50	35.71	21.43	7.14			
	∑ (fji *C)	209	152	191	210	149	150	169			
$Rj = \frac{\sum (fji * C)}{\sum (fji)}$		6.97	5.07	6.37	7.00	4.97	5.00	5.57			
Judges Rank of Rj		2nd	5th	3rd	1st	6th	7th	4th			
Rc=2.357Rj-7.01		**9.42**	**4.94**	**8.00**	**9.45**	**4.70**	**4.78**	**6.12**		∑Rc	47.41
		Food security dimension	Habitat security dimension	Empower't Security dimension	Occup.l security dimension	Envir.l Security dimension	Water security dimension	Com.p Security dimension			

Where: $\boldsymbol{R_c}$*= Scale value of weighting of each livelihood dimension,* $\boldsymbol{R_j}$*= mean of each livelihood dimension*

Source: Own computation from field survey (2019)

Table 3.1/row16 shows the weights of each livelihood security dimension. For example, dimensional data description shows that the food security dimension has a total of 45 potential indicators and 117 categories. A weight of 9.42 was attached to it. The habitat security dimension has a total of 5 indicators and 13 categories inserted in the first MCA. A weight of 4.94 was attached to it. In turn, the empowerment security dimension (1st ranked weight) has a total of 5 potential indicators and 13 categories inserted in the first MCA. A weight of 8.0 was computed and attached to it. The occupational security dimension (second high judges perceived importance to rural heads) is attached with 9.45 weights and it has a total of 3 potential indicators and 8 categories inserted in the MCA model.

Furthermore, the environmental security dimension having 12 potential variables and 30 categories attached with a 9.45 scale value. Similarly, the water security dimension (sixth component) of the rural households' multidimensional livelihood security index has a total of 13 indicators and 26 categories having judges' perceived importance of 7.78. Last but not least, the community participation security dimension was identified as the seventh major component of the livelihood security index. It has a total of 11 indicators and 24 categories with 6.12 weights. Overall, seven livelihood security dimensions with a total of 92 potential indicators, 224 categories, weights identified and attached. However, not all of the potential indicators and their

categories found key variables. Hence, to identify the major livelihood security indicators used to compute the separate and multidimensional rural households livelihood security indices, further two stages of MCA analysis was made as follows:

Livelihood Security Key Indicators, Categories, And Weights

The potential number of livelihood security data indicators and categories were described under dimensions (above). This section attached non-arbitrary weights to 92 indicators and 224 categories as follows:

Preliminary MCA

To reduce the variables using *preliminary MCA,* the researcher inserted the 92 categorical livelihood security indicators into the MCA model then by observing the preliminary association patterns with the principal axis that was multidimensional livelihood security, the MCA model excluded 12 indicators (months of the year the house households faced food shortage) because the variables did not sufficiently vary with the principal axis and reduced a total of 92 indicators to 80 and 226 modalities/categories to 200.

First MCA

Results

To get the first MCA results of the principal inertia and weights of each indicator, along with the seven livelihood security dimensions, the 80 potential livelihood security indicators and 200 corresponding modalities/categories were interested in the first MCA (Table 3.2).

Table 3.2: First multiple correspondence analysis results

Principal		Percent	Cumulative percent
Dimension	Inertia		
dim 1	.0128893	23.75	23.75
dim 2	.0080666	14.86	38.62
dim 3	.0049222	9.07	47.69
dim 4	.0042747	7.88	55.56
dim 5	.0036764	6.77	62.34
…	….	….	….
dim 35	8.23e-08	0.00	83.97
Total	.0542677		100

Source: Own computation (2019)

Based on Table 3.2, the principal inertia shows the relative importance of each dimension that explains the amount of inertia each dimension explains. Accordingly, out of the total 35 dimensions, dimension one scored the highest amount of explained principal inertia (23.75%)

followed by dimension two with the second-largest principal inertia (14.86%). Dimensions one and two explain 38.63% of the total inertia. This shows us that dimension one/first axis alone captures and explains 23.75% of the total inertia of the multidimensional livelihood security. In other words, the other dimensions comprise a very small percent of the principal inertia. The same table revealed the sum of dimension one and dimension two (38.62%) and the total inertia (sum of all/breakdown of principal inertias of dimensions) equals .0542677(100%). It is the total inertia explained by all dimensions.

Non-arbitrary weights- FAOC property

The main intent of this section was to analyze the association of each livelihood security weight to the principal axis/dimension one (23.75% inertia), thereby, without losing substantial consistency, reduce the number of indicators and corresponding categories. The main criterion used was the First Axis Ordering Consistency (FAOC) property[10]. The variables that have the FAOC property are those obeying the rule that multidimensional livelihood security increases from a position of livelihood insecurity to a position of livelihood security throughout the first axis/dimension one, thereby, proceeded to eliminate some variables based on FAOC. This property is a necessary condition for livelihood security index construction and, thereby, to order rural households according to their multidimensional livelihood security position.

According to this axiom (FAOC property), the modality of the variables indicating livelihood security should have increasing scores on the selected first axis, that is, dimension one. All indicators and categories were non-arbitrarily estimated. A critical investigation of each indicator's weights/singular values[11] contribution to dimension one against FAOC property was made. Those indicators that satisfy the monotonicity or First Axis Ordering Consistency (FAOC) property were retained for the second MCA, otherwise removed. That is, to test whether the model was robust to the underlying properties, thereby, improve the model in a way that satisfies the FAOC property, a review of the behavior of each livelihood security variable was made. For example, *food security indicators* results (standard deviation and FAOC property) revealed that out of the total 33 indicators and 93 categories inserted in the first MCA, only 13 indicators having 52 categories (injera/grain, bread/grain, Wat/pulses, oilseeds or

[10] **FAOC property:** *states that there must be an ordinal consistency between the ordering of categories and the ordering of weights across categories, either in increasing or decreasing order (Asselin2002).*

[11] **Weights/singular values**: *variables correlation with first dimension that represent relative contributions of each indicator to first axis/principal inertia/ dimension one.*

processed oil, milk, butter, egg, potato, vegetables/tomato, carrot and kosta, fruits/orange, banana & avocado, and beverages/tell, Areke & Soft drinks) and having discriminating power or standard deviation above the average/eigenvalue (0.70) and satisfied the FAOC property. Thus, these 33 food security indicators and 93 corresponding categories are non-arbitrary allowed to be inserted in the second MCA; others having a standard deviation less than 0.70 were omitted rationally.

Habitat security indicators results (standard deviation and FAOC property) also revealed that out of the total 5 indicators and 13 categories inserted in the first MCA, only 3 indicators having 9 categories (ownership of house/dwelling, transport facilities, and means of transport) having discriminating power or standard deviation above the average/eigenvalue (0.54) found only one indicator means of transport. Thus, to include more indicators and corresponding categories, the first three variables having the largest standard deviation/most discriminating power and satisfied FAOC property were selected to be inserted in the second MCA. These include ownership of house/dwelling, transport facilities, and means of transportation, others omitted.

Besides, for *empowerment security indicators,* despite average/eigenvalue was computed as 0.43, three empowerment livelihood security indicators having largest standard deviation/most discriminating power and satisfied FAOC property like participation in community service, access to service giving organization, and participation in local planning were inserted in the second MCA. Despite the average/eigenvalue is 0.76, the three indicators having the largest standard deviation/most discriminating power and satisfied FAOC property like employment status, job according to education, and satisfaction with the present working environment was inserted in the second MCA.

Furthermore, to *environmental security indicators,* 6 variables and 18 categories having discriminating power or standard deviation above the average/eigenvalue (0.57) and full filled FAOC property were inserted in the second MCA. These were soil pollution, water pollution, air pollution, soil erosion, and groundwater shortage, and flood or drought-prone condition. Those 6 indicators having 18 categories being less discriminating power or standard deviation below the average/eigenvalue (0.57) like clean drinking water, irrigation use, use of inorganic fertilizer, participation in afforestation, use of bio-pesticide, and soil and water conservation practices were rationally omitted from the re-scaling of the second MCA.

The water security dimension was the sixth component of the rural households' multidimensional livelihood security index. It comprised a total of 13 indicators and 26 categories in the first MCA weights. However, (Table 9.8) identified only 7 indicators and 14 categories that have the largest discriminating power or standard deviation above the average/eigenvalue (0.40). These include pipe water, public water, borehole without a hand pump, borehole with the hand pump and distance from safe drinking water (30 minutes round trip) and hence non-arbitrarily inserted in the second MCA, others omitted because their discriminating power or standard deviation was found less than the average/eigenvalue (0.40). These omitted water security dimension indicators include hand dung wall, dam, pond, lake, running river/stream, and groundwater. Last but not least, the *community participation security dimension* was the seventh major component of the livelihood security index. To non-arbitrarily identify indicators in the second MCA, 12 indicators and 24 categories constituted the community participation dimension.

However, it was found that all of them have large discriminating power (>0.45 standard deviation) and also full-filled the FAOC property. This enabled the researcher to include indicators like government organization, fallowing, crop rotation, manure, use of chemical fertilizer, inter-cropping, terracing, tree planting, soil, and stone band, furrowing, counter plow, and strip cultivation in the second MCA. That means no indicator of the community participation security dimension was omitted from the re-scaling of the principal axis in the first MCA. Overall, out of the total 80 indicators and 200 categories inserted in the first MCA, 45 (60%) indicators and 127 categories that were non-arbitrarily identified have large discriminating power and satisfy FAOC property. While 36 indicators (40%) and 73 categories having less discriminating power and non-FAOC property, those having large discriminating power and satisfy FAOC property were included in the second MCA as follows.

Second MCA

The second/final MCA focused to identify key livelihood security indicators used to construct the separate and composite livelihood security indices of the study area. In other words, set of key livelihood security indicators and corresponding modalities/categories were assumed to differentiate sample households' status of multidimensional livelihood security. Both second MCA and its weights were computed as follows:

Results

The purpose of the second MCA result is to raise the explanatory power of dimensions one from 23.75%/first MCA result to the present second MCA result (Table 3.3).

Table 3.3: Final multiple correspondence analysis results

Principal		Percent	Cumulative percent
Dimension	Inertia		
dim 1	.0224814	26.09	26.09
dim 2	.0140765	16.14	42.43
dim 3	.0087742	10.18	52.61
dim 4	.0068354	7.93	60.54
dim 5	.0032806	5.38	65.92
…	…	…	…
dim 26	3.84e-07	0.00	82.78
Total	0.0861709	100	

Source: Own computation (2019)

As shown in Table 3.3 (above), out of the total 26 dimensions, dimension one scored the highest amount of explained principal inertia (26.09%) followed by dimension two with the second-largest principal inertia (16.34%). This shows us that dimension one/first axis alone captures and explains 26.09% of the total inertia of the multidimensional livelihood security. The other remaining dimensions comprise a very small percent of the principal inertia. The same table revealed the sum of dimension one and dimension two (42.43%) and the total inertia (sum of all/breakdown of principal inertias of dimensions) equals 0.0861709 which was .0542677(100%) in the first MCA result. It was the total inertia explained by all dimensions.

Re-scaled weights

This section intended to get major /key multidimensional livelihood security variables. But to undertake variable reduction and include them in the construction of the composite index, selection of cutoff points was a challenge because different scholars used different cutoff points/singular values. For example, Hair *et al*. (1995) used greater than 0.2, Ezzrari & Verme (2012) used greater than 2.0, and Desawi (2019) used greater than 2.5 weights or singular values. That means, indicators having cutoff points greater than these numbers were retained and included in the list of major/key variables to construct the livelihood security index, otherwise removed and excluded from the composite livelihood security index of each study.

The choice of the cutoff of points of these scholars was based on a rule of thumb[12]. Nevertheless, in the current study a discriminating power or mean of the standard deviation of all the 47 indicators was computed as 0.73. With this cut-off point, water security and community participation security dimension were expected to be eliminated from the livelihood security index. Thus, the researcher used the respective dimension's average/egen value[13] as a cutoff point. That means, any livelihood security indicators having discriminating power or standard deviation greater than the respective dimension's average could be taken as key livelihood security index variable, otherwise excluded from the list of the major/key livelihood security indicators.

Food security key variables include *food* items (13 different food baskets) and frequencies consumed in the last seven days. Thus, a total of (9) indicators and 36 modalities/categories having discriminating power/standard deviation greater than or equal to **1.11** was used to construct rural household's food security index in general and the composite index in particular. Previous studies by Twigg (2001), Baby (2005), and Barela *et al*. (2018) identified several related food security indicators consistent with the current study. *Habitat security key indicators* operationalized as sample heads ownership of house/dwelling, transport facilities, and its means. Despite the cutoff point was 0.69, the researcher decided to include all three variables with 6 categories as key indicators of habitat security indices and that of the composite index. Scholars like Twigg (2001) and Baby (2005) were also used habitat security as their composite index.

In turn, *empowerment security key indicators* for this study denotes rural households' participation in community services, access to service giving institution, and their participation in local planning, implying 3 indicators and 6 modalities/categories were identified to construct habitat security indices of the sample household in the general and composite index of the woreda. Previous studies (Wickramsinghe, 1999; IFAD, 2001; Singh & Hiremath, 2010) identified several related empowerment security indicators consistent with the current study. Whereas, *occupational security key indicators* include employment status, job according to education, and satisfaction with the present work environment and have 3 indicators and 8

[12] **A rule of thumb:** *a broadly accurate guide or principle, based on practice rather than theory.*

[13] **Egen value:** *is in linear algebra is a nonzero vector that changes by a scalar factor when linear transformation is applied to it. The corresponding eigenvalue, often denoted by \lambda, is the factor by which the eigenvector is scaled. Sometimes also known as characteristic roots, characteristic values (Hoffman and Kunze 1971), proper values, or latent roots (Marcus and Minc 1988, p. 144).*

modalities/categories. Previous studies (Twigg, 2001; Baby (2005) identified several related occupational security indicators consistent with the current study.

Environmental security key indicators were operationally focused on the extent of environmental pollution issues [water and air pollution, soil erosion groundwater shortage, and flood/drought on the farm] in the sample household's respective kebele having 5 key indicators and 15 modalities/categories. Previous studies (Wickramsinghe, 1999; Dahl, 1995; Singh & Hiremath, 2010; Baby 92005) identified several related environmental security indicators consistent with the current study. Whereas, *water security key indicators* include access to pipe water, public water, and distance from safe drinking water, rainwater, and spring water, implying that 5 key indicators and 10 modalities/categories were used to develop the water security indices and the overall multidimensional security index. Previous scholars (Dahl, 1995; CARE India, 1997; Twigg, 2001) used water security consistent with the present study as one of the livelihood security dimensions.

A community participation key indicator was operationally defined as the involvement of sample households in government organizations, land management practices, and soil conservation practices on their farmland having 7 key indicators and 16 modalities/categories. CARE India (1997) and Lendernberg (2002) used as another dimension of multidimensional livelihood security index development. Overall, a total of 35 key livelihood security indicators and 110 corresponding categories were used to construct livelihood security indices of each seven dimensions and composite multidimensional livelihood security index of the study area as follows:

3.5.2. Construction Of Livelihood Security Indices

Separate Livelihood Security Indices

So far, based on two major steps of MCA, 35 key livelihood security indicators, 110 categories, and each weight were identified and computed respective indices (Table 3.6 and Figure 3.2). This section aimed to construct separate livelihood security indices for the seven dimensions. The table and figure revealed that sample households were found in different livelihood security indices. For example, UNDP (2016a) Goal 6 states that ensuring availability and sustainable management of water and sanitation for all. In the current study area data was collected from

non-arbitrarily selected five water security indicators and 10 corresponding categories having egen value greater than or equal to 0.47: access to pipe water (egen value=0.47) and access to public water (egen value=0.50), distance from safe drinking water /30 minutes round (egen value=0.50), sources of drinking water like rainwater (egen value=0.48) and spring water (egen value=0.50). The mean *water security index* of the study area was found as 0.468.

The result was triangulated with other water security dimension figures. For example, out of the total 387 respondents, safe and improved drinking water sources (pipe water) at least a 30-minute walk from home (round trip). That is, instead of the pipe water source, rural household heads of the study area were mostly using rainwater (135/35%) and spring water (219/56.6%) sources. Besides, secondary data sources from Woreda Water Office (2017; 2018) also confirmed that the major sources of potable drinking water in the study area include 1st spring, 2nd Tope water, 3rd River, 4th Well, and 5th Pond. Both primary and secondary data sources revealed that access to the potable water source to the rural household heads and their families in the study area was very difficult. As a result of lack of clean drinking water sources in the short distance have multifaceted problems on the health status of rural household heads and their families in the current study area. For example, secondary data source from Jimma Geneti Woreda Health Office (2017; 2018) reported that water-borne diseases like diarrhea 1,331(15%) in 2017 and 418 (15.82%) in 2018, infection of skin 826(9%) in 2017, and 366 (13.83%) in 2018.

A study by Jabeen *et al*. (2011) also revealed health hazards due to lack of potable water like diseases such as typhoid, cholera, hepatitis, worm infestation, diarrhea, skin infection, eye infection, stomach problems, and allergies. Added with water-borne diseases, lack of clean water by rural households also could result in the long-distance walk of women, especially, girls at the expense of their education could have a deterring role on their future capabilities. Above all, it increased the workload of women. Deprivation in drinking water was not exceptional to the current study area. Alemeseged (2016) found a total of 48.7% of rural household heads deprived of drinking water. Similarly, Desawi (2019) found also 43% of rural household heads were deprived of drinking water indicators.

The *empowerment security index* of the sample households' of the study area was constructed from three indicators and 96 categories each having different egen values: participation in

community service (egen value= 0.43), access to service giving institutions (egen value= 0.45), and participation in local planning (egen value= 0.47). It was the second (mean index=0.755) implying that the status of sample households for empowerment security dimension was found not as it ought to be.

The mean *occupational security index* was computed as 0.823. It was developed from three indicators and eight categories: employment status (egen value= 0.1.30), job according to education (egen value= 49) and satisfaction with the present working condition (egen value= 0.50). A consistent result from descriptive statistics also shows that out of the total 358 respondents, the majority of them (255/71.235) owned regular employment. Other sample households owned seasonal employment (56/15.64%), were not able to work due to handicaps (5/1.40%), were daily laborers (41/11.45%), and were salaried workers (1/.28%). However, the majority of them (221/60.22%) don't have a job according to their education. This resulted in the dissatisfaction of 152(44.44%) sample households' with their present working environment. Furthermore, both the current study, Twigg (2001), and Baby (2005) used the occupational security dimension to develop households livelihood security index (HLHSI) and composite multidimensional livelihood security index (MLHSI).

Furthermore, following Lendernberg's (2002) study used *community participation security* (mean index=0.960) in the analysis of the rural households' extent of multidimensional livelihood security. The index was developed from 7 indicators and 16 categories having egen value greater than 0.47: participation in government organization (egen value=1.45), participation in land management practices like (fallowing/field rotation egen value=0.49), manure (egen value =0.50), and use of chemical fertilizer (egen value=0.49), and participation in soil conservation practices like terracing (egen value= 0.50), tree planting (egen value =0.50) and strip cultivation (egen value= 0.49). Descriptive results also e consistent results. For example, out of the total 387 sample households who responded to this item it was found that only 34/9.52% of them participated in government organizations, and did not participated in fallowing/field rotation (230(59.43%), manure (178/45.99%), terracing (204/52.71%), and tree planting(203/52.45%) and used chemical fertilizer (153/39.53%) and practiced strip cultivation (156/40.31%).

Habitat security (mean index=1.137) was constructed from three indicators and nine categories: ownership of housing/dwelling (egen value= 0.43), transport facilities (egen value= 0.48) and

means of transportation (egen value= 1.14). Previous scholars like Twigg (2001) and Baby (2005) also used the habitat security dimension to construct households' composite livelihood security index in general and their habitat security indices in particular. Both indicators were about sample households' housing and basic amenities. Descriptive results also revealed consistent results. For example, out of the total 387 sample households who responded to this item it was found that 316 (92.13%) owned their own house, 107 (36.39%) respond that basic amenities like transport facilities to their house are available and most sample households (194/65.54%) used the house as their major mode of transport facilities.

Environmental security (mean index=1.852) was constructed from five indicators and 15 categories having egen values greater than or equal to 0.71: extent of environmental pollution related indicators (water pollution (egen value= 0.71), air pollution (egen value= 0.71), and soil erosion (egen value= 0.73)), groundwater storage (egen value= 0.71) and flood or drought-prone condition (egen value= 0.75). Descriptive statistics show that out of the 387 total sample households 159(44.79%) and 167(49.97%) respond to the extent of water pollution and air pollution, respectively "somewhat" as opposed to "very much" problem. However, 155(45.19%), 160(48.48%), and 143(42.56%) sample households responded " very much" to the environmental problem related to soil erosion, groundwater shortage, and the seriousness of flood or drought conditions on farmland, respectively. Each response was below the 50% number of samples. Previous studies (Wickramasinghe, 1999; Dahl, 1995; Singh & Hiremath, 2010; Baby (2005) identified several related environmental security indicators consistent with the current study.

The dominant livelihood security component, *food security* (mean index=3.01) was constructed from sample head data on food consumed baskets on seven days recall bases and divided into 9 indicators and 36 categories, having egen value[14] greater than or equal to 1.11. These types of food baskets include bread/grain (egen value=1.35), meat including chicken (egen value=1.16), milk (egen value=1.17), butter (egen value=1.23), egg (egen value=1.18), potato (egen value=1.33), vegetables/tomato, carrot & kosta (egen value=1.20), spices/ salt and zinjibil (egen value=1.11), and beverages/tella, areke and soft drinks (egen value=1.31). Out of the total 387 sample households consumed bread once/day (201/51.94%), twice/day (51/13.16%), and three

[14] Egen value: used to identify key livelihood security indicators in the construction of each livelihood security dimension indices (see, final MCA, Table 9.12, above).

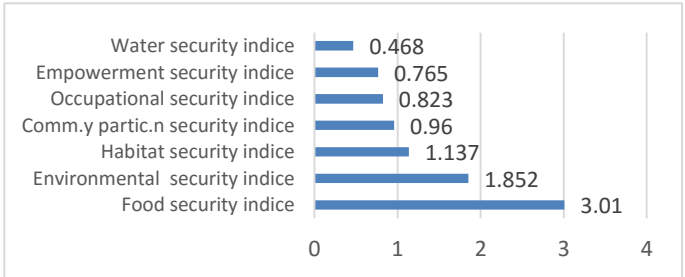
times/dy (11/2.84%). However, 124/32.04% consumed never at all in the last seven days before this study. The later sample household's missed eating food items (bread) full of carbohydrates in the last seven days preceding the current study. Different results were also revealed in the other eight food security indicators. Furthermore, concerning the month household food insecure, primary data was collected on the twelve months (January- December). Most sample households responded that they are food insecure during July (238/61.50%) and August (256/66.15%), implying that households are highly food insecure during August. The potential reasons for sample households' food insecurity during lean periods (July and August) are due to stock clearance for seeds during the agricultural calendars. In the study area, July and August months are know for non-harvesting times. It also implies that sample households of the study are failed to produce sufficient food for households. That is, sample households' grain stock is full during the harvesting seasons such as December to February).

In the above paragraphs, 242 (62.53%) households responded to food insecurity to families throughout the year. The main reasons for food insecurity include the inability to produce sufficient grains (317/82.12%, inability to rear sufficient livestock (251/65.03%), meager financial income (228/59.07%), drought/shortage of rainfall (149/38.34%), shortage of farmland (266/68.91%) and shortage of oxen (170/44.04%) as the major reasons being food insecure status. They identified a limited amount of food consumed (155/40.05%), no food at all (12/3.10%), skip a meal (63/16.28%), sleeping hungry (74/19.12%), children first (162/41.86%), meal size reduction (66/17.05%), borrowing from neighbor/relatives (47/12.14%), working on other farms (59/15.255), livestock disposal/de-stocking (189/48.84%), change cropping pattern (47/12.14%), migration to nearby towns for labor (80/20.67%) and sell off small animals (107/27.65%) as coping strategies for mitigating family's food poverty.

Table 3.4: Inter-household inequality of livelihood security indices of each dimension

LHS dimensions	LHS category	Mean/ indices	Std. dev
Water security indices	**Low**	0.468	0.238
Empowerment security indices	**(≤0.755)**	0 755	0.3 2
Occupational security indices	**Middle**	0.823	0.467
Comm. participation secu. indices	**(>.755-**	0.960	0.359
Habitat security indices	**≤1.137))**	1.137	0.457
Environmental security indices	**High**	1.852	0.553
Food security indices	**(>1.137)**	3.01	0. 89

Figure 3.2: Ranking inter-household inequality of livelihood security indices in order of ascending significances



Source: Own computation (2019)

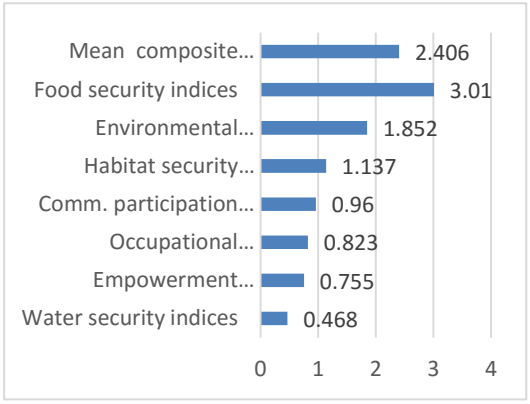
Composite Livelihood Security Index

To compute the overall multidimensional livelihood security index (MLHSI) of the sample households of the current study area, major procedures of the previous studies (Baby, 2005; Singh & Hiremanth, 2010; Rahman & Akter, 2010; 2014; Akter, 2012) adhered. The result is stipulated under Table 3.5.

Table 3.5: Composite livelihood security index of sample households at woreda level (N=387)

LHS indices	Mean index	St.Dev
Water security indices	0.468	0.238
Empowerment security indices	0.755	0.332
Occupational security indices	0.823	0.467
Comm. participation security indices	0.960	0.359
Habitat security indices	1.137	0.457
Environmental security indices	1.852	0.553
Food security indices	3.01	0.689
Mean composite index	**2.406**	**0.907**

Figure 3.3: Livelihood security indices of each dimension



Source: Own computation from field survey (2019)

Table 3.5 shows the overall livelihood security index of the current study area was 2.406. When compared to the finding of CARE India (1997) it implies the result was greater than that of Baster/India (1.9). The same table further revealed that the sample kebeles were on the fragile end of the rural households' multidimensional livelihood security index equilibrium.

3.5.3. Decomposition of Livelihood Security Indices

Decomposition of both separate and composite livelihood security indices results enables this study to rank sample households according to their livelihood security portfolios.

Decomposition of Separate Livelihood Security Indices

By livelihood security equilibrium (0-5 scale)

Table 3.6: Decomposition of separate livelihood security indices by different livelihood security categories

LHSI <1.137	≥1.137<LHSI≤3.0	High end: ≥3.0
The lower end of the equilibrium (Serious livelihood security indices)	Middle of the equilibrium (Fragile livelihood security indices)	The upper end of the equilibrium (Well livelihood security indices)

Source: Own classification (2019)

Lower Equilibrium Scale [LHSI <1.137]: As shown above, the water security index (0.468) was found at the end of the livelihood security equilibrium implying serious livelihood security of

sample heads. When compared the result was less than that of the Basar/Index reported by CARE India (1997). The result was found against Goal 6 of the UNDP (2016a). The empowerment security index (0.755) was another separate livelihood security found at the lower end of the livelihood security equilibrium implying that the study area empowerment livelihood security index is higher than that of Bangladesh with the mean index of 0.108 reported by Rahman & Akter (2014). Both results imply serious empowerment security conditions.

Besides, the occupational security index (0.823) shows sample heads were found in a state of serious livelihood security condition. Compared to the findings of Baby's (2005), the current study area occupational security index was higher than the three farmers categories' occupational security index in India (/ 0.44 mean index), marginal farmers (0.49 mean index), and small farmers (0.75 mean index). Besides, the community participation security index (0.960 mean index) of the study area was found at the end of the livelihood security equilibrium. The result was by far less than the community participation security mean index (1.25) Bastar of India computed by CARE India (1997).

Middle Equilibrium Scale [$\geq$1.137<LHSI$\leq$3.0]: The habitat security index (1.137 mean index) of the study area was found in the middle of the livelihood security equilibrium. Also, the environmental security index (1.852 mean index) was found in the same category. The state of the environmental security index of the current study was found higher than that in India reported by Baby (2005) laborers (0.80 mean index), marginal farmers (0.69 mean index), and small farmers (0.78 mean index).

Higher Equilibrium Scale [$\geq$ 3.0]: The food security index (3.01 mean indexes) was the only livelihood security indices found in the well-protected livelihood security equilibrium in terms of availability of food baskets at the household level throughout the year except for the three lean periods. The potential reason is that the woreda is well known in its crop and animal production (Woreda Agriculture office, 2017; 2018) and hence found not in the list of the Oromia Food insecure woreda (Oromia Bureau of Agriculture, 2009). The result was found higher than that of food security dimension index of developing countries, for example, India computed by Baby (2005): laborers (0.43) and marginal farmers (0.65), Rahman & Akter (2014) (0.555) in Bangladesh, and Bareta *et al*. (2018) (0.407) in India. But lower than small farmers of India (0.88) computed by Baby (2005) and CARE India (1997) who computed food security index as

2.3 on a scale of 1-5 points. These classifications of livelihood security domains show that irrespective of location/kebele differences in opportunities, sample households of the study area appear equally insecure in terms of potable water supply, empowerment, occupational and community participation securities. This does not mean that call for the same intervention strategy is equally applicable everywhere in kebeles. There are location/ kebele differences in the component indicators. Access to assets/capital endowment should be taken into consideration to design program intervention to improve the water, empowerment, occupational and community participation securities of the sample heads. Areas, where springs, farmlands, livestock, and fishing activities are more accessible, should take as an opportunity to improve the current status. More specifically, water-enhancing policies are equally suitable everywhere.

Decomposition of a Composite Livelihood Security Index

The study decomposes the overall livelihood security index of the study area by livelihood security categories, farming system, kebele, sample heads distribution, and MDP poverty categories, respectively.

By multidimensional livelihood security categories

Table 3.7: Decomposition of composite livelihood security indices by different livelihood security categories

MLHSI ≤1.606243	1.606243<MLHSI≤1.67608	High end: above 1.67608
Low (Serious livelihood security indices)	Medium (Fragile livelihood security indices)	The upper end of the equilibrium (Well protected livelihood security indices)

Source: Own classification (2019)

Based on the classifications of multidimensional livelihood security index ranging from low or serious livelihood security index (1), medium/fragile multidimensional livelihood security index (2), and well-protected multidimensional livelihood security index (3), it was found that five out of the seven livelihood security dimensions were categorized under low or serious livelihood security conditions. These include water, empowerment, occupational, community participation, and housing securities. Thus, rural multidimensional livelihood security-enhancing intervention strategies are required. No multidimensional livelihood security domain was found under the medium category. Furthermore, it was found that only two livelihood security dimensions like environmental livelihood security (1.852) and food security dimension (mean index= 3.01) were found in the range of well-protected livelihood security dimensions. A similar finding by Baby (2005) reported that rural household food and environmental securities emerged as the most important dimension in India, too. Nevertheless, a contrary result was reported by Barela *et al*. (2018) that the social security dimension but not the food security dimension has emerged as an

important dimension for their study area. In turn, according to CARE (1997) only education security (mean index=2.705) and primary health care (mean index=3.125) were above the midpoint of the overall livelihood security index (mean index=2.5). Thus, when decomposed in terms of livelihood security categories, it is possible to conclude that the state of rural household's multidimensional livelihood security in terms of water security, empowerment security, occupational security, community participation security, and habitat security dimensions required quick programming responses to help rural households improve their lives.

By farming system

Sample households' of the current study area were also distributed according to their farming systems (Table 3.8). Results of the same table revealed that high landers have contributed the highest number (51) of sample households into the low MLHSI category followed by plain area (36) and coastal area (25) residents. Whereas, 4 sample households from the plain area and 2 sample households from the coastal area contributed to the medium MLHSI category. However, the majority of the sample households (102) from high land areas followed by plain area (90) and coastal area (77) were categorized under the high MLHSI category. Hence, sustainable rural multidimensional livelihood security improving policies targeting highlanders should be designed followed by plain and coastal areas, respectively.

Table 3.8: Classification of households' MLHSI by farming system (N=387)

Farming Type location	MLHSI categories			
	1	2	3	Total
Highland	51	0	102	153
Plain area	36	4	90	130
Coastal area	25	2	77	104
Total	112	6	269	387

Legend

1: Low category(MLHSI ≤1.606243)
2: Medium (1.606243<MLHSI≤1.67608)
3: High category (MLHSI >1.606243)

Source: Own computation from field survey (2019)

By kebele of sample heads

Table 3.9, below presented the decomposition of rural households' multidimensional livelihood security index by sample households' kebele. Results show that out of the total 387 sample households 112/28.94% sample households from the twelve kebeles categorized under low MLHSI highest from Adi Leka Tulu Chali kebele, 6(0.02)categorized under medium MLHSI category highest from Gudetu Jimma kebele and majority 269/69.5% categorized under high MLHSI category highest from Hunde Gudina kebele followed by Gudetu Jimma Kebele. Households from Gudetu Jimma and Hunde Gudina Keble are found a high percentage of

MLHSI potentially because they are highly accessible to irrigation facilities (enhanced livelihood potentials) as compared to less number of sample households from Adi Leka Tulu Chali and Gidami Dabsho kebeles counting a high number of sample households under low MLHSI category. Hence, while improving the multidimensional livelihood security issues of sample heads in the study area, intervention strategies targeting first Adi Leka Tulu Chali kebele followed by Gidami Dabsho and Balballa Sorgo kebeles are required.

Table 3.9: Classification of households' MLHSI by kebele (N=387)

Kebele	MLHSI categories			
	1	2	3	Total
Gudetu Jimma	7	3	36	46
Kulala Didimtu	3	1	25	29
Gudetu Geneti	11	0	21	32
Gidami Dabsho	16	1	17	34
Balbalaa Sorgo	14	0	17	31
Gamo Nagaro	6	0	22	28
Adi Leka Tullu Chali	20	0	13	33
Charo Gabano	5	0	25	30
Damu Gembo	9	0	10	19
Lalisa Biya	7	0	26	33
Hagaya	9	1	7	17
Hunde Gudina	5	0	50	55
Total	112	6	269	387

Legend

1: Low category(MLHSI ≤1.606243)

2: Medium (1.606243<MLHSI≤1.67608)

3: High category (MLHSI >1.606243)

Source: Own computation from field survey (2019)

By sample heads

The average livelihood security index of sample households in Jimma Geneti woreda was measured using the arithmetic mean. Then, categorized according to the three livelihood systems of the households involved in the study. Results of Table 3.10 show that when sample households of the study area are distributed across different categories of multidimensional poverty index, it was found that 112 (28.94%) found under low category, 6(1.55%) found under medium category, and the majority (269/69.51%) found under the highest category. This doesn't mean that sample heads of the study area are well secured in terms of the seven multidimensional livelihood security domains. They distributed more across the high category due to the majority of the sample heads of the study are food secured in all months (except August and July months) as compared to the other livelihood securities. The result was inconsistent with the finding of Barela *et al*. (2018) who reported that 48.33% of sample households were under a low composite multidimensional livelihood security index.

Table 3.10: Classification of households as per their mean MLHSI (N=387)

HHs according to their MLHSI category	Frequency & Mean MLHSI			Range			S.D
	N	%	Mean	Max	Min	Range	
Low (≤1.606243)	112	28.94	1.317	1.676	0.893	0.783	0.163
Middle (>1.606243 & LSi<=1.67608)	6	1.55					
Highest (>1.67608)	269	69.51					
All households	387	100	2.406	3	1	2	0.907

Source**:** Own computation from field survey (2019)

By MDP categories

The researcher has also classified sample households' state of MLHSI by their multidimensional poverty decompositions (Table 3.11).

Table 3.11: Classification of households' MLHSI by MDP categories (N=387)

Poverty category	MLHSI categories			
	1 Low category (≤1.606243)	2 Medium category (>1.606243 & LSi<=1.67608)	3 High category (>1.67608)	Total
MPI severe poor	186	88	3	277
MPI poor	43	10	2	55
MPI vulnerable	39	14	1	54
MPI non-poor	1	0	0	1
Total	269	112	6	387

Source: Own computation from field survey (2019)

The results under the table are a clear indication of the inverse association between rural households' state of multidimensional poverty and their livelihood depletions. That is, 186 sample households who are MPI severe poor were grouped under the low MLHSI category. Ellis (1999) states that rural livelihood security diversification can improve household livelihood security, thereby, reduce poverty. Consistently, livelihood diversification helps households combat instability in income and thereby increases the likelihood to maintain livelihood security and reduce vulnerability to poverty (Choung *et al*., 2015). Specific food security dimension as one element of multidimensional livelihood security index, World Bank (2015) reported that under the right conditions, a 10% increase in fertilizer use […production and productivity increased…] would reduce poverty by 0.4%. Conversely, the higher the depletion of multidimensional rural livelihood security, the more sample heads MPI severely poor. These results imply that by improving the multidimensional livelihood security state of rural households one can also reduce their multidimensional poverty, too. Hence, a rural

development policy targeting rural multidimensional livelihood security enhancement shouldn't is undermined.

3.5.4. Determinants of Multidimensional Livelihood Security

Diagnosis Tests for Ordered Logit Model

A diagnosis test of multicollinearity assumptions for six discrete variables using *pwcorr command* was done (Table 3.12). This was done using coefficients of contingency [chi-square /χ^2 based measure of association]. If it varies the degree of associations among dummy explanatory variables (greater than 0.75), the parameter estimate would seriously be affected by the presence of multicollinearity among variables. However, in the case of the current study there was no value 0.75 or above that indicates a stronger relationship between dummy or explanatory variables, no serious multicollinearity problem.

Table 3.12: Multicollinearity Test of ologit model six discrete variables

	s2_q7	s3_q12	s3_q15	s3_q17	s4_q57	s4_q62
Agro-ecology (s2_q7)	-					
Sex of HH (s3_q12)	0.0315	-				
Marital status of HH (s3_q15)	-0.0189	-0.0693	-			
Literacy of HH (s3_q17)	0.0918	-0.1155	-0.1197	-		
Member of cooperative (HH) (s4_q57)	0.0448	0.0028	0.0378	0.0069	-	
Member of social group (HH) (s4_q62)	0.0371	0.0317	0.0202	0.2056	0.1703	-

Source: Own computation from field survey (2019)

Besides, no multicollinearity assumptions test among five continuous explanatory variables (Table 3.13). A rule of thumb of VIF>10 detects serious multicollinearity problems, otherwise, no multicollinearity problem. In this study, looking into the same Table 3.13, above show no multicollinearity (VIFs <10) implying that the assumption of the ologit model was met and possible to trust coefficients and P-value in the analysis of the determinants of rural households multidimensional livelihood security. That is, the ologit model is fitted to the current data.

Table 3.13: Multicollinearity Test of ologit model five continuous variables

Variables	VIF	TOLERANCE= 1/VIF
Live stockholding (TLU)	1.14	0.880471
Landholding (hectare)	1.11	0.897747
Family size	1.07	0.934229
Age	1.06	0.945266
Dependency Ratio	1.01	0.986380
Mean vif	1.08	

Source: Own computation from field survey (2019)

Determinants of Rural Households' Multidimensional Livelihood Security

Table 3.14, below suggests one out of eleven independent variables affecting sample heads' multidimensional security in the study area.

Table 3.14: Determinants of multidimensional livelihood security

MLHSI categories	Coef.	Std. Err.	z	P>z	Odds Ratio
Agro-ecology/farming system (s2_q7)	0.2570948	0.1828841	1.41	0.16	1.293168
Sex of the HH head (s3_q12)	0.0672364	0.4641826	0.14	0.02**	0.9349741
Marital Status of HH head (s3_q15)	0.0435661	0.1700149	0.26	0.01***	1.044529
Literacy level of HH head (s3_q17)	-0.4125869	0.2221171	-1.86	0.063	0.6619357
HH member of social group (s4_q57)	-13.38605	1060.854	-0.01	0.99	1.54E-06
HH member of cooperatives (s4_q62)	0.9403146	0.4195972	2.24	0.025**	0.390505
Age of the HH head	0.4387658	0.3500459	1.25	0.03**	0.6448318
F_size of HH head	0.2845682	0.2382443	1.19	0.04**	0.752339
Live stockholding (TLU)	-0.040397	0.0283433	-1.43	0.154	0.960408
Dependency Ratio (DR)	-1.238719	0.6518219	-1.9	0.00***	0.2897551
HHs' landholding (s4_q75)	0.101552	0.0955213	1.06	0.00***	0.9034342
/cut1	-17.69208	1060.854			-17.69208
/cut2	-17.63025	1060.854			-17.63025

Note: ***, **, * significant at 1% (for significant p-value<0.01), 5% (for significant 0.01<p-value<0.05), and 10% (for significant p-value>0.05), respectively.

Source: Own computation from field survey (2019)

Based on the results of Table 3.14, seven out of eleven explanatory variables significantly affected rural households' state of multidimensional livelihood security. The details are as follows:

Sex of the HH head: As expected, the result of the ologit show positive (β= 0.0672364) and at 5% statistically significant (p-value= 0.02>0.05) effect of the sex of the household heads on multidimensional livelihood security implying that being a male-headed household, log of the odds of multidimensional livelihood security improves by 93% compared to female-headed households. This was so because in rural areas of the study area man has more access to seven multidimensional livelihood security domains than a woman. Akter (2012) reported an insignificant effect of sex on multidimensional livelihood security.

Marital Status of HH head: As assumed, the result of the ologit above show positive (β=0.0435661) and at 1% significant (p-value= 0.01 < 0.05) effect of the variable marital status of multidimensional livelihood security, implying that the log of odds multidimensional livelihood security get enhanced by 104% for married heads than single or unmarried heads. The

potential reason may be the more the household head gets married there is high the probability of couples' participation in different multidimensional livelihood security domains. Akter (2012) reported an insignificant effect of marital status on multidimensional livelihood security.

HH member of cooperatives: consistent with the hypothesis, the result of the ologit show positive (β=0.9403146) and at 5% statistically significant (p-value= 0.025 < 0.05) effect of the variable member of cooperatives on sample heads multidimensional livelihood security, implying that the log of odds multidimensional livelihood security get enhanced by 39% for cooperative members than non-members. The potential reason maybe being a member of cooperatives, household heads get the opportunity to work jointly with other heads. This could enable them to learn from each other about all the impacts of the seven livelihood security components, thereby, refrain from working against each security element. The result is consistent with the findings of (Champer & Conway, 1992; Scoones, 1998; Carney *et al*., 1999; Ellis, 2000b).

Age of the HH head: the result of the ologit show positive (β=0.4387658) and at 5% significant (p-value= 0.03< 0.05) effect of the variable age of the heads on sample heads multidimensional livelihood security, implying that the log of odds multidimensional livelihood security get enhanced by 64.5% for households long years of experiences than those with lesser age and fewer experiences in protecting overall livelihood security dimensions. In other words, Age/proxy of the overall experience of the household head was found to significantly increase the probability of the respondents being empowered, thereby, well-protected multidimensional livelihood security. Akter (2012) reported an insignificant effect of age on multidimensional livelihood security.

F_size of HH head: In their study, Rahman & Akter (2014) reported that family size has positively and significantly increased the probability of being food secure and empowered. On contrary, Akter (2012) reported that family size reduces the probability of rural households' multidimensional livelihood security because the larger the family size the more they are demand basic needs, thereby, affect it negatively. However, this study assumed that family size has a positive and significant effect because the bigger availability of family labor means, more members bring more resources to the households; for example, produce more food due to the availability of family labor. Consistent with the report of Rahman & Akter (2014) and current

assumption, the result of the ologit show above revealed positive (β=0.2845682) and at 5% significant (p-value= 0.04 < 0.05) effect of the variable on sample heads multidimensional livelihood security, implying that the log of odds multidimensional livelihood security get enhanced by 75% as household heads age get increased. However, the results were found inconsistent with the report of Akter (2012).

Dependency Ratio (DR): was assumed to negatively affected rural households' composite livelihood security because the more the dependents the more their demand for basic needs. Consistently, the result of the ologit also shows negative (β=-1.238719) and at 1% significant (p-value=0.00< 0.05) effect of the variable on sample heads multidimensional livelihood security, implying that the log of odds multidimensional livelihood security get enhanced by 28.9% as households dependency decreases. The result is consistent with Akter (2012) and Rahman & Akter (2012; 2014).

HHs' landholding: Consistent with Akter (2012) and the assumption of the current study, the landholding variable was found positive (β=0.101552) and at 1% significant (p-value= 0.00 < 0.05) effect of the variable on sample heads multidimensional livelihood security, implying that the log of odds multidimensional livelihood security get enhanced by 90.3% as households' ownership of larger landholding in hectare than those smallholders and landless households. The potential reason is that land is the main source of the wealth of rural households (i.e. food security).

3.6. Key Results, Conclusions, and Recommendations

3.6.1. Key Results

To draw conclusions and recommends, the following key results are identified:

1. Despite wide livelihood security considerations, food security and nutritional security status and determinants of rural households have been enormously studied both in rural development, food security, and other fields. It is about the protection of the present multidimensional livelihood security, thereby; assure sustainable development for the next generation. Hence, the current study focused to describe its status and investigate its determinant, too. Responses were made to specific questions related to its current status in terms of the seven livelihood security components (food security, habitat security, empowerment security, occupational security, environment security, water security, and

community participation security) indices. The scale values/weights of each livelihood security dimension were determined using Guilford's (1954) Normalized Rank Order Method. However, non-arbitrary weights were attached to key livelihood security indicators using the multiple correspondence analysis (MCA) method. Results show that the overall livelihood security index of the current study area was 2.4.

2. Results further evidence that the separate livelihood security domains as food security (mean index=3.01), environmental security (mean index=1.852), water security (mean index=.468), empowerment security (mean index=.755), occupational security (mean index=0.823), community participation security (mean index=0.960), and habitat security (mean index=1.137), implying that food security alone having mean index above the composite livelihood security index significantly contributed to the majority of sample households in a state of highest MLHSI category. By implication, the other livelihood security indices like water security, empowerment security, occupational security, community participation security, and habitat security have contributed to sample households in a state of serious or fragile multidimensional livelihood security equilibrium. Based on the above results it is also possible to imply that there exist inter-household inequalities of livelihood security indices in the study wereda.
3. The other findings show that high landers have contributed the highest number (51) of sample households into the low MLHSI category followed by plain area (36) and coastal area (25) residents, implying the need for multidimensional livelihood security interventions in the highland area of the woreda followed by plain and coastal areas.
4. In terms of kebele, being highest from Adi Leka Tulu Chali (20HHs) followed by G/Dabsho (16HHs) kebeles was found mostly in a fragile state of multidimensional livelihood security, a total of 112 (28.94%) of sample households from the twelve kebeles were categorized under low MLHSI.
5. Moreover, results of the ologit model show that Sex of the HH head, Marital Status of HH head, HH member of cooperatives, Age of the HH head, F_size of HH head, Dependency Ratio (DR), and HHs' landholding are found a statistically significant effect on their state of multidimensional livelihood security in the study area.

3.6.2. Conclusions

Based on the above key results, three major and silent conclusions are drawn:

1. Inter-household inequality of livelihood security indices in the study wereda.
2. A fragile state of multidimensional livelihood security prevails in all agro-ecology/farming systems but is serious in highland areas
3. The fragile state of multidimensional livelihood security prevails in all the 12 kebeles but is serious in Adi Leka Tulu Chali and G/Dabsho kebeles

3.6.3. Recommendations

Based on the above key results and conclusions drawn, the following recommendations are made:

1.The narrow considerations of rural households' livelihood security (food security and/or nutritional security only) dominated the analysis of the desired outcomes of the rural households' livelihood portfolios. In contrary to the previous studies, the current study analyzed rural households' livelihood security and its determinants holistically, thereby, developed composite and separate livelihood security indices of the sample households. It was based on the assumption of the MLHSI approach is a rapid look at actual rural households' livelihood security status and response programs. That is, the approach is one vehicle that can help us to understand both constraints to rural households' multidimensional poverty alleviation and can help very effective design, thereby, help sample households in a state of fragile livelihood security make their rural life a better living place. Results show that the overall livelihood security index of the current study area was 2.4 concluding that 28.94% of respondents were found under the low category, 1.55% under the medium category, and 69.51% under the highest or in a state of well-protected multidimensional livelihood security equilibrium category.

Food security index (mean index=3.01) has the highest share in the current status of composite livelihood security followed by environmental security (mean index=1.852), habitat security (mean index=1.137), community participation security (mean index=0.960), occupational security (mean index=0.823), empowerment security (mean index=.755) and water security (mean index=.468) respectively in order of their contribution from high to least. So, improving the current state of rural households having a mean index less than the overall livelihood

security index like water security, empowerment security, occupational security, and community participation security requires policy strategies and programs. Because, improving the current status of these separate livelihood security indices could increase the overall multidimensional livelihood security status from the high category to the highest category, thereby, enable rural households to cope up with and recover from multiple occurrences of shocks and hence reduce their vulnerability and severe multidimensional poverty status.

2. However, other findings show that while high landers have contributed the highest number (51) of sample households into the low MLHSI category followed by plain area (36) and coastal area (25) residents. These results call for action-oriented multidimensional livelihood security interventions in the highland area of the woreda followed by plain and coastal areas, respectively through a government partnership with sample households. A public-rural household partnership is required because the aim of the multidimensional livelihood security analyses invites rural households at the grass-root level to rapidly identify their livelihood status and design for a quick programming response and implementations by themselves. It avoids underprivileged rural households from kebeles in a state of fragile livelihood security (for example, ALT/Chali and G/Dabsho kebeles) waiting for the impacts of the national economic reforms to trickle down. The multidimensional micro-level livelihood security baseline data enables policy researchers to analyze the lag between macro policy reform, trickle-down benefits, and impacts on the grass-root household level. Government involvement is required for both constraints beyond the households in a state of fragile or serious multidimensional livelihood security.

3. Moreover, the results of ologit show that the explanatory variables like Sex of the HH head, Marital Status of HH head, HH member of cooperatives, Age of the HH head, F_size of HH head, Dependency Ratio (DR), and HHs' landholding have statistically and significantly impacted on the rural households' overall multidimensional livelihood security. This result evidenced the need for government multidimensional livelihood security intervention strategies from the side of Sex of the HH head, Marital Status of HH head, HH member of cooperatives, Age of the HH head, F_size of HH head, Dependency Ratio (DR), and HHs' landholding.

CHAPTER FOUR
RURAL HOUSEHOLDS' MULTIDIMENSIONAL[15] AND PARTICIPATORY POVERTY ANALYSIS IN JIMMA GENETI WOREDA[16]

Abstract: *As the estimates of the multidimensional approach indicate rural households' poverty is still widespread and severe everywhere: 1.45 billion people worldwide and 49% in Ethiopia are found to be multidimensional poor. However, several scholars argue that rural households' voices are missing from multidimensional approaches. The need for a combination of rural poverty analysis is a key to better estimate poverty. Thus, the objective of this study is to analyze the level of poverty and identify determinants of rural households' poverty using a combination of two approaches in Jimma Geneti A mixed-methods approach is used to achieve the research objective. Primary data were collected woreda, Ethiopia. from 387 randomly and 90 purposively selected households using survey questionnaires, in-depth unstructured and semi-structured interviews, and focus group discussions. Data through the MDP approach is analyzed using multidimensional poverty index, whereas, participatory poverty index (PPI) for participatory poverty analysis. Furthermore, the ordered logistic regression model and participatory scoring matrix are used to analyze the determinants of poverty using a multidimensional approach and participatory approach, respectively. Both approaches revealed enriched results of severely poor households. As the two approaches identified overlapping dimensions and indicators there are also missed dimensions and indicators Furthermore, while results of the ordered logit regression analysis indicated that kebele dummy, marital status, literacy status, farm size, and membership to cooperatives of households are found to be significant determinants of multidimensional poverty, participatory scoring matrix identified old age, illness, lack of farmland, a few livestock and being women-headed as perceived determinants of poverty. These results show us that both approaches could capture comprehensive rural poverty status and yet enable decision-makers to eradicate rural poverty and make it a history. Therefore, now, it is possible to conclude that the use of both approaches by rural households' state of poverty researchers and development planners is an issue that shouldn't be circumvented.*
Keywords: Rural households, MPI, PPI, ologit model, participatory scoring matrix, Jimma Geneti Woreda/ Ethiopia

4.1.Introduction

When rural households' poverty is estimated using the multidimensional approach, there are four competing multidimensional poverty theories/approaches. First, the Theory of Fuzzy sets/Totally Fuzzy approach (TFA) denotes characterizations of lists of deprivations indicators assumed to measure each particular aspect of poverty (Filippone *et al*., 2001; Lutz, 2004; Deutsch & Silber, 2005; Costa & Angelis, 2008; OPHI, 2009; Betti *et al*., 2014; Delalic *et al*., 2017). Second, information theory denotes weights to be attached each indicator (Deutsch & Silber, 2005; Lugo & Maasoumi, 2007; Kakwani & Silber, 2008; Asselin, 2008; Vivien *et al*., 2013; Aberge & Brandoline, 2014; Caldern & Kovacevic, 2015). According to Calderon & Kovacevic (2015) when weights attached to all indicators are summed up the result equals one. Third, efficiency analysis is another approach that states to designate someone as poor or non-poor, information

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on different indicators of well-being or poverty should be brought into one/aggregation index called multidimensional poverty index (Deutsch & Silber, 2005; Wagle, 2008; OPHI, 2014a; Alkire *et al*., 2015; Afonso *et al*., 2015; Wang & Wang, 2016). Fourth, capability theory/ axiomatic derivations approach developed after Sen (1981) and as general theoretical framework widely used in multidimensional poverty analysis denotes poverty is multidimensional and its measurement requires multidimensional poverty indices (Deutsch & Silber, 2005; Chakravarty, 2006; Alkire & Foster, 2008;2011; Rolf & Eugenio,2012; Datt, 2013;2018; Rolf & Andrea, 2014; Dhongde & Haveman, 2015; Bérenger,2016).

Sen's (1981) capability theory/ axiomatic deprivation approach guided the study. The major reasons include it is simple for analysis of multidimensional poverty (OPHI, 2018), its MPI decomposability into various socio-economic characteristics of rural poor, its flexibility compared to the rigidity of the monetary approach to include many deprivation dimensions and indicators, it doesn't need linear regression's test for normality, linearity, homogeneity, multicollinearity, autocorrelation, and homoscedasticity assumptions. That is, it is assumption-free. Besides, the capability theory/ axiomatic deprivation approach doesn't necessarily require tests for post-estimations. Above all, capability theory/ axiomatic derivations approach of Sen (1981) was chosen because it has been commonly used by previous multidimensional poverty researchers (Deutsch & Silber, 2005;Chakravarty, 2006; Alkire & Foster, 2008;2011; Rolf & Eugenio ,2012; Datt, 2013;2018; Rolf & Andrea, 2014;Dhongde & Haveman, 2015; Bérenger,2016; Alemeseged, 2016; Desawi, 2019).

Sen (1976; 1981; 1985; 1992) conceptualized capability as a combination of various functioning [achievements] a person can achieve to be able to live longer, to be well-nourished, healthy, and literate. Contrary to the monetary definition of poverty (lack of income), it was after the conceptualization of capability theory that led researchers to redefine poverty as a multidimensional phenomenon. It coined the new name multidimensional poverty that refers to lack of capabilities or deprivations such as low levels of health and education, poor access to clean water and sanitation, inadequate physical security, lack of political voice, and insufficient capacity and opportunity to better one's life (Sen 1976; 1981; 1985; 1992; World Bank, 2004; 2014; Alkire & Santos, 2010b; Alkire & Foster, 2008; 2011; UNDP, 2014a; 2014b; OPHDI, 2017; 2018).

Concerning poverty estimates, traditionally poverty has been measured using a one-dimensional monetary approach. Given the importance of other dimensions of rural poverty, previous studies like World Bank (2014), OPHI (2014a; 2014b; 2014c), Amao *et al*. (2017), OPHI (2017;2018), and UNDP (2019) underscore the importance of non-monetary measures of poverty analysis.

Contrary to the MDP approach to rural households' poverty estimate, Participatory Poverty Analysis (PPA) is a qualitative approach to identify the poor from the non-poor (Chambers, 1994a; 1994b). In other words, contrary to income poverty, rural households' conceptualized poverty as multidimensional (Citro & Robert, 1995; Majeed & Malik, 2014; Melaku, 2016). Likewise, different related approaches guide the analysis of rural households' poverty qualitatively. Zaid *et al*. (2006) documented four competent participatory methods. These are quantitative methods that generate numerical data, qualitative methods explore meanings, top-down methods essential decisions (information to be gathered and how it to be collected) are made by specialists, and participatory methods local people have active participation. The latter is again divided into four other competent participatory methods presented as *First*, rapid rural appraisal (RRA) developed in the 1970s and 1980s refers to series of information collection techniques, *Second*, participatory rural appraisal (PRA) replaced due to frequent critics made against RRA (extractive and highly dependent on expert interpretation).

PRA is carried as teamwork that refers to a family of approaches, methods, attitudes, and behaviors and enable and empower people (Chambers, 1994a; 2004; World Bank, 1996; Duraiappah, *et al*., 2005; Zaid *et al*., 2006), *Third*, participatory learning and action (PLA) interchangeably used with PRA and extremely effective in tapping the unique perspectives of the rural poor (Zaid *et al*., 2006), and *Fourth*, participatory poverty analysis (PPA) refers to an "instrument of poverty reduction and aim to improve the effectiveness of poverty reduction policies through the understanding of those experiencing it"(Norton, 2001:6). Now, it is time to rationally select the most relevant participatory poverty analysis of this study. Accordingly, participatory poverty analysis (PPA) was chosen to guide the current study. The rationales are many. For example, the PPA approach could facilitate primary data gathering from rural households' perspectives. The approach has multiple data collection tools. It involves the poor for gathering such data and analyzes it of which problem ranking, wealth ranking (World Bank, 1996; Norton, 2001; Champer 1994a; 2004; Duraiappah, *et al*., 2005; Zaid *et al*., 2006;

Tsegaye, 2008; Hinds, 2013). The PPA approach was mainly chosen because previous scholars like Shen *et al*. (2011) used a participatory poverty index (PPI) and sequenced poor villages according to their poverty degree based on their PPI results. It was chosen following Melaku (2016) who used a participatory scoring matrix by poor to identify their perceived determinants of being poor. Hence, when rural poverty is assessed using a participatory qualitative approach in SSA (e.g. the poor in Cameroon) distinguished the poor from the non-poor different ways: the presence of hunger, fewer meals a day and nutritionally inadequate diets, meager and irregular income spent on food, non-existent or low sources of cash income, feeling powerlessness and inability to make themselves heard (Citro & Robert, 1995). Similarly, Melaku (2016) identified the poor from non-poor as " a poor person is the one who has low or no land to cultivate, small house, disability or ill for a long period, the chance of being unsuccessful and poor working habit"(p:77-78). Concerning the perceived determinants of participatory poverty, poor people identified multiple determinant/ explanatory variables such as family size, age, gender, and residence (Majeed & Malik, 2014) and land ownership, livestock holding, access to irrigation, and others (Melaku, 2016). Overall, in what follows, section 4.2 reviews the empirical and qualitative findings of the previous studies. Section 4.3 presents the specific objectives and basic questions. However, section 4.4 presents the methods used to analyze the status and determinants of rural households' multidimensional and participatory poverty. Section 4.5 presents the results and discusses the descriptive, econometric, and qualitative findings. Finally, section 4.6 concludes and recommends.

4.2.Empirical and Qualitative Results of Rural Poverty

This section presents the results of the status and determinants of rural households' poverty estimated by the multidimensional approach and participatory approach, respectively.

4.2.1. MDP related Empirical Reviews

Poverty is deep-rooted and widespread multidimensional. For example, old results of MDP show that, worldwide, 1.45 billion people from 103 countries are multidimensionally poor in 2017 (OPHI, 2017). However, based on the new Alkire & Jahan (2018) revised MPI indicators, 1.34 billion (23.3%) MPI poor people living in 105 developing countries in 2018. Decomposition result shows that 85% of the world's multidimensional poor live in rural areas (OPHI, 2014a). However, 1.1 billion/84% rural people live in intense MPI poor greater than that of 0.2 billion urban MPI poor) (OPHI, 2018). As reported by Alkire and Jahan (2018) MPI poor were acute in

40 countries of SSA (559 million people/42%) in 2018. According to UNDP (2019), in 2015 and 2017, about 68% and 65% of Sierra Leone's population was multidimensional poor being highest in the rural area (86.3%) compared to an urban area (37%). In East African, Levine *et al*. (2012) computed the old national multidimensional poverty index (MPI) for Uganda and found that 89% lived in multidimensional poor status.

When multidimensional poverty status decomposed into eleven deprivation indicators, several reviews of the related literature show that deprivation in those indicators still prevails in all corners of our world. For example, the nutrition/adult indicator is Goal 2 of the UN sustainable development goal. The goal seeks to end hunger and all forms of malnourishment and to achieve sustainable food production by 2030 (UNDP, 2017). Conceptually, nutrition is the quantity and quality of food that the body receives (Khan, *et al*., 2018). Acquiring accurate and adequate nutritional information can affect individual and public lifestyle decisions and health status (Sharf *et al*., 2011). It also could inform nutritional choices positively and promote the maintenance of a healthy nutritional status of rural household heads (Quaidoo, 2018; Alkire & Jahan, 2018). However, a lack of accurate and adequate nutritional information entails the deprivation of a rural household. For example, different kinds of disease, weakness, and disabilities are closely related to the intake of insufficient amounts of food nutrients (Khan *et al.*, 2018).

Several studies show that there are several undernourished people. For example; worldwide about 793 million people were undernourished in 2014-2016, down from 930 million in 2000-2002 (UNDP, 2017). In 2018, it was found that over 60% of poor persons share their households with someone who is nutritionally deprived worldwide (OPHI, 2018). Southern Asia and sub-Saharan Africa accounted for 63 percent of undernourished people worldwide in 2014-2016 (UNDP, 2017). More than half of the adult population in Sub-Saharan Africa faced moderate or severe food insecurity in 2015; the level was severe for one–quarter of adults in the region (UNDP, 2016b). Ethiopia has one of the world's highest incidences of undernourished individuals. Approximately 49% of the population is without adequate nutrition (FAO, 2000; CSA, 2005). Furthermore, households suffering from chronic food insecurity have been made beneficiaries of safety-net programs in Ethiopia (NPC, 2017). In Tigray, Werie Leke woreda, 13(3.6%) of rural household heads have reported their illness due to malnourishment

(Alemeseged, 2016). Concerning, nutrition/child indicators, children are the most visible victims' malnutrition**.** The term malnutrition covers: 'under nutrition' like stunting (low height for age), wasting (low weight for height), underweight (low weight for age) and micronutrient deficiencies or insufficiencies (a lack of important vitamins and minerals), and other is overweight, obesity and diet-related no communicable diseases (such as heart disease, stroke, diabetes, and cancer) (WHO, 2016). Results show that in 2016, an estimated 155 million children under age 5 were stunted (low height for their age), 52 million were suffering from wasting (low weight for their height), and 41 million were overweight (UNDP, 2017). In the case of Ethiopia, about 47% of children less than five experience chronic and 24% severe malnutrition. Given these high levels of malnutrition and vitamin A deficiency, it is likely that deficiencies in other micronutrients like zinc, iron, and vitamin C also exist in-country (CSA, 2005; FAO, 2000).

Child mortality indicator is Goal 3 of the UN SDGs (2017) that targets to be achieved at the end of 2030. Studies show that, worldwide, 183 million (14%) poor people live in a household in which a child has died in five years before the survey, i.e., deprived in child mortality (OPHI, 2018). In SSA, for example, in Sierra Leone, 19.3% of the population was deprived of child mortality indicators in 2017 and 15.2% in 2019 (UNDP, 2019). In East Africa, for example (Uganda), according to the 2005/2006 data, health indicators show that in 43% of households a child has died within the past five years (Levine *et al*., 2012). Moreover, less than 5 child mortality per 1000 children has an ascending trend (64% in 2013/14 and 67% in 2015/16 in Ethiopia (NPC, 2017). The multidimensional poverty study by Alemeseged (2016) revealed that 35(9.8%) of the sampled household heads have experienced under-five child mortality in the last five years preceding his study. In the same region (Tigray), Desawi (2019) found 30% of sample household heads have experienced child mortality. All results remain appalling.

Based on the years of schooling indicator, the education dimension of multidimensional poverty was mapped under Goal 4 of UN sustainable development goals. It focused on training throughout life; and the knowledge, skills, and values needed to function well and contribute to society (UNDP, 2016b). Results show that worldwide, 657million people (49%) are deprived of years of schooling (OPHI, 2018). In SSA, the Censored headcount ratio for years of schooling indicator in Sierra Leone was found as 50.8% in 2017 and was 46.3% in 2019

(UNDP, 2019). Results show that deprivation in education, captured by years of schooling was consistently declined over 1994 (43%), 2004, 2017 (10%) in Ethiopia (Bruck & Sindu, 2013). Besides, at K=4, 22% of households did not have at least one household member who had completed five years of schooling in Tembien woreda of the South Western Tigray regional state (Desawi, 2019). Concerning school attendance indicators, Worldwide, 486million people (36%) are deprived of school attendance (OPHI, 2018). In SSA, the censored headcount ratio for the school attendance indicator in Sierra Leone was found as 21.1% in 2017 and it was 19.8% in 2019 (UNDP, 2019). In Ethiopia, SDG 4 was integrated into GTP II. Achievements of the country show that pre-school enrollment increased from 39 percent in 20014/15 to 49.9 percent in 2015/16 in 2014/15 fiscal year and gender-parity- index marginally declined from 0.93 in 2014/15 to 0.91 in 2015/16; in 2015/16 (NPC, 2017). In Ethiopia, results show that deprivation in education, captured by school attendance consistently declined over 1994(63%), 2004, 2017 (31%) implying that large numbers of households in Ethiopia were deprived of child enrollment (Bruck & Sindu, 2013). The proportion of households with a child between ages 7-15 years that had a child out of school fell from 83% to 58% in rural areas of Ethiopia (World Bank, 2014). Further studies also reported similar deprivation of rural household heads in school attendance indicators. For example, while Alemseged (2016) has reported 80.1% deprivation, Desawi (2019) reported 30% deprivation in school attendance. At K=4, Desawi(2019) found 25% deprivation in school attendance in Degu'a Tembien woreda, Tigray regional state (Ethiopia).

Cooking fuel indicator is SDG 7 of the United Nation that state as ensures access to affordable, reliable, sustainable, and modern energy for all by 2030 (UNDP,2016a) and the same document reported that in 2014, some 3 billion people, over 40% of the world's population, relied on polluting and unhealthy fuels for cooking. Besides, nearly 90% of all 1.3 billion MPI poor persons cannot simply light a burner or turn on an electric burner to cook; they gather or purchase cooking materials made of wood, dung, coal, or charcoal (OPHI, 2018). Worldwide1199 million people (89%) are deprived of cooking fuel (OPHI, 2018). In SSA, for example, the censored headcount ratio for cooking fuel indicator in Sierra Leone was found as 19.37.7% in 2017 and 27.2% in 2019(UNDP, 2019). Furthermore, while Alemeseged (2016) found 357(100%) deprivation of rural household heads in cooking fuel/"absolute deprivation", at K=4 Desawi (2019) found the highest censored headcount ratio (60%) as compared to other MPI

indicators. The sanitation indicator is another MPI indicator. Households improved sanitation facilities [flush to a piped sewer system, flush to pit, bucket, pit latrine, and composting toilet] is very important in reducing the risk of illness (UNICEF, 2016; WHO, 2014). However, results show that between 2000 and 2015, the proportion of the global population using improved sanitation increased from 59% to 68%, however, 2.4 billion were left behind among them were 946 million people without any facilities at all who continue to practice open defecation (UNDP, 2016b). The global result shows that 1043 million people (78%) of MPI poor persons lack an adequate hygiene toilet such as a composting toilet, protected pit latrine, or a toilet that flushes to a sewage system (OPHI, 2018). In SSA, for example, the censored headcount ratio for sanitation indicators in Sierra Leone was found as 83.5% in 2017 and was 60.9% in 2019 (UNDP, 2019). In East Africa, 89% of Uganda's population lived in households where the sanitation facility is neither shared nor not improved in 20005/06 (Levine *et al*., 2012). In Werie Leke Woreda, Alemeseged (2016) found the report of 65.8% of rural household heads not using improved sanitation. A similar multidimensional poverty researcher by Desawi (2019) has also reported 56% of rural household heads were deprived of sanitation indicators in Degu'a Tembien Woreda.

The drinking water indicator is another MPI indicator categorized under goal 6. That is, UNDP (2016a) Goal 6 states that ensuring availability and sustainable management of water and sanitation for all reporting that in 2015, 6.6 billion people (91%) of the global population used an improved drinking water source, compared with 82% in 2000; however, in 2015 an estimated 663 million were still using unimproved sources or surface water (UNDP,2016). Moreover, 589 million people (44%) of poor persons around the world lack access to clean water within a 30-minute round trip walk from their homes (OPHI, 2018). In SSA, the censored headcount ratio for drinking water indicator in Sierra Leone was found as 58.3% in 2017 and was 42.8% in 2019 (UNDP, 2019). However, in Uganda, 74% lived in households without access to safe water in 2005/06 (Levine *et al*., 2012). Deprivation in drinking water declines from 81% in 1994 to 67% in 2017 in Ethiopia (Bruck & Sindu, 2013). Furthermore, while Alemeseged (2016) found a total of 48.7% of rural household heads deprived of drinking water indicator, Desawi (2019) found 28% deprivation in drinking water alone (at K=4) in the same region but different study areas.

Concerning electricity indicators, Goal 7 states that ensure access to affordable, reliable, sustainable, and modern energy for all and reported as the proportion of the global population with access to electricity increased steadily, from 79% in 2000 to 85% in 2012, however, despite these improvements, 1.1 billion people were still without electrical service in 2012 (UNDP,2016b). Another document shows that worldwide 721 million people (54%) are deprived of electricity (OPHI, 2018). In SSA, the censored headcount ratio for the electricity indicator in Sierra Leone was found as 79.3% in 2017 and it was 55% in 2019 (UNDP, 2019). At K=4, Desawi (2019) found 55% deprivation in electricity in the study woreda. The housing indicator is also another MPI indicator of multidimensional poverty analysis**.** Goal 11 of the United Nations' sustainable development goals states to renew and plan cities and other human settlements in a way that fosters community cohesion and personal security while stimulating innovation and employment (UNDP, 2016a). Secondary data source shows that 1046 million people (78%) of poor persons worldwide live in a house where the floor is dirt, sand, or natural; or where the walls and roof are rudimentary-may be cardboard, plastic sheeting, grass, or mud-in a heavy rainstorm, or strong winds, or if a thief investigates, such a home is no haven (OPHI, 2018). In SSA, the censored headcount ratio for asset indicators in Sierra Leone was found as 38% in 2017 and 41.1% in 2019 (UNDP, 2019). The study on housing indicators in Ethiopia shows that the percentage of households deprived of the quality of housing declines from 84% in 1994 to 68% in 2017 (Bruck & Sindu, 2013). In Werie Leke Woreda, Alemsged (2016) found none of the sample household heads having floor material made of cement.

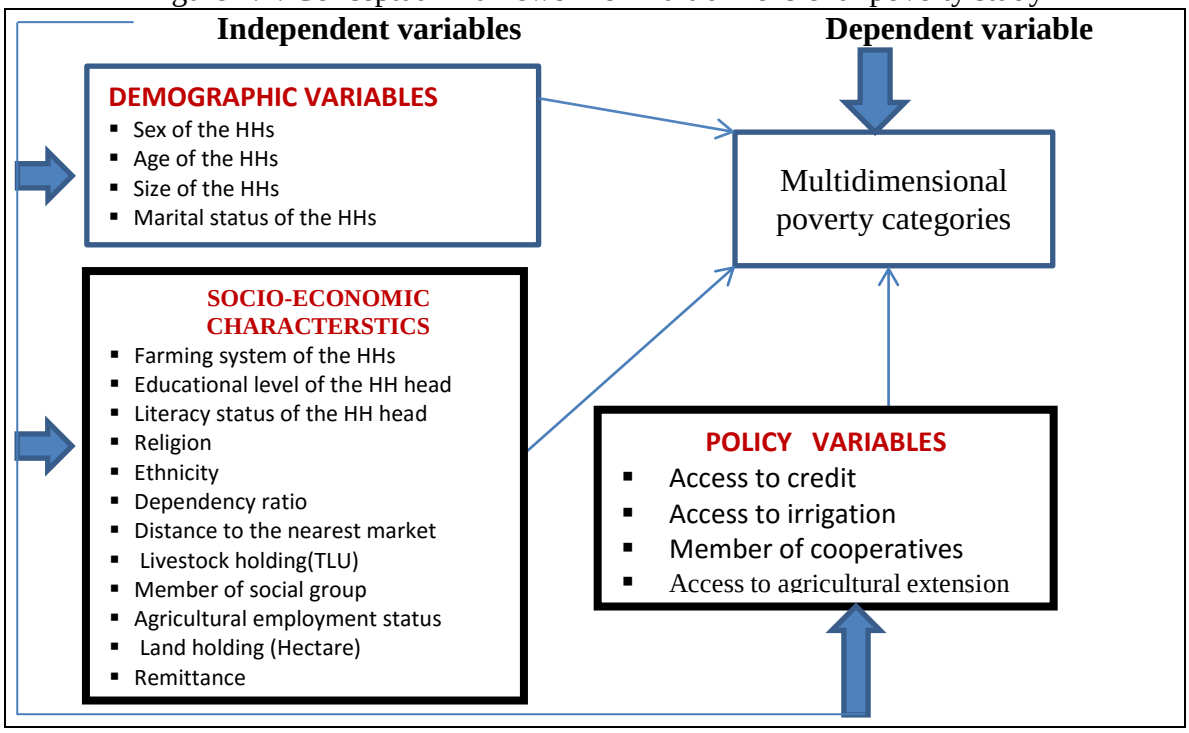
Last but not least, asset indicator is categorized under goal 6 of UNDP sustainable development goal. Goal 1 of the United Nations sustainable development goal state that ending poverty in all its manifestations, including extreme poverty everywhere at the end of 2030, however, the proportion of the global population living below the extreme poverty line dropped by half between 2002 and 2012 from 26% to 13% (UNDP, 2016b). Worldwide 572 million people (42%) are deprived of assets i.e., poor people do not own basic assets (either a car or truck or at least two of these items: radio, television, telephone, bicycle, motorbike, or refrigerator) that contribute to their wellbeing and economic activity (OPHI, 2018). In SSA, the censored headcount ratio for asset indicators in Sierra Leone was found as 45.6% in 2017 and was 41.1% in 2019 (UNDP, 2019). Moreover, most individuals are without material assets such as telephone, television, and motor vehicle in Uganda in 2005/06 (Levine *et al*., 2012). Deprivation

in assets declines sharply from 42% in 1994 to 4% in 2017 in Ethiopia (Bruck & Sindu, 2013). Similarly, Alemsged (2016) found that 86.8% of the rural household heads were deprived of asset indicators.

Multiple determinant factors have been contributing to rural households' MPI poor. For example, Sabir *et al*. (2006) found farm productivity, old age of the head, prices of the outputs, bigger household size, lack of infrastructure, and dependency ratio were the major determinants of poverty; however, the education of head was inversely related to poverty in Pakistan. Moreover, Hashmi *et al*. (2008) revealed the chance of being in poverty increased due to an increase in household size and dependency ratio and decreased the likelihood of being poor due to increased education, the value of livestock, remittances, and farming in Pakistan. In Lao People's Republic/LPR Pasanen (2017) used Alkire & Foster (2007) method and found that household multidimensional poverty is associated with the proportion of children in a household, low levels of infrastructure, and a high prevalence of practicing agricultural activities but not with household size in LPR. In Sub-Saharan Africa, Sekhampu's (2013) study shows that the age and employment status of the household head reduces the probability of being poor, however, household size was associated with an increased probability of being poor in the country. Based on Alkire and Foster (2008), Amao *et al*. (2017) reported that household size, gender, year of education, the share of dependent on the household head, land ownership, and non-agricultural wages were significant determinants of poverty in Nigeria. In East Africa, household size has significantly contributed to MPI poor in Uganda, other factors constant (Levine *et al*., 2012). In Eritrea, Bahta & Haile (2013) found that poverty status was negatively associated with education level, type of resident, size of land, number of meals, remittance, access of credit from relatives, credit institutions, opinion to credit, rain-fed crop, irrigated crop, income from agriculture and income from non-agriculture, however, family number, number of children, children at school-age and rent of land highly positively related to poverty in Eritrea. In Ethiopia, Alemeseged (2016) found that sex (being male-headed household) and level of education of the household head (being illiterate or attended religious/traditional school) and distance to the nearest market increases the probability of the household being MPI poor whereas ownership of radio, the size of the cultivated land, and the size of tropical livestock unit (TLU) cattle reduce the probability of the household being MPI poor. Similarly, Desawi (2019) revealed that household size was found an important demographic factor that significantly and negatively influenced

multidimensional poverty, coefficient of household education was a negative and statistically significant determinant factor and household contact with extension agents was statistically significant and negatively associated with the household's MDP. Furthermore, Girma and Temesgen (2018) found that some livestock in tropical livestock unit, participation in off-farm income activities, and age, use of improved seeds, total land size holding, family size, and access remittance income is found to be significant determinants of households' poverty and all of them are inversely related to it, whereas, age dependency the ratio is significantly and positively correlated to households' poverty, the probability of a household being poorly increased due to its dependency ratio. Based on the related reviews the researcher established the following conceptual framework that guides the study (Figure 4.1).

Figure 4.1: Conceptual Framework of multidimensional poverty study



Source: Own conceptual framework (2019)

Description and hypotheses of each independent variable were explained as follows:

Poverty category (Poverty) named as multidimensional Poverty index/MPI: was the dependent variable described as 1=MPI severely poor, 2=MPI poor 3=MPI variable 4=MPI non-poor and was investigated against the effect of those explanatory variables. Thus, it was hypothesized that multidimensional poverty index (MPI) is a function of the following explanatory variables that were included in the model:

X1: Agro-ecology/farming system: Rural households have different farming types. Households located in highland areas and being engaged in producing barley, wheat, and others and households located in the coastal area engaged in producing maize, teff, and fish were expected to be MPI poor than those households located in the plain area engaged in producing maize, teff and others. This was assumed due to gully erosion of highland areas and swampy farmland of coastal areas that could deplete the livelihoods of those households.

X2: Place of residence/kebele: rural kebeles of the study area who have access to education centers, health facilities, and good living standard opportunities like good sanitation, drinking water, asset, and others were expected to be MPI non-poor, otherwise MPI vulnerable, MPI poor or MPI severely poor.

X3: Sex of HH head: Apata *et al*.(2010) examined the determinants of rural poverty in Nigeria and their results show that female-headed households' increase the probability of persistence in poverty. Thus, the sex of the household was expected to impact their multidimensional poverty either positively or negatively. For example, the female household head was expected to increase their probability of being multidimensional poor as compared to the male household head. Despite the new family law of Ethiopia (gender equality), it was due to traditional higher resource control and decision-making the role of the male household head.

X4: Age of the HH head: the chance of being in poverty increased due to an increase in household age (Sabir *et al*., 2008). Thus, the multidimensional poverty status of the household head was expected to increase as his/her age increases. That is, the age of the household head has the probability of reducing households' poverty status, expected to become MPI non-poor, otherwise MPI vulnerable, MPI poor, or MPI severely poor. A household with an active and able to work hard could get more education, health, and living standard costs, thereby, reduce multidimensional poverty status. On the contrary, the age of the household head has the probability of perpetuating households' poverty status. For example, when the household is older (unable to become productive), it was expected that such households become multidimensional poor.

X5: The family size of the HH head: the household size was positively significant at 1% implying that in an increase in the household size, there is a probability of an increase in the

poverty of the respondents by about 8% (Amao *et al*., 2017). Similarly, the chance of being in poverty increased due to an increase in household size (Sabir *et al*.,2006; Hashmi *et al*.,2008; Ballon & Apablaza, 2012). A similar study was reported by Bruck & Sindu (2013). Thus, according to the arrow of the conceptual framework of the study, *cetirus paribus*, the bigger the household head family size, it was hypothesized increased probability of the household in multidimensional poverty, otherwise MPI non-poor.

X6: Marital status of HH head: Rural farm activities require extensive family (husband and wife) labor engagement. Married household heads were expected to be MPI non-poor than single, divorced, and/or widowed household heads.

X7: Education level of HH head: the chance of being in poverty is inversely related to the education of the household (Sabir *et al*.,2006; Hashmi *et al*.,2008). Thus, it was expected to hypothesize that the education level of households inversely/negatively associated with the probability of the household being poor [i.e, increase in the education level of the household head was expected to decline the log of the odds of being MPI poor or MPI sever poor, otherwise MPI non-poor).

X8: Literacy status of HH head: According to Ibrahim & Umar (2008) the number of literate adult males and females in the household were found as the major determinants of multidimensional poverty. Literacy level (ability to read, write and do simple arithmetic) accepted to influence poverty: numbers of literate household members decrease their probability of becoming MPI poor. Meaning, it was expected that multidimensional poverty could be greatest among less literate household heads, otherwise MPI non-poor.

X9: Religion of the HH head: Religion of the household head has a determinant role on their chance of multidimensional poverty status. Depending on the number of holidays and household asset depletion for several festivals in a year, Orthodox Church followers were expected to be a high probability of MPI poor than other religions.

X10: Ethnicity of the HH head: Land ownership has a determent effect on the status of rural households' multidimensional poverty. One of the means of land ownership in Ethiopia is through inheritance from families. In the study area, the majority of the sampled households were Oromo expected to inherited farmland from families originally in each kebeles than other

ethnic groups migrated there. Thus, it was hypothesized that non-Oromo sample households were expected to be MPI poor.

X11: Dependency Ratio: the chance of being in poverty increased due to an increase in household dependency ratio (Sabir *et al*., 2006; Hashmi *et al*., 2008). The dependency ratio of the household head (ratio of the population of dependent age less than 15 and above 64 to the population of productive age 15 to 64 years), was expected to increase households being MPI poor or MPI sever poor, otherwise expected to be MPI non-poor. That means, because more dependents' depend on less productive working groups (less resource accumulation), as the ratio of dependents increases, the multidimensional poverty status of such households increases.

X12: Livestock holding (TLU): Apata *et al*.(2010) examined the determinants of rural poverty in Nigeria and found that livestock assets significantly affect the probability of existing in poverty. Rural households' of the study area who have large livestock holding were expected to be MPI non-poor, otherwise expected to be either MPI vulnerable, MPI poor, or MPI severely poor. This was so because ownership of large livestock holding in the rural areas enables them to produce more and more financial income from the sales, enable them to reduce the probability of being MPI poor.

X13: Agricultural employment status: agricultural employment status was expected to have a significant influence in reducing rural households' poverty in the study area. In other words, the current study hypothesized that agricultural employment of the rural household in the study area has a negative association with their poverty status. If a household is in agricultural employment, keeping other factors constant, a household was expected to be MPI non-poor, otherwise expected to be MPI vulnerable, MPI poor, or MPI severely poor.

X14: Landholding (Hectare): land ownership was a significant determinant of poverty (Amao *et al*., 2017). Thus, keeping other factors (soil fertility, access to modern agriculture, and others) was expected to negatively determine MPI status. It was hypothesized that rural households in the study area who owned larger farm sizes have more likely to be MPI non-poor than those with relatively smaller land sizes, otherwise expected to be either MPI vulnerable, MPI poor, or MPI severely poor. It was expected that an increase in land ownership reduces the poverty status of the rural households in the study area.

X15: Access to remittance: The remittance of the rural household head is also hypothesized by this study as the multidimensional poverty status of the study area negatively associated with remittance (i.e, other things constant, a given marginal effect indicate remittance increase by one more unity was expected to decrease the probability of a household head being MPI non-poor, otherwise expected to be either MPI vulnerable, MPI poor, or MPI sever poor.

X16: Saving: Rural poverty falls with saving (Tesfahun, 2005). Results of the econometric analysis show that only at marginally significant levels households with access to an informal saving association (*Equb*) were less likely to be multidimensional poor (Bruck & Sindu, 2013). Thus, it was hypothesized that saving has a determining role in the status of rural households in the study area. That is, the more the samples saved, the less they are poor, otherwise sever poor.

X17: Access to credit: Apata *et al*. (2010) examined the determinants of rural poverty in Nigeria and reported that access to micro-credit significantly affects the probability of existing in poverty. Households who have access to micro-credit were expected to be out of poverty. Meaning, if a household is non-accessed to credit services, it was expected household to be MPI vulnerable, MPI poor, or MPI severely poor, otherwise MPI non-poor It shows us that poverty and rural households' access to credit has a negative association.

X18: Access to irrigation: households who have access to irrigation were expected to be out of poverty. It shows us that poverty and rural households' access to irrigation could be expected to have a negative association. In other words, rural household heads in Gudetu Jimma, Kalala Didimtu, BalbalaSorgo, Gidami Dabsho, Gamo Negero, Charo Gobeno, Damu Genbo, and Lalisa Biya kebeles who have access to irrigation were expected to be multidimensional non-poor as compared to that kebele who do not have access to irrigable land, otherwise expected to be MPI vulnerable, MPI poor or MPI sever poor.

X19: Membership in cooperatives: households who are membership in cooperatives were expected to be out of poverty. Meaning, multidimensional poverty status and rural households' membership in cooperatives have a negative association. If a member of the cooperative, a household was expected to be MPI non-poor, otherwise expected to be MPI vulnerable, MPI poor, or MPI severely poor.

X20: Access to agricultural extension: Rural households' access to agricultural extension services/training has also been a determining factor in their multidimensional poverty status.

Those households who get accessed to agricultural extension services/training were expected to be less chance of MPI poor than those who didn't.

4.2.2. Results of Previous Participatory Studies

Different methodologies/PPA tools could be used to analyze rural households' poverty. For example, wealth ranking, social mapping, and seasonal calendars, transect walks, problem tree or ranking matrix, and semi-structured interviews (Hinds, 2013). Having three different ways, ranking methods enables researchers and practitioners to gain an understanding of local perceptions and preferences on a range of issues. Accordingly, problem ranking identifies the most important problems households faced and ranking them in order of importance. However, while preference ranking involves putting different options along a horizontal axis and criteria on a vertical axis in a matrix (Hinds, 2013), wealth ranking is about socio-economic stratification/ different wealth groups, thereby, identify the most vulnerable or excluded people that can be done using either focus groups and/or scorecards (Leavy *et al*., 2013). Besides, wealth ranking assumes community members have a good sense of who among them is more or less well off (Theis & Grady, 1991). In general, results obtained through ranking processes can be triangulated by follow-up discussions with participants (Chambers 1994a; 1994b). Other similar scholars, for example, Tsegaye (2008) and Hinds (2013) identified other PPA techniques such as an in-depth interview with key informants, focus group discussions, and direct observations. Participatory poverty studies were done by World Bank (2000; 2004), Mowafi (2014), Melaku (2016), and Alemeseged (2016) used the PPA approach and its tools. For example, Melaku, 2016) who used the PPA approach identified the poor from non-poor using a participatory scoring matrix. Alternatively, Lx (2005) and Shen *et al*. (2011) proposed a participatory poverty index (PPI) computed using the PPI formula.

Furthermore, there are various qualitative data analysis techniques available in the PPA approach literature. For example, discourse analysis is a method of analyzing naturally occurring talk (spoken interaction) and all types of written texts (Mikkelsen, 2005; Carol *et al*., 2012). The other one is content analysis is a systematic analysis of the content of text/ written documents originated from newspapers, reports, diaries, and others (Anol, 2012; Carol *et al*., 2012). The one that narratives, transcribed experiences of people/interviewee, and identifies broader interpretive framework (holistic perspective) is narrative analysis (Bell, 1999; Ezzy, 2002; Carol *et al*.,

2012). An inductive way of interpreting recorded/text data about a social phenomenon to build theories about that phenomenon is the focus of Grounded Theory Methods (GTM) (Morrill *et al*, 2000; Babbie, 2010).

Unique case- analysis is a case-oriented analysis where one looks more closely into a particular case. Looking closely at the details, such a type of qualitative data analysis aims to understand a particular case or several cases at once. That is, a case-oriented understanding attempts to understand a phenomenon from the standpoint of the participants, on the contrary, cross-case analysis involves an examination of more than one case; this can be either available–oriented or case-oriented analysis (Babbie, 2010). Conservation, interim, and semiotics are other types of qualitative data analysis techniques. That is, using conservation analysis is a specific qualitative method for analyzing the sequential organization and details of everyday interaction like friends' pictures, interim/variable-oriented analysis aim to achieve a partial and/or sometimes useful for an overall explanation using relatively few variables, and semiotics/"science of signs" analysis concerned with the search for symbols and meanings intentionally or unintentionally attached to signs (Babbie, 2010). However, objective hermeneutics originally formulated for analyzing natural interactions (e.g. family conversations), is subsequently used to analyze all sorts of other documents (art and Picturegraphs) (Flick, 2010).

Based on the above reviews of methodologies used to analyze rural poverty, when the poor are asked to conceptualize poverty, the rural poor define poverty as a multidimensional phenomenon (World Bank, 2004). Besides, the poor overwhelmingly describe their situation as "multidimensional deprivations of food, housing, assets, material, non-material, income, land, services, social exclusion, isolation, powerlessness and dependency"(Mowafi, 2014:48). Furthermore, the Ukraine poor conceptualized poverty as hunger and malnutrition, whereas, in Guatemala, poverty was defined as lacking basic food and housing and having to ask for charity (World Bank, 2000). In Ethiopia, poor people conceptualize poverty as multidimensional as lack of money and food to eat, small land, incapability to fulfill basic needs, and a lack of cloth (Alemeseged, 2016). The other poor conceptualize poverty as "a situation that leads human being's life to sub-human states due to long-term illness, disability, lack of basic resources like land, livestock and money"(Melaku, 2016:77).

Concerning the identification of the poor from non-poor Lekshmi *et al*. (2008) conducted a study in Tamilnadu (India) using wealth ranking methods. Results show that out of 150 households 18(2%) were under the rich category, 63(42%), and 69(46%) came under medium and poor categories, respectively. Furthermore, Shen *et al*. (2011) conducted a participatory study and found different PPI results and sequenced poverty degrees accordingly for five villages in China. In Sub-Saharan Africa, the poor in Cameroon distinguished the poor from the non-poor in five different ways of which presence of hunger, fewer meals, and feelings of powerlessness are the ones (Citro & Robert, 1995). In Ethiopia, Melaku (2016) found " a poor person is the one who has low or no land to cultivate, small house, disability or ill for a long period, the chance of being unsuccessful and poor working habits"(pp: 77-78). Similarly, Zaid *et al*. (2006) found that water shortage/count 11 ranked 1st and followed by medicine shortage/counts 13, however, over 10 children ranked last for Awulo Villagers. Concerning the perceived determinants of poverty, Majeed & Malik (2014) found that poverty was greatest among the less literate households in Pakistan. In Ethiopia, Melaku (2016) used a participatory scoring matrix and found land for cultivation, livestock holding/oxen, and access to irrigation was among the most determinant factors of participatory poverty analysis in the study area.

4.3. Gap Analysis

Similarities and differences between the current study and some previous MDP studies are presented next. For example, to identify the MPI poor from non-MPI poor, the previous multidimensional rural household poverty researchers such as Alkire & Foster (2007), Batana (2008), Alkire & Foster (2008), Oyekale *et al. (*2010), Alkire (2011), IFAD (2012), Alkir & Santos (2013), Oyekale & Oyekale (2013), Alkire & Roche (2013), World Bank (2014), OPHI (2013;2017), and Amao *et al*.(2017) are theoretically guided by Sen's (1981) capability theory and methodologically have employed axiomatic deprivation methodology of multidimensional poverty proposed by Bourguignon & Charkravary (2003) and Atkinson (2003). Similarly, the current study has a similar theoretical orientation (Sen's (1981) capability theory) and methodological approach (axiomatic deprivation). This shows us that, in analyzing rural households' multidimensional poverty, there will be no differences in the theoretical foundation and methodological approach to identify the MPI poor from non-MPI poor between the previous studies and the current study. The other similarity between the previous studies and the current study is that both have a similar type and numbers (three dimensions of MDP: health, education,

and living standard dimensions) of the household's multidimensional poverty profile. However, the gap between the previous scholars' works and the current study lies in several critical differences:

First, difference in number and composition of indicators in the MPI used. To identify the poor from non-poor, the previous studies have employed deprivation indicators of Alkire & Santos (2010a; 2010b; 2010c; 2013) and that of Alkire & Foster (2008; 2011). Based on these deprivation indicators they have computed the aggregate of their respective MPI results. However, according to Alkire &Jahan (2018) revised new global 2018 MPI indicators such as deprivation indicators used by the previous scholars are old global MPI indicators resulting in the aggregation of the old MPI results. However, the current study is conducted based on the new type and the number of MPI indicators suggested by Alkire & Jahan (2018) (see, Table 4.1). A slight modification is made with the nutrition indicator of Alkire & Jahan (2018). In doing so, this study is found most significant to widen the knowledge source on rural multidimensional poverty analysis literature.

Second, previous studies have computed their respective old MPIs based on a deprivation cutoff point of 1/3 (33.3%).To the extent of the knowledge of the researchers, all the previous multidimensional poverty researchers failed to decompose their respective MPIs into different MPI categories. Rather they decomposed it into two categories as MPI poor and MPI non-poor. The only attempt made to decompose old MPI results as nearly MPI poor, vulnerable MPI, and severe MPI poor did Batana (2008), Alemseged (2016), and OPHI (2017) make a study. Thus, based on the new global 2018 MPI cutoff points, the current study fills the gap and contributes to rural household multidimensional poverty literature by decomposing the MPI poor result of the study area into four categories/ multivariate. For example, every person with a deprivation cut-off score (K) less than 0.2% identified as MPI non-poor, $0.2<K<0.363\%$ MPI vulnerable, $0.363<K<0.50$ MPI poor, and greater than or equal to 1/2 (50%) severe MPI poor (Alkire & Jahan, 2018). Such decomposition of rural poverty will help policymakers and planners to comprehensively identify who are poor and who are not, thereby, by giving priority to MPI severely poor households, reduce the extent and severity of multidimensional poverty/MDP.

Third, methodological gaps that exists between previous studies and the current study. For example, to identify the determinants of rural households' multidimensional poverty different

econometric models are available. It requires a few procedures. For example, to see whether the data meet the assumptions of the model different post-estimation/diagnosis tests need to be carried out. Then, application of econometric models (Bewick *et al*., 2005), specification error tests, and finally, goodness-of-fit tests (Archer & Lomeshow, 2006). In Ethiopia, to analyze the determinants of multidimensional poverty from panel data, Bruck & Sindu (2013) employed the Fixed Effect Logit model. Both Alemeseged (2016) and Desawi (2019) employed a binary logistic regression model. On the contrary, both Teka *et al*. (2018) and Girm & Temesgen (2018) used the Logit model. None of the above scholars employed ordered logit regression that makes this study unique. In other words, unlike the previous studies which measured MPI poverty dichotomously into MPI poor and MPI non-poor, the current study measured as a polychotomous variable (there are four possible outcomes such as MPI non-poor, MPI vulnerable, MPI poor, and severe MPI poor) following Adepju (2018), and employed ordered logit (Ologit) model regression analysis. Thus, it could be a relevant methodological contribution to the growing studies on multidimensional poverty. Finally, the current methodological exercise and empirical study are made in a setting (study area) where such studies have never been done.

Furthermore, when rural poverty is analyzed using PPA, the methodological and spatial differences are among the critical differences between the previous studies and the current study. Nobody used concept mapping and cross-case analysis techniques. Also, by integrating with UN sustainable development goals, none of them identified poverty dimensions and corresponding indicators. Spatially, no similar study is conducted in the current study area.

4.4.Specific Objectives and Basic Questions

The following are the specific objectives and corresponding basic questions of rural households' poverty analysis:

To describes the status of rural households' poverty in the study area.

a. In which MPI indicators sample households of the study area are mostly deprived and MPI poor?
b. What is the status of their MPI indices (incidence of poverty, the intensity of poverty, and aggregate poverty)?
c. When decomposed into MPI dimensions and indicators which have contributed most to MPI poor of the study area?

d. What is the status of the distribution of MPI in terms of poverty categories, farming systems, and kebeles?
e. How rural households conceptualized poverty?
f. How poor identify poor from non-poor?

To investigates determinants of rural households' poverty in the study area.

g. Are there any statistically significant variables determining sample heads' multidimensional poverty? Coefficients, odds ratio, and marginal effects?
h. Are there any determinants of rural poverty perceived by poor households? If yes, how they identified it? What are they?

To undertake methodological comparisons of rural poverty results generated by MDP vs PPA approaches in the study area.

i. Are there differences in conceptualizing poverty?
j. How do the two poverty estimates identify the poor from non-poor?
k. Are there any overlapping dimensions and indicators? What about the missed ones? If yes, what are they?

4.5.Methods and Procedures

This section focused on the methods and procedures used to analyze rural households' poverty. Accordingly, while section 4.5.1 presents the methods and procedures of multidimensional poverty analysis, section 4.5.2 presents that of participatory poverty analysis, respectively.

4.5.1. Methods and procedures of MDP Analysis

Descriptive Techniques: Test of sensitivity of MPI indicators: analysis of the correlation between MPI indicators found important. According to Bryman & Cramer (2005) while Pearson correlation/linear relation is applicable for data that fulfills the assumptions interval or ratio level, linearly, and bivariate normally distribution, Spearman correlation is applicable for ordinal variables which is the case of the current study. It refers to a statistical measure of the strength of a monotonic [17] relationship between paired data (Bryman & Cramer, 2005). Spearman correlation coefficient was used to test the sensitivity of MPI indicators of this study because MPI indicators are ordinal variables, it doesn't require normality assessment, it is a non-

[17] Monotonic relationship/function of paired data: *neither increases nor decreases as its independent variable increases.*

parametric statistic and mostly used by previous researchers like Levine *et al*. (2012) and Desawi (2019). Below is the formula to compute Spearman rank correlation of ordinal variables such as ranks:

$$\rho = \frac{6(\sum D2)}{N(N2-1)} \ldots\ldots\ldots\

maximum of 1 when the person is deprived in all component indicators. A person, who was not deprived in any indicator, receives a score equal to 0. Contrary to Alkire & Jahan (2018), the person experience weighted deprivations in every eleven indicators not ten indicators of these authors. Hence, the composite deprivation scores (Ci) of this study was given by:

$$\mathbf{Ci} = \frac{\boldsymbol{w1}}{\mathbf{1}} + \frac{\boldsymbol{w2}}{\mathbf{2}} + \cdots + \frac{\boldsymbol{wd}}{\boldsymbol{d}} \quad \text{.....(4.2)}$$

Where, Ci= Composite deprivation score ranging from 0 to 1 (0-100%), **Note:** Ci= 1 if the person is deprived in indicator I and Ci= 0 otherwise, Wi= Weight attached to indicator I with $\sum_{\mathbf{i=1}}^{\mathbf{d}} \mathbf{wi} = \mathbf{1}$

Aggregation method/ the two stages of Alkire and Foster (2011)

Step three: Calculating headcount ratio (H) (who is poor?): Once the poor people are identified, following Alkire & Jahan (2018) the headcount ratio/H (percentages of poor households who are multidimensional poor were computed by the equation:

$$H = \frac{q}{n} \quad \text{.....(4.3)}$$

Where, H=head count ratio/ adjusted headcount ratio/percentage of poor households/ incidence of poverty, q=number of multidimensionally poor people identified using the dual cut-off approach, and n=Total population.

Step four: Calculating intensity of poverty (A)(how poor?): is the average share of indicators in which poor people are deprived or the proportion of the weighted indicators in which, on average, multidimensional poor people are deprived (Alkire & Jahan, 2018). Hence, the average deprivation share across the poor in the study area was computed by:

$$A = \frac{1}{q}\sum_{1}^{q} C \quad \text{.....(4.4)}$$

Where, A=Average share of deprivation indicators in which the poor people are deprived also called average poverty or poverty intensity [HOW POOR?], q=the number of multi-dimensionally poor people, C=is the deprivation score of each poor person. It takes the value of ranging between 0 (indicating that the person does not experience any weighted deprivation) and 1 (indicating that the person experiences weighted deprivations in each of the ten indicators).

Step five: Calculating adjusted headcount ratio (or aggregate MPI(the product of incidence and intensity)-Adjusted FGT (M_0): Finally, the product of the headcount ratio *(H)* and the average deprivation share/ poverty intensity *(A)* gives the multidimensional poverty measure or named as adjusted- headcount ratio *(M_0)* or aggregate MPI. Alkire & Jahan (2018) and current study used Formula 4.5. That is, M_0= H*A ……..……..(4.5)

Where, M_0=Multidimensional poverty measure/ adjusted headcount ratio (M_0) or aggregate MPI, H=head count ratio, A=average deprivation share/ poverty intensity.

Econometric Techniques: The determinant part focused on methodologies related to diagnostic tests and ordered logit model and its specification. A binary logistic regression model is applicable for dichotomous outcomes of the dependent variable. The dependent variable of this study is ordinal variables inherently ordered categories/ polynomious outcomes. For example, the current study has categorized sample households into four MPI categories (MPI non-poor, MPI vulnerable, MPI poor, and MPI severely poor). Hence, binary logistic regression is inapplicable. In such cases, Adepoju (2018) suggests an ordered logit model with STATA command (*ologit*). Because ordered logit model is a regression model employed to investigate when the outcome/independent variable is ordinal outcomes. The choice between these two models was rationally justified. Following Adepoju (2018), the ordered logit model was given as:

$$Y_i^* = \beta' X_i + e_j \quad -\infty < Y_i^* < -\infty \ldots\ldots\ldots\

$$log\left[\frac{\gamma_j(x_i)}{1-\gamma_j(x_i)}\right] = \mu_j - [\beta_1 x_{1i} + \beta_2 x_{2i} + \cdots + \beta_k x_{ki}] \text{.....(4.9)}$$

J= 1…, J; i= 1,…, n

In which, 'Y_j' cumulative probability was as following:

$$\gamma_j(x_i) = \gamma\left(\mu_{j-\beta' x_i}\right) = P(Y_i \leq j|x_i) \text{.....(4.10)}$$

Where,B_i =column vector and of parameters(β_1, β_1,…,β_k),X_i = column vector of explanatory variables (X1,X2,…X20,Table below),μ_j = only dependent on the probability of predicting category and is not dependent on explanatory variables,The crisp part, i.e,

$$\beta_1 x_{1i} + \beta_2 x_{2i} + \ldots + \beta_k x_{ki} \text{.....(4.11)} = \textit{dependent part of the category}$$

χ^2 statistics in parallel regression test was calculated as follows:

$$x^2 = -2logLikelihood_{Cm} - (-2logLikelihood_{Cm}) \text{.....(4.12)}$$

Where, Cm = current model, Gm = General model, if the calculated χ^2 is more than χ^2 in the table, it will indicate the rejection of the null hypothesis which means the current model is estimated correctly.

Parameters were estimated by the maximum likelihood estimation method, which maximizes the probability of categorization.

$$L(Y|\beta; \mu_1, \mu_2, \ldots, \mu_{J-1}) = \prod_{i=j}^{n} \prod_{i=0}^{J} [\gamma(\mu_{j-\beta' x_i}) - \gamma\left(\mu_{j-1} - \beta' x_i\right)]^{-zij} \text{.....(4.13)}$$

Where,'z_{ij}' = *Binary variable. It equals 1 when the observed group for person 'i' is 'j', and if they are not equal, it equals zero. Newton-Raphson algorithm was used in the maximizing process.*

The calculation of the marginal effect of one unit change in X_k predicator on the probability of 'j' category was as follows:

$$\frac{\partial P(Yi = j|xi)}{\partial xk} = \left[\frac{\partial_{\gamma\left(\mu_{j-\beta' x_i}\right)}}{\partial xk} \frac{\partial_{\gamma(\mu_{j-1} - \beta' x_i)}}{\partial xk}\right]$$

$$= [\lambda(\mu_{j-1} - \beta' x_i) - \lambda(\mu_j - \beta' x_i)]\, \beta_k$$

$$in\ which\ \mu_{j=+\infty}, \mu_{0=-\infty}, \lambda j(Xi) = {}^{\partial \gamma j(xi)}/_{\partial xk} \text{.....(4.14)}$$

Making decisions about using variables' values in estimation is very important because the marginal effect depends on the values of all explanatory variables. Since total Probability always equals 1, the total marginal effect for each variable is zero. But it should be noted that the marginal effect is not directly on binary variables, and it can obtain by calculating the difference

between the two possible probabilities.

Identification of variables: Identification of the factors that determine poverty has local and cultural dimensions (Mtapuri, 2011). As a result, identifying these causes of poverty can be a complex exercise (Sekhampu, 2013), Despite such a complex exercise, identification and description of both the dependent variable and independent variables is the focus of this section (Table 4.2).

Table 4.2: Expected independent variables[19] and their descriptions (N=387)

S/N	Variable name	Variable type	Value	Expected sign	Sources
	Poverty/MPI	Dependent	1=MPI severely poor, 2=MPI poor 3=MPI vulnerable 4=MPI non-poor		
X1	Agro-ecology/farming system	Categorical	1=if highland, 2= if plain area , 3= if coastal area		
X2	Place of residence/kebele	Categorical	12 kebeles		
X3	Sex of HH head	Dummy	1 if male and 0 if female	+/-	Apata et al.(2010)
X4	Age of the HH head	Continuous	1=if less than 35, 2=if 35-64, 3= if 64+ years old	+/-	Sabir et al., 2008
X5	Family size of the HH head	Continuous	1= if less than4, 2=if 4-8 , 3=if 8+ number of family	+/-	(Amao et al., 2017; Sabir et al.,2006; Hashmi et al.,2008; Ballon & Apablaza, 2012; Bruck & Sindu, 2013).
X6	Marital status of HH head	Categorical	1= if single, 2= if married, 3= if divorced, 4=if widowed, 5= if separated, 6= if polygamy	+/-	
X7	The education level of HH head	Ordinal	1= if never attain any primary, 2= if primary, 3= if secondary, 4=if above secondary	-	(Sabir et al.,2006; Hashmi et al.,2008).
X8	Literacy status of HH head	Ordinal	1= if able to read, 2= if able to write, 3= if able to read, write, & do simple arithmetic, 4=if able to do simple arithmetic, 5= if illiterate	-	
X9	Religion of the HH head	Categorical	1= if waaqeffata, 2= if orthodox, 3= if Muslim, 4=if catholic, 5= if protestant	+/-	
X10	The ethnicity of head	Categorical	1= if Oromo, 2= if Amhara, 3= if Tigray	+/-	
X11	Dependency ratio	Continuous	The ratio of dependents to independents		(Sabir et al., 2006; Hashmi et al., 2008).
X12	Livestock holding (TLU)	Continuous	Livestock holding size in TLU	+/-	Apata et al.(2010)
X13	Agricultural employment status	Dummy	1 if employed and 0 if unemployed	+/-	
X14	Landholding (Hectare)	Continuous	The total land size in hectares (2012 EC)	+/-	(Amao et al., 2017)
X15	Access to remittance	Dummy	1 if a HH has access to remittances and 0 o.w	+/-	
X16	Saving	Dummy	1 if a HH has saved and 0 otherwise		(Tesfahun, 2005).
X17	Access to credit	Dummy	1 if HH has access to credit and 0 otherwise	+/-	Apata et al. (2010)
X18	Access to irrigation	Dummy	1 if HH has access to irrigation and 0 otherwise	-	
X19	Membership in cooperatives	Dummy	1 if HHs is a member of cooperative and 0 otherwise	+/-	
X20	Access to agricultural extension	Dummy	1 if HHs is accessed to extension and 0 otherwise	+/-	

NOTE: The study described the variables and proposed the hypothesis as described under section 4.2.1 and Figure 4.1, above.

[19] **Variable:** is any factor that can be manipulated and measured, and can take on different values, Thus, a variable can change in quantity or quality (Shuttleworth, 2008) and can noted similar throughout this dissertation

4.5.2. Methods and Procedures of PPA

Participatory poverty analysis is a bottom-up approach. It considers the voice of the poor. To participatory collect and analyze primary data, the approach requires some steps to have adhered to. Hence, this study followed the procedures used by previous scholars such as World Bank (1996), Norton (2001), Champer (1994a; 2004), Duraiappah, *et al*. (2005), Zaid *et al*., (2006), Tsegaye (2008), Shen *et al*. (2011), and Hinds (2013), presented next.

Step one, first-round data collection: to collect bottom-up primary data from the rural people of the current study, four qualitative data collection tools like an in-depth interview (6 samples), participatory observation, semi-structured interview (72 samples), and focus group discussion (12 samples) were used. One may ask about the validity of such data. To ensure the validity of qualitative data, Creswell (2009) suggests multiple data collection tools. Accordingly, using the mentioned tools above, qualitative data on rural poverty was collected from a total of 90 rural heads. To make qualitative data collected easy for analysis, the researcher aligns the results to secondary sources like GTP II and UN SDGs. As quantitative data has data set, multiple data source generated through multiple tools is known as *corpus data* [20]in the qualitative study. However, because the corpus data generated from multiple sources crude data was found difficult for analysis, it seeks to proceed with few additional steps.

Step two, concept mapping[21]: as the component analysis[22] is for a quantitative study, concept mapping is for the qualitative study. The former is a numerical data reduction technique and the latter is aimed at generating concepts and thick texts using various techniques[23]. Both focused on reducing crude data and were ready for analysis.

Step three, identification of dimensions and indicators: Using step two, this step was a critical step where this study moves away from the corpus data/original generated under step one. The step aims to generate thick data for analysis. In other words, in multidimensional poverty analysis, rural poverty has three dimensions and ten indicators (Alkire & Foster, 2011; Alkire & Santos, 2010a; Alike & Jahan, 2018). However, these dimensions and indicators have been suggested from top to bottom by technical experts alone. In the current study, neither rural

[20] **Corpus data:** *Thick data from multiple sources (see, Bogdan & Biklen, 1992).*
[21] **Concept mapping:** *Help to see relationships and patterns of complex, multiple and interwoven reality (rural poverty) on a single page, i.e., it is a reduction of corpus data…PW correlation of Qt research (see, Bogdan & Biklen, 1992)*
[22] **Quantitative component analysis techniques**: *(multiple correspondence/principal commitment analysis)*
23 **Qualitative crude data reduction techniques:** *individual case analysis or cross-case analysis (see, Babbie, 2010).*

poverty dimensions nor indicators were adopted from the top. From primary crude data generated by the poor, then through concept mapping and followed by integrations with secondary data sources enable this study to identify 6 rural poverty dimensions and 17 indicators. The final list of dimensions and indicators was agreed on by the six participants of the local people from Charo Gobeno kebele (Gafare sub-village).

Step four, second-round primary data collection: Once the dimensions and indicators of rural poverty are identified, the response of 72 purposively selected sample heads was collected from each kebele (one sample per kebele participated). Here, semi-structured interviews and direct observation tools were used. This step was a very critical step to lay a foundation to construct rural sample heads participatory poverty index (PPI) (step five) because it needs a quick "yes/no" response of sample heads, otherwise difficult to construct the index. Focus group discussion with 12 samples was conducted to identify the perceived determinants of rural poverty.

Step five, data analysis techniques: To describe the status of rural poverty, cross-case analysis was employed. It enables this study to identify thick texts (dimensions) used in the construction of PPI. Besides, the basic idea of participatory poverty analysis (PPA) is including poor people's views in the analysis of poverty. Lx (2005) and Shen *et al*. (2011) underscored the limitations of the above qualitative data analysis techniques and suggested an alternative technique known as PPI. Indeed, despite its numerical value outcome, it is based on the voice of poor people, for example, identification of poverty dimension and indicators. Thus, this study strictly followed the procedures of computing statistical analysis (PPI) suggested by Lx (2005) and Shen *et al*. (2011). That is, $PPI = 20 \times [W_j (Ii \times W_{jk})]$ .....(4.15)

$$PPI = 20 \times [W1 (I_1 \times W_{11} + I_2 \times W_{12}) + W_2 (I_3 \times W_{21} + I_4 \times W_{22} + I_5 \times W_{23}) + W_3 (I_6 \times W_{31} + I_7 \times W_{32} + I_8 \times W_{33}) + W4 (I_9 \times W_{41} + I_{10} \times W_{42} + I_{11} \times W_{43} + I_{12} \times W_{44}) + W_5 (I_{13} \times W_{51} + I_{14} \times W_{52} + I_{15} \times W_{53}) + W_6 (I_{16} \times W_{61} + I_{17} \times W_{62})] \quad (4.16)$$

Where, PPI= Participatory poverty index, 20= Constant, I_i =value of 17 poverty indicators identified by the poor, i= 1-17, W_j= Weight of each dimensions, j= 1-6, $W_1 + W_2 + W_3 + W_4 + W_5 + W_6 = 1$, W_{jk} = Second – the level weight of 17 poverty indicators, K= 1-6, $W_{11} + W_{12} + W_{21} + W_{22} + W_{23} + W_{31} + W_{32} + W_{33} + W_{41} + W_{42} + W_{43} + W_{44} + W_{51} + W_{52} + W_{53} + W_{61} + W_{62} = 1$

Table 4.3: PPI deprivation categories: % PPI= total deprivation indicators (17)/4= 4.25

PPI non-poor		PPI vulnerable	PPI poor	PPI severely poor
0	4.25	8.5	12.75	17
0	25%	50%	75%	100%
Researcher modified: 0<PPI≤1.53		PPI >1.53 & PPI≤2.03	PPI >2.03 & PPI≤2.53	PPI >2.53

Note: the result of the PPI calculated from the formula below is triangulated with the qualitative data captured by in-depth interview and participatory observation,

Besides, there are also some procedures followed by this study to analyze the perceived determinants of rural poverty. For example, Melaku (2016) analyzed the determinants of rural poverty as perceived by sample households using the participatory scoring matrix/PRA 10 seeds technique. The researcher used the same methodology. Hence, to investigate how poor/ prevalence or severity of poverty was in the study area, PPA followed these procedures:

Step one, Identification of FGD participants: From the insiders, 12 rural households (one from each kebele) assumed to have comprehensive knowledge of their local area context were purposively sampled. From the outsiders such as FGD facilitator/researcher and FGD, note-taker/assistant researcher joined the FGD participants. The latter two FGD participants have no control over the process except facilitation role,

Step two, brainstorming: Blessing of the elders was made first. Indeed, such cultural respect for the qualitative study could have a high potential of getting trust and rapport from the participants. This has been practiced by PRA practitioners including the researcher who has long years of PRA training, service, and baseline data collections using multiple PRA tools. Then, ground rules (respect each other, off mobile, and active participation) of FGD were set by participants. It was after elders' blessing followed by setting ground rules of the FGD exercise that the FGD facilitator/researcher asked participants to identify causes/determinants of rural households' poverty. During participants brainstorming session FGD note take/assistant researcher took field notes identified as the perceived determinants of rural poverty,

Step three, scoring each determinant: FGD facilitator/researcher asks each FGD participant to provide the score for each determinant across each prevalence or severity of poverty based on a 5-point Likert scale[24] (Table 4.4),

Table 4.4: PPA prevalence & severity of rural poverty/PRA- 10 seeds techniques

Where, 5 (Strong sever), 4 (Sever), 3 (Undecided), 2 (Not severe), and 1(Strongly not severe),

Determinants	Prevalence or severity of persevered rural poverty							
	5	4	3	2	1	Total scores	Mean score	% of mean score

Source: Sample table adopted from Melaku (2016)

Step four, adding scores: following Melaku (2016), a Participatory scoring matrix was used. That is, FGD facilitator/researcher and FGD note-taker/assistant researcher quickly added three scores (total scores, mean scores, and % of mean scores), using below:

[24] Likert Scale: *see, Trochim (2005)*

That is,

- Total scores = total of the score provided by 12 FGD participants,
- But mean score is the total score divided by the number of FGD participants

$$\text{Mean score} = \frac{\text{Total score}}{\text{Number of score providers,i.e 12}} \ldots\ldots\ldots\

deprived (0) and poor (1) and, otherwise non-poor (0) because Ci it less than K(Alkire & Santos, 2010a). This shows us that to censor or identify the 387 sample households of the study area as MPI poor or MPI noon-poor, their weighted deprivation score (Ci) is a highly important cutoff point.

In other words, like categorizing rural households as deprived or non-deprived (but uncensored-i.e., only dichotomized as either deprived/non-deprived), to censor sample heads as MPI poor or MPI non-poor, weighted deprivation score (Ci) is used. Thus, the objective of this section is to locate proton of deprivation and poor households in a given MPI indicator, thereby, view poverty as the state of multiple deprivations, in turn reducing any of the numbers of deprived and MPI poor in any indicators by reducing the censored headcount ratios reveal the possibility of reducing multidimensional poverty status of the households in the study area. However, there are two important points to be raised and answer: sensitivity of each MPI indicator and new poverty cutoff (K).

Test of Sensitivity of MPI Indicators

Concerning the test of the sensitivity of each MPI indicator, the weighted deprivation score (Ci) of the rural households is a highly important cutoff point to identify them as deprived or non-deprived. It was assumed no significant correlation between each MPI indicator. Low correlation coefficients were expected. Because closely correlated MPI indicators pose some problems (Levine *et al*., 2012; Desawi, 2019) in rural household heads multidimensional poverty analysis. This instigated the researcher to primarily test the sensitivity of each MPI indicator of the current study. Then, after analyzing each censored MPI indicator each MPI indices was computed. To do the test for sensitivity of each MPI indicator, Section 4.5.1, above proposed Spearman rank correlation coefficients for the same (results of the Spearman rank correlation coefficients as shown in Table 4.5, below.

Except for the correlation between nutrition/ child vs adult (ρ= 0.514) and the correlation between school attendances vs years of schooling (ρ= 0.587), most of the results of the Spearman rank correlation coefficients show weak. This study tolerated the result of strong correlations between nutrition/child and school attendance indicators for two reasons: none out of eleven MPI indicators found a weak correlation and not violate the ten MPI indicators proposed by Alkire & Jahan (2018). That is, all the selected MPI indicators of the current study

have "weak" ($0.00<\rho<0.19$) and "very weak" ($0.20<\rho<0.39$) correlation coefficients. Correlations less than 0.4 are acceptable (Alkire & Foster, 2008), i.e, deprivation in one MPI indicator is not significantly explained by deprivation in any other MPI indicator and the MPI index of the study contained different dimensions of multidimensional poverty. It was great to know that an insignificant correlation exists between each MPI indicator. Another important is issue was to compute the new poverty cutoff (K). The process is called censoring headcount ratio (H) using weighted deprivation score (*ds* in the recent STATA codebook).

Table 4.5: Test of the sensitivity of MPI indicators/Spearman correlation between MPI indicators (N=387)

MPI indicators	1	2	3	4	5	6	7	8	9	10	11
Nutrition /adult (1)	-										
Nutrition/ child (2)	.514	-									
Child mortality (3)	-.029	.105	-								
Years of schooling (4)	.067	.154	-.093	-							
School attendance (5)	.053	.130	-.075	.587	-						
Cooking fuel (6)	-.053	.105	-.093	.016	.087	-					
Sanitation (7)	.069	.085	.071	-.046	-.053	.087	-				
Drinking water (8)	-.139	-.008	.053	.003	-.017	.015	-.029	-			
Electricity (9)	.012	-.028	.038	-.067	-.023	-.035	.101	.108	-		
Housing (10)	.009	-.007	.123	-.022	-.089	.077	-.016	.071	.003	-	
Asset (11)	-.237	-.022	.053	-.067	-.119	-.029	-.061	.270	.108	.041	-

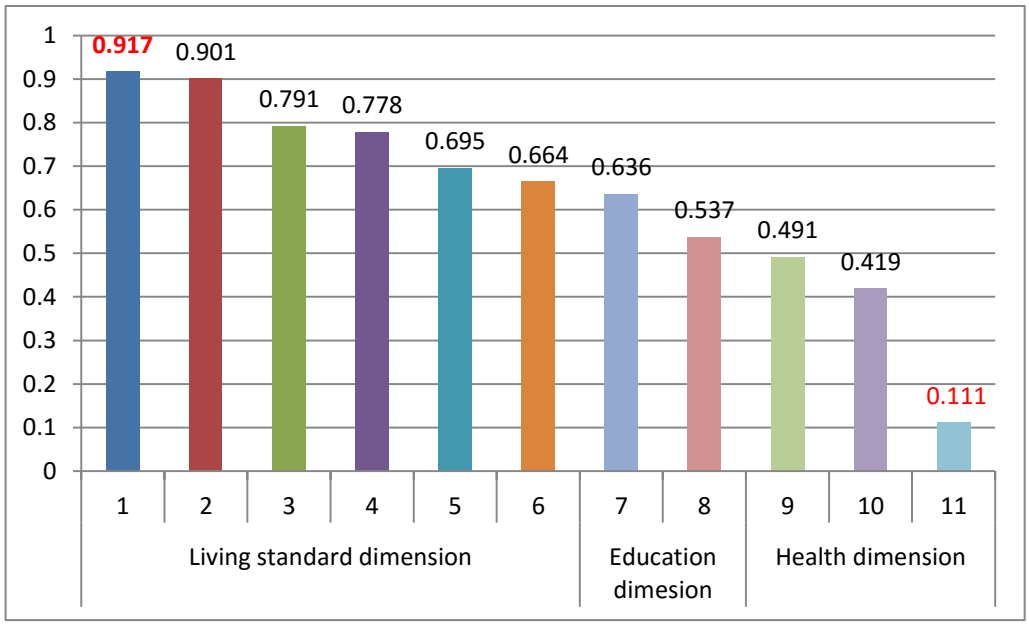
Source: Own computation (2019)

The New Poverty Cutoff (K)

Concerning *the* new poverty cutoff (K), note that the adjusted headcount ratio (M_0) value is highly sensitive to the choice of poverty cutoff. Results vary with the changes over different poverty cutoffs used, for example, see previous studies by Alkire & Foster (2011), Adeoti & Poloola (2012), Alemeseged (2016), Amao *et al*.(2017), Dawas (2018), Alkire & Jahan (2018), and Desawi (2019). To locate the poor and view poverty as the state of multiple deprivations those scholars used poverty cutoff K=0.333 for 10 MPI indicators as a threshold and others various K values. However, the gap analysis (section 1.3) poverty cutoff (K) made this study unique. A simple mathematical equation was followed to get it, that is, if ten indicators K equal 0.333, what is K for eleven indicators like a mathematical equation. The new poverty cutoff was then K equals 0.3663 that was used to compute each MPI indices. That is a household with a value of K< 0.3663 was considered as MPI non-poor, and K> 0.3663 was considered as MPI poor, or households are deprived in at least 36.63% of the selected indicators, exclusively in the case of this study. Then, based on the above results and discussions made about the sensitivity of

each MPI indicator and new poverty cutoff, the current data were censored. That is, when the data was censored (proportion of households who were both deprived and MPI poor), the first five deprived and the poor number of household heads were found in the living standard dimension followed by health and education dimensions (Figure 4.2, below).

Figure 4.2: Censored headcount ratio (households deprived in each indicator and poor at K=0.3663).



Source: Computed from own field survey (2019)

Cooking Fuel Indicator

Cooking fuel indicator is Goal 7 modern "energy for all" by 2030 of the United Nations. Nevertheless, out of a total of 387 samples in the study area (355/91.7%/highest deprivation rate) of they were found deprived and MPI poor in this indicator alone. Furthermore, when the figure is disaggregated into different poverty categories results show that 250(70.42%)- MPI severely poor, 52(14.65%)-MPI vulnerable poor, and 53(14.93%)-MPI poor implying that higher than other cooking fuel deprivation rates for examples, global rate report by OPHI (2018), Sierra Leone (UNDP, 2019) and Desawi (2019) finding. Nevertheless, the current result is less than Alemeseged's (2016) absolute deprivation rate in cooking fuel indicator alone. These two results (deprivation rate and poverty rate in cooking fuel indicator alone) imply that sample households of Jimma Geneti woreda are both highest deprived and MPI poor in cooling fule indicator of multidimensional; poverty analysis. In conformity to the current findings, secondary data from Jimma Geneti Woreda Water, Mineral and Energy Office (2017; 2018) revealed that some of the *cooking fuel/ domestic energy sources* include firewood, charcoal, crop residue, animal dung,

and less importantly Kerosene in both 2017 and 2018. Rural households have been exposed to indoor air pollution (due to limited ventilation problems). Besides, UNDP (2016) reported that such cooking fuel may produce toxic emissions.

Furthermore, sample households may encounter respiratory disease in their families. In the worst scenario, it leads to cause preventable death. These were further affirmed by the secondary source of Woreda Health office (2017; 2018) that out of the top ten diseases in the woreda, acute upper respiratory 1,365 (15%) cases ranked 2nd in 2017 and 283 (10.71%) cases ranked 4th in 2018. Others may include irritated eyes and lungs of the household heads, especially women and children in the family. Furthermore, besides the health risk of using cooking fuels made up of wood and charcoal, the largest number of deprived rural household heads entails that there is an environmental security threat of the study area due to deforestation activities. Hence, despite Fincha'a artificial dam is located partially in the woreda, sample heads have been deprived of modern cooking fuel, results call for responsible government expansion of rural electrification to be used as a source of modern cooking fuels for rural households. Doing so implies deforestation (environmental security) and health security of rural households that the country has been known for long years of famine, drought, and health crisis due to climate change-induced by exogenic human factors.

Sanitation Indicator

Similarly, when the primary data of the current study was censored, it was found that 269(69.5%) of the household heads in the study area were deprived and 191(71%)-MPI severely poor, 43(15.99%)-MPI poor, and 35(13.01%)-MPI vulnerable in sanitation indicator alone. As the censored indicator ranked second (after cooking fuel indicator) it is possible to imply that sample households encountered non-improved sanitation facilities contrary to the required improved sanitation facilities (flush to the piped sewer system, flush to pit, bucket, pit latrine, and composting toilet] (UNICEF, 2016; WHO, 2016) for them to be in better living standard. When the current 69.5% deprivation rate of sample heads in sanitation indicator is compared and contrasted to other findings, it is higher than the global sanitation indicator rate report for the year 2000 and 2015 (UNDP, 2016b) but the 71% MPI severely poor is less than 78% MPI poor persons globally lacking an adequate hygiene toilet such as a composting toilet, protected pit latrine, or a toilet that flushes to a sewage system (OPHI, 2018). Compared to the SSA, current

deprivation in sanitation is higher than 60.9% deprived population in Sierra Leone in 2019 (UNDP, 2019), Alemeseged (2016) result and Desawi (2019) report. However, the result was less than that of 83.5% population in Sierra Leone in 2019 (UNDP, 2019) and that of 89% of Uganda's population in 2005/06 (Levine *et al*., 2012 both deprived and poor in sanitation indicator alone. Results imply that the sanitation facility is neither shared nor not improved in developing countries in general and in the current study area in particular. This assertion was consistent with Levine *et al*. (2012).

Further analysis shows that based on SDG guidelines rural household heads of the study area have neither privately improved nor improved but shared sanitation facilities rather assumed have been using open defecation. Consequently, such poor sanitary facilities in the rural area could be disastrous (contamination of their drinking water sources and health crisis) for rural household heads and their families. This assertion was strengthened by the secondary source of the Woreda Health Office (2017; 2018) that non-potable drinking water sources (springs, rivers, and ponds) have been seriously caused the severe health crisis (in terms of diarrhea and cholera) of rural people in the woreda. Thus, Emphasis to be given to the sanitation of the rural households is found very important by the woreda. Otherwise, no rural education on personal hygiene and sanitation means insecure health and environmental rural livelihood securities.

Drinking-Water Indicator

Against compelling Goal 6 of the United Nations "sanitation for all", it was found that 306 (79.07%) of the household heads in the study area were deprived of drinking water lacking it within a 30-minute round trip walk from their home and 220(71.90%)-MPI severely poor, 43(14.05%)-MPI poor and 43(14.05%)-MPI vulnerable poor, and 1(0.29%), MPI non-poor. The result was found higher than the global drinking water deprivation rate in 2018 (OPHI, 2018), Sierra Leone population deprivation in drinking water indicator in 2017 and 2019 (UNDP, 2019), the national 67% in 2017 for Ethiopia as reported by Bruck & Sindu (2013), Alemeseged (2016) and another result by Desawi (2019) but less than for Uganda in 2005/06 as reported by (Levine *et al*., 2012). All figures show that despite global population who used an improved drinking water source (Pipe water) increasing from 2000 in 2015 (UNDP, 2016b) at least a 30-minute walk from home, round trip, however, both in SSAs and current study area, rural population are still using unimproved sources of drinking water at least at a 30-minute walk from

their residents. For example, in the current study area, it was found that the major sources of drinking water include 1st spring water, 2nd rainwater, 3rd pond, 4th Finacha'a Lake, and 5th running water (Table 4.6).

Table 4.6: Rural household heads source of drinking water (N=387)

Source	Yes			No		Total	
	N	%	Rank	N	%	N	%
Springwater	219	56.6	1st	167	43.2	386	99.7
Rainwater	135	35	2nd	251	65	386	99.7
Pond	63	6.3	3rd	323	83.5	386	99.7
Lake	52	13.4	4th	324	86.3	376	97.2
Running river/stream	51	13.2	5th	335	86.6	386	99.7
Dam	13	3.4	6th	373	96.4	386	99.7
Groundwater	39	10.1		347	89.7	386	99.7

Source: Own computation (2019)

A review of the secondary data source shows a contrary figure to the above findings (79.07%) deprived clean water in 2019,i.e, 66.42% of the rural population in the woreda accessed potable water sources [25]in 2017 (Woreda Water Office, 2017; 2018). Both primary and secondary data sources revealed access to potable water sources of the rural household heads and their families in the study area is very difficult. Lack of clean drinking water sources in short distances has multifaceted problems for rural household heads and their families. Diseases such as typhoid, cholera, hepatitis, worm infestation, diarrhea, skin infection, eye infection, stomach problems, and allergies (Jabeen *et al*., 2011) are some of them. In the study area, for example, diarrhea 1,331(15%) cases ranked 4th in 2017 and 418 (15.82%) cases ranked 1st in 2018, infection of skin 826(9%) cases ranked 6th in 2017 and 366 (13.83%) cases ranked 3rd in 2018 (Woreda Health Office, 2017; 2018) in Jimma Geneti woreda. The long-distance walk of women, especially, girls at the expense of their education could have a deterring role on their future capabilities. Above all, it increased the workload of women. Thus, rural development policy targeting rural households' access to clean drinking water (pipe water) at less than a 30-minute walk from their home needs to be in place. Emphasis has to be given to women of the study area researching clean water. This can be possible by developing nearby boreholes to the sample heads deprived of clean water. Other water schemes can be used as a mechanism to reduce the current deprivation rate o drinking water.

[25] **Potable water sources:** *spring and well water (Woreda Water office, 2017;2018) contrary to its global definition as improved drinking water source (pipe water)(UNDP ,2016a; Alkire & Jahan, 2018) accessed at less than 30-minutes walk.*

Electricity Indicator

The electricity indicator is Goal 7 calling for "modern energy for all" of the UNDP (2016a) sustainable development goals. Based on UNDP Goal 7, the censored result shows that 269 (**69.5%)** of the household heads in the study area were deprived and 244(69.91%)-MPI severely poor, 53(15.19%)-MPI poor, 51(14.61%)-MPI vulnerable poor, and 1(0.29%)-MPI non-poor. The current access to electricity indicator was found less than global access to electricity reports in 2000 and 2012 by (UNDP, 2016b), in 2018 by (OPHI, 2018), for Sierra Leone in 2017 by (UNDP, 2019), and another report by Alemeseged (2016) but greater than national electricity deprivation indicator rates (45.75% in 2014/15 and 44% in 2015/16)(NPC,2017) and what Desawi (2019) reported, too. Figures show that access to modern "electricity for all" (biogas, solar energy, and generator) (UNDP, 2016a; Alkire & Jahan, 2018) is still challenging everywhere. Recently, Ethiopia has had success stories in ensuring Goal 7 by increasing its electricity generation capacity to more than 4,269.5 MW. Many power-generating development schemes are under construction every year in the country. The Grand Ethiopian Renaissance Dam (GERD) has reached above 70 percent completion in 2021. Construction of the transmission line increased from 14,065 km in 2014/15 to 15,137 km in 2015/16. Coverage of electricity supply increased from 54.25 % in 2014/15 to 56 % in 2015/16 (NPC, 2017). Thus, being optimistic, the rural access to electrification program in Ethiopia could reverse the situation of rural household heads cooking fuel and electricity supply all over the country in the coming few years, if sustainable peace and stability are in place.

Housing Indicator

The housing indicator is Goal 11 of the United Nations' sustainable development goals state that to renew and plan cities and other human settlements in a way that fosters community cohesion and personal security while stimulating innovation and employment (UNDP, 2016a). The current study area shows that 57 (66.4%) of the household heads in the study area were deprived and 190(73.93%)-MPI severely poor, 27(10.51%)-MPI poor, and 40(15.56%)-MPI vulnerable poor. As most of the poor persons worldwide live in poor housing conditions[26] (OPHI, 2018) current result was found less than the global rate. While Alemsged (2016) reports none of the samples in Werie Leke Woreda to have floor material made of cement, study result deprivation in housing

[26] **Poor housing conditions:** *floor is dirt, sand, or natural; or walls and roof are rudimentary-may be cardboard, plastic sheeting, grass, or mud- in a heavy rainstorm, or in strong winds, or if a thief investigates, such a home is no safe haven (OPHI, 2018).*

indicators was still less than the national average (68% in 2017) (Bruck & Sindu, 2013) but higher than that of poor housing conditions in Sierra Leone both in 2017 and in 2019 (UNDP, 2019).

Deprivation in housing indicators in the study area was found very poor. This assertion can be further elaborated by analyzing each "housing indicator" proposed by Alkire & Jahan (2018). For example, in the study area separation of residency room/house from kitchen and animal residency was found that out of the total 387 household heads 66(17.1%) and 77(19.9%) of them were living in a house where rooms are separated from kitchen and animal residency, respectively. Concerning the roofing material of their housing condition, the household heads of the study area have responded that 4(1%) plastic sheets cover, 73(18.9%) grass cover, 9(2.3%) stone or slate, 320 (82.7%) corrugated iron sheets were used in the construction of their house. Furthermore, the type of wall material used in the construction of rural household heads were 3(8%) from plastic sheets cover, 330(85.3%) from wood/timber wall, 243(62.8%) from mud wall, 22(5.7%) from corrugated iron sheets and 8(2.1%) from hollow concrete blocks. Out of the total respondents, 341(98.1%) of rural household heads reported that mud was the major type of floor material used in the construction of their houses. A few household heads have constructed their floor from material from wood (32/8.3%) and cement with concrete (19/4.9%). Hence, to achieve Goal 11, Ethiopia has to invest and work to improve rural housing conditions. This may call for improving the quality and quantity of rural households' ownership of livestock holding. Other mechanisms may be promoting the saving culture of rural people. Besides, integrating rural housing issues with their agricultural and health extension issues is vital. These assets of the rural households enhancing their financial income and reduce multiple occurrences of shocks. Thus, they can construct new rural houses that fulfill the requirements of quality residential houses. No matter how long it will take, Goal 11 will be a reality in Ethiopia in the coming years.

Asset Indicator

Livelihood asset ownership is the major source of rural households' gets out of the trap of poverty. Asset indicator is Goal 1 aimed at "end poverty" in all its form everywhere (UNDP, 2016a). The goal calls for all people to enjoy a basic standard of living and social protection benefits. However, in the current study area it was found that 301 (77.8%) were deprived 213 (70.76%)-MPI severely poor, 44(14.62%)-MPI poor, 43(14.29%)-MPI vulnerable poor, and only

1(0.33%), MPI non-poor. The result was found far higher than the global deprivation in asset indicator (OPHI, 2018) and that of Sierra Leone both in 2017 and in 2019 (UNDP, 2019). That is, more than fifty percent of the rural household heads in the study area didn't own more than one of the asset indicators like radio, TV, telephone, computer, animal cart, bicycle, motorbike, refrigerator, car, or truck. Radio and telephone are the basic assets required for getting information about the market price and weather conditions for rural household heads. The lack of such basic assets by the majority of the rural household heads in the study area entails that they are not getting information on the market opportunities of their agricultural products. They were also failed to track weather patterns for timely agricultural calendars like sawing and harvesting activities. Furthermore, animal carts, bicycles, motorbikes, cars, and tracks are means of transportation of rural people and their agricultural products to the nearby market. Deprivation of these assets in the study area revealed to us that rural household heads lack means of modern transportation in getting to and from work or visiting families and friends or market places.

Lacking access to transportation can leave people feeling isolated and make it harder for them to get the jobs needed to improve conditions for themselves and their families (OPHI, 2018). Furthermore, it increased the workload of women is carrying agricultural products to the market. Another similar result was reported. For example, according to OPHI (2018), globally more than two-fifths (42%) of poor people don't own basic assets (either a car or truck or at least two of these items: radio, television, telephone, bicycle, motorbike, or refrigerator) that contribute to their being in very poor wellbeing. In Sub-Saharan Africa, for example (Uganda), according to the 2005/2006 data, most individuals were without material assets such as telephone, television, and moto vehicle (Levine *et al*., 2012). Deprivation in assets declines sharply from 42% in 1994 to 4% in 2017 in Ethiopia (Bruck & Sindu, 2013). Similarly, Alemsged (2016) found that 86.8% of the rural household heads were deprived of asset indicators.

Years of Schooling Indicator

The education dimension of multidimensional poverty was mapped under Goal 4 of UN sustainable development goals. Current results show that out of 387 rural household heads who responded to the survey questionnaire, 208(53.7%) were deprived, and 208(53.8%), MPI poor in this indicator. When the MPI figure is disaggregated into different poverty categories, it was found that 202 (97.12%)-MPI poor, 5(2.4%)-MPI vulnerable poor, and 1(0.48%)-MPI severely

poor. Comparative result analysis shows that the current result (deprivation in years of schooling, at age 7 years[27]) is higher than the global deprivation rate in years of schooling (OPHI, 2018), Sierra Leone rate both in 2017 and in 2018 (UNDP, 2019) and that of Desawi (2019) finding.

The current result implies that more than half of the rural household heads of Jimma Geneti woreda didn't have at least one family member that completed seven years of schooling. The deprivation rate in this particular MPI indicator is found worse everywhere, against "education for all" of the UN sustainable development goal. Thus, a nation to be out of multidimensional poverty status is required to access their citizens to a very demanding human right (quality education) inequitably between gender and other socio-economic factors. In the case of rural households' access to education, integrated functional adult literacy could reverse the MPI poor of rural people. Hence, focus on such delivery to rural households has also a prime role in achieving Goal 4 of UN sustainable development goals- "ending hunger and poverty" by 2030, not rural poverty for all.

School Attendance

Results of the censored headcount ratio of the primary data revealed that 208(53.8%) of the household heads were deprived and poor. When 246(63.6%) figure is disaggregated into different poverty categories, it was found that 221(89.84%)-MPI severely poor, 24(9.76%)-MPI poor, and 1(0.41%)-MPI vulnerable poor. Current deprivation in school attendance indicator was found higher than the global rate (OPHI, 2018), censored headcount ratio for Sierra Leone both in 2017 and in 2019 (UNDP, 2019), national pre-school average rates /39 % in 20014/15 and 49.9 % in 2015/16 (NPC, 2017), and other findings reported by both Alemeseged (2016) and Desawi (2019) implying that large numbers of households in Ethiopia were deprived in child enrollment. The assertion is consistent with that of Bruck & Sindu (2013). However, the result was found less than the 2014 national finding for Ethiopia by (World Bank, 2014). The statistic implies that most of the rural household heads live in a household in which a school-age child is not attending school. This reflects the reality that, lack of education not only affects the child but also the household, which will not be able to benefit from the increased earnings the child would be able to gain as an educated adult. High land dwellers were found less sending their children

[27] **7 years of schooling:** *is Ethiopia compulsory access to primary education)(MOE, 1994).*

than others. The largest numbers of household heads not sending their children were found in Gudetu Jimma followed by Gidami Dabsho.

Overall, the major reasons not sending their children to school as reported by respondents were found due to financial problems (117/50.9%), distant school (92/40%), unwillingness (11/4.8%), disability (5/2.2%), and help the family in farming (5/2.2%)(Table 4.7, below). As reported by rural household heads, the financial problem was a challenge to send their children to school. Despite, primarily public education in Ethiopia is free (no registration fee, no school fee, no textbook fee), no doubt that schooling at primary education needs costs for the purchase of pens, pencils, and exercise books. A household head with limited capacity could be unable to send his/her children to school. Moreover, as reported by the rural household heads' distant school was another deterring factor to send to school. Rural children in the study area faced the remoteness of the school. They have to travel all the long distances, bushes, and forests to get access to the school. Besides, week physical strength of school children less than seven years, the remoteness of the school in the study area could be observed as having double effects on girls. As for coping mechanisms, some household heads may keep their children at home until they become physically strong to travel long distances for schooling. Overall, global, regional, national, and local results show that the lack of children's access to education is a global challenge to achieve the "education for all" Goal of the United Nations. This calls for the world to be in partnership for solidarity to ensure world children have access to quality education irrespective of where they are born, their nation, and nationalities, too.

Table 4.7: Possible reasons for rural household heads' not sending children to school

Possible reasons		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Distant school	92	23.8	40.0	40.0
	Unwillingness	11	2.8	4.8	44.8
	Financial problems	117	30.2	50.9	95.7
	Disability	5	1.3	2.2	97.8
	Help family in farming	5	1.3	2.2	100.0
	Total	230	59.4	100.0	
Missing	System	157	40.6		
Total		387	100.0		

Source**:** Own computation (2019)

Nutrition Adult Indicator

The nutrition adult indicator is Goal 2 of the UN sustainable development goal. The goal seeks to end hunger and all forms of malnourishment and to achieve sustainable food production by 2030 (UNDP, 2017). However, in the current study area results of the household heads who were both

deprived and MPI poor in adult nutrition indicator was found as 162 (41.9%) deprived and 138(85.19%) - MPI severely poor, 7 (4.32%)- MPI poor, and 17(10.49%)- MPI vulnerable poor. Results of the study area deprivation in nutrition/adult indicator rate were found higher than global poor person deprivation reported by (OPHI,2018), Southern Asia and Sub-Saharan Africa rate reported by UNDP (2017), national finding by FAO (2000) and CSA (2005) but less than the finding of Alemeseged (2016). Both results imply that consistent with NPC (2017) rural households elsewhere and the current study area having suffered from chronic food insecurity. Indeed, as (Khan, *et al*., 2018) state nutrition is the quantity and quality of food that the body receives. Acquiring accurate and adequate nutritional information is vital to the well-being of rural households and their members (Quaidoo *et al*., 2018; Alkire & Jahan, 2018). However, lack of such accurate and adequate nutritional information entails deprivation of a rural household in such indicator that ultimately could result in what Khan *et al.* (2018) mention as different kinds of disease, weakness, and disabilities. Thus, deprivation in nutrition/adult indicators could is a major challenge to Goal 2 to end hunger and all forms of malnourishment by 2030 (UNDP, 2017).

Nutrition Child Indicator

Children are the most visible victims of malnutrition (WHO, 2016). Compared to the other MPI deprivation indicators, the current result shows a slightly more number of rural households 197(50.9%) were not deprived and MPI poor as compared to those who were deprived and MPI poor (190/49.1%) in child nutrition indicator. However, in the study area deprivation in nutrition/child indicator rate was found higher than 47% chronic and 24% severe malnutrition rates in 2005 as reported by FAO (2000) and CSA (2005). Given these high levels of malnutrition, it is possible to imply that sample heads children of the study area are unlikely to be free from deficiencies in vital micronutrients like vitamin A, Zinc, Iron, and Vitamin C. Both the micro-level and the national level figures also imply that there exist such deficiencies in the mentioned micronutrients in the country.

Child Mortality Indicator

Likewise, reducing child mortality/Goal 3 of the UN sustainable development goals (2017) is the eleventh MPI indicator. Results show that majority of sample households self-reported that non-deprived 344(88.9%) and MPI non-poor as compared to less proportion of deprived households 43(11.1%) in child mortality indicator. This is to say that being non-poor, households in the

study were living with less proportion of child mortality rate. However, the result is lower than the 2017 global child mortality deprivation rate (14%) reported by OPHI (2018) and that of 19.3% of Sierra Leone deprived in child mortality indicator in 2017 and 15.2% in 2019 (UNDP, 2019). Still the current child mortality indicator rate of the study area was by far less than the ascending national rates (64% in 2013/14 and 67% in 2015/16 (NPC, 2017), Alemeseged (2016), and Desawi (2019) found, too. All results remain atrocious that require government interventions. Overall, sample households of the study area were found deprived and MPI poor in each indicator. Using post-estimation marginal effects, Alemeseged (2016) has investigated explanatory factors that significantly contributed to rural households' deprivation in each MPI indicator that may or may not be the cause for the current indicators. However, the current study has suggested future research.

4.6.2. Multidimensional Poverty Indices

In chapter one, it was described that unidimensional monetary poverty estimate poverty using income or consumption. However, in multidimensional poverty estimates, the aggregate index (MPI) identifies those households on the cusp of poverty and those suffering from severe poverty (OPHI, 2018). Section 4.5.1 identified who is the poor (AF measure, stage one). It also decomposed the MPI into different MPI categories. But the section didn't aggregate. Aggregating the deprivations of multidimensional measures is the second stage of AF methodology (Alkire & Foster, 2011; Alkire & Jahan, 2018). Weighted deprivation score (Ci) of the rural households is a highly important cutoff point to identify them as deprived or non-deprived. This section focused on the presentation and discussions of the results of the parametric class of MPI measures (incidence of poverty/H, poverty gap/A, and aggregated adjusted headcount ratio/M_0) at new poverty cutoff (K=0.3663) (Table 4.8).

Table 4.8: Parametric class of MPI results of the study area (for 11 indicators, K=0.3663)

Poverty cut-off (K)	MPI indices	Value	Std. Err	Confidence interval (95%)	
K=36.63%	▪ Incidence of poverty(H=q/n)	0.801	0.020	0.761	0.841
	▪ Poverty gap(A=M_0/H)	0.663	0.009	0.646	0.680
	▪ Adjusted multidimensional headcount (M_0=H*A)	0.531	0.015	0.501	0.561

Source: Computed from own field survey (2019)

A household was considered multidimensional poor, if deprived in at least 36.63% of the weighted indicators, otherwise MPI non-poor. Such indices help to see the number of deprived

households in which dimension and indicator and to what extent. Table 4.8 presented the value of prevalence of poverty (H), the intensity of poverty (A), aggregate MPI (M0). Standard error and confidence of interval were depicted in the table. Their results and discussions follow:

Incidence/Prevalence of Poverty (H)

The incidence of poverty is the number of households that experienced overlapping deprivations. Hence, as can be seen; the incidence of multidimensional poverty (H) was 80.1%. Since this estimate is based on a sample, it has a margin of error. Thus, the 95% confidence interval is also presented in Table 4.8. This means that with a 95% confidence interval the true multidimensional poverty headcount ratio of the population is between 76.1% and 84.1%, exactly it lies. This implies that when the three dimensions (health, education, and living standard) and eleven indicators were analyzed, about 80.1% of the sample household heads (n=387) of Jimma Geneti woreda were declared multidimensionally poor. Studies on the results of incidence of poverty (H) were found different when compared to the current study. For example, Ballon & Apablaza (2012) in Inodonesia, Alkire & Jahan (2018) in Sub-Saharan Africa, UNDP (2019) in Sierra Leone and Amao, *et al*. (2017) in Nigeria computed different incidences of rural heads poverty. When compared, the current result was higher than Indonesia (32%) in 1993, Sub-Saharan Africa (57.8%) in 2018, and Sierra Leone (64.8%) in 2017 incidence of poverty. In East Africa, Levine *et al*. (2012) found less incidence of poverty (H) for Uganda as 72.2%. The result was still higher than Desawi's (2019) finding (60.2%). However, less than what Bruck & Sindu (2013) found the incidence of Ethiopia poverty as (84.2%, K equals 3), the findings of OPHI (2016) for Ethiopia as (92.2%) in 2016 and that of the national average reported by Alkire & Jahan (2018) as (83%) in 2018. The synthesis of the results implies that the percentage proportion of rural poor household heads found deep-rooted and prevails everywhere. This, in turn, escalates the aggregation of the MPI index, hence, the results call for a reduction in rural heads' incidence of poverty. It can be possible by improving the current status of the eleven MPI deprivation indicators. The section also describes the intensity of poverty in the study area.

Intensity/Average Share of Deprivation (A)

In the literature, it was said that headcount ratio (H) violates dimensional monotonicity and dimensional decomposability), hence, computing intensity/poverty gap (A) is necessary. It is the average proportion of weighted indicators in which the poor are deprived. Besides, the intensity of

poverty is about the number of deprivations households faced on average. In the current study area result of 66.3% was obtained. That is, each poor person is, on average, deprived 66.3% of the weighted indicators. Similar to the incidence of poverty, since this estimate is based on a sample, it has a margin of error. Thus, the 95% confidence interval is also presented in Table 4.8. This means that with a 95% confidence interval the true multidimensional poverty intensity of the population is between 64.6% and 68.0%, exactly true.

The current study area intensity of poverty (A) was found higher than several results in different areas. For example, based on the findings of Ballon & Apablaza (2012) it was higher than the intensity of poverty for Indonesia (40%) in 2000 & (38%) in 2007), SSA average share of deprivation (54.9%) in 2018 reported by Alkire & Jahan (2018), Sierra Leone 57.9% in 2017 found by UNDP (2019), and 52.2% in Nigeria at K equal 30% (Amao *et al*., 2017). Furthermore, the average share of deprivation of the sample heads was found still higher than the average share of deprivation (A) for Uganda (East Africa), 50.8% reported by Levine *et al*. (2012). When compared to the national average share of deprivation, as reported by Bruck & Sindu (2013), it was found as (44.8%, K equals 3) and hence study area result was found higher. Moreover, compared to the recent national study conducted in 2016, still, the result of the study area was found higher than the national average share of deprivation 59.6% reported by OPHI (2016) and 58.5% in 2018 found by Alkire & Jahan (2018). At the woreda level, the result was found higher when compared to Desawi (2019) who computed the average intensity of poverty in the case of Degu'a Tembein as 58.3%. These results imply that the average intensity of poverty is widespread in all places including the current study area but deep-rooted in Jimma Geneti woreda.

Composite/Adjusted Headcount Ratio (M_0)

A multidimensional poverty index has been used to estimate the composite poverty index. The index reflects multiple dimensions (health, education, and living standard) constituted from eleven deprivation indicators discussed above. Thus, the multidimensional poverty index known as adjusted multidimensional headcount (M_0) reflects the composite/product of deprivation of prevalence of poverty and intensity of poverty. It combines information on the prevalence of poverty (H) and the average extent of a poor person's deprivation (A) in the study area. A result of the multidimensional poverty index (MPI) of the study area was computed as 53.1%. This means, rural household heads of the study area experience 53.1 % of the total deprivations that

would be experienced if all rural household heads were deprived in all the eleven MPI deprivation indicators. Similar to the incidence and intensity of poverty, since this estimate is based on a sample, it has a margin of error. Thus, the 95% confidence interval is also presented in Table 4.8. This means that with a 95% confidence interval the true multidimensional poverty-adjusted multidimensional headcount (M_0) of the population is between 50.1% and 56.1%, exactly the index is between the two margins.

Comparative analysis of the current study area composite multidimensional poverty index with similar studies in other developing countries shows higher results than any of these nations, for example, the aggregate poverty index for Indonesia was 3.2% in 2007(Ballon & Apablaza, 2012), Sub-Saharan Africa was 31.7% in 2018 (Alkire & Jahan, 2018), Sierra Leone was 37.5% in 2017 (UNDP, 2019), Nigeria was 41% in 2017(Amao *et al*., 2017), Uganda was 36.9% (Levine *et al*.,2012). Concerning the national composite index, in 2012, Seff & Jolliffee (2016) found the national composite multidimensional poverty index as 90% and in 2014 as 86% implying that the current study area composite index was found less than the national average of the two years. Still, less than the national average (55%) report found by OPHI (2018) for the study area 2016, Nevertheless, the current result was found higher than the findings of Bruck & Sindu (2013) for Ethiopia reported the aggregate poverty (M_0) of the country or the percentage of households who are multidimensionally poor in Ethiopia as 49% in 1994, 37% in 2004, and 22% in 2009. Similarly, when compared to the recent study done by Alkire & Jahan (2018), the study area result was higher than their MPI finding (49%) for the year 2018. Furthermore, while the current aggregate result was smaller than the 70.3% finding by Alemeseged (2016), it was still higher than what Desawi (2019) found adjusted multidimensional poverty of the study area as 35.1%. Jimma Geneti woreda was found severely impacted by the high aggregate multidimensional poverty index. The next section presented and discussed the relative contributions of dimensions and indicators to the overall MPI.

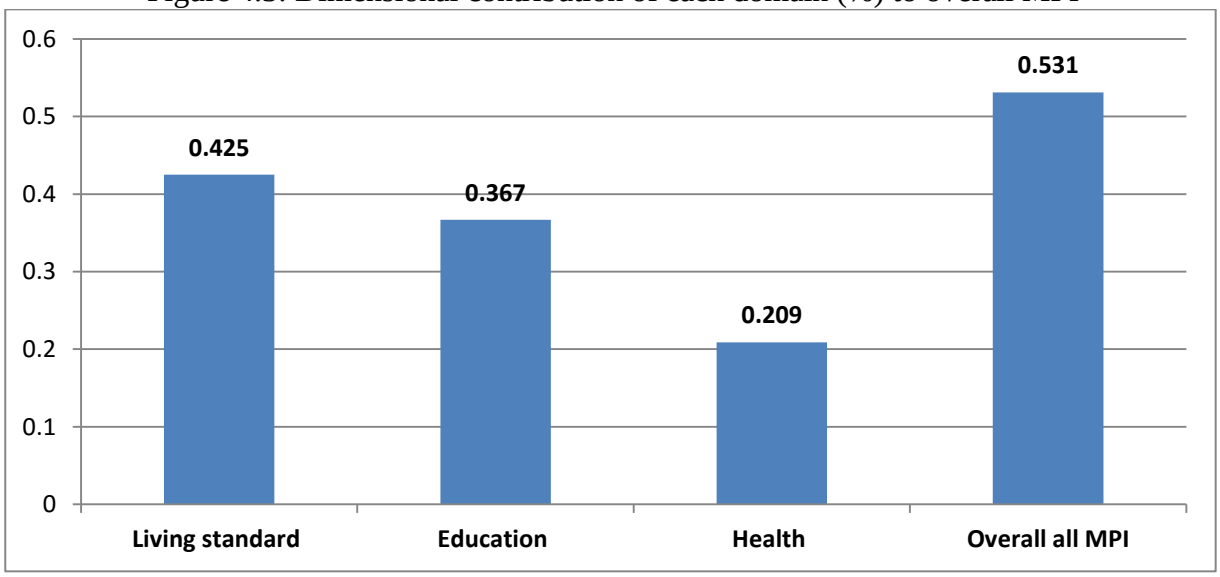
4.6.3. Relative Contributions to Overall MPI

Dimensional Contributions

Alkire & Jahan (2018) mention that, the revised global MPI addresses a composite multidimensional poverty index constituted of three dimensions (health, education, and living standards). The current study adopted these three dimensions and computed the study area aggregate multidimensional poverty index. Hence, in response to the basic question under

specific objective one (relative % age contributions) of each dimension to the overall composite index (53.1%), this section presented each relative result of three dimensions (Figure 4.3). The overall results of Figure 4.3 revealed each MPI dimension contributes differently to the overall MPI index (53.1%) of the study area. For example, the living standard dimension contributed the highest (42.5%) to the overall composite index. This result is consistent with Alkire and Santos (2010), Levine *et al*. (2012), Alemeseged (2016), Amao *et al*. (2017), and Desawi (2019). Other dimensions like education contributed 36.7% and health contributed 20.9%. Hence, to reduce sample heads' multidimensional poverty in the study area, the living standard dimension should be a policy target. In other words, prior attention should be given to living standards followed by education and then health dimensions. Furthermore, woreda budget decision making has to focus on improving the standard of the living conditions of the rural area by providing basic services like modern cooking fuel, electricity, drinking water, sanitation, housing, and building their assets, too

Figure 4.3: Dimensional contribution of each domain (%) to overall MPI



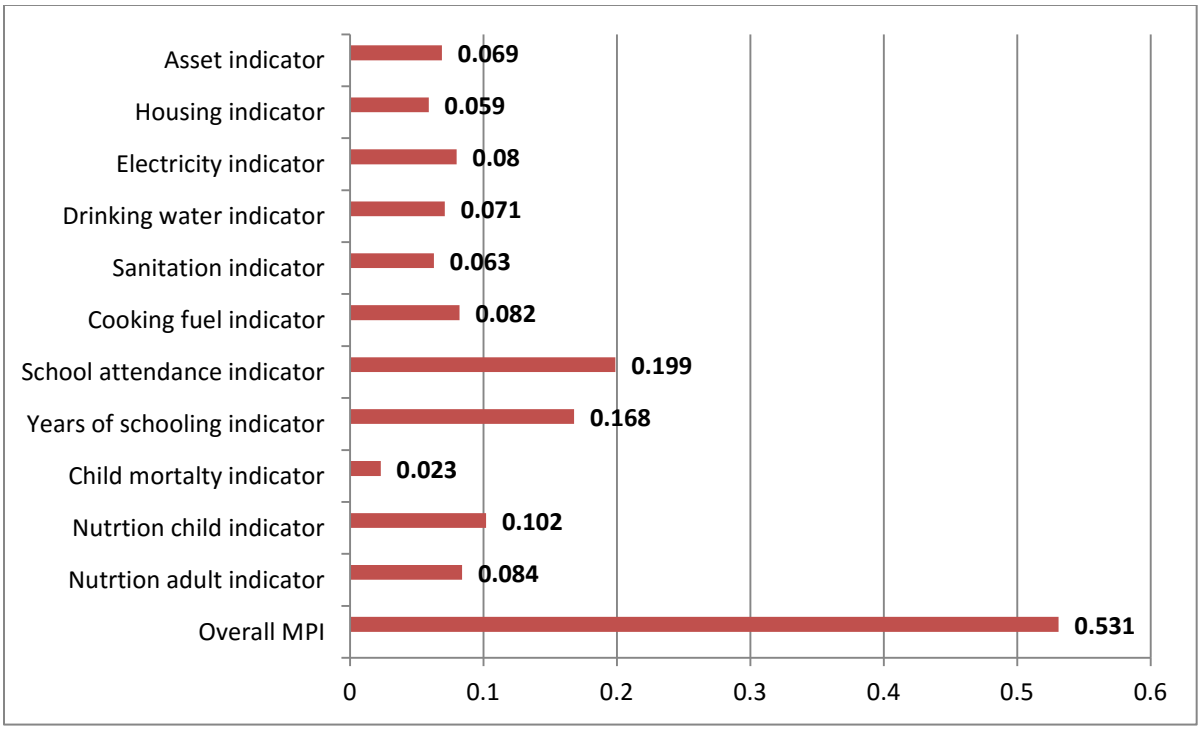
Source: Computed from own field survey (2019)

MPI Indicators Contributions

This section analyzed the relative contributions of each MPI indicator to the overall composite index of the study area. Results show each MPI indicator contributes differently to the overall MPI score. For example, the school attendance indicator (19.9%) was found as the highest contributor to the overall composite index of the study area implying that multidimensionally poor sample household heads in the woreda live with a child who is not attending school (Figure

4.4). This assertion was found consistent with the national children attendance issue reported by OPHI (2019).

Figure 4.4: Relative contribution of each indicator to the overall MPI result (%)



Source: Computed from own field survey (2019)

The second-largest contributor to aggregate MPI deprivation of the study area was found as years of schooling (16.8%) implying that in Jimma Geneti woreda sample heads lived in a situation where no school-aged child (age 7 years old) attending school followed by the situation no household member aged 10 years or older has completed six years of schooling. On contrary, as reported by Levine *et al*. (2012) years of schooling were found the biggest relative contributor to the overall poverty index in Uganda and as reported by UNDP (2019) in UNDP, too.

Both Alemeseged (2016) and OPHI (2019) reported similar findings that multidimensional poor rural households lived in a situation where their children are deprived of compulsory education for all goals of the United Nations. Hence, while fighting against the multidimensional poverty issue in the woreda the results call for prior attention to be given to school attendance and years of schooling indicators. The woreda education office has to work hard to ensure all children must attain school without leaving anyone behind. This could ensure that every future adult citizen had a well-rounded and functional education. Besides, the poverty reduction strategy has to focus

also on other MPI deprivation indicators like the nutrition child indicator (contributed 10.2%, third) and others according to the percentage contributions stipulated in Figure 4.4, above.

4.6.4. Decomposition[28]/Deconstruction of MPI Indices

Indeed, this section aims to locate where the highest/challenges of rural incidence of poverty and composite index lie and what needs to address. Doing this analysis enables the current study to see how poverty differs in the same study area. That is what the study calls for a comprehensive understanding of rural households' poverty for which the uni-dimensional monetary approach becomes blind and criticized forever.

Decomposition by Poverty Categories

Based on OPHI (2015) in general and the proposition of Alkire & Jahan (2018) in particular, who decomposed rural heads poverty into different categories, this study also adapted their work and decomposed rural heads' incidence of poverty, the intensity of poverty, and aggregate adjusted headcount ratio into four different poverty categories. However, differs from these scholars because the newly computed poverty cutoff (K) equals 0.3663 (Table 4.9).

Table 4.9: Comparisons of the summary table for poverty categorization

Poverty categories (MPI)	OPHI (2015), % K=0.333	Alkire & Jahan (2018),% (K=0.333)	Current study (2021),% (K=0.3663)
Non-poor	0<k<0.199	K<0.2	K<0.2
Vulnerable	0.20<K<0.333	. 20<K<0.333	. 20<K<0.3663
Poor	0.333<k<0.50	0.333 < k< 0.5	0.3663 < k< 0.5
Severely poor	K> 0.50	K> 0.50	K> 0.50

Source: OPHI (2015), Alkire & Jahan (2018) and own survey data (2019)

Based on these poverty categories, 387 sample household heads of the study area were categorized according to their poverty categories as follows. Results of the frequency distribution (Table 4.10) show that out of the total 387 sample households, 1(0.26%) of them were found MPI non-poor and 54(13.95%) of them were found MPI vulnerable. Vulnerability to multidimensional poverty (VMDP)[29] refers to the potential that rural households enter into poverty or chronic poverty in the future or it is forward-looking poverty that is technically known as *"ex-ante":* the probability of people (rural people) falling into poverty in near future

[28] **Decomposition of poverty:** *in this study refers to* **1st** *categorization of sample heads into different categories and* **2nd** *deconstruction of the MPI indices in to socio-economic characteristics as MPI non-poor, MPI vulnerable, MPI poor and MPI severely poor, unlike MPI poor and MPI non-poor.*

[29] Vulnerability to multidimensional poverty (VMDP): For details, please, (*see*,Desawi,2019)

(Abraham, 2013; Brihanu & Tesfahun, 2017; Desawi, 2019). Detail investigation of the vulnerability to multidimensional poverty of the sample heads of the current study area was not the focus of this study. It opted for future research. Rather, based on backward-looking data, the current study was a "*post-ante*" multidimensional poverty analysis. Hence, the distribution of sample households across different poverty categories urges the government body to give due development interventions that benefit sample heads being MPI poor and MPI-severely poor.

Table 4.10: Frequency distribution sample heads by poverty categories (N=387)

Poverty category/(MPI)	Freq.	Percent	Cum.
MPI non-poor (K< 0.2%)	1	0.26	100.00
MPI vulnerable (0.20 %< K<0.3663%)	54	13.95	99.74
MPI poor (0.3663 %< K<0.50%)	55	14.21	85.79
MPI sever poor (K>0.50%)	277	71.58	71.58
Total	387	100.00	

Source: Computed from own field survey (2019)

Decompositions by Farming System[30]

Table 4.11, below depicts the results of the decomposition of MPI indices by the farming system. Thus, in absolute value, when the overall MPI result (80.1%) is decomposed by sample heads' farming system, the highest incidence of poverty (83.7%) was experienced by rural heads located in coastal areas of Fincha'a artificial hydroelectric dam engaged in producing Teff, Maize & practicing traditional fishing activities followed by highlanders (79.1%) and plain area residents (78.5%). The reasons may be diverse. For example, as sample heads are closer to the coastal area swampy area is becoming wide expands and overflow over the wide farmland of rural households. In search of green pasture, their livestock may be dying due to the nature of wetland around coastal areas of the artificial lake. It depleted rural households' financial asset sources (livestock) and natural asset capital (farmland).

Depletion of such vital rural household assets, by lowering their diversification strategies, significantly increases their probability of multidimensional poverty (Moser, 1980; Carney, 1998; World Bank, 2000; Losch *et al*., 2012; Mensah, 2014; Chuong *et al*., 2015). That is, household heads located in resource-rich areas (relatively plain areas) are less likely to be multidimensional poor as compared to household heads located in resource-depleted areas

[30] **Types of farming system:** *in this study refers to* **Highland area** *(no Teff & Maize production in the kebele),* **Plain area** *(Teff & Maize production in the kebele) and* **Coastal area** *of Fincha'a Lake (Teff, Maize & fishing production in the kebele/island)*

(coastal areas followed by highland areas). Hence, multidimensional poverty is determined by the location/types of farming system of the household heads. In terms of contribution, highlanders contributed most (39%) followed by plain areas (32.9%) and 28.1% by coastal area sample heads to the overall 80.1% of the incidence of poverty. Thus, as a policy direction emphasis has to be given to rural households located in the coastal areas.

Table 4.11: Distribution of MDP by MPI indices, MPI categories, and farming system (N=387)

	MPI indices/poverty categories	Absolute/contribution	Farming system of households			Total
			Highland area	Plain area	Coastal area	
MDP decomposition by MPI indices vs farming system of HHs	Incidence of poverty (H),%	Absolute	0.791	0.785	0.837	0.801
		Contribution	0.390	0.329	0.281	1.000
	Intensity of poverty (A),%	Absolute	0.649	0.660	0.686	0.663
		Contribution	0.979	0.994	1.036	1.000
	Aggregate poverty (M0),%	Absolute	0.513	0.518	0.574	0.531
		Contribution	0.382	0.327	0.291	1.000
MDP decomposition by different MPI categories vs farming system of HHs	MPI sever (K>0.50%)		109	88	80	277
	MPI poor (0.3663<K<0.50%)		26	18	11	55
	MPI vulnerable (0.2<K<0.3663%)		18	24	12	54
	MPI non-poor (K<0.2%)		0	0	1	1
POP.SHARE,%			153 (0.395)	130 (0.336)	104 (0.269)	387 (100)

Source: Computed from own field survey (2019)

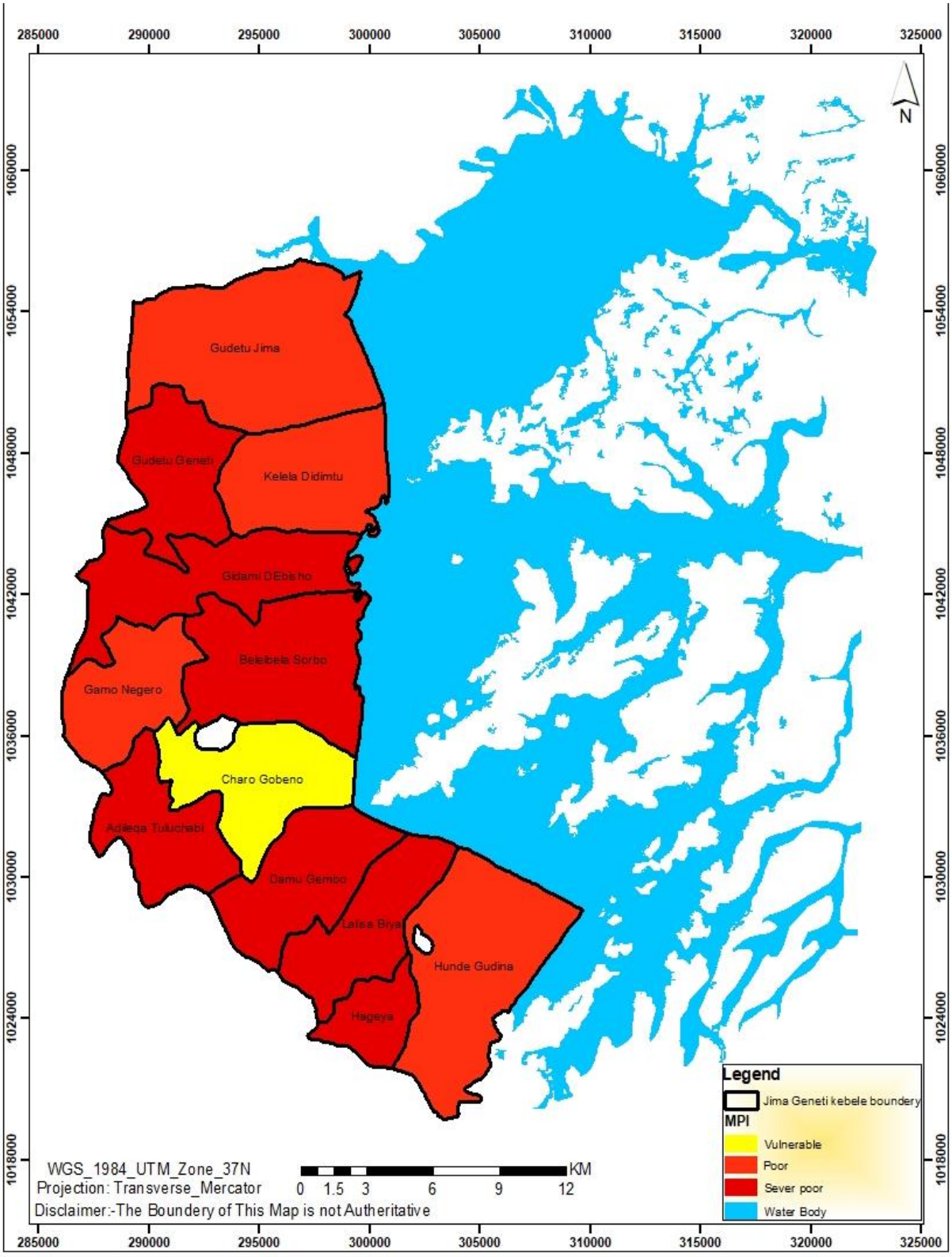
Besides, looking into Table 4.11, above, it was found that out of the total 153 rural households located in highland area 109(71.2%) MPI severely poor, 26(16.99%) MPI poor, 18(11.76%) MPI vulnerable and none of them were found MPI non-poor. As compared to those households, highlanders are expected to be given priority in any multidimensional poverty reduction efforts of the woreda. Moreover, out of the total 130 rural households located in plain area 88(67.7%) MPI severely poor, 8(13.8%) MPI poor, 24(18.5%) MPI vulnerable and nobody found MPI non-poor. Similarly, households located in coastal areas 80(76.9%) MPI severely poor, 11(10.6%) MPI poor, 12(11.5%) MPI vulnerable and only 1(.96%) sample head found MPI non-poor.

Decomposition by kebele of sample heads

Distribution of MPI indices and kebeles

Using availability sampling techniques, all the rural twelve kebeles were sampled in this study. To see the distribution of poverty in the current study area by respective kebele, the researcher produced STATA results (Figure 4.5, below).

Figure 4.5: Distribution of the multidimensional poverty index of the study area by kebele



Source: Ethiopia Mapping Agency, expert assisted map (2021)

Results show that out of the twelve sampled kebeles no rural kebele of the study area with sample heads lived MPI non-poor. All of them were found MPI poor. But when decomposed only Charo Gobeno kebele (located in the plain area) found MPI vulnerable. This is so because the kebele is very close (adjacent to Hareto town) and sample heads get easy access to development interventions. For example, the kebele ECCE[31] school was constructed by the Generation in Action Development Association in 2009. The kebele also get accessed to quality school constructed by hollow concrete blocks which are very difficult to find such kind of school in other kebeles. Sample heads around "Tusha" area also accessed to another primary school. Furthermore, the kebele privileged access to spring developments like "Bure" spring. Hand-pump water schemes are also available in most parts of the kebele. The health post is available in the kebele around "Gafare" area. Farmers Training Center is also there.

However, the remaining 4 (33.33%) sample kebeles (Gudetu Jimma, Kalala Didimtu, Gamo Negero, and Hunde Gudina kebeles) found MPI poor and 7 (58.33%) sample kebeles like Gudetu Geneti, Gidami Dabsho, Balbala Sorgo, Adi Leke Tulu Chali, Damu Genbo, Lalisa Biya and Hagaya kebeles found MPI sever poor. With respect to sample kebeles with highest multidimensional poverty index, results show that the first four sample kebeles include: Incidence of poverty (H): 1st Balbala Sorgo kebele (93.5%), 2nd, Damu Genbo kebele (89.5%), 3rd, Hagaya kebele (82.4%) and 4th, Gudetu Geneti (81.3%), Intensity of poverty (A): 1st Balbala Sorgo kebele (78.6%), 2nd, Hagaya kebele (76.1%), 3rd, Adi l Leka Tulu Chali kebele (75.6%) and 4th ,Gudetu Geneti (66.4%), and Aggregate poverty index (M_0):1st Balbala Sorgo kebele (73.5%), 2nd, Damu Genebo Kebele (66.4%), 3rd, Hagaya kebele (62.7%) and 4th, Adi leka Tulu Chali (61.8%). The overall aggregate poverty indexes imply that rural poverty reduction strategies should give due emphasis.

1st, Balbala Sorgo kebele

This kebele is highly characterized by swampy areas in the woreda in the kebele, rural heads located on the mainland, and the "*Chittu*[32]" island of Balabala Sorgo kebele have been found affected by the rise of the level of Fincha'a Lake. The result of the incidence of poverty of the kebele was found as 93.5%, contributed 9.4%, and first-ranked high prevalence. The population

[31] **ECCE school:** *early childhood care and development refers pre-school service program for chilcern aged less than school-age of the country*
[32] **Chittu:** Island detached from mainland and engulfed by water body (*see*, both refered mentioned maps).

share of the kebele was found as 8%. While the absolute intensity of poverty Balabala Sorgo kebele was found as 78.6% (contributed, 118%), its aggregate MPI was 73.5%, contributed 11.1%. Besides, in Balbala Sorgo kebele, when MPI is decomposed by different poverty categories, it was found that out of the total sample households (31/0.080%), 27 sample heads, MPI severely poor, 2 sample heads each MPI poor and MPI vulnerable, respectively and no household was found MPI non-poor in Balbala Sorgo Kebele implying that MPI indices were widespread in the kebele when compared to the remaining sample kebeles of the study area. The major reason is that in Balbala Sorgo kebele there have been serious livelihoods depletions due to Fincha'a Lake. For example, due to flood and overflow of the Lake, there are losses of animals, humans, and crops. This could be further evidenced by the special support and basic service deliveries given by local non-governmental organizations like Education for Development Association, the generation in Action Development Association, an international NGO (World Vision- Ethiopia) to the poor heads living in the kebele. Hence, development intervention (hydroelectric dam construction) shouldn't have any environmental impact and above all shouldn't disrupt the livelihood sources of the nearby rural households. It has to encompass the meanings of sustainable rural development. Re-locating sample heads living on "*Chittu*" island demand urgent re-location on the mainland in kebele.

2nd, Damu Genbo kebele

Damu Genbo kebele is located after Charo Gobeno kebele on the way to Kidame Gebeya town. In terms of farming systems, the kebele is characterized by both farming systems (high land, plain area, and coastal areas). A telephone interview with Fituma Chimdessa and Asfaw Mitiku (20/01/2020) revealed that Damu Genbo kebele is known for its capital town of Wollega "Kifle Hager[33]" during the imperial period of Ethiopia. Oromo, Amhara, Walayita, Sidama, Gumuz, Kefa, and other nations and nationalities have been living in the kebele. Results show the number of deprived rural households (89.5%, contributing 5.5%), the intensity of poverty (7.4%, contribute 111%), and adjusted headcount ratio (66.4%), second-ranked next to Balbala Sorgo kebele. Besides, in Damu Genbo kebele, when MPI is decomposed by different poverty categories, it was found that out of the total sample households (19/0.049%) 16 households were MPI severely poor, 2 households were found MPI poor, 1 household was MPI vulnerable, and no household was found MPI non-poor in the kebele. There are several reasons. For

[33] **Kifle Hager:** *is the higher administrative unit that constitutes some woredas. Currently, re-named as zone.*

example, Damu Genbo kebele sample heads lack quality education and health services. No rural electric supply and potable water supply services in the kebele. Sample heads get access to dirty water sources from the running "*Laga Gida*"[34]. As the kebele is dominated by high land area, only a few rural households located in the plain area and coastal area have access to very small plots of traditional irrigation. A very small portion of the kebele (Kara area) has access to a very short-kilometer asphalt road from Shambu to Bako towns. The environmental destruction on Jaldesa Mountian could perpetuate the current high prevalence of poverty in the kebele. These imply that to reduce the MPI status of Damu Genbo kebele and its prevalence of poverty (H), priority numbers have to be given.

3rd, Hagaya kebele

Hagaya Kebele is also found in a remote area from Hareto town (capital town of the study woreda). When one moves to Kidame Gebeya or Wayu town of Jimma rare woreda, Hagaya kebele is located after Lalisa Biya kebele, at a very short distance from Kidame Gebeya. As indicated in Table 5.7, below, the population share, prevalence of poverty, intensity of poverty and composite MPI of Haga kebele was as 4.4%, 82.4% (contribution 4.5%), 76.1% (contribution 116%), and 62.7% (contribution 5.2%), respectively. Besides, it was found that out of the total sample households (17/0.044%) from the kebele, 14 households were MPI severely poor, no household was found MPI poor, 3 households were MPI vulnerable, and no household was found MPI non-poor in the kebele. The potential reason may include proximity of the kebele to get quality education and health services and poor living standards. Thus, the kebele also needs priority interventions.

4th, Adi Leka Tulu Chali kebele

Adi Leka Tulu Chali kebele is located in the high-altitude area of the woreda. Mountian Chali is found in this kebele. It has a total population share of 8.5%. When MPI indices of the study area decomposed, results show the incidence of poverty (81.8%, 8.7% contribution), the intensity of poverty (75.6%, 114% contribution), and aggregate poverty (61.8%). Besides, the kebele was found characterized by 30 households MPI severely poor, 3 households MPI vulnerable, and no household was found no household MPI poor and non-poor in the Kebele. Several potential reseasons exist for which lack of access road. The rural road constructed in the kebele was

[34] **Laga Gida:** *Laga is Oromo language. Laga Gida means, Gida river*

found difficult to access the kebele for the provisions of basic services like education, health, and improve living standards of the sample heads. Most of the access rural road in the kebele was eroded. Most of the children in the kebele either have been renting houses in Hareto town or find a relative close to Hareto town for their education. Recently, Oromia Development Association (ODA) has constructed a primary school in the kebele. No, health institution is found in the kebele. Access to potable water was absent. Living standard parameters, for example, electricity, modern cooking fuel, housing, and others are at low status. This implies that the kebele has to be among the top prioritized kebeles in multidimensional poverty reduction efforts in the study area.

4.6.5.Determinants of Rural Households' Multidimensional Poverty

Diagnosis Test of No Multicollinearity: While undertaking the screening of risk factors (diagnosis Tests) of ologit assumption, there were two separate tests of the multicollinearity assumption of ologit model. First, test multicollinearity assumptions for discrete explanatory variables. This was done using pairwise correlation (*pwcorr* STATA command). Results show no value 0.75 or above that indicates a stronger relationship between dummy or explanatory variables implying that no serious multicollinearity problem (Annex 4.1). Second, Variance Inflation Factor/VIF diagnosis test of no multicollinearity assumption among five continuous variables. Results show no multicollinearity problem ("rule of thumb" of VIF<10 in each predictor variable) (Annex 4.2) showing that the assumption of the ordered logit model was met and possible to trust coefficients and P-value in the analysis of the determinants of multidimensional poverty of the current study.

Determinants[35] of Multidimensional Poverty

Table 4.12 shows that five explanatory variables are identified as statistically significant determinants of the probability of household heads to be MPI poor (p-value<0.05), presented in the next paragraphs.

As a hypothesized result of the ordered logistic regression analysis revealed that *kebele of the household heads* have negatively (β=-.2820006) and significantly (p=0.002<0.05) influenced sample households being MPI poor, implying that households' living in non-coastal areas compared to households' kebeles located around coastal areas, decreases the log of odds of

[35] **Determinants of MDP:** *refers to its proximate causes (Haughton & Khandker, 2009).*

being MPI poor by 75.4%, other factors constant. The marginal effect .0343387 indicates that as variation in kebele of sample households having a good education, health, and other development opportunities increases by one more unit, the probability of being MPI poor decreases 3 times or by 3.4% at a 1% significance level. The current result is consistent with the findings of Bogale *et al*. (2005), Bogale (2011), and Bahta & Haile (2013). Results imply that rural multidimensional poverty status is location-specific, for example, rural households from Balbala Sorgo kebele lived with the highest multidimensional poverty index due to the impact of Fincha'a Lake. This assertion was found consistent with Bogale (2011) who analyzed the extent and determinants of rural household poverty in the eastern highlands of Ethiopia.

The marital status of sample heads has positively (β=.7524454) and significantly (p=0.007<0.05) influenced households being MPI poor, implying that the log of odds of being MPI poor for single, divorced, and/or widowed household heads' increases by 12.2%, other factors constant. The marginal effect -.0916238 indicates that being an unmarried household head increases the probability of being MPI poor by 9.2% which is statistically significant at 1%. Anyanwu (2014) reported consistent results in Nigeria.

The literacy level of sample heads has negatively (β=-.8986961) and significantly (p=0.003<0.05) influenced households being MPI poor. Other factors remained constant, being literate the log of odds of being MPI poor decreases by 40.7% when compared to illiterate. The marginal effect .1094324 indicates that as the literacy status of household heads increases by one more unit, the probability of being MPI poor decreases by 10.9% which is statistically significant at 1%. Bruck & Sindu (2013) and Alemeseged (2016) reported similar findings.

Landholding (in hectare) has positively(β=0.3949135) and significantly (p=0.035<0.05) influenced households being MPI non-poor, implying that the log of the odds of being multidimensional non-poor increases with the increases in households size of landing holding in a hectare, ceteris paribus by 42.6%. The marginal effect -.0432171 indicates that as the probability of the landholding size in a hectare of heads increases by one more unit, the probability of being MPI poor decreases by 4.3%. This result is consistent with the findings of several scholars (Bogale *et al*., 2005; Bahta & Haile, 2013; Alemeseged, 2016; Amao et al., 2017; Desawi, 2019).

Membership in cooperatives: Consistent with the presumption and previous findings of Bogale (2011) results show that being a member of cooperatives negatively (β=-1.973214) and statistically significant determinants of the probability of households being MPI poor (P=0.218>0.05), implying that being a member of cooperative, log of the odds of multidimensional poor decreases by 13.9% when compared to non-members. The marginal effect .24027743 indicates that as the probability of heads becoming a member of cooperatives increases by one more unit, the probability of being MPI poor decreases by 24%.

Table 4.12: Results of the econometric ologit model

Significant variables (Xs) (A)	Coefficients (B)			Odds ratios (C)		Marginal effects(D)	
	βs	Std. Err.	p>/z/	or	p>/z/	dy/dx	p>/z/
Agro-ecology/farming system	-.7473385	.3839514	0.052	.4736255	0.052	.0910019	0.040
Place of residence/kebele [1]	-0.2820006	.0901174	0.002*	0.7542732	0.002	0.03433387	0.000
Sex of HH head	-.1076989	.8020386	0.893	.8978979	0.893	.0131143	0.893
Age of the HH head	-.5882251	.5784934	0.309	.555312	0.309	.071627	0.304
Family size of the HH head	-.3885906	.3449206	0.260	.6780118	0.260	.0473179	0.254
Marital status of HH head [3]	0.7524454	.2793369	0.007*	2.122183	0.007	-0.0916238	0.003
Education level of HH head	.5779587	.4381775	0.187	1.782396	0.187	-.0703769	0.176
Literacy status of HH head [2]	-0.8986961	.3029484	0.003*	0.4071001	0.003	0.1094324	0.001
Religion of the HH head	-.0872457	.1294163	0.500	.9164519	0.500	.0106237	0.498
Ethnicity of the HH head	-13.03462	3911.859	0.997	2.18e-06	0.997	1.5872	0.997
Dependency ratio	1.904517	1.338803	0.155	6.716161	0.155	-.2319092	0.145
Livestock holding (TLU)	.017913	.0507831	0.724	1.018074	0.724	-.0021812	0.724
Agricultural employ.t status	-16.12434	1715.921	0.993	9.94e-08	0.993	1.963428	0.993
Landholding (in hectare) [5]	0.3949135	.1680824	0.035**	1.426057	0.035	-0.0432171	0.027
Access to remittance	.120613	.6673171	0.857	1.128188	0.857	-.0146868	0.856
Saving	-.3025048	.6545885	0.644	.7389649	0.644	.0368354	0.643
Access to credit	-.4558967	.5380377	0.397	.6338793	0.397	.0555136	0.392
Access to irrigation	.8305034	.7275302	0.254	2.294473	0.254	-.1011287	0.246
Membership in cooperatives[4]	-1.973214	.7784798	0.011**	0.1390094	0.011	0.2402743	0.006
Access to agricul.l extension	-1.065823	.8657498	0.218	.3444443	0.218	.1297831	0.213
/cut1	-33.50834	4271.654		-33.50834			
/cut2	-31.88762	4271.654		-31.88762			
/cut3	-29.29321	4271.654		-29.29321			

Note: ***, **, * significant at 1% (for significant p-value<0.01), 5% (for significant 0.01<p-value<0.05), and 10% (for significant p-value>0.05), respectively

Source: Computed from own field survey (2019)

4.7. Results and Discussions of Participatory Poverty Analysis

4.7.1. Conceptualizing Rural Poverty

The way rural households conceptualize poverty requires rigorous investigation. Sample heads of the study area were required to define poverty as perceived by them (Box 4.1). The result implies a consensus among rural households on what constitutes rural poverty. This assertion is consistent with Anafo (2014) who states as no universal consensus, too. However, based on the results of Box 4.1, it is now possible to generally witness poor households' conceptualized poverty as deep and multidimensional phenomenon. The result is consistent with the findings of

previous qualitative participatory poverty researchers like Citron & Robert (1995), Zaid *et al*. (2006, Chambers (1994a; 194b), Duraiappah *et al*.(2005), Norton (2001), Hinds (2013), Leavy & Haward (2013), Melaku(2016), and Alemeseged (2016). Poverty was conceptualized deeply by sample heads because the poor identified several missed dimensions and indicators of rural poverty proposed by Alkire & Santos (2010b), Alkire & Foster (2011), & Alkire & Jahan (2018).

Box 4.1: Unadulterated voices of the poor (the concept of poverty)

Poverty is:

1. *A manifestation of rural households' loss of livestock due to lack of vaccination (I_1, I^{36}_2, I_3, I_4, I_5, and I_6). Such conceptualization of poverty by rural households is integrated[37] with UNDP sustainable development goal/SDG 3,*
2. *Children's drop-out from school systems due to lack of education material is also households' failure to join and complete their children from higher education institutions and it is also lack of integrated functional adult literacy (IFAL) (I_1& I_2) that is integrated with UNDP sustainable development goal/SDG 4,*
3. *Lack of potable drinking water, sanitation, and electricity supply (I_1, I_2, I_3, I_4, I_5, and I_6) that is integrated with UNDP sustainable development goal/SDG 6 & 7,*
4. *A situation where rural households encountered price increase shock and fail to cope up with it, lack of rural households' access to agricultural extension services, dependency on on-farm livelihood, and migration of family members for better living (I_1, I_2, I_3, I_4, I_5, and I_6) that is integrated with UNDP sustainable development goal/SDG 1 & 2,*
5. *An indication of people undertaking Female Genital Mutilation/FGM, the physical violence of spouse and children and lack of participatory decision making between the spouses concerning their common properties (I_1, I_2, I_3, I_4, I_5, and I_6) and it is integrated with UNDP sustainable development goal/SDG 5. The definition is consistent with the definition of poverty by social exclusion approach reported by Ramachandran (2016) from India, and*
6. *Characterized by cutting of trees for multiple purposes such as house construction, farm tool, and charcoal and it is also lack of engagement in the conservation practices at kebele level in general and on own farmland in particular (I_1, I_2, I_3, I_4, I_5, and I_6) that is integrated with UNDP sustainable development goal/SDG 11.*

Source: PPA primary data (2019)

4.7.2. Identification of the Poor from Non-Poor

In the above paragraphs, poverty was conceptualized by poor sample heads of the study area as a multidimensional phenomenon. To comprehensively understand rural poverty, conceptualization is not enough. More analyses of how the poor identify the poor from non-poor also have prime importance in building alternative approaches to rural poverty study. The rationale was what Haughton & Khandker (2009) state as we measure poverty to identify the poor from non-poor. Then, reduce or alleviate it. In this regard, to identify the poor from non-poor, while the monetary poverty approach has been using controversial poverty line as poverty cutoff ($1.25, now $ 1.90), multidimensional poverty estimate used 0.333 as a poverty cutoff point (Apata *et al*., 2010; Alkire & Foster, 2011;

[36] I: Interviewee

[37] Integration: (*See*, NPC, 2017; UNDP, 2017).

Alemeseged, 2016; OPHI, 2017;2018; Amao *et al*., 2017; Alkire & Jahan, 2018). Neither of them was used by poor, rather multiple qualitative criteria (Box 4.2).

Box 4.2: Unadulterated voices of the poor (identification of the poor).

A household is poor:

1. *If at least one person with a disability exists in the member of the household, he/she is considered poor because he/she can't take medical treatment. Rich has money and can take his/ her disabled person to hospital-like Nekemte. Furthermore, a household is poor if he/she has any member who encountered sudden road traffic injuries/death. A household with ETB less than ETB 50.00 is considered as poor,*

2. *If a household has persons with disabilities (due to health and lack of money to take to the medical center), the rich can medicate their families and be free from disability due to health problems. Take for example vaccination. While the poor household is unable to develop their spring for clean water, the better off households construct their spring. The former drinks dirty water and the latter does not. Besides, while the poor faced shock of input price increase, the non-poor cope with it by selling livestock.*

3. *The poor failed to produce more. The non-poor produce more. Do you know why? The reasons are differences in agricultural extension service (fertilizer). The poor couldn't afford the price and the non-poor afford the price of the skyrocketing price of fertilizer. A small business like petty trade is a means to identify the poor from the non-poor. Because the poor don't have start-up capital couldn't engage in small business as compared to the non-poor having better start-up capital. This difference in start-up capital may be due to educated families of the non-poor households' families earning monthly income and support him/her. Consistently, a household is poor if he/she earns ETB 50.00 per day per person.*

4. *The poor have limited farm size (less than 0.1 hec.). Permanent employment in farming is unthinkable. However, because the non-poor has farmland size greater than 0.5hec. has the probability of engaging him/herself in agricultural employment. The poor earn income from their child labor but the non-poor do not. The poor undertake FGM of their daughter but some non-poor do not because they get information from their educated children about its health crisis.*

5. *The poor's daughter is forced to marry but the non-poor are not. Do you know why? The kidnappers know that the non-poor have money and take them to court which the poor couldn't due to financial capacity. In terms of participatory decision-making of the common asset may be the non-poor is better as they have no asset to be a cause for a property dispute. Comparatively, the non-poor don't destroy forests and as a result, contribute less to air pollution than the poor. Because the poor have to cut trees and sell firewoods for other incomes. Because the non-poor has more number families and large farmland able to participate in conservation practices on their land,*

6. *If poor people don't have the radio for HIV/AIDs education and don't take care. They are the ones highly vulnerable. However, non-poor have radio and get educated about HIV/AIDS. The poor because of lack of balanced food to eat may be contracted Hepatitis B disease for long period. The non-poor get medical treatment and cure of such disease. Poor household children drop out than non-poor household children the reason is that poor household children require jobs for their families' survival while that of the non-poor only focus on their education. In terms of vaccination poor households never bother about the vaccination of their children due to low education level whereas it is not in the case of non-poor households. Relative to the non-poor households poor households are highly encountered input price increase shock. The non-poor household's children capture more fish than those poor household children. This is so because poor household children are mostly hired (employed at better offs) and couldn't get permission to go to the lake.*

7. *While poor households' are mostly migrated abroad, the non-poor households' send migrants abroad. The main reason is they do have better survival strategies. For the hazards like erosion, poor households' are highly vulnerable than non-poor households. This is because the non-poor houses are made of CIS and that of poor households is made of local material that is easily destroyed with sudden erosion. In terms of income diversification, the non-poor has diversified sources (on-farm, non-farm, and off-farm activities) than poor households. Poor households' children are highly vulnerable to child labor exploitation than that non-poor households. The problem of maternity leave, members of Parliament, and forced marriage is more serious with poor households than non-poor. This so because non-poor household heads have good rapport and trust than the poor households to be representative both at kebele and woreda level.*

   If poor households ill malaria disease because they can't get "Hagobore", don't use birth control, illiterate, faced multiple shocks, lack vaccination, only on-farm, lack monthly salary, sending children abroad, lack income, spouse without maternity leave, no member of parliament, frequently punish children when crying for food, no mini-market,

burning trees for cooking and others.

8. *They didn't deprive me of all that I listed. For examples, rich households' children are in the school up to university level, have large farm size (6-10 from different wives) and employed permanently in farming activities, respect household family members (fewer harassments), have electricity, and don't cut trees and don't sell charcoal. Have a wide range of assets (on-farm, non-farm, and migration for education) and cope up with hazards, boys and girls attain schooling in their own or rented house in Hareto town, however, the poor households are poor because they don't fulfill what rich households owned,*

9. ***I**f a household committed suicide due to a lack of food and cloth for children. A household that lacks health insurance is poor and a household without farm-land and corrugated iron sheets. Just like me!! If someone lacks children's vaccination, lacks own saving both in cash and agricultural products, lack access to extension services, lack small business/trading, without monthly salary just like you and lacks financial income, for example, min ETB 50/person/day, I call him/her poor, and*

10. ***I**f a poor is the one with grass housing, no social protection from the government, don't vaccinate children and animals, faced multiple shocks, don't information, non-diversified activities, lacks financial income, don't have permanent employment just like me, forced to marry, pollute the environment, no waste disposal and failed to conserve soil and water on own land. Non-poor don't. Furthermore, a household is poor when he/she failed to send children to school, drinking dirty water, unemployed especially in farming, violates spouse rights, cut trees, withdraw children from school, don't have a house that copes up hazards, biased to boys schooling.*

Source: PPA primary data (2019)

Hence, analyzes of the current result implies that the way PPA approach identified the poor from non-poor and the result is inconsistent with both the MDP approach (poverty cutoff=1/3) used by MDP researcher (Apata *et al*., 2010; Alkire & Foster, 2011; Amao *et al*., 2017; Alkire & Jahan, 2018; OPHI,2017; 2018), monetary approach (poverty line=$1.25, now $ 1.90) used by Noglo (2014), Laderchi (2015), and Suppa (2016) but slightly consistent with the findings of different participatory poverty researchers like Zaid *et al*. (2006) problem ranking, Lekshmi *et al*.(2008) wealth ranking, Melaku (2016) well-being ranking, and Citro & Robert (1995).

4.7.3. PPA Dimensions & Indicators

Moving Away from Corpus Data to Text Data- definition and identification of poverty were captured as presented in the above Boxes 4.1 and 4.2. Both results were crude data and difficult to analyze, construct PPI, and compare the result with MPI. Thus, as data reduction in quantitative research, moving away from such corpus data (from interview & observation) to written study or text data in qualitative is very essential. Results were analyzed using the cross-case analysis technique (Annex 4.3), then, dimensions & indicators were identified.

Progressive differentiation of the unadulterated voices (what is poverty? Who is poor?) of the poor people captured through the in-depth interviews was inserted in the concept matrix. The final text data was achieved through cross-case analysis technically known as integrative re-conciliation. That is, key informants' voice was analyzed systematically by integrating their progressively differentiated voices generated through an in-depth interview (I) and non-

participatory observation (NPO). However, to undertake the subsumption process, the researcher consulted document review (D) to align these results with both GTP II and SDGs. That is, the purpose of cross-case analysis to move the data from corpus data to text data or to make ready qualitative data for analysis using thick data generated from the concept matrix and integrated with Ethiopia's GTP II and UN SDGs. It enables the researcher to easily analyze the qualitative data given both participants, national and international perspectives. It also enables the researcher to identify PPA dimensions and indicators. In other words, the in-depth interview sessions progressively differentiated many pieces of information that describe the concept of poverty and who are poor. However, it was very difficult to establish meanings and themes, unless otherwise, analyzed using cross-case analysis techniques. The cross-analysis of the key informants 1 to 6 and participatory observation were found overlapping and have clear patterns across the concept map. Accordingly, the following six PPA dimensions and their meanings identified using the PPA approach:

Health [animal] dimension: poverty is a manifestation of rural households' loss of livestock due to lack of vaccination (I_1, I_2, I_3, I_4, I_5, and I_6). Such conceptualization of poverty by rural households is integrated with UNDP sustainable development goal/SDG 3 (NPC, 2017; UNDP, 2017). Dimensionally, it differs from human health dimension of multidimensional poverty proposed by Alkire & Jahan (2018) and corresponding indicators.

Education dimension: Poverty is children's drop-out from school systems due to lack of education material, is also households' failure to join and complete their children from higher education institution and it is also lack of integrated functional adult literacy (IFAL) (I_1, I_2, I_3, I_4, I_5, and I_6). Such conceptualization of poverty by rural households is integrated with UNDP sustainable development goal/SDG 4 (NPC, 2017; UNDP, 2017). Dimensionally, it overlaps with the education dimension of multidimensional poverty proposed by Alkire & Jahan (2018) but different in terms of the list of indicators.

Living standard dimension: Poverty is a lack of potable drinking water, sanitation, and electricity supply (I_1, I_2, I_3, I_4, I_5, and I_6). Such conceptualization of poverty by rural households is integrated with UNDP sustainable development goal/SDG 6 & 7 (NPC, 2017; UNDP, 2017). Dimensionally, it overlaps with the living standard dimension and list of indicators of multidimensional poverty of Alkire & Jahan (2018).

Livelihood dimension: Poverty is a situation where rural household encountered price increase shock and fail to cope up with it, lack of rural households' access to agricultural extension services, dependency on on-farm livelihood, and migration of family members for better living (I_1, I_2, I_3, I_4, I_5, and I_6). Such conceptualization of poverty by rural households is integrated with UNDP sustainable development goal/SDG 1 & 2 (NPC, 2017; UNDP, 2017). It is the missed dimension and list of indicators proposed by Alkire & Jahan (2018).

Empowerment dimension: Due to lack of education on its health consequences, poverty is an indication of people undertaking Female Genital Mutilation/FGM, the physical violence of spouse and children, and lack of participatory decision making between the spouses concerning their common properties (I_1, I_2, I_3, I_4, I_5, and I_6). Such conceptualization of poverty by rural households is integrated with UNDP sustainable development goal/SDG 5 (NPC, 2017; UNDP, 2017). Like the livelihood dimension and its corresponding indicators, the empowerment dimension and its list of indicators are the missed dimension and list of indicators as compared to the dimensions and indicators of multidimensional poverty proposed by Alkire & Jahan (2018). The empowerment dimension of poverty suggested by the PPA approach is consistent with the social exclusion approach definition of poverty reported by Ramachandran (2016).

Environment dimension: Poverty is characterized by cutting of trees for multiple purposes such as house construction, farm tool and charcoal and it is also lack of engagement in the conservation practices at kebele level in general and on own farmland in particular (I_1, I_2, I_3, I_4, I_5, and I_6). It is integrated with UNDP sustainable development goal/SDG 11 (NPC, 2017; UNDP, 2017). It is among the missed dimensions and list of indicators of multidimensional poverty proposed by Alkire & Jahan (2018).

Results imply that new rural poverty dimensions and indicators were indented by PPA (bottom-up) overlooked by both monetary and multidimensional approaches (top-down). In other words, results of the PPA approach found deep but consistent with the multidimensional concept of poverty reported by several previous scholars (Sen 1976; 1981; 1985; 1992; World Bank, 2004; 2014; Alkire & Santos, 2010a; Alkire & Foster, 2008; 2011; UNDP, 2014a;2014b OPHI, 2017;2018).

The weights attached to PPA dimensions and indicators were vital stages to be discussed. This is so because PPA dimensions and indicators don't have equal importance. In quantitative

research, statistical tools such as multiple correspondence analysis or principal component analysis generate and attach weights to each poverty category. None of these techniques are used in the current qualitative study. Rather, the researcher adopted an equal weighting approach used by the MDP approach suggested by Bruck & Sindu (2013) and Alkire & Jahan (2018) (Table 4.13).

Table 4.13: PPA dimensions, indicators, and corresponding equal weights

A	B	C	D	E
Type of poverty (Dimensions) (6)	**Poverty recognition (Indicators) (17)**	**SDG area**	**Connotations of poor people (Poor or deprived if....** two years before this study)	**Weights (Wik)**
Health[animal] [an(W_1=1/6=0.1667	1Mortality/animal	SDG 3	Household member lost any own animal due to many diseases	W_{11}=1/12=0.0833
	2Vaccination/animal		Household head with any animal non-accessed to vaccination	W_{12}=1/12==0.0833
Education (W_2=1/6==0.1667)	3 Drop-out	SDG 4	The household head having any child drop-out of primary education	W_{21}=1/18=0.0556
	4 Higher education		The household head having no child joined & completed from HEI	W_{22}=1/18=0.0556
	5 IFAL		Household head non-accessed to integrated functional adult literacy	W_{23}=1/18=0.0556
Living standard (W_3=1/6==0.1667)	6 Drinking water	SDG 6	The household does not have access to improved drinking water	W_{31}=1/18=0.0556
	7 Sanitation		Household head practiced open defecation	W_{32}=1/18=0.0556
	8 Electricity	SDG 7	the household has no rural electric supply	W_{33}=1/18=0.0556
Livelihood (W_1= W_4=1/6==0.1667)	9 Shock	SDG 1 SDG 2	Household head faced input price increase (seasonality)	W_{41}=1/24=0.0417
	10 Extension service		Household head non-accessed to ant form of extension service	W_{42}=1/240.0417
	11 On-farm LH		No household member involved in fishery production	W_{43}=1/240.0417
	12 Migration		Any household member subjected to any human trafficking	W_{44}=1/240.0417
Empowerment (W_5=1/6==0.1667)	13 FGM	SDG 5	Household having a girl/s subjected to female genital mutilation	W_{51}=1/18=0.0556
	14 Physical violence		Household head subjecting spouse to physical violence	W_{52}=1/18=0.0556
	15 Decision making		A household head non-participatory decision on common property with a spouse	W_{53}=1/18=0.0556
Environment (W_6=1/6==0.1667)	16 Deforestation	SDG 11	Household cut trees for charcoal, fire-wood, farm tool, & house construction	W_{61}=1/12==0.0833
	17 Conservation		Household has not practiced soil and water conservation practices on own farmland	W_{62}=1/12==0.0833
∑Wj= 1				∑Wjk= 1

Source: Primary PPA data (2019)

4.7.4. Participatory Poverty Index (PPI), its Decompositions, and Sequencing PPI Degree/Severity

Alternative to the multidimensional poverty index used by Alkire & Jahan (2018), to describe the status of rural poverty using the PPA approach, Shen *et al*. (2011) suggests participatory poverty index. The current PPI value of the study area was computed. Thus, when rural poverty is estimated using the PPA approach, it was found that the mean PPI value of the 72 sample heads from 12 sample kebele was 2.37 which represents the woreda level rural poverty profile. Furthermore, the specific implementation of poverty alleviation work is restrained by several factors. For examples, poverty alleviation resources, poverty alleviation ability and failed to categorize sample heads according to their different PPI status, farming system, and their kebele, too implying that PPI can also be decomposed as presented in the subsequent paragraphs

Decompositions by PPI indicators

Decomposing rural poverty by PPI indicators enables the identification of which PPI indicator (s) rural heads are deprived, thereby, design an effective poverty alleviation strategy and rationally identify PPI indicators to be primarily improved (Table 4.14).

Table 4.14: Decomposition by % deprived and disaggregated PPI indicators (N=72)

Type of poverty (Dimensions)	Poverty recognition (Indicators) (17)	% age of deprived and disaggregated PPI poor				
		Deprived		PPI poor disaggregated		
		N	%	Poverty categories	N	%
Health (animal)	Mortality/animal	15	20.83	PPI severely poor (PPI > 2.53)	9	0.60
				PPI poor (2.03< PPI ≤2.53)	4	0.27
				PPI vulnerable (1.53 < PPI ≤ 2.03)	2	0.13
	Vaccination/animal	67	93.06	PPI severely poor (PPI > 2.53)	11	0.16
				PPI poor (2.03< PPI ≤2.53)	49	0.73
				PPI vulnerable (1.53 < PPI ≤ 2.03)	7	0.10
Education	Drop-out	62	86.11	PPI severely poor (PPI > 2.53)	11	0.18
				PPI poor (2.03< PPI ≤2.53)	45	0.73
				PPI vulnerable (1.53 < PPI ≤ 2.03)	6	0.10
	Higher education	65	90.28	PPI severely poor (PPI > 2.53)	11	0.17
				PPI poor (2.03< PPI ≤2.53)	45	0.69
				PPI vulnerable (1.53 < PPI ≤ 2.03)	9	0.14
	IFAL	65	90.28	PPI severely poor (PPI > 2.53)	11	0.17
				PPI poor (2.03< PPI ≤2.53)	48	0.74
				PPI vulnerable (1.53 < PPI ≤ 2.03)	6	0.09
Living standard	Drinking water	67	93.06	PPI severely poor (PPI > 2.53)	11	0.16
				PPI poor (2.03< PPI ≤2.53)	47	0.70
				PPI vulnerable (1.53 < PPI ≤ 2.03)	9	0.13
	Sanitation	68	94.44	PPI severely poor (PPI > 2.53)	11	0.16
				PPI poor (2.03< PPI ≤2.53)	50	0.74
				PPI vulnerable (1.53 < PPI ≤ 2.03)	7	0.10
	Electricity	69	95.83	PPI severely poor (PPI > 2.53)	11	0.16
				PPI poor (2.03< PPI ≤2.53)	49	0.71
				PPI vulnerable (1.53 < PPI ≤ 2.03)	9	0.13
Livelihood	Shock	72	100	PPI severely poor (PPI > 2.53)	11	0.15
				PPI poor (2.03< PPI ≤2.53)	51	0.71
				PPI vulnerable (1.53 < PPI ≤ 2.03)	10	0.14
	Extension service	44	61.11	PPI severely poor (PPI > 2.53)	10	0.23
				PPI poor (2.03< PPI ≤2.53)	31	0.70
				PPI vulnerable (1.53 < PPI ≤ 2.03)	3	0.07
	On-farm livelihood	72	100	PPI severely poor (PPI > 2.53)	11	0.15
				PPI poor (2.03< PPI ≤2.53)	51	0.71
				PPI vulnerable (1.53 < PPI ≤ 2.03)	10	0.14
	Migration	9	12.50	PPI severely poor (PPI > 2.53)	3	0.33
				PPI poor (2.03< PPI ≤2.53)	5	0.56
				PPI vulnerable (1.53 < PPI ≤ 2.03)	1	0.11
Empowerment	FGM	72	100	PPI severely poor (PPI > 2.53)	11	0.15
				PPI poor (2.03< PPI ≤2.53)	51	71
				PPI vulnerable (1.53 < PPI ≤ 2.03)	10	0.14
	Physical violence	61	84.72	PPI severely poor (PPI > 2.53)	10	0.16
				PPI poor (2.03< PPI ≤2.53)	43	0.70
				PPI vulnerable (1.53 < PPI ≤ 2.03)	8	0.13
	Decision making	67	93.06	PPI severely poor (PPI > 2.53)	11	0.16
				PPI poor (2.03< PPI ≤2.53)	48	0.72
				PPI vulnerable (1.53 < PPI ≤ 2.03)	8	0.12

Type of poverty (Dimensions)	Poverty recognition (Indicators) (17)	% age of deprived and disaggregated PPI poor				
		Deprived		PPI poor disaggregated		
		N	%	Poverty categories	N	%
Environment	Deforestation	66	91.67	PPI severely poor (PPI > 2.53)	11	0.17
				PPI poor (2.03< PPI ≤2.53)	50	0.76
				PPI vulnerable (1.53 < PPI ≤ 2.03)	5	0.08
	Conservation	64	88.89	PPI severely poor (PPI > 2.53)	10	0.16
				PPI poor (2.03< PPI ≤2.53)	48	0.75
				PPI vulnerable (1.53 < PPI ≤ 2.03)	6	0.09

Source: Own computation based on PPA data (2019)

Based on Table 4.14, above, the following are the degree of PPI severity as per PPI indicators (most severe to lowest severe):

Shock indicator: The result of the cross-case analysis identified shock as an indicator (specific issue) of the livelihood dimension (a big issue or major theme constructed). Results show that 72(100%) purposively sampled households revealed that they encountered input price increase shock. As a result, 11 (15%) are PPI severely poor, 51(71%) are PPI poor and 10(14%) are PPI vulnerable. Triangulation, with the unadulterated voices of the poor show consistent result. For instance, on day one interviewee conceptualized poverty as "poverty is the incapability to purchase agriculture inputs due to input price increase. In contrast, better-offs purchased whatever the price of the input, that is, a household faced input price increase of agriculture products failed to get income, so he/she become poor" (I_1).

On-farm livelihood/fishing indicator: The result of the cross-case analysis also identified an on-farm livelihood/fishing indicator (specific issue) from the livelihood dimension. Results show that 72(100%) purposively sampled households revealed that no household member was involved in fishery production. As a result, 51(71%) are PPI poor and 10(14%) are PPI vulnerable. Triangulation, with the unadulterated voices of the poor show consistent result. For instance, on day one interviewee conceptualized poverty as " poverty is households' lack of engagement on fish production… even not much, households in *Chittu* Island do it. Fincha'a Lake located at our figure tip" (I_2).

FGM indicator: is from empowerment dimension of PPA approach. Results show that 72(100%) purposively sampled households responded that their daughter/s are subjected to female genital cutting (FGM). As a result, 11 (15%) are PPI severely poor, 51(71%) are PPI poor and 10(14%) are PPI vulnerable. Triangulation, with unadulterated voices of the poor show consistent result. For instance, on the first day interviewee1 conceptualized poverty as "…at the age of 6 years, my first daughter undergoes FGM. She was very sick for more than a month…" (I_1).

Electricity indicator: is from the living standard dimension of the PPA approach. Results show that 69(95.83%) purposively sampled households responded that they don't have a rural electric supply. As a result, 11 (16%) are PPI severely poor, 49(71%) are PPI poor and 9(13%) are PPI vulnerable. Triangulation, with the unadulterated voices of the poor show consistent result. For instance, interviewee4 conceptualized poverty as "…poor people use firewoods while better-off families get accessed to rural electrification. That is poverty!" (I_4).

Sanitation indicator: The sanitation indicator is the second PPI indicator from the living standard dimension. Results show that 68(94.44%) purposively sampled households responded that they have been practicing open defecation. As a result, 11 (16%) are PPI severely poor, 50(74%) are PPI poor and 7(10%) are PPI vulnerable. Triangulation, with the result of the researcher's non-participatory observation, shows that no latrine around interviewee4 house suggesting that the household is using open defecation mostly common in rural areas of the study area.

Vaccination/animal : is the first PPI indicator from the health dimension. Results show that 67(93.06%) purposively sampled households responded that they don't access any animal vaccination. As a result, 11 (16%) are PPI severely poor, 49(73%) are PPI poor and 7(10%) are PPI vulnerable. Triangulation, with the result of data collated from interviewee1, show that poverty is a situation where rural people's children and their animal lacks vaccination ((I_1, I_2, I_4, and I_5).

Drinking water indicator: is the third PPI indicator from the living standard dimension of the PPA approach to analyze rural poverty. Results show that 67(93.06%) purposively sampled households responded that they don't have access to the potable water supply. As a result, 11 (16%) are PPI severely poor, 47(70%) are PPI poor and 9(13%) are PPI vulnerable. The researcher made the triangulation of this figure with the result of data collected through non-participatory observation. It revealed that both except interviewee 6 both collect water from Bure spring with a discharge capacity of less than 1lt/sec.

Decision-making indicator: is among the three PPI indicators of empowerment dimension used to rural poverty. Results show that 67(93.06%) purposively sampled households responded that no participatory decision making between the spouses concerning their common properties. As

a result, 11 (16%) are PPI severely poor, 48(72%) are PPI poor and 8(12%) are PPI vulnerable. The researcher made the triangulation of this figure with the result of data collected through an in-depth interview that states "poverty is lack of participatory decision making between the spouses concerning their common properties: (I_1, I_2, I_3, I_4, I_5, and I_6).

Deforestation indicator: this indicator is from the environmental dimension of the PPA approach to poverty analysis. Results show that 66(91.67%) purposively sampled households responded that they cut trees for charcoal, firewood, farm tool, & house construction. As a result, 11 (16%) are PPI severely poor, 50(76%) are PPI poor and 5(8%) are PPI vulnerable. Triangulation of this figure with the result of data collected from interviewee 6 shows that "because the poor have less diversification of livelihood sources, pollute the environment and failed to conserve soil and water on own land" (I_6).

*Higher education indicator***:** is one of the PPA indicators of education dimension. Results show that 65(90.28%) purposively sampled households responded that they don't have a child who joined & completed from any higher education institution (HEI). As a result, 11 (17%) are PPI severely poor, 45(69%) are PPI poor and 9(14%) are PPI vulnerable, other factors remain constant. Triangulation of this figure with the result of data collected from interviewee shows that:

> *Poverty is an indication of a household head that has no child joined & completed from the higher education institution. Look! , I have around six children. None of them joined university, let alone completing it. In my neighbors, Ato Jabessa Jira [has 6 children all joined university and completed and hired in a government office). And Ato Argachew Robeta (has 7 children of which 5 joined and completed university)…we are indifferent in living (I_3).*

IFAL[38] *indicator:* is the second PPA indicator of the education dimension. Results show that 65(90.28%) purposively sampled households responded that they lacks integrated functional adult literacy program/IFAL. As a result, 11 (17%) are PPI severely poor, 45(69%) are PPI poor and 9(14%) are PPI vulnerable, *citrus paribus*. Triangulation of this figure with the result of data collected from interviewee shows that "a household who lacks integrated functional adult literacy program/IFAL is considered as poor because of lack of information on the importance of education for people like me who are above young age"(I4).

[38] IFAL: Integrated Functional Adult literacy

Conservation indicator: apart from deforestation indicator, conservation indicator is the second PPA indicator of environment dimension. Results show that 68(88.89%) purposively sampled households responded that they don't practice soil and water conservation practices on their farmland. As a result, 10 (16%) are PPI severely poor, 48(75%) are PPI poor and 6(9%) are PPI vulnerable, other factors remain constant. Triangulation of this figure with the result of data collected from interviewee shows that:

> *If rural people are rich, why they burn forests for extra land? Why they cut trees for housing? why they refuse conservation?...rich people have large farm sizes, big houses made of corrugated iron sheets, made of cement floors, well-cemented floors, and actively participate in conservation and practice by themselves on their land once trained by development agents* (I_6).

Drop out indicator: is the third education dimension of PPA poverty analysis. Results show that 62(86.11%) purposively sampled households responded that they have a child drop-out from primary education. As a result, 11 (18%) are PPI severely poor, 45(73%) are PPI poor and 6(10%) are PPI vulnerable. Triangulation of this figure with the result of data collected from interviewees shows that "poverty is dropping out of own children from primary education for child labor" ($I_1, I_2, I_3, I_4, I_5, I_6$ **).**

The physical violence indicator: is the third PPI indicator from the empowerment dimension. Results show that 61(84.72%) purposively sampled households responded that they have to experience of subjecting spouse or children to physical violence. As a result, 10 (16%) are PPI severely poor, 43(70%) are PPI poor and 8(13%) are PPI vulnerable, *citrus paribus*. Triangulation of this figure with the result of data collected from interviewee shows that "poverty is punishing own spouse if disagree or children seeking for food, education and clothing" (I_5).

Extension service indicator: is among the four PPA indicators under the livelihood dimension. Results show that 44(61.11%) purposively sampled households responded that they don't access any form of extension services. As a result, 10 (23%) are PPI severely poor, 31(70%) are PPI poor and 3(7%) are PPI vulnerable, other factors constant. Triangulation of this figure with the result of data collected from interviewee shows that "poverty is punishing own spouse if disagree or children seeking for food, education and clothing" (I_5).

Mortality/animal indicator: is the second health dimension of the PPA approach. Results show that 15(20.83%) purposively sampled households responded that they lost own animal due to animal diseases. As a result, 9 (60%) are PPI severely poor, 4(27%) are PPI poor and 2(13%) are PPI vulnerable, other factors constant. Triangulation of this figure with the result of data collected from interviewee shows that "poverty is a manifestation of household head's animal mortality due to disease" (I_3).

Migration indicator: is the fourth livelihood dimension of the PPA approach. Results show that 9(12.50%) purposively sampled households responded that household members were subjected to human trafficking. As a result, 5 (56%) are PPI poor and 1(11%) are PPI vulnerable, other factors constant. Indeed, migration from rural to urban areas within a country and out-migration are inherent components of the development process. According to Kothari (2002) and Baby (2005) migration could reduce and perpetuate rural households' poverty. That is, the shortage of workforce during peak agricultural plowing, sowing, and harvesting period's migration perpetuates rural poverty (Kothari, 2002; Baby, 2005). However, the flow of remittances reduces rural poverty (Kothari, 2002; Baby, 2005; World Bank, 2007; 2014; 2015; World Economic Forum, 2017). Finally, the above discussions revealed that poverty resource allocation in terms of PPI indicators should be for shock, on-farm livelihood/fishing, FGM, electricity, sanitation, vaccination/animal, drinking water, decision making, deforestation, higher education, IFAL, conservation, drop out, physical violence, extension service, mortality/animal, and migration indicators, respectively.

Decomposition by sample heads

When poverty is estimated using the PPA approach, Shen *et al*. (2011) suggest and categorize sample household heads into different PPI categories. Following them, the current study categorized 72 PPA sample heads (Table 4.15). The Table shows that no sample head in the current study area found PPI non-poor. In other words, 10 (13.89%) of them categorized under PPI vulnerable having a PPI value of less than or equal to 1.53 and greater than 2.03. Furthermore, out of the total 72 PPA sample households' majority (51/70.83%) of them found PPI poor having PPI value greater than 2.03 and less than or equals 2.53, however, 11(15.28%) sample heads found PPI severe poor having PPI value greater than 2.53. This suggests that if the livelihood sources of these vulnerable households are diversified they may enter PPI non-poor, otherwise PPI poor.

Table 4.15: Decomposition of composite PPA by sample heads (N=72)

PPI categories	N	%	Total
PPI non-poor (≤1.53)			
PPI vulnerable (PPI >1.53 & PPI ≤2.03)	10	13.89	13.89
PPI poor (PPI >2.03 & PPI <≤2.53)	51	70.83	84.72
PPI severely poor (PP>2.53)	11	15.28	100
Total	72	100	

Source: Primary PPA data (2019)

Decomposing by farming system

In a situation where the number of poor kebeles is too big and kebele based poverty alleviation is constrained due to limited poverty reduction resources it is also possible to fight poverty by decomposing the PPI result in terms of rural households' agroecology or farming system, thereby, households in the farming system with high PPI get the priority of poverty intervention efforts by the woreda. Accordingly, Table 4.16 revealed that out of the total 72 sample households, 34 (47.2%) located in the coastal area of the study woreda. In terms of PPI categories, 7 (20.6%) PPI sever, 21 (61.8%) PPI poor, and 6(17.6%) PPI vulnerable, compared to the other sample households located in either high or plain areas. This suggests that priority has to be given to sampling households located in coastal areas followed by plain area and high land area residents respectively.

Table 4.16: Decomposition of percent of households by the farming system (N=72)

Types of farming system	PPI categories			Total
	PPI vulnerable	PPI poor	PPI sever	
High land area	0	11 (91.7%)	1 (8.3%)	12 (16.7%)
Plain area	4 (15.2%)	19 (73.1%)	3 (11.5%)	26 (36.1%)
Coastal area	6 (17.6%)	21 (61.8%)	7(20.60%)	34(47.2%)
	10	51	11	72

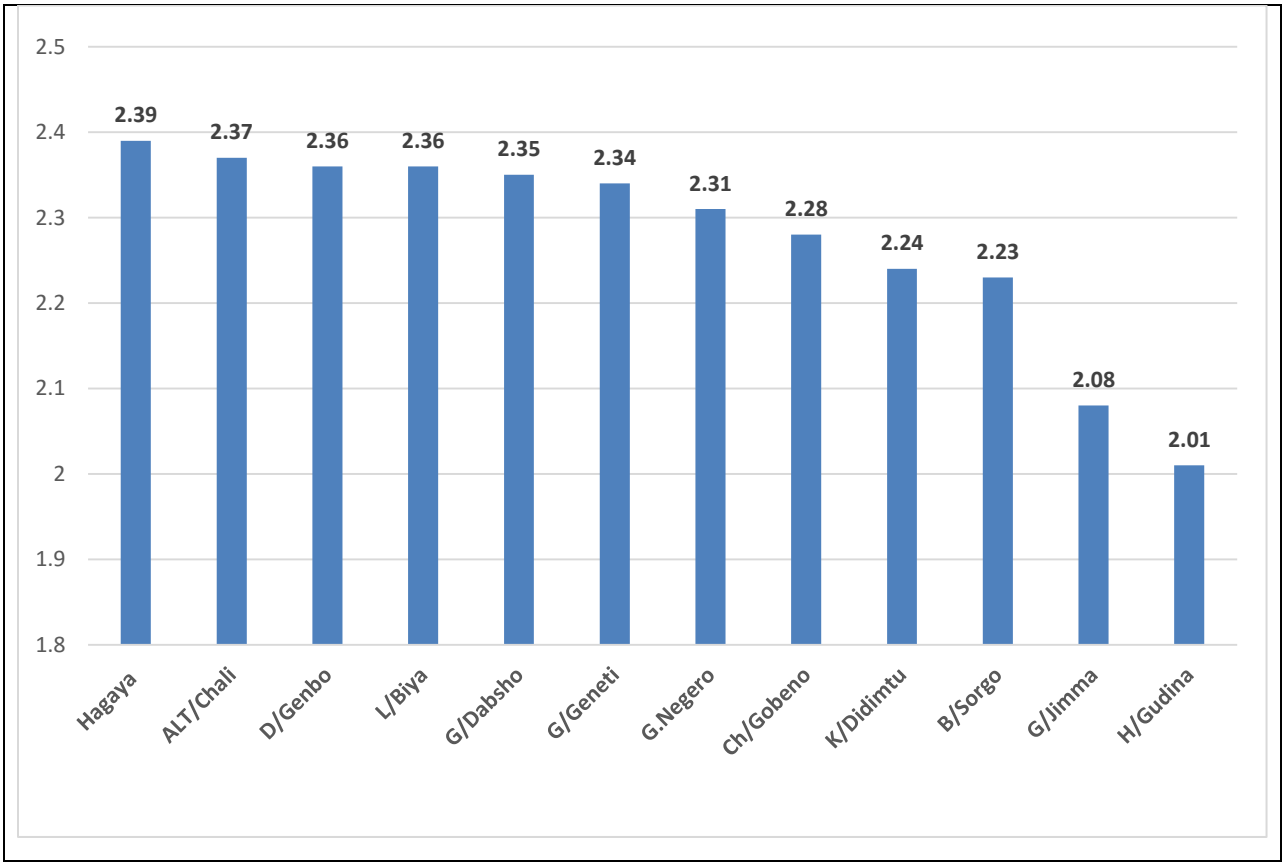
Source: Own computation based on PPA data (2019)

Decomposition and sequencing by kebele of sample heads

PPI value of each sample household can explain their poverty degree. Hence, the mean of each simple household was computed to get the PPI of each kebele. Results of PPI for each kebele show that Hagaya kebele (2.39), ALT Chali kebele (2.37), D/Genbo kebele (2.36), L/Biya kebele (2.6), G/Dabsho kebele (2.35), G/Geneti (2.34), G/Negero (2.31), Ch/Gobeno (2.28), B/Sorgo (2.23), G/Jimma (2.08) and H/Gudina (2.01). The sequencing of the poverty degree of each kebele was made from high PPI to low PPI (Figure 4.6).

PPA results suggest the PPA approach in general and the PPI equation, in particular, can better recognize the poor kebeles. Furthermore, targeting each kebele's poverty level and designing a poverty alleviation strategy, lays a solid foundation for rationally and effectively use the limited poverty alleviation resources. Figure 4.6 presents the sequencing of the poverty degree of each sample kebele.

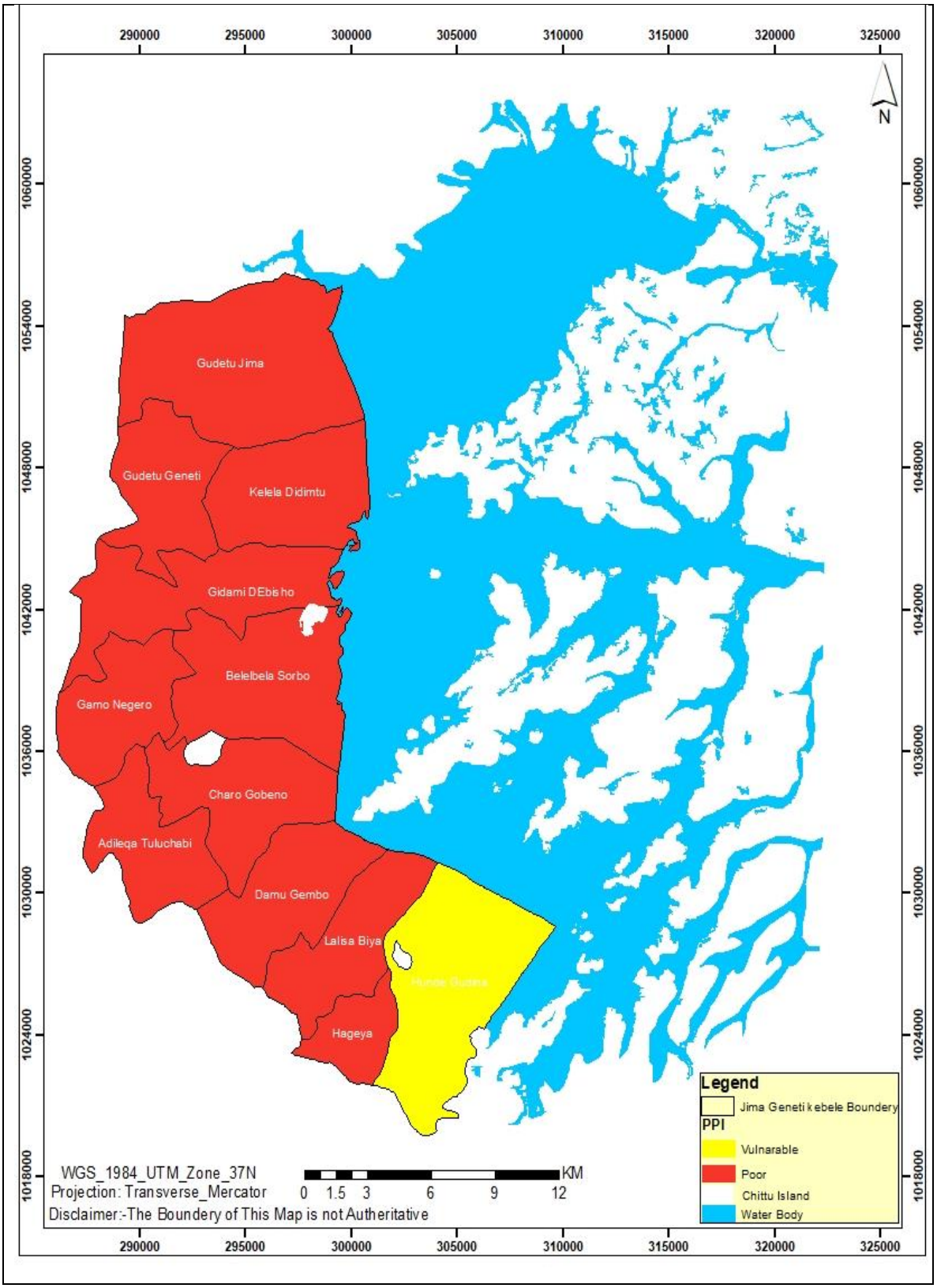
Figure 4.6: Sequencing of poverty degree of each sample kebele



Source: Own computation based on PPA data (2019)

When each kebele sequenced according to their PPI severity it was found as presented in fig 3.1 (1st Hagaya Kebele with PPI sever followed by Adi Leka Tulu Chali and Dambu Genbo kebeles, respectively, when compared to the three kebeles with the smallest PPI value(Hunde Gudina, Gudeti Jimma and Balbala Sorgo Kebeles, low degree of poverty). The advantage of PPI to rationally allocate according to PPI sever was consistent with the assertion of Shen *et al*. (2011). Besides, Figure 4.6 above, Figure 4.7 presented the PPI of each sample kebele. Results revealed that when rural poverty is estimated using the PPA approach, 11sample kebeles found PPI poor and only Hunde Gudina kebele found PPI vulnerable. No MPI non-poor/sever.

Figure 4.7: Participatory Poverty Index by woreda and Kebele



Source: Ethiopia mapping agency, expert assisted (2021)

Based on these results, the perceived determinants o rural poverty of the study area were identified by participants of the FGD as follows:

4.7.5. Perceived Determinants of Rural Poverty

In the previous sections, conceptualizing poverty and identification of the poor by the active involvement of the poor themselves discussed. Results show that while poverty was in-depth and PPI value revealed that 91.2% of the sampled kebele found PPI poor. FGD participants identified the causes of rural heads being in a state of PPI poor (Annex 4.4, below/column B). FGD facilitator/researcher asked each FGD participant to provide the score for each determinant across developed measurement indicators (i.e., prevalence or severity).

FGD participants were invited to put relevance based score 0-5 for each determinant:

- ✓ 0 ….least important factors
- ✓ 5 …most important factors

They used PRA 10 seeds techniques (column C/Annex 4.4). Concerning the adding of scores, the FGD facilitator/researcher and FGD note-taker/assistant researcher quickly add the scores provided by all FGD participants (Column D/Annex 4.4). For the result of the mean score, % of the mean score and maximum score see (column E, G & F/Annex 4.4), respectively. Thus, PPA focus group discussion participants identified a total of 24 perceived causes of rural households' poverty. Thus, according to their degree of perceived importance, results of the participatory scoring matrix on the prevalence & severity of rural poverty were computed as shown in Annex (4.4). That is, while old age (total score 120), illness (total score 120), lack of farmland (total score 120), a few livestock (total score 120), and being women-headed (total score 120) are identified as most determinants, lack of credit/big interest (total score 29), lack of working habit (total score 37), non-cooperative member (total score 42), and loss of harvest (total score 41) are identified as least important factors. Detail narrations are found under (Annex 4.4).

Old age (>64+ years): One of the major determinant causes of rural poverty perceived by the purposively sampled FGD participant is being old age. Using 5 point Likert-scale (most important cause given 5 and least important cause given 0), the 12 FGDs participants scored old age 10 out of 10 and hence the total score given to the old age factor is found 120. A household being old age (mean score value of 10 & percentage mean score of 250%) us that poverty increased due to increase in rural household age, otherwise non-poor. In other words, old age is

perceived by rural communities as having the power of perpetuating their poverty status. This is so because "*when the household is older, he/she becomes unable to become productive*"(FGD participants). The result is consistent with the findings of the rural households' multidimensional poverty researchers like Sabir *et al*. (2006) and Hashmi *et al*. (2008). It is also consistent with the finding of Majeed & Malik (2014) who used the PPA approach, too.

Illness (status): The health status of rural households is also perceived as a determinant factor of their poverty status. Participants state that "*while a health household head engages in his/her day-to-day activities, the ill household head does not. As a result, vulnerable to poverty due to less production and productivity*". The FGD participants of the current study also revealed the same result that being ill is a cause for rural households'' in poverty (mean score 10 and percentage of the mean score of 250%), otherwise non-poor. Melaku (2016) reported consistent results with a mean score of 2.43 and a percentage mean score of 18.57%.

Lack of farmland (<0.5 hect): Farmland for the rural households is one of the natural capital from which resource flows and services are derived into their stock of livelihood sources. FGD reflections revealed that "*an increase in land ownership reduce poverty status of the rural households, otherwise poor if owned less than 0.25hec*". Similarly, participants of FGD revealed that households' who farmland less than 0.5 hec are vulnerable to poverty (mean score 10 and percentage of mean score 250%) than those households who owned larger farmland. Landholding does have a significant influence on their deprivations. Keeping other factors constant, a similar MDP study by Amao *et al*. (2017) revealed that land ownership was a significant determinant of poverty. Melaku (2016) who used the PPA approach also reported consistent findings.

A few livestock (less than 2, mainly oxen and cow): The number of livestock owned by rural households also determines their poverty status. That means, the more the number of livestock owned by rural households the less their vulnerability to poverty. Sample households who participated in the PPA process also revealed that "*rural households who owned less than 2 number of livestock (oxen and cow mainly) are in poor*" (FGD participant 1, 2, 3 & 4), numerically, (10 mean score and 200% percentage of mean score). Furthermore, PPA researchers (Majeed & Malik, 2014; Melaku, 2016) similarly revealed that livestock holding is one of the determinants of rural household's poverty. Indeed, MPD researchers for example

Apata *et al*. (2010) reported consistent findings with that of PPA researchers and the current study.

Being Women-headed: as compared to male household heads, being a female-headed household increases the probability of persistence in poverty. That is, rural poverty status decreases with the increases in the presence of a female household head. Results of the participatory scoring matrix also revealed that being women headed household is a major determinant of rural poverty (mean score 10 and percentage of mean score 200%). The main reason stated is that:

> "*Rural households' livelihood is dependent on farming. As the farming activity is commonly practiced by the man, women are expected to work on household chores. As a result, women-headed households are obliged either to rent or share farm products with male-headed households. These scenarios potentially reduce the livelihood sources of the women-headed households which in turn vulnerable them to poverty*" (FGD participants).

Previous MDP researchers like Amao *et al*. (2017), Teka *et al*. (2018), and Ballon & Apablaza (2012) reported similar findings with the PPA approach of the current study. Expensive input (fertilizer ETB 380-450 ETB/Qtl): Participants of the FGD state that "*expensive input (fertilizer ETB 380-450 ETB/Qtl) is one of the causes of rural households being in poor condition*". The above table revealed a 9.91 means score and 198.33% of the mean score of the expensive input as the determinant of poverty. Lack of irrigable land (less .25 hect): Participatory analysis of the current study also revealed that lack of irrigable land (less than 0.25 hect) (9.25 mean score and 185% of mean score) by rural households is one of the causes of their being in poor status. A similar PPA study by Melaku (2016) revealed the same. Besides, MDP researchers like Bogale (2011), Tesfahun (2005), and Bahta & Haile (2013) witnessed that poverty status was negatively associated with irrigated crops. Lack of irrigable land as a cause of rural poverty is further strengthened by the reflection of the FGD participant as:

> *Rural poverty falls with the size of cultivable irrigable land. That is, "as households access to irrigable land (greater 0.25) increases, their probability of becoming poor reduces, otherwise poor. Irrigable land is unevenly distributed in the world. For example, parts of kebeles like Gudetu Jimma, Kalala Didmtu, Gidami Dabsho, Balabala Sorgo, Charo Gobeno, and Damu Genbo have irrigable land. Within the kebele not all households per kebele own irrigable land. For example in Charo Gobeno households who are geographically own land adjacent and downstream Gida River owned irrigable land* (FGD participant 9).

Death of oxen (No.): In the size of tropical livestock unit (TLU) cattle reduce the probability of the household being MPI poor (Alemeseged, 2016). Nevertheless, the death of livestock (oxen) increases their poor status. This is revealed by the participatory scoring matrix of the above Table. Participants discussed that the death of oxen (8.58 mean score and 171.67% mean score) is among the determinants of rural households' poverty status. The result is similar to the qualitative reflection of the FGD participant:

> *Farming land and the production of livestock are our major livelihood sources. Farm products are sometimes destroyed with heavy rainfall and pests. In search of green pasture, our livestock is walking long distances adjacent to Fincha'a Lake. Some of them are taken by the water. Lack of sufficient grazing land and animal diseases have been the major causes for the death of our livestock. Households who frequently lost their livestock due to death are in a state of poor condition. They copy up with lending from better offs* (FGD participant 10).

Lack of agricultural income (total less than 2,500 ETB/yr): Agricultural products (sale of crop products: teff, maize, wheat, nouge, bean, barely; and sale of animals: cattle, sheep, Goat, Donkey, Horse; sale of livestock products: skimmed milk, butter, and cheese) are among the other rural households'' sources of total income (house construction, masonry work, painting work, monthly salary, daily wage, petty trade, sell of trees, sell of child labor, rent of land and others). PPA scoring matrix revealed that households who earn their annual agricultural income less than ETT 2,500.00 are vulnerable to poverty (mean score of 4.92 and % mean score of 16.89%). Lack of saving (cash, min. ETB 500/yr): Rural poverty falls with the number of rural households saved. Participants reflected that:

> *A household may earn financial income from agricultural products like the sale of crops, cereals, and others. They may also earn from the sales of livestock like cows, oxen, sheep, goats, and others. Others may earn from the sale of their child labor and or daily wages from the better-off households. Sometimes, such households expense more than their income. Others saved a small amount, i.e. ETB 500/yr. In our opinion, a household that lacks saving and or saved less than ETB 500/yr is in a state of poor condition. That is, lack of saving is among the determinants of poverty* (FGD participant 10).

Using a participatory scoring matrix, the researcher computed the objective or numerical value for lack of saving as a cause of poverty. The consistent results revealed that households who lack saving (in cash, min. ETB 500/yr) are vulnerable to poverty (8 mean score and 160% of mean score). MDP researchers like Tesfahun (2005) and Bruck & Sindu (2013) found consistent findings with the PPA approach; suggesting us that lack of rural households' saving is a determinant factor of their poverty status.

Lack of road access: The researcher quotes "*lack of access to the rural road has a significant contribution for rural households in a state of poor condition*" (Participants of FGD). The subjective or qualitative meaning being this statement is that road infrastructure has a positive contribution to rural households' mobilization of agricultural inputs to farming areas and products to the markets. It has a significant contribution for their in and out the flow of their products. In turn, contributes to less chance of being in a state of poor condition. PPA data analysis results revealed the same. That is, results show that rural households' that lack road access (8 mean score and 16% of mean score) are in a state of poverty. Poor soil fertility (hect/any): World Bank (2015) states that "under the right conditions, a 10% increase in fertilizer use would reduce poverty by 0.4%" (p. 61). Meaning, poor soil fertility affects the production and productivity of rural households. The use of fertilizer input could reverse the problem. In the current study area, PPA participants revealed that poor soil fertility (any hect). Having a mean score of 8 and a % score of 160 is an indication of the rural household in a state of poor condition. The researcher quotes the reflections of the FGD participants on poor soil fertility as a cause of rural poverty as follows:

> *We are engaged in farming activities. Our land has been exhaustively utilized and has become losing its fertility. Due to heavy erosion, it losses its fertility, Many years ago, we are increasing the soil fertility using a large number of livestock. Because of lack of grazing land our livestock population has been declined and unable to enhance soil fertility. We depend on chemical fertilizer. It has become too expensive. The agricultural produce we collected per year is less than the total fertilizer cost. We are in a state of poor condition. By implication, poor soil fertility is among the causes of our being in poor condition (FGD participants' reflections).*

Poor extension services (less than 3 times visit per/year): Agricultural extension services are crucial in enabling producers to realize the increased production and productivity in accessing information for marketing and the other support services essential for agricultural development towards poverty reduction and overall development. Participants of the FGD reflected that "*rural households who get accessed to agricultural extension services/training are expected to be less chance of being poor than those who didn't*" (FGD participant 12. PPA results also revealed that poor extension service delivery (less than 3 times/year visit by development agents) (6.25 mean score and 156.25% mean score) could reveal that a household is in a state of poor condition. Several researchers (Mvuna, 2010; John, 2014; Mwamakimbula, 2014; Abdallah and Abdul-Rahman, 2016; Umeh & Ekwenegne, 2017; Ijatuyi, *et al*., 2017; Girma & Temesgen. 2018) on

the nexus between agricultural extension services and poverty reduction reported consistent results, too.

Lack of education (grade level): There exists an inverse relationship between education level and poverty status. According to the information captured from FGD participants "*an increase in the education level of rural households, there is a likelihood of decreasing in a poor state. In other words, if someone is not educated: he/she is poor, violet spouse and children rights and less represented in woreda or kebele level parliament*" (FGD participant 5). Computation of the participatory scoring matrix with a mean score of 6.08 and % mean score of 152.08, PPA participants similarly revealed that rural households who lack education are in a state of increased poverty than those having increased education levels. MDP researchers (Ballon & Apablaza, 2012; Bahta & Haile, 2013; Alemeseged, 2016; Amao *et al*., 2017; Desawi, 2019) reported consistent findings with current PPA results.

Being unmarried: Rural agriculture is labor-intensive. Large family engagement is essential to overcome the rural agricultural works. Even sometimes it requires working in a group that is locally called "*Debo*". If more production exists, it is less likely to be in a state of poverty. By implication, let alone unmarried, rural agriculture is tough enough for those who married. Similar to these presumptions, the participatory scoring matrix result of the current study revealed that rural households who are unmarried (7.08 mean score and 141.67% of mean score) are in a poor status than those married rural households. Based on the reflection of the unmarried FGD participant the potential reason stated is that:

> *As a women-headed household, I perceived myself as poor because of the lack of a spouse to farm. For example, my husband has died some years ago. I don't have a man to farm. So, I shared my crops with a person who worked for both of us. Hence, being unmarried one can't increase farm products and other livelihood options that lead to the state of poorness (FGD participant 2 & 10).*

Swampy farmland: The current study area's total land coverage is 410.068 km^2/410,068 hectares (Woreda Finance, 2017; 2018). Coastal kebeles like Gudeti Jimma, Kalala Didimtu, Gidami Dabsho, Balbala Sorgo, Charo Gobeno, Damu Genbo, Lalisa Biya, Hagaya, and Hunde Gudina are located in swampy areas of Fincha'a Lake either in whole or in part. Their agricultural farmland is covered by the water body of the Lake. Over years, the farmland of these kebeles is found converted to swampy areas and becomes difficult to farm. During FGD, participants

reflected that "*rural households whose farmland is covered by water body from Fincha'a lake or converted into the swampy area have been living in a state of deprivation as their main livelihood source is depleted*"(FGD participants). Consistently, results of the participatory scoring matrix identified swampy areas (6.75 mean score and 135 % mean score) as a determinant factor of rural households being in a state of poverty.

A large number of dependents (≠ of dependent age less than 15 and above 64 years old): Whether the number of dependents (≠ of dependent age less than 15 and above 64 years old) or not is a controversial factor of poverty among FGD participants. Some FGD participants reflected the positive contributions of child labor (age less than 15) and old ages' cumulative experience (age greater than 64 years) to rural households' poverty reduction and have to be included in the list of the causes of poverty. Others strongly argued that child labor (age less than 15) and old ages' cumulative experience (age greater than 64 years) have no significant contribution to poverty reduction and have to be excluded from the determinant factor of poverty. The final consensus built among the FDG participants resulted in the inclusion of a large number of dependents (≠ of dependent age less than 15 and above 64 years old) in the list of the causes of rural poverty. Hence, the study used the variable among the lists of participatory poverty scoring matrices. Results revealed that a household with a large number of dependents (≠ of dependent age less than 15 and above 64 years old) having 6.58 mean score and 131.67% of the mean score is found as a cause of rural poverty, but less in mean score and % mean score when compared to the first five determinant factors. Consistent findings are reported by MDP approach researchers (Sabir *et al*., 2006; Hashmi *et al*., 2008) who underscore that the chance of being in poverty increased due to an increase in household dependency ratio. It is also consistent with the subjective reflection made as "*a person is poor if he/she didn't have work like farming or other activities. Most young people are not working. They undertake forced marriage and abduction. The simply eat food from families*" (FGD participant 6). Lack of trading skill (skill types like petty trades): Apart from agricultural incomes, FGD participants reflected that non-farm activities like "*non-agricultural activities (trading), handcraft activities (weaving, carpentry, house mudding) and trading (grain, local drinks, soft drinks, small ruminants as a mean to escape from rural poverty during the shortfalls of income from on-farm activities*)" are rural households' sources of livelihoods. Results of the participatory scoring matrix (3.75 mean score and 125 % of mean score) identified a lack of trading skill (skill types like petty trades) in

the 18th order of importance to the FGD participants. Lack of composite[39] making skill: According to the reflections of the FGD participants of the current study "*to enhance soil fertility, rural households use own making composite fertilizer. Nevertheless, due to lack of composite making skill and lack of livestock, not all rural households use it, as a result, households who lack such skill are in a state poor condition because they couldn't produce more"*. Indeed, the result of the calculation of the participatory scoring matrix revealed that lack of composite making skill (4.92 mean score and 122.92 % of mean score) is among the less perceived subjectively identified causes of rural poverty.

Being ex-soldiers: According to the reflections of the FGD participant 11 "*ex-soldiers of Derge regime, lacks farm and sustainable livelihood sources, they are comparatively in the poor state than the rural households who owned farmland*". The participant further described as Jimma Geneti woreda is known for its crop and animal production. However, FGD 1 mentions that "family illness and death of oxen" as causes of poverty. They also listed factors such as "landless ex-soldiers/"Derge" and lack of education, and lack of composite making skill" as a cause of being poor. The computation of the scoring matrix also revealed being an ex-soldiers increases the likelihood of in poor condition. Loss of harvest (greater than 1.5 Qtl/year): Rural households' annual farming activities completed by harvesting. Improper harvesting techniques will result in the loss of harvest and pave the way to the state of poverty. Results of the PPA scoring matrix revealed that loss of harvest greater than 1.5 Qtl/ year (4.75 mean score and 95% mean score) is among the causes of poverty. FGD participant listed the following reason for post-harvest losses of their agricultural products:

> *Many factors accelerate the primary causes of losses. For instance, loss of harvest is due to unexpected rain and wildlife. Besides, inadequate harvesting and handling, improper storage facility, inadequate transportation, inadequate packaging, and inadequate marketing system enhance the magnitude of post-harvest loss. This leads households to a state of poverty* (FGD participant10).

Non-cooperative member: FGD participant 9 states that *"households who are membership in cooperatives are to be out of poverty, otherwise in poverty, but less important determinant compared to the other causes of poverty*". The participatory scoring matrix of households' being a non-cooperative member (3.5 mean scores and 70 % of mean score) similarly revealed that the variable has less importance. In the formal government institution there is the cooperative office,

[39] Composite: is organic fertilizer made of three primary nutrients (Nitrogen, Phospherous and Potassium)

"non-member and member households are different in poverty status. Member households get several advantages than non-members, poverty status differs accordingly" (FGD participant 9). During the FGD, the researcher raised why non-member, and it is said that "lack of awareness and sometimes it is non-voluntary based" (FGD participant 9). Conversely, Bogale (2011) who employed the MDP approach states that a household head being a member of cooperatives revealed negatively and statistically significant determinants of the probability of being MPI poor.

Lack of working habit[40] *(behavior):* Previous PPA researcher Melaku (2016) reported that working habit (in behavior) (1.14 mean score and % 22.86 mean score) is the other determining factor of rural poverty. According to the current FGD participant 8 "a *household head who lack good working habit: working all days except sun day and traditional skills is probably in a state of poverty than hard workers but less important when compared to other determinant factors*". Consistently, PPA matrix scoring revealed a lack of working habit (3.08 mean score and 61.67 % of mean score) as a less important determinant factor of rural poverty. Besides, FGD participant 8 reflected on lack of working habit as a cause of poverty as "*there are several causes of rural household's poverty. For example, lack of working habits or laziness is a cause of poverty. Rural people have no option, other than farming. If a household and his or her household member are not working no doubt they will get poor"* (FGD participant 8). The researcher made a probe question, why rural poor lack working habit? And he states as *"they lack working habit because of several reasons, for example, more time for border dispute and the family issue at court and young and old people are depending on household heads to work. Youngsters are always in town come back home during the night"* (FGD participant 8). Lack of credit (big interest): PPA focus group participants reflected that "*due to big interest rate, with least relative importance, rural households who lack access to micro-credit are in a state of poverty, otherwise out of poverty. That is, poverty is caused due to lack of credit, access from Oromia saving and credit exist but high interest (greater than 24%) discoursed us*" (FGD participant 10). That is, lack of credit has less relative significance to households' poverty state. This is consistently confirmed by the participatory scoring matrix (2.42 mean score and % of the mean score of 60.42). On the contrary, MDP researchers state "access to credit does have significant influence of households'

[40] **Working habit:** "*is a state of working from Monday to Saturday, except, Sun day and other significant public holidays and engaging oneself on traditional skills in the womb of the community for betterment of the living standard of the household members*" (FGD participants.

deprivation in each MPI indicator" (Apata *et al*., 2010). Finally, the FGD participant's reflection captured multidimensional causes of poverty. The researcher made the direct quotes of the participant as a major summary to the subjective qualitative descriptions and objective qualitative analyses of the determinants of rural poverty as follows:

> *Poor people are always sick and don't have many medicines. Poverty is a situation that insisted households' children drop out of school. It is also described as a lack of clean water. It denotes a lack of permanent employment like farming. Poor people send/hired their children aged 5 to 17 to better-off families. Don't have a CIS house. Vulnerable to erosion. Daughters are forced to marry because they are out of school. Some poor women undertake FGM as a source of income because they are poor. Boys than girls went to school/ high disparity. Poor women have no decision-making power when the spouse sells cattle or other ruminant animals like sheep or goats. Poor people cut tree for charcoal as a source of income* (FGD participant 7)

Furthermore, lack of working habit, large number of dependents, non-cooperative member, old age, lack of irrigable land, lack of farmland, lack of credit/big interest, loss of harvest, being unmarried, a few livestock (less than 5), lack of saving (cash), lack of income, poor extension service delivery, illness, expensive inputs supply, death of oxen, lack of education, ex-soldiers without farm-land, being women-headed, lack of composite preparation skill and others (FGD participant 12). The final stage of the PPA exercise is consensus building, lessons & closure of participatory qualitative data collection and analysis. Accordingly, the FGD facilitator/researcher asks FGD participants for the consent and approval of the FGD results on the status (STEP 1) and determinants (STEP 2) of rural poverty analysis using participatory poverty analyses (PPA) and lessons learned from FGD exercise by participants in general and by the researcher are also captured. As a researcher, besides ordered logit model (objective-based assessment) used to identify determinants of multidimensional poverty of rural households in the current study area, participatory scoring matrix enable the current study to display additional qualitative and participatory way of poverty determinants. Finally, the FGD facilitator/researcher asks elders to pray and notify END of FGD exercise, FGD note-taker submits the FGD outputs to the researcher.

4.8. Comparisions of MPD Vis-à-Vis PPA Results

4.8.1.Conceptualizing Poverty

This section analyzed the definition given to poverty by the MDP approach and PPA approach. In the case of MDP approach, following Sen (1981) different scholars (Sen 1976; 1981; 1985; 1992; World Bank, 2004; 2014; Alkire & Santos, 2010a; 2010b; Alkire & Foster,

2008; 2011; UNDP, 2014a; 2014b; OPHDI, 2017; 2018) conceptualized poverty as multidimensional phenomenon. However, qualitative participatory poverty researchers (Zaid *et al*., 2006; Chambers, 1994a; 1994b; Duraiappah *et al*.,2005; Norton, 2001; Hinds, 2013; Leavy &Haward, 2013) claimed lack considering the voices of the poor by MDP approach in conceptualizing poverty. Thus, compared to the MDP approach the current PPA participants conceptualized poverty in several different ways (Box 4.1).

(Insert Box 41, here)

When compared to the MDP approach the multidimensional but with more insights, the PPA approach conceptualization of poverty is consistent with the findings of Citron & Robert (1995), Melaku(2016), and Alemeseged (2016) that confirmed that argument of Anafo (2014) who states as no universal consensus on what constitutes poverty.

4.8.2.Identification of the Poor from Non-poor

In the above paragraph, the MDP approach conceptualized poverty as a multidimensional phenomenon (health, education, and living standard dimension) (Alkire & Jahan, 2018; OPHI, 2017; 2018). Another equivalent issue of measuring poverty is the need for identifying the poor from the non-poor. That is Haughton & Khandker (2009) state that we measure poverty to identify the poor from non-poor, thereby, reduce or alleviate poverty. Accordingly, several MPD approach researchers (Apata, *et al*., 2010; Alkire & Foster, 2011; Alemeseged, 2016; OPHI, 2017; 2018; Amao *et al*., 2017; Alkire & Jahan, 2018) used global MPI poverty cutoff 1/3 or 0.33.33%) implying that every person with a deprivation score/C equal to or greater than 1/3 of 0.333% is identified as multidimensional poor, otherwise, MPI non-poor. On contrary, with the PPA approach, there is no such poverty cutoff point. The sample households of the current study area identified the poor from non-poor using multiple identification criteria (Box 4.2).

(Insert Box 4.2, here)

In the current study the above analyze imply that the way PPA approach identified the poor from non-poor and the result is inconsistent with both MDP approach (poverty cutoff=13/) used by MDP researcher (Apata, *et al*., 2010; Alkire & Foster, 2011; Alemeseged, 2016; OPHI, 2017; 2018; Amao *et al*., 2017; Alkire & Jahan, 2018), monetary approach (poverty line=$1.25, now $ 1.90) used by Nunes (2008), Rahman & Titmir (2013), Noglo (2014), Laderchi (2015), and Suppa (2016), and even participatory poverty researchers like Zaid *et al*. (2006) problem

ranking, Lekshmi *et al*.(2008) wealth ranking, Melaky (2016) well-being ranking, and however, slightly consistent with Citro & Robert (1995).

4.8.3.Rural Poverty Dimensions and Indicators

Identification of the number of possible deprivation dimensions and indicators that a given rural household encountered is among the essential procedures of measuring rural poverty status and determinants of rural households. Both MDP and PPA approaches to rural poverty measurement identified overlapping and missed poverty dimensions and indicators presented next.

(Insert Table 4.1 and Table 4.13, here)

Overlapping poverty dimensions and indicators

Based on the results of Table 4.1 and Table 4.13, above, with the MDP approach (up to bottom) Alkire & Santos (2010a;2010b), Alkire & Foster (2011), Alkire & Roche (2013), Alkire *et al*. (2015), and Alkire & Jahan (2018) proposed only two overlapping possible deprivation dimensions (education and living standard dimensions) a given rural household encountered. Consistently, the PPA approach (bottom to up) participatory identified two overlapping rural poverty dimensions like education and living standard dimensions. Except, Alkire & Santos (2010a;2010b), Alkire & Foster (2011), and Alkire *et al*. (2015) MDP researchers like Alkire & Roche (2013) and Alkire & Jahan (2018) and PPA approach proposed three overlapping indicators such as drinking water, sanitation, and electricity both from the living standard dimension that a given rural household encountered.

Missed poverty dimensions and indicators

Several missed poverty dimensions and indicators were identified by the poor. For example, the PPA approach identified 4 missed rural poverty dimensions like animal health, livelihood, empowerment, and environmental dimensions. These missed rural poverty dimensions are integrated with UNDP sustainable development goals: animal health dimension (SDG 3) livelihood dimension (SDG 1&2), empowerment dimension (SDG 5), and environment dimension (SDG 11). Furthermore, countering of indicators show that (Alkire & Santos,2010a;2010b; Alkire & Foster, 2011; Alkire *et al*.,2015) listed 7 deprecation indicators, Alkire & Roche (2013) listed 10 deprivation indicators, Alkire & Jahan (2018) listed 10 but researcher modified into 11 deprivation indicators and PPA approach listed 17 possible deprivation indicators a given rural household encountered. Based on the results of the PPA approach the 14 missed deprivation indicators are mortality/animal (SDG3), vaccination/animal

(SDG3), drop-out (SDG4), higher education (SDG4), IFAL (SDG4), shock (SDG 1 &2), and others.

4.9. Key Results, Conclusions and Recommendations

4.9.1. Key Results

The following are some of the major key results of rural households' poverty analysis using multidimensional and participatory approaches:

1. The status and determinants of rural poverty were analyzed using a multidimensional approach. It is an up-down approach quantitative poverty estimation where standardized dimensions and indicators are harnessed from the intensive literature review. Using such approach, the censored headcount ratio (at K=0.3663) shows the proportion of households who are poor and deprived in each MPI indicator. After the censoring process, results show that sample households were highly deprived and MPI poor in the order of cooking fuel (91.7%), drinking water (90.2%), asset (79.1%), housing (77.8%), & electricity (269/(69.5%) from standard living dimension. It is followed by education dimension MPI indicators(school attendance/63.6% and years of schooling/53.7%) and health dimension MPI indicators (nutrition child/49.1%, nutrition adult/41.9%, and child mortality/11.1%).

2. Besides, results of the incidence of poverty/prevalence rate were (H=0.801), the average share of deprivation/intensity of poverty was (A=0.663) and the overall multidimensional index was (M0=0.531, i.e., considering poverty threshold as 0.3663, MPI poor households' encountered 53.1% of the total deprivation if all sample households were poor and multidimensional deprived in all the eleven MPI indicators), implying that majority of the rural households in the study area were multidimensional poor, even more than any time the national MPI (49% in 1994, 37% in 2004 and 22% in 2009. and 49% in 2018). Results also imply that poverty in the study area has been deep-rooted and multidimensional sever.

3. While dimensionally living standard dimension contributed (42.5%), education dimension contributed (36.7%) and health dimension contributed (20.9%) to the overall MPI poor. In terms of MPI indicators school attendance (0.199%) and years of schooling (0.168%) were the highest relative contributors to the overall MPI poor of the study area. Based on these results, it is also possible to imply that living standard dimension, school attendance, and

years of schooling indicators have significantly contributed to the overall MPI poor that seeks priority area of government interventions in the struggle to make poverty history.

4. The other interesting findings of the current study were the results of the frequency distribution of the sample households by their different MPI categories and its decomposition by their location or type of farming systems. It revealed that 1(0.26%) MPI non-poor, 54(13.95%) MPI vulnerable, 55(14.21%) MPI poor, and 277(71.58%) MPI severely poor.

5. In terms of their farming system 109(71.2%) from the highland area, 88(67.7%) from the plain area, and 80(76.9%) from the coastal area were MPI severely poor sample households.

6. Further decomposition of MPI indices by kebele of the sample households revealed that first, Balbala Sorgo kebele (H=93.5%), second Damu Genbo kebele (H=89.5%), and third, Gidami Dabsho kebele (H=85.3%) and in terms of aggregate deprivation first, Balbala Sorgo kebele (M0=73.5%), second, Damu Genbo kebele (M_0=66.5%), and third, Adi Leka Tulu Chali kebele (M_0=61.8%) were the first three kebeles experienced highest simultaneous deprivations. These results further evidenced the need for priority intervention in Balbala Sorgo, Damu Genbo, and Adi Leka Tulu Chali kebeles.

7. Results of the ordered regression model show us the presence of multiple causal factors to sample households being in a state of MPI poor. Now, it is possible to conclude that simultaneous occurrences of explanatory variables impact rural HHs' MDP status in the study area. Hence, in their poverty reduction efforts, these results also implied the need for government attention to consider location or kebele, their marital status, literacy status, farm size, and membership to cooperatives of households. Because statistically verified as significant determinants of households being multidimensional poor.

8. Furthermore, when rural households poverty is analysed using participatory approach, in conceptualizing poverty, a concept mapping matrix was used to progressively differentiate unadulterated voices of the poor. Using an integrative reconciliation approach or cross-case analysis technique the final thick text data was achieved. Moving away from the corpus data to text data and make the qualitative data ready the already generated thick data from the concept matrix was integrated with Ethiopia's GTP II and UN SDGs. It enabled the researcher to easily analyze the qualitative data given both participants, national and

international perspectives. Results implied that poor rural households conceptualized poverty multidimensional phenomena consistent with previous scholars (Sen 1976; 1981; 1985; 1992; World Bank, 2004; 2014; Alkire & Santos, 2010a; Alkire & Foster, 2008; 2011; UNDP, 2014a; 2014b OPHDI, 2017;2018) definition of poverty but in a more detailed, overlapped, and missed dimensions and indicators of rural poverty.

9. For the identification of the poor from non-poor, unlike monterey approach's poverty line, results of the PPA approach implied poor households identified the poor from non-poor using multiple deprivation criteria. Moreover, Alkire & Jahan (2018) categorized MPI poor households into different poverty categories (non-poor, vulnerable, poor, and severely MPI poor). Following the same procedure as Shen *et al*. (2011), the overall mean PPI result of the study area was found as 2.28.

10. Results of the frequency distribution of the 72 PPA sample households into different poverty categories implied that no PPI non-poor (<1.53) households, 10 (13.89%) found PPI vulnerable (PPI ≤1.53 & PPI < 2.03), 51/70.83%) found PPI poor (PPI ≥2.03 & PPI < 2.53), and 51/70.83%) PPI severely poor (PP>2.53). That is, the majority were PPI poor households. Moreover, sequencing of poverty degree of each kebele was made from high PPI to low PPI, implying that decomposition of PPI result by farming system show 34 (47.2%) located in the coastal area followed by 26 (36.1%) households from the plain area and 12 (16.7%) households from the highland area. In terms of kebele Hagaya kebele with PPI value equals 2.39 ranked first followed by ALT Chali kebele (PPI= 2.37), D/Genbo kebele (PPI=2.36), L/Biya kebele (PPI= 2.6), G/Dabsho kebele (PPI= 2.35), G/Geneti (PPI= 2.34), G/Negero (PPI= 2.31), Ch/Gobeno (PPI= 2.28), B/Sorgo (2.23), G/Jimma (2.08) and H/Gudina (PPI= 2.0). Meaning, the limited poverty alleviation resource of the study area has to go first for Hagaya kebele followed by ALT Chali kebele and D/Genbo kebele.

11. Yet more, results of the decomposition of rural poverty by PPI dimension and indicators implied that shock (100%) and on-farm livelihood/fish production (100%) deprivation indicators from livelihood dimension and FGM deprivation indicator (100%) from empowerment dimension were highest relative contributors to PPI poor as compared with low deprivation indicators (migration/13% from livelihood dimension, mortality/animal/21% from animal dimension and extension service indicators from livelihood dimension.

12. For determinants of rural poverty, results of PPA participatory scoring matrix on the prevalence & severity of rural poverty according to their degree of perceived importance implied old age, illness, lack of farmland, a few livestock, and being women-headed as the major determinants of rural households' poverty. Moreover, they provide lack of credit/big interest, lack of working habit, non-cooperative member, and loss of harvest contributed to the PPI poor of sample households in the study area. PPA approach ordered shock (100%) and on-farm livelihood/fish production (100%) deprivation indicators from livelihood dimension and FGM deprivation indicator (100%) from empowerment dimension as compared with low deprivation indicators (migration/13% from livelihood dimension, mortality/animal/21% from animal dimension and extension service indicators from livelihood dimension.

4.9.2. Conclusions

Based on the above key findings, the following major conclusions are drawn:

1. Rural multidimensional poverty in the study area is widespread, deep-rooted and sever. Rural multidimensional poverty is highest in highland areas than the plain and coastal areas. Rural multidimensional poverty is wide in all Kebeles but wide and sever in Balbala Sorgo and Dambu Genbo Kebeles.
2. Rural households conceptualized poverty as multidimensional phenomena. Rural poor households conceptualized poverty multidimensional phenomena consistent with previous scholars poor rural households conceptualized poverty multidimensional phenomena consistent with previous scholars.
3. Compared to multidimensional poverty analysis, participatory poverty analysis approach identified several overlapped and missed dimensions and indicators of the correlates of rural households.
4. Both MDP and PPA detected multiple causes of rural households' poverty. In comparision PPA approach identified more several determinants of rural households' poverty.

4.9.3.Recommendations

Based on the above key findings and conclusions, the following major recommendations are made:

1. Following the Alker & Foster (2011) methodology and revised and standardized global MPI indicators suggested by Alkire & Jahan (2018), this study broadens the discussions of rural households' multidimensional poverty by going away from a conventional monetary approach to rural households' poverty assessment. In terms of cross-sectional prevalence and the composite index of the revised MPD cut-off point K>0.3663, results and conclusions of the current study show that rural poverty in the study is a multidimensional burden of the study woreda.

   That is, when poverty is estimated using the multidimensional approach, sample households were highly deprived in cooking fuel indicator, school attendance indicator, and least deprived in nutrition child indicator implying that sample households of the study area were deprived in all the three dimensions of multidimensional poverty. Hence, woreda water, mineral, and energy office should give priority to rural households to get access to rural electrification program. Likewise, the woreda education office is recommended to create out-of-school children's access to quality education. This can be possible by constructing new classrooms and satellite schools in distant villages. The woreda health office is also recommended to create awareness for rural parents to feed their children nutritious diets. This can be possible through the village-level health extension workers.

2. Given that the fact that majority of the sample rural households in the study area were multidimensional poor and given the fact that decomposition of MPI poor varies in terms of sample households' agroecology/farming system, therefore, to reduce relevant deprivations, it is scientifically reasonable and fair to prioritize the scarce government resources in order of sample households located in highland areas followed by those located in plains and coastal areas, respectively.

3. The percentage of multidimensional poverty also varies between kebeles of the sample households. Thus, it is also important to prioritize rural poverty reduction actions depending on the percentage of households facing the most deprivations. Accordingly, it is recommendable that the regional government in general and the woreda finance and economic development office continue working on reducing rural poverty at the micro-level by introducing and aiming poverty reduction policies that give priority to most

multidimensional deprived kebeles like the present case of Balbala Sorgo, Damu Genbo and Adi Leka Tulu Chali kebeles, respectively.

4. Indeed, rural households' multidimensional poverty reduction resource allocation could also consider the highest deprivation areas in terms of multidimensional poverty dimensions. In this case, results revealed sample households of the current study were highly deprived in the living standard dimension. Thus, regional and local government rural households' multidimensional poverty policy that give due attention first to living standard dimension followed by education and health dimensions become indispensable. Besides, results of the disaggregation of the MPI revealed that the highest incidence of multidimensional poverty was observed in cooking fuel indicator. As a result, depending on the findings of micro-level rural households' multidimensional poverty data in terms of MPI deprivation indicators, policies and programs aiming to reduce multidimensional poverty in most deprived MPI indicators like cooking fuel and electricity should be a priority area of local, regional and national government rural multidimensional poverty reduction efforts. In other words, disaggregating multidimensional poverty deprivation indicators helps to bring out which MPI indicators need to be focused primarily on to address specific target groups affected by such deprivation areas of the MPI indicators.

5. One of the uniqueness of the current study is its alternative econometric model selection. Previous scholars investigated the determinants of rural households using a binary logistic regression model. However, by further decomposing MPI poor households into different poverty categories, the study employed an ordered logit model. Results of the ordered logit model investigated several determinant factors of rural households in a state of multidimensional poor. Thus, to alleviate rural households' multidimensional poverty and "to make poverty a history" a rural multidimensional poverty reduction strategy that considers the effect of rural households' determinant variables kebele dummy, marital status, literacy status, farm size, and membership to cooperatives of household heads should be designed by both local, regional and federal governments. Indeed, rural development planners should pay great attention to independent and statistically significant variables affecting MPI deprivation indicators, too. Among several ways, imperative rural development policy targeting micro-level poverty alleviation and positive discrimination of sample households by their marital

status, farm size, and cooperative membership should be enacted. Furthermore, rural poverty reduction efforts could be possible by promoting basic education for all and accessing the deprived number of adult rural households to integrated functional adult literacy (IFAL) programs. Developing nations, if they need to get their majority of rural households out of poverty recommend literate their adults.

6. Rural poverty measurement has been dominated by the monetary approach. Including the poverty line issue, the approach has several weaknesses. In response, it was after Sen's (1981) capability theory that rural poverty analysis considers multidimensional approach. That is, the need to estimate the incidence, intensity, and composite multidimensional poverty has been becoming secured the attention of scholars. Nevertheless, in both quantitative analyses of rural households' poverty different scholars, development practitioners, and policymakers claimed to need an alternative way of rural poverty analysis where the unadulterated voices of the poor households herd. Since then participatory poverty analysis (PPA) has been insufficiently contributing to rural poverty analysis. This study gave due consideration to this approach, too. Accordingly, using the integrative reconciliation approach or cross-case analysis technique the final PPA thick text data contrarily conceptualized poverty as more multidimensional than lack of income only. To identify the poor from non-poor, it was found and concluded that poor households identified the poor from non-poor using multiple deprivation criterion than the poverty line that has been used by monetary approach. Besides, the comparative analysis of the results of rural poverty data generated by MDP and PPA evidenced that the PPA approach captured overlapping and missing rural poverty dimensions and corresponding indicators. The constructed PPI explored different more missed dimensions of poverty in an innovative way. Meaning, PPI can better recognize the state of rural poverty at the micro-level and allocate resources from a multidimensional perspective to rural poverty reduction which was not considered by previous studies. Therefore, in the process of designing rural poverty strategies and policies, it is possible to recommend the local, regional and federal governments to revisit their choices of specific multidimensional poverty indicators both contributed from the previously known dimensions (living standard, education, and health dimensions) and missed dimensions like animal health, livelihood, empowerment and environment dimensions identified by the current PPA approach. This would include the revisit of the poverty cut-off

point and weights attached to each dimension and indicator. The latter helps to facilitate international comparisons. Hence, alongside with monetory and/or multidimensional poverty approached polivy makers and future reserachers are recommended to employ PPA.

7. A rural poverty estimate using a combination of MDP and PPA was missed in the previous studies. Hence, to comprehensively capture, analyze and allocate rural households' poverty reduction scare budget, thereby, ensure sustainable rural development, it is recommendable that local, regional, and national rural development planners use a combination of rural households' poverty estimation and analysis approaches. That is, a more robust measurement of rural poverty should be targeted. Indeed, having such complementary rural households' poverty measures brings the picture into clear focus. This could lay a solid foundation for both rationally and effectively using the limited rural poverty alleviation resources. It also helps the rural development implementers in general and MPI severely poor households get quickly out of the trap of rural multidimensional poverty and live in the highest well-being level: an issue that shouldn't be circumvented.

CHAPTER FIVE
ANALYSIS OF RURAL HOUSEHOLDS' ACCESS TO AGRICULTURAL EXTENSION SRVICES IN JIMMA GENETI WOREDA[41]

Abstract: *Effective, comprehensive, need-based, and participatory agricultural extension service is a major factor in improving the income and welfare of rural households. However, it has been reported that ineffective, non-comprehensive, and not need-based in many developing countries. The study analyzed the status and determinants of rural households' access to agricultural extension services in the case of Jimma Gebeti Woreda (Ethiopia). A mixed-methods approach is used. Primary data are collected from 387 samples. Descriptive and inferential statistics and logit models are used to analyze the data. Results revealed that there are non-accessed sample heads to agricultural extension services in the current study area. Weak links between agricultural research and farmers extension problems, lack of coordination and communication between agricultural sectors and higher learning institutions, and lower salary level and fewer resources for field agricultural extension agents are found the major potential reasons/challenges that make sample households' non-accessed. Furthermore, Kebele/"ganda" of the household head, access to agricultural extension training, access to credit service, irrigation use, and rural households' having a telephone were found the major determinant factors. Thus, based on the above results it is possible to conclude that rural households' access to agricultural extension services is not as it ought to be. Above all it is found that the extension delivery is mostly non-participatory. Therefore, policy majors that could avert the above challenges and determinants are recommended like for example, empowering extension workers and delivering pluralistic and need-based agricultural extension services.*

Keywords: Households, access to agricultural extension services, logit model, Jimma Geneti Woreda (Ethiopia)

5.1.Introduction

As cited in Haynes *et al*. (2010), Haug (1999) defined agricultural extension as a function of providing need and demand-based knowledge in agronomic techniques and skills to rural communities to improve their production, income, and (by implication) quality of life. Agricultural extension is the application of scientific research and new knowledge to agricultural practices through farmer education (Ijatuyi *et al*., 2017). Furthermore, according to scholars like Rogers (1995) and Dercon & Douglas (2014), there are nine competing theories/models of agricultural development in general and agricultural extension services in particular of which high payoff input model (need for investments on modern high payoff inputs and make available to farmers in poor countries) (Rogers, 1995) and diffusion of information (DoI) theory that assumes the diffusion of agricultural technologies, expertise and new ways of doing things from

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advanced households and regions to traditional households and regions was a better source of agricultural development (Rogers, 1995; Dercon & Douglas, 2014).

The status and determinants of rural households' access to agricultural extension services have different descriptive data presentations and econometric data analysis techniques. For example, showing the type and composition of extension services received by farmers in Haiti, Jamil *et al*. (2016) used a pie graph. Abdallah & Abdul-Rahman (2016) analyze the age characteristics, monthly incomes, and mean schooling years of sample heads using mean/average in Ghana. However, a simple percentage was used to analyze farmers who belong to farmers associations. To analysis data on agricultural extension services in Nigeria, Umeh & Ekwengene (2017) employed descriptive statistics (percentages). Furthermore; Tata & McNamara (2016) used another descriptive statistic known as the mosaic plot (i.e, research participants on the X-axis vs Farm-book challenges on the Y-axis) in South Africa. To describe the socio-economic characteristics of the respondents another researcher Ijatuyi *et al*. (2017) employed descriptive statistics such as percentages, frequency tables, and mean scores in the same country.

In East Africa, Mwamakimbula (2014) used has assessed the factors impacting agricultural extension training programs in Kilolo district (Tanzania) using descriptive statistics. Besides, descriptive statistics (frequencies, mean, standard deviation, x^2-square, and t-test) were employed by Ethiopian researchers (Gurmessa *et al*., 2011) in Dugda, Boset, Ada'a, and Fentale districts (Oromia, Ethiopia). Besides, to investigate the determinants, rural households' access to agricultural extension service researchers also used different econometric data analysis techniques. For example, to analyze the determinants factors of agricultural extension services performance and impacts on farmers' behavior in Indonesia Jamil *et al*. (2017) used Structural Equation Modeling (SEM). However, in SSA (Ghana) to estimate the probabilities of women's access to extension services or non-access, Abdallah & Abdul-Rahman (2016) used the logit regression model. Umeh and Ekwengene (2017) have conducted on determinants of utilization of agricultural extension packages of selected arable crops among farmers in Enugu State (Nigeria) using the Tobit regression model. However, to analyze the effect of extension service(s) and socio-economic characteristics on the livelihood of cattle development project beneficiaries in the North West province of South Africa, Ijatuyi *et al*. (2017) employed Ordinary Least Square regression and the Tobit regression models.

To analyze data on the relationship between Farm-book challenges with explanatory variables such as gender, age, and educational qualification, ability to use the internet, and internet access in the field these scholars used econometric data analysis multivariate techniques were employed by Tata and McNamar (2016) in South Africa. Gender differences in access to extension services and agricultural productivity in Ethiopia were studied by Catherine *et al*. (2012). Using a regionally representative dataset they analyzed the data by a cross-sectional instrumental-variable regression method.

Rural households' access to participatory *agricultural extension services* a fundamental role in rural household's poverty reduction and their livelihood security enhancement (Jonh, 2014; World Bank, 2015; Abdallah & Abdula-Rahman, 2016; Ijatuyui *et al*., 2017; Tigabu & Girma, 2018). In Sub-Saharan Africa, rural households' access to participatory agricultural extension services is influenced by their age, gender, marital status, family size, land ownership, rearing experience, farming experience, and extension visits in South Africa (Ijatuyi *et al*., 2017). Abdallah & Abdul-Rahman (2016) have conducted on the determinants of rural women access to agricultural extension and advisory services in Ghana and t-value results showed that factors such as level of education, farming experience, farm size, income, extension contact, marital status, household size, and farming status had a significant positive relationship with the utilization of agricultural extension packages in the country. In Ethiopia, gender, education, landholding, livestock holding, and store distance have determinant factors on household access to agricultural extension and advisory services (Catherine *et al*., 2012). Multiple secondary data sources from woreda government offices revealed that no scientific analysis of the status and determinants of sample households poverty, livelihoods, and their access to agricultural extension services. The remaining sections include section 5.2 which reviews the results of previous studies. While section 5.3 presents the specific objectives and basic questions, section 5.4 presents the methods used to analyze rural households' access to agricultural extension services. Section 5.5 presents the results and discussions. Finally, section 5.6 concludes, implies, and recommends.

5.2.Empirical Review

Results of both descriptive analysis (status) and results of econometric analysis (determinants) of rural households' access to agricultural extension services) were reviewed under this section,

respectively. For example, Jamil *et al.*(2016) identified different types of ineffective and non-participatory agricultural extension services (aquaculture, improved/high yield varieties of crop production, arboriculture techniques, field techniques, livestock production techniques, aviculture, and apiculture in Haiti. Qamar (2005) reported that poor utilization of internet access in the field for development agents/DA. Consistently, internet access influences rural households' access to agricultural extension services in rural Greece (Michailidis *et al*., 2011).

In Sub-Saharan Africa, Tata & McNamara (2016) identified several personal and wider socio-economic factors that influence the use of ICT (e.g. Farm-book[42]) in agricultural extension in South Africa. Besides, Ijatuyi *et al*. (2017) reported the low status of rural households' access to agricultural extension services in South Africa. Furthermore, witnessing its low delivery status, Abdallah & Abdul-Rahman (2016) reported that farmers in Ghana accessed to agricultural credit (15%), lack knowledge of improved seeds (92%), apply fertilizer on their farms (86%), the average number of visits made by extension agent (0.21) and the average distance from the farm to input store (2.67 Km). In Nigeria, Jibowu (2002) and Umeh & Ekwengene (2017) revealed the low status of rural households' access to agricultural extension services, too. They reported some potential reasons like poorly motivated extension agents (Jibowu, 2002), scarcity of input 93(14.19%), land scarcity 92(14.0%), lack of fund 86(13.12%), untimely availability of inputs 83(12.67%), untimely dissemination of technologies 81(12.36%), no change in yield 62(9.46%), irregular technology 55(8.39%), poor understanding of technology 7(1.06%), and technologies doesn't agree with the culture of the people 2(0.3%) (Umeh and Ekwengene, 2017).

In East Africa, due to major reasons like poor organization and coordination of extension training programs, lack of a participatory approach among extension agents, poor support by the government for the extension sector, and extension agents live far from their assigned villages due to lack of housing, that leads to lack of transport for extension agents seems to be the major reason for not helping farmers in their work station Mwamakimbula (2014) found low status of rural households' access to agricultural extension training in Tanzania. In Ethiopia, studies by Gurmessa *et al*. (2011), Catherine *et al*. (2012), and Abrham (2013) also revealed the low status of rural households' access to agricultural extension services in the country. The overall

[42] *Farm-book: enables extension agents to assess productivity and profitability of farming enterprises in a faster and more reliable manner, so as to increase farmer incomes and achieve food security (Tata & McNamara, 2016)*

descriptive results show that ineffective, non-participatory, and non-need-based, and low-status pluralistic types of agricultural extension services are delivered in many developing countries.

Relevant literature on agricultural extension services identified multiple determinants of rural households' access to agricultural extension services. For example, Yurttaș & Atsan (2006) reported that households' need for extension services differ based on their age. In witness, Abdallah & Abdul-Rahaman (2016) found older household heads (at a certain age) are more likely to access different types of extension services in rural Ghana. The potential reasons are older farmers have a comparative advantage in terms of capital accumulation, extension visits & creditworthiness (Abdallah & Abdul-Rahaman, 2016). Consistently, Umeh & Ekwengene (2017) found that the age of sample households' had a negative and significant relationship with the utilization of agricultural extension packages in rural Nigeria. The education level of the household head is another determinant factor. That is, according to Boahene (1995), Yurttaș & Atsan (2006), Catherine *et al*. (2012), Arias *et al*. (2016), Abdallah & Abdul-Rahaman (2016), and Umeh & Ekwengene, 2017) an increase or improvement on the education level of sample households' enhance or boost utilization of agricultural extension packages, *ceteris paribus*. Arias *et al*. (2016) found that prior agricultural training is another major determinant of the receipts of agricultural extension services by rural households in Haiti.

Furthermore, Catherine *et al*. (2012) asserted shorter distance to the market is more likely to have a significant influence on rural households' access to agriculture-related information in rural Ethiopia. Also, Arias *et al*. (2016) found that location (distance from town) is an important determinant of the likelihood of receiving agricultural extension services by rural households in Haiti. That is, there exists an inverse relationship between distance to town and the probability of demand for extension services by households (Abdallah & Abdul-Rahaman, 2016). The main reason reported is that as nearness to major markets decreases, transactions cost decrease, market participation increases, and rural households' demand for extension services encouraged(Arias et al., 2016; Abdallah & Abdul-Rahaman, 2016).

The income of sample households' having a positive and significant relationship with the utilization of agricultural extension packages in rural Nigeria is identified by Umeh & Ekwengene (2017). Distance to input supply as another important determinant of the likelihood of receiving agricultural extension services by rural households is reported by Arias et al. (2016)

and Abdallah & Abdul-Rahaman (2016). Furthermore, Qamar (2005) identified that the imperfect initial organizational set-up of FTCs, unhealthy perception and lack of trust in extension prevails in many developing countries has been negatively contributed to the rural households' access to agricultural extension services. This is further strengthened by Jamil *et al.* (2016) who states that poor management of agricultural extension has negatively determined rural households' access to such services.

Still, there are other growing literature that identified several determinants of rural households' access to agricultural extension services: effective, participatory, and need-based agricultural extension services have a motivational factor to households adopt agricultural extension services, if not, demotivate them to adopt it (Churi *et al*., 2012), promoting a hybrid system of extension may be more efficient than supporting only public or NGO provided extension services (Arias *et al*., 2016), and lower salary level and fewer resources for field extension agents have been negatively affected the effectiveness of rural households' access to agricultural extension services (Moris, 1991) are some of these determinants.

In turn, Belay & Abebaw (2004) reported the efficiency of agricultural extension work depends on the availability of personnel who are qualified, motivated, committed, and responsive to the ever-changing social, economic, and political environment. Also, Jamil *et al*. (2016) found that the development of human resources has positively affected the action program of agricultural extension services and improved farmers' behavior (competency and participation) in agricultural extension services. Abdallah & Abdul-Rahaman (2016) found that extension agents could play a significant role in increasing knowledge of fertilizer use by farmers. They found an insignificant relationship between households' access to agricultural extension services and the frequency of extension visits.

Despite there have been increasing demands for the services, agricultural extension services,, and education provided in many developing countries found has had little impact on the home villages of the farmers. Several challenges/bottleneck problems have been affecting the effectiveness of agricultural extension services. For instance, unhealthy perception of extension (Qamar, 2005), lower salary level and fewer resources for field extension agents (Moris, 1991), ill-trained and ill-equipped village extension workers, and others have been contributed to it. As coping strategies, empower extension workers (Mwangi, 1998; Rivera *et al*., 2001) and

integrating rural households' issues to agricultural extension services achieve pluralistic agriculture extension and an advisory service was proposed by GFRAS (2015).

Proposed strategies of integrating rural households' issues to extension delivery include gender equity/gender-transformative approach *(*Malapit & Quisumbing, 2015; GFRAS, 2016), building on food security dimensions (FAO, 2006), improving availability of diverse, nutrient-dense, and market-oriented foods (Timmer, 1997; Remans *et al*., 2011), modernizing agricultural extension service (Bushamuka *et al*., 2009), improving access to a diverse diet (Pingali, 2015; Sibhatu *et al*.,2015), safeguarding stability (Bardhan, 1980; Moore *et al*., 1997; SPRING, 2016), optimal utilization of nutrients (FAO, 2006), and WASH (WHO, 2016; SPRING, 2014; UNICEF, 2016; Headey *et al*., 2016).

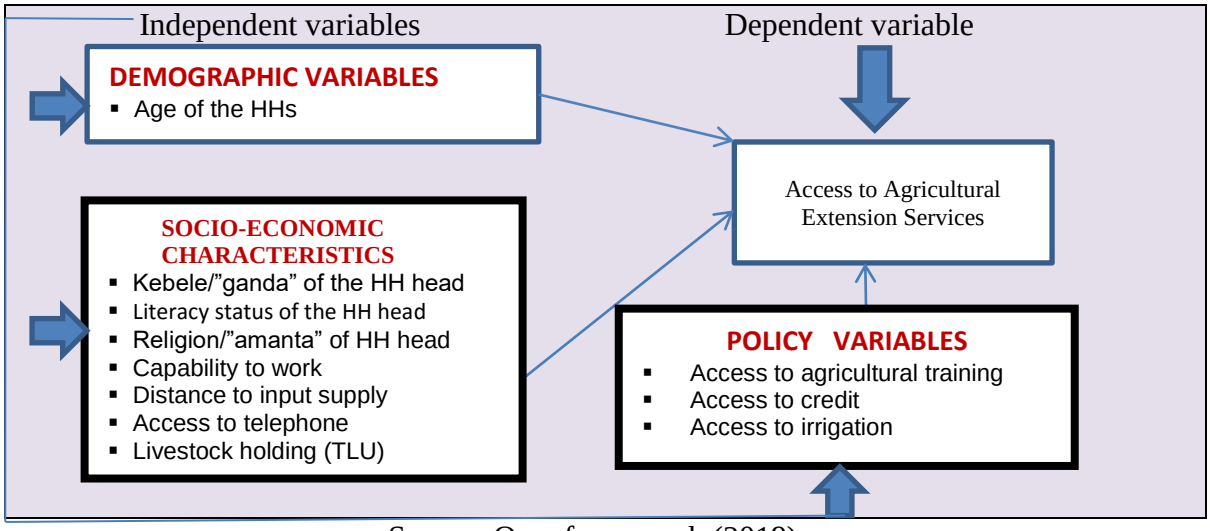
In Ethiopia, given rural households' food security issue as the prime goal of extension, based on FAO (2009) food security concept, found "ineffective" and "futile" (Tilahun, 1999; Degife & Nega,2000). During the imperial period the first five-year plan (1957–1962) document that fails to give due attention to improve the extremely low productivity of agriculture (Fentahun *et al*., 2017), during "Derge" donor-driven initiatives targeting wealthy smallholders, lack of common perceptions between technology generators and extension personnel, inadequate representation and participation of farmers, inadequate manpower, limited finances, one-way communication and insufficient or even absence of monitoring and evaluation (Kassa, 2003; Gebremedhin *et al*., 2006) and since 1991 bottlenecks identified by federal MoA & NR (2017) were among the challenges to the effectiveness of Ethiopian agricultural extension services.

In the study area, there are various dominant cereals like Teff, Wheat, Barley, Sorghum, and Maize (Woreda Agriculture and Natural Resource Office, 2017; 2018), livestocks production like cattles, goats, and others (Woreda Animal Health Office, 2017; 2018), very limited irrigation facilities (Woreda Irrigation Office, 2018). Neither of the documents has grouped households of the study area either based on asset endowment or income-based indicators or both. Despite agriculture play a significant role in the rural households of the study area, some of the major constraints of agriculture in this district includes fluctuation of rainfall, increased costs of agricultural input, a large number of unproductive labor, the backwardness of work culture, undeveloped working culture, land degradation and loss of fertility, absence of local research and encouragement on farmers plot/farm, absence of modern irrigation scheme, absence of crop

diversification, big number of families and population surge that significantly contribute to scare farmland, poor agricultural lands fertility and others as a result, low production, more pressure on scarce farm land, in return, perpetuate rural-to-rural migration or rural -to- town migration. Besides, the major constraints of rural agriculture in study area include "the gradual loss of land productivity particularly depletion of soil fertility and hence the low yield and low productivity of agricultural production increase the problem of household poverty"(Woreda Finance and Economic Development Office, 2017:18).

Based on the above review, the gap analysis revealed that Ethiopia, despite considerable growth of households' participation in extension services, remained low (Abrham, 2013). That is, in enhancing household livelihood security and reduce poverty, in particular, rural poverty, different studies have shown that there are several determinant bottleneck problems of the effectiveness of Ethiopian's agricultural extension services. The current study has investigated both the status and determinants of rural households' access to agricultural extension services, thereby, established the association among dependent variables in the study area (Figure 5.1).

Figure 5.1: Conceptual framework of households' access to agricultural extension services



Source: Own framework (2019)

5.3.Specific Objectives and Basic Questions

The specific objectives and corresponding basic questions include:

To describe the current state of rural households' access to agricultural extension services.

a. Do rural sample heads of the study area get access to agricultural extension training? What about access to full packages of agricultural extension services? If yes, what are they?
b. What are the perceived identified by sample heads challenges?
c. What are coping strategies do they propose?

To examine the determinants of rural households' access to agricultural extension services.

d. Are there significant socio-economic variables affecting rural sample heads' access to agricultural extension services? If yes, what are they?

5.4.Methods

The socio-economic characteristics of the rural households' data captured through access to agricultural extension services survey questionnaire are analyzed using descriptive statistics like frequency, percentage, mean, and standard deviation. However, the logit model is used to analyze the determinants of rural heads' access to agricultural extension services. Before applying the model, diagnosis tests for the assumptions of the model were made. For example, coefficient of contingency/chi-square (χ^2) based measure of association was used to test the no multicollinearity assumption of categorical independent variables. However, Variance Inflation Factor (VIF) was used to test for continuous variables.

Logistic regression called logit model was used. The model was specified as follows. In the logit model, the log odds of the outcome were modeled as a linear combination of the predictor variables because the linear regression model is used only when the dependent variable is continuous. In the linear probability model, the dichotomous dependent variable is expressed as a linear function of the explanatory variables. Although one can estimate the linear probability model by the standard Ordinary List Square Methods as a mechanical routine, the result will be beset by several estimation problems. A linear probability model may generate predicted values outside the admissible 0-1 bound, which violate the basic tenets of probability.

Pindyck and Rubinfeld (1981) acknowledged that the logit model that is based on the cumulative logistic probability function is computationally easier to use than the other types and will be used in this study. That is, the logistic distribution has the advantage over others in the analysis of dichotomous dependent variables. Besides, the logistic distribution is extremely flexible, relatively simple from the mathematical point of view, and lends itself to meaningful

interpretation. Furthermore, logistic regression is used for modeling where the dependent variable is discrete. In this study, the dependent variable (access to agricultural extension services) is a dummy discrete variable. When the dichotomous nature of such dependent variable is taken into consideration, factors influencing rural households' access to agricultural extension services can be estimated using the Probit or Logit models. This is because Logit and probit models translate the values of the independent variables (X_i), which may range from -∞ to +∞ into a probability for (Y_i) which ranges from "0" to "1" and compel the disturbance terms to be homoscedastic. This makes the selection between the two models very sticky as both models provide equally efficient parameters. The forms of probability functions depend on the distribution of the difference between the error terms associated with a choice.

The probit models assume the existence of an underlying latent variable for which a dichotomous realization is observed (Maddala, 2002) and (Abbey & Admassie, 2004), thus given the model:

Probability functions

$$Y_i^* = \beta_o + \sum_{j=1}^{k} \beta j Xij + \epsilon i, \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (5.1)$$ Latent variable [not observable]

Where, Y_i^* = Latent variable (not observable), Yi = Dummy variable (observable) defined as

{1if >0, otherwise 0……...5.2 dummy variable [observable]

Logit model estimates the probability of a household to be either [access to agricultural extension services 1, otherwise 0. Two major steps were followed. First, is our logistic model is reliable or how well the model is fitted? While R-squared was used in the linear regression model, livelihood ratio is used for logit model assessment. The hypothesis of the study was that:

* Null hypothesis (H0): *always for all model slope coefficients are equal to zero or independent variables jointly measure nothing, i.e H0=0*

*Alternative hypothesis (H1): *not equal to zero*. We reject the null hypothesis if the computed model value is greater than the critical value at 99% confidence interval, otherwise accept the alternative hypothesis. Accordingly, below were the three alternative formulas (5.3-5.5) to compute the restricted livelihood ratio

$$\ln L0 = n[P1 \ln P1 + (1 - P1) \ln(1 - P1)] \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (5.3)$$

Where n is the sample size, p1 is the dependent variable equal to 1, and 1-p1 is the dependent variable equals to

Alternatively, LR = 2[lnLR – lnL0]…….…… (5.4)

Where LR is the livelihood ratio, lnLR is the restricted livelihood ratio, or when all the independent variables are removed but the constant remains.

It is an unknown value to compute. But lnLo is an unrestricted livelihood ratio which is known from the odds ratio output. An alternative to equations (5.3) and (5.4), equation (5.5) below is also used to compute the unknown value (i.e' restricted livelihood ratio/lnLR)

$$\text{R-squared}=\mathbf{1}-\frac{\mathbf{LnLo}}{\mathbf{LnLR}}$$

$$\text{R-squared-1} = -\frac{\mathbf{LnLo}}{\mathbf{LnLR}}$$

$$-\text{lnL0}= (\text{R-squared})\text{lnLR}$$

$$\text{lnL0}= -(\text{R-squared})\text{lnLR}\text{……..……(5.5)}$$

Where, both R-squared or pseudo R2 value and the unrestricted livelihood ratio (lnLO) value can be obtained from the odds ratio outputs. Hence, following Gujarati (1999), the logistic regression model characterizing adoption by the sample households is specified as:

$$P_i=F(Z_i)=F[\propto+\sum_{i=1}^{m}\beta iXi]=[\frac{1}{1+e^{-[\alpha+\sum\beta iXi]}}]\text{……..….(5.6)}$$

Where, e = represents the base of natural logarithms (2.718…), $X_{i=}$ represents the i^{th} explanatory variable, $P_{i=}$the probability that an individual makes a certain choice (in this study saying yes or no), α and $\beta_{i=}$ are parameters to be estimated. It should be noted that the estimated coefficients do not directly indicate the effect of change in the corresponding explanatory variables on the probability (P) of the outcome occurring. Rather the coefficients reflect the effect of individual explanatory variables on its log of odds. The positive coefficient means that the log-odds increase as the corresponding independent variable increases (Neupane *et al*., 2002). The coefficients in the logistic regression are estimated using the maximum likelihood estimation method. The logistic distribution function for the determinants of households' access to agricultural extension services can be specified as:

$$[1-P_i)=[\frac{1}{1+e^{zi}}\text{……..……(5.7)}$$

Where, $Z_i=\beta_0+\beta_iX_i$, Z_i represents Logistic Distribution Function

Using equation (7.5) and (7.6), the odds ratio becomes

$$\frac{P_i}{1-P_i}=\left[\frac{1+e^{zi}}{1+e^{-zi}}\right]=e^{zi}\text{…….……(5.8)}$$

Alternatively,

$$\frac{P_i}{1-P_i}=\left[\frac{1+e^{zi}}{1+e^{-zi}}\right]=e^{[\alpha+\sum_{i=1}^{k}\beta iXi]}\text{ … … … … ….……..….(5.9)}$$

That is, to estimate the probabilities of households' access to extension services or non-access in this study, the logit model [binary logistic regression] will be used since the results are similar to probit. The logit model [binary logistic regression] is selected because it is important to identify the relationship between the dichotomous dependent variables and any form of explanatory variables, the model doesn't have restrictive distribution assumptions and also the model is used by other researchers such as Abdallah and Abdul-Rahman (2016). Taking the natural logarithms of equation (10.9) give the logit model as indicated below

$$Zi = \ln[\frac{P_i}{1-P_i}] = \alpha + \beta 1X1i + \beta 2X2i + \cdots + \beta mXm \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (5.10)$$

If we consider a disturbance term, u_i, the logit model

$$Zi = \alpha + \sum_{i=1}^{m} \beta tXti + Ui \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (5.11)$$

OR

$$\log(\frac{P_i}{1-Pi}) = \sum \beta jXij + ei$$

Where, P = P [Y = 1] denotes, the probability that a household has access to agricultural extension service, P = P [Y = 0] denotes, the probability that a household has no access to agricultural extension service, Pi =represents the conditional probability that a household has access to extension service, (1 −Pi) =denotes the conditional probability that a household has no access to extension service, β_j's=are vectors of coefficients to be estimated, X_j's =are vectors of explanatory variables (Table 5, first column), $\varepsilon_{i=}$ the error term. In general, the logistic regression model including the disturbance term can be expressed as:

$$Z_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_{3+} \beta_4 X_{4+} \beta_5 X_5 \ldots + \beta_n X_n + \varepsilon_i \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\

efficient and consistent parameter estimates. Annex 5.1 presented the dependent and independent variables. The study described the variables and proposed the following hypothesis:

X1: Age of the HH head*:* Yurttaș & Atsan (2006) revealed that households' need for extension services differ based on their age. That is, Abdallah &Abdul-Rahaman (2016) found that because older farmers have a comparative advantage in terms of capital accumulated, extension visits, and creditworthiness, they are more likely to access different types of extension services in rural Ghana, but only at a certain age. In other words, access to agricultural extension services differs with their ages. Consistently, Umeh & Ekwengene (2017) found that the age of sample households' had a negative and significant relationship with the utilization of agricultural extension packages in rural Nigeria. Hence, in the current study area, it was expected that sample households' age has a negative and significant influence on their access to agricultural extension services, other factors remain constant. In other words, the more the age of the sample households' the more they get access to agricultural extension services.

X2: Place of residence/kebele: Arias *et al*. (2016) also found that location (kebele/village) is an important determinant of the likelihood of receiving agricultural extension services by rural households in Haiti. As a result, households' location/kebele was assumed to be negatively and significantly influence their access to agricultural extension services, other factors remain constant.

X3: Religion/"amanta" of HH head: is expected to have a negative influence on rural households access to agricultural extension services

X4: The literacy level of the HH head is expected to have a positive influence on rural households' access to agricultural extension services

X5: Access to agricultural extension training: Arias *et al*. (2016) found that prior agricultural training is a major determinant of the receipts of agricultural extension services in Haiti. Households who have access to agricultural extension training were expected to have access to agricultural extension services. That is, it was expected that this variable has a positive and significant association with rural households' access to agricultural extension services.

X6: Access to credit: Households who have access to micro-credit were expected to have access to agricultural extension services. That is, it was expected that this variable has a positive and significant association with rural households' access to agricultural extension services.

X7: Access to irrigation: Households who have access to irrigation were expected to have access to agricultural extension services. That is, it was expected that this variable has a positive and significant association with rural households' access to agricultural extension services.

X8: Distance to input supply store: Arias *et al*. (2016) found that location (distance to input supply) is an important determinant of the likelihood of receiving agricultural extension services by rural households in Haiti. Abdallah & Abdul-Rahaman (2016) found that distance to input store found to be significant at 10% significance level in rural Ghana. Similarly, distance to input supply store was expected to have a positive and significant influence on sample households' access to agricultural extension services in the study area, other factors remain constant.

X9: Access to the telephone has a positive influence

X10: Livestock holding in TLU: Yurttaș & Atsan (2006) revealed that households' need for extension services differ based on their number of cattle owned. In the study area, livestock production is the major livelihood source of sample households. This livestock requires animal health-related extension services. Hence, it was similarly proposed that livestock holding (TLU) of sample households' has a positive and significant influence on their access to agricultural extension services, other factors remain constant.

X10: Poverty: Mvuna (2010) argued that "extension services are crucial in enabling producers to realize the increased production and productivity in accessing information for marketing and the other support services essential for agricultural development towards poverty reduction and overall development" (p. 116). Thus, it is expected that poverty is inversely and negatively influences rural households' access to agricultural extension services.

5.5.Results and Discussions

5.5.1. Status of Rural Households' Access to Agricultural Extension Services

Access to Agricultural Extension Training

One of the channels of disseminating agricultural extension services from public or private extension delivery to rural households is training: a method targeting to bring behavioral change to rural households. Table 5.1, below presented the status of sample households' access to agricultural extension training, frequencies, places, usefulness, and problems related to farmland. Table 5.1 results show that while 261/69.79% accessed, 113/30.21% of sample households were not accessed to agricultural extension training delivered in the last 12 months

preceding this study. Open-ended survey questionnaire concerning why non-accessed to agricultural extension training delivered in the woreda was raised. Results show that lack of motivation by development agents and lack of participatory and need-based agricultural extension training by government workers, distance, and poor quality of FTCs are among the list of data captured through an open-ended questionnaire. Consistent results were reported. For example, several studies (Moris, 1991; Benor *et al*., 1984; EEA/EEPRI, 2006; Wambura *et al*., 2012; Mwamakimbula, 2014) have been conducted on factors impacting agricultural extension training programs, thereby, resulted to inaccessibility of most rural households.

One of these factors was related to development agents and unilateral public extension delivery systems. The major task of development agents (DAs) is to provide capacity-building agricultural extension training to households followed by practical demonstrations on their farmland. However, in most studies (Moris, 1991; Benor *et al*., 1984; Mwamakimbula, 2014) lower salary levels and fewer resources for field extension agents, and lack of knowledge about participatory extension approaches by extension agents contributed to the inequitable provision of agricultural extension training to rural households. Asfaw *et al*.(2012) found that less contact of rural households with extension agents hamper their accessibility to effective agricultural extension training. Besides, Benor *et al*. (1984) and Asfaw *et al*.(2012) revealed rural households' access to agricultural extension training was constrained by a lack of participatory and need-based agricultural extension training monopolized by the government or ministry-operated extension system. Weak links between research and extension and inadequate government support affected rural households' participation in agricultural extension training (Wambura *et al*., 2012).

Furthermore, seven major systematic bottlenecks appear to prevent more-farmer-oriented tailoring service delivery showing inadequate performance of FTCs in Ethiopia such as limited involvement of farmers in FTC management, insufficient resources for FTCs, most FTCs have non-long-term plans for sustainability, inadequate incentives to motivate and retain development agents, limited knowledge and skill of development agents, limited training to farmers and inadequate incentives for model farmers for their time to support resource-poor farmers (MoA & NR, 2017). Concerning the poor quality of FTCs [insufficient resources and quality construction] in the study area, field observation during data collection was carried. For

example, Hagaya kebele FTC wall was constructed from poorly fixed corrugated iron sheets (not hallow concrete blocks). During the data collection training, the researcher observed the internal facilities in the FTC. No agricultural farm tools for demonstration of practical on-farm activities. Inside the compound of the FTC, no demonstration of animal production (improved cattle with varieties for fattening and dairy, no demonstration samples of modern beekeeping, and others) except the production of Teff and Maize on a small plot of land in the compound of the FTC. Insufficient resources for FTCs (MoA & NR, 2017) were evidenced in the study area that potentially prevents sample households from their access to agricultural extension training delivered in the last 12 months before this study.

The frequency of agricultural extension training delivered is about how often sample households are accessed to agricultural extension training per year during the 12 months preceding this study. Results show that while 108(39.27%) sample households responded trained more than twice per year, 92(33.45%) and 75(27.27%) accessed the training twice per year and once per year respectively. According to Federal MoA & NR (2019) document, the length of agricultural extension training should be "short term package training" (p.8). Indeed, a long stay of rural households on training either in FTCs or in kebele houses harms their production and productivity. It harms their production by the loss of a long time at the expense of labor and time investment on agricultural production and productivity. That is, distancing rural households for long hours and long days from their close supervision of on-farm products could reduce their production and productivity due to their absence from their close follow-up and timely weeding out and harvesting of their products. Despite how long short is training package is unclear, breaking down the provisions of intensive and extensive agricultural extension training to rural households throughout the calendar and being accompanied by on-farm land training seems plausible. In such a way, it could be expected to ensure the effectiveness of agricultural extension training provided, other factors remain constant.

A place of the agricultural extension training delivered is related to FTCs, kebele house, on-farm, or a combination of these places. As reported by the sample households of the study area most of the agricultural training delivered to sample households of the study area were took place in FTCs (153/51.17%). However, another agricultural extension training was reported to take place at kebele house (24/8.03%), FTC and kebele house (35/11.71%), and all

(81/27.09%). Secondary data sources from MoA & NR (2019) show that accessing farmers to agricultural extension training "on FTCs improve skill and knowledge so that they accept and implement improved agricultural practices and technologies on their plots to increase agricultural production and productivity"(p.8). The same document revealed that conducting agricultural extension training and demonstration of improved technologies and best practices on model farmers' farm improve their skill, which is critically important to increase agricultural production and productivity. However, out of the total 299 sample households of the study area who responded to the item (place), only 6(2.01%) of them responded that such training was carried out on- farmland, implying that on-farm centered agricultural extension training [practice based training] is found less emphasized that put the effectiveness of the extension services in question in the woreda. Therefore, sample households need-based provision of agricultural extension training coupled with working agricultural research centers and practical implementation of theoretical lessons delivered in either FTCs or in kebele households can improve sample households of the study area production and productivity.

The usefulness of agricultural extension training delivered denotes the potential benefits sample households gained from being accessed to agricultural training*:* For the use of agricultural extension training delivered to rural households, 173(51.18%) of the, strongly agreed the training is useful to them. An open-ended survey questionnaire was raised to sample households who responded strongly agree and agree to the agricultural extension training delivered in the woreda. Responses show that training on modern fattening benefits them in the form of consumption and financial income for fertilizer payment, children's education costs, and family medical costs. Indeed, agricultural extension training packages [modern fattening, animal production, crop production, weed control, dipping techniques, vegetation production, soil and water conservation, etc.] for rural households have multiple chains of benefits for them throughout the farming calendar. For example, training on modern fattening delivered to rural households enables them to promote modern fattening of cattle and ruminant animals either for household-level consumption or for commercial purposes. For household-level consumption, as responded it ensures the food security of household members. Besides, the financial income from the sale of fattening animals encourages rural households to participate in livelihood diversification, thereby, reduce rural households' vulnerability to multidimensional poverty and

other shocks. In general, secondary data sources from the MoA & NR (2019) show that accessing farmers to agricultural extension training improves the capacity of farmers.

Table 5.1: Access to agricultural extension training (N=387)

Access to agricultural extension training by sample heads	Response options	Response result		
		N	%	Total
In the last 12 months, do you get access to agricultural extension training?	Accessed	261	69.79	374
	Non-accessed	113	30.21	
How often the agricultural extension training was delivered in a year?	Once per year	75	27.27	275
	Twice per year	92	33.45	
	More than twice per year	108	39.27	
Where is the place of the agricultural extension training?	FTC	153	51.17	299
	Kebele house	24	8.03	
	On-farm	6	2.02	
	FTC and kebele house	35	22.71	
	All	81	27.09	
Do you agree that the agricultural extension training was useful?	Strongly agree	173	51.18	338
	Agree	34	10.06	
	Undecided	45	13.31	
	Disagree	72	21.30	
	Strongly disagree	14	4.14	
What major problem/s your agricultural farmland does face?	Poor soil fertility	66	19.94	331
	Soil erosion	69	20.85	
	Both	196	59.21	

Source: Computed from own field survey (2019)

Access to Agricultural Extension Services

Agricultural extension service refers to the process of extending need and demand based knowledge and skill from a center of learning to those in needs (farmers and other actors) to solve their immediate problems (soil infertility, pesticides, soil erosion, and others) and increase production and productivity of farmland thereby achieve quality life. Nevertheless, due to anthropogenic and/or natural causes, the farmland of rural households could face multiple problems. For example, on an item related to farm land-related problems, sample household underscored the presence of both poor soil fertility (66/19.94% and soil erosion (69/20.85%) problems on their farm-land, suggesting the production, productivity, and effectiveness of agricultural extension service delivery to sample households has been questionable.

Farm-land of the rural households is one of their natural assets (Ellis, 1999; 2000a; DFID, 1999; Odero, 2006; Houweling, 2009; Barbier & Hochard, 2014; Garedew, 2017). No doubt that poor soil fertility and soil erosion problem on the farm-land of rural households affect their production and productivity. One of the purposes of the agricultural extension service package is to access rural households to agricultural extension service delivery packages, thereby; enhance soil

fertility through the utilization of technologies adoption and soil erosion control mechanisms like conservation measures. Based on this background information, 266(71.31%) sample households responded they are disproportionally accessed to agricultural extension services in the last 12 months preceding this study. However, 107(28.69%) responded non-accessed to the agricultural extension services. Sample households' access to agricultural extension services (types & frequencies) (Table 5.2).

Table 5.2: Sample households' access to agricultural extension services (types & frequencies)

Sample households' access to agricultural extension services (access, types, and frequencies)	Access					**Frequencies**			
	Accessed		Non-accessed		Total	Once per year	Twice per year	Three & above/yr	Total
	N	%	N	%		N(%)	N(%)	N(%)	
Access: Do you access agricultural extension services in the last 12 months?	266	71.31	107	28.69	373				
Types: What are some of the agricultural extension services did you get accessed in the last 12 months? ACCESS TO:	YES		NO		TOTAL				
	N	%	N	%					
1. Provision of vaccine	249	64.34	138	35.66	387	98(44.55%)	96(43.64%)	26(11.82%)	220
2. Pest infestation	263	67.96	124	32.04	387	154(67.54%)	58(25.44%)	16(7.02%)	228
3. Weed control	288	74.42	99	25.58	387	119(53.36%)	82(36.77%)	22(9.97%)	223
4. Feeding technique	218	56.33	169	43.67	387	90(50.28%)	63(35.20%)	26(14.53%)	179
5. Weather problem	137	35.40	250	64.60	387	83(72.17%)	18(15.65%)	14(12.17%)	115
6. Modern agricultural /farm inputs	261	67.44	126	32.56	387	143(69.42%)	45(21.84%)	18(8.74%)	206
7. Credit services	139	35.92	248	64.08	387	88(73.95%)	17(14.29%)	14(11.76%)	119
8. Irrigation use	218	56.33	169	43.67	387	109(59.56%)	51(27.87%)	23(12.57%)	183
9. Dipping technique	166	42.89	221	57.11	387	89(61.38%)	34(23.45%)	22(15.17%)	145
10. Milking technique	136	35.14	251	64.86	387	83(68.60%)	23(19.01%)	15(12.40%)	121
11. Use of organic manures	217	56.07	170	43.93	387	114(61.29%)	49(26.34%)	23(12.37%)	186
12. New seed varieties	254	65.63	133	34.37	387	126(62.38%)	50(24.75%)	26(12.87%)	202
13. Crop production	238	61.50	149	38.50	387	114(56.44%)	48(23.76%)	40(19.80%)	202
14. Vegetable production	222	57.36	165	42.64	387	100(53.19%)	50(26.60%)	38(20.21%)	188
15. Modern poultry production	193	49.87	194	50.13	387	103(60.95%)	33(19.53%)	33(19.53%)	169
16. Modern beekeeping production	154	39.79	233	60.21	387	91(62.33%)	36(24.66%)	19(13.01%)	146
17. Market linkage	89	23.00	298	77.0	387	59(64.84%)	19(20.88%)	13(14.29%)	91
18. Soil and/ or water conservation practices	226	58.40	161	41.60	387	107(59.44%)	55(30.56%)	18(10%)	180
19. Modern dairy production	134	34.63	253	65.37	387	71(55.91%)	37(29.13%)	19(14.96%)	127
20. Modern fattening [cow/shoat]	156	40.31	231	59.69	387	84(60.87%)	35(25.36%)	19(13.77%)	138
21. Farm book	51	13.18	336	86.82	387	32(68.09%)	11(23.40%)	4(8.51%)	47

Source: Computed from own field survey (2019)

According to Ijatuyi *et al*. (2017), agricultural extension services encompass a wider range of learning activities: agriculture, health, and business organized for rural households. In the current study area, twenty one different types of agricultural extension services (Table 5.2) were identified and responded to which types and how often sample households accessed. Each presented and discussed next.

Weed control, pest infestation, agricultural /farm inputs & seed variety services

For weed control, secondary sources from Woreda Agriculture and Natural Resource Office (2017/2018) show that weeds of different varieties are some of the on-farm challenges of sample

households that have been increasing the wastage of their farm products. As a result, to control the spread of weeds on the farmland of sample households, herbicide like 2-4D was distributed for 3,420 farmers in 2017 and 2,461 farmers in 2018(Woreda Agriculture and Natural Resource Office (2017/2018) implying chemical sprays. In conformity, results of the primary data source show that 288(74.42%) samples respond accessed to weed control extension services; 119(53.36%), 82(36.77%), and 22(9.97%) accessed once per year, twice per year and three and above per year respectively during 12 months preceding this study.

Chemical sprays against weeds by rural households have serious health and environmental threat. It could also decline the demand for their agricultural products spoiled with inorganic material. Organic agricultural products have a more local and global market. Struggle to control weed shouldn't be against the principle of sustainable rural development. The sample households should prioritize alternative chemical-free weed control, for example, traditional way of hand weeding. It is a difficult task for sample heads having large farm size, But possible to cope up working in "*Debo*" and/or "*Idir*".

Pest infestation-related extension service is another type of agricultural extension service sample households accessed. Results of the same table reveal while 263 (67.96%) are accessed once per year (154/67.54%), 58(25.44%) twice per year, and 16(7.02%) three and above per year, 124(32.04%) of them respond non-accessed to pest infestation related extension service in the last 12 months preceding the current study. Secondary data sources show that 263 farmers in 2017 and 150 farmers in 2018 were accessed to the provision of pesticides control (in kg/lt)(Woreda Agriculture and Natural Resource Office (2017/2018). Similarly, pest infestation with chemicals should not be encouraged by sample households. Local people have their reservoir of knowledge on how to get rid of pets. Due consideration is required by the sample households on the application of scientific knowledge with their rich experiences against pest control. Development agents on each kebele are expected to identify and promote community knowledge-based control of pets.

Furthermore, as reported by 66/19.94% of sample households, their farmland has been facing poor soil fertility. Application of agricultural/farm input (fertilizer) has the purpose of soil fertility improvement. Development agents have played a significant role in providing agricultural extension services related to fertilizer usage. In conformity to this, 261(67.44%)

sample households responded they are accessed once per year (143(69.42%), 45(21.84%) twice per year, and 18(8.74%) three and above per year to modern agricultural/farm inputs, while 126(32.56%) not. This primary data is triangulated with the secondary data source and reveals that in 2017 5,309 farmers and 2018 5,563 farmers were accessed to fertilizer named NPS+B and accessed 8,314 farmers in 2017 and 5,471 farmers in 2018 to Urea (Woreda Agriculture and Natural Resource Office (2017/2018). Despite chemical fertilizers (NPS+B) could boost land productivity, no doubt in the long run could devastate the land and create serious environmental threats. Such application of chemical input is against the notion of sustainable rural development. This study suggests alternative non-chemical fertilizers (manure and cow dungs).

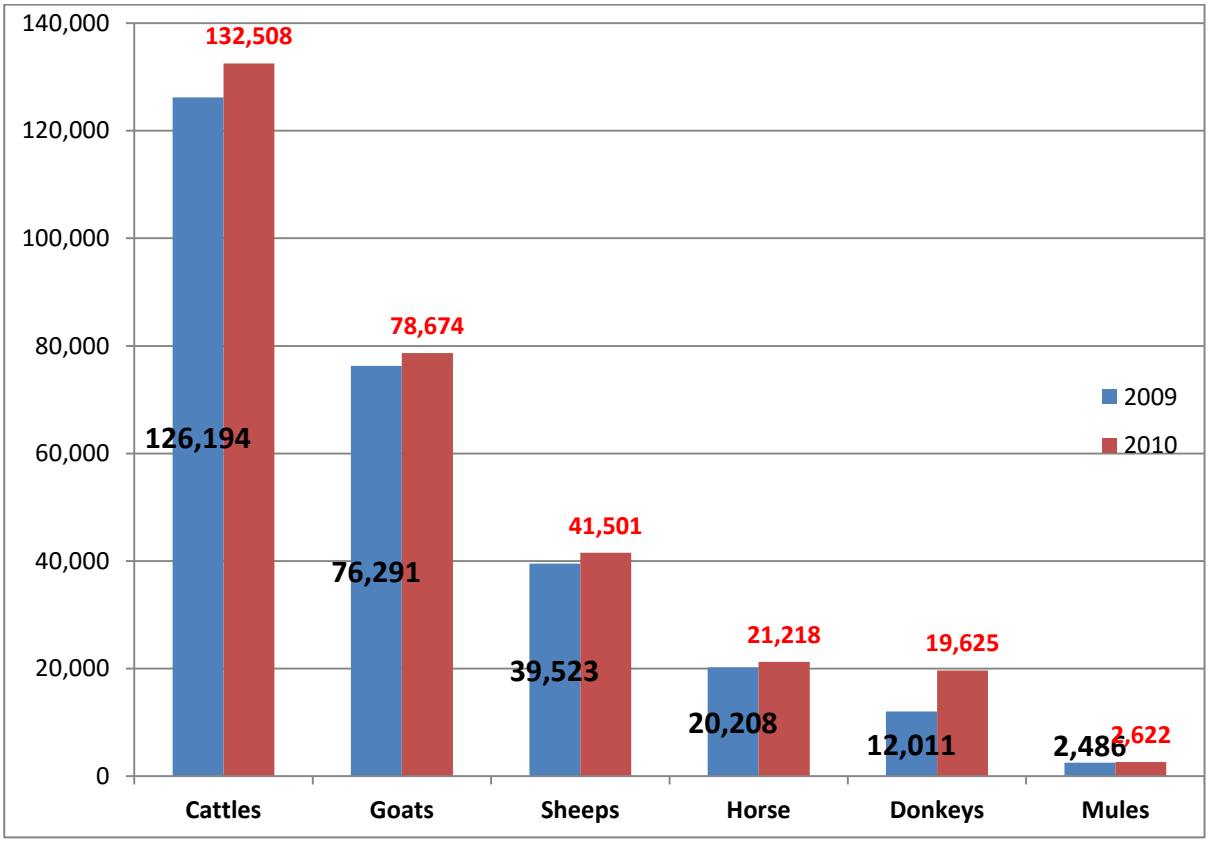
mproved new seed varieties are found among the accessed agricultural extension package by sample households (254/65.63%) once per year (126(62.38%), 50(24.75%), and 26(12.87%). For example, in 2017 335 Qtl and 2018 285 Qtl improved wheat variety and in 2017 506 Qtl and 2018 555 Qqtl improved maize variety distributed (Woreda Agriculture and Natural Resource Office (2017/2018). However, 133(34.37%) sample households who participated in this study are not accessed to such new seed varieties (high yield variety seeds). High yield variety seeds are essential for increased productivity of hectors.

Despite the presence of inequitable distribution of high yield variety seeds (Wheat and Maize) among sample households, even the amount of Quintals distributed in 2017/18 seems insignificant as compared to the big number of sample households in the woreda. Indeed, it has been repeatedly reported that at the national level there exists a shortage of high yield variety, broken seeds, and delay/untimely in distribution (Spielman *et al*., 2010) as one of the major challenges of effective agricultural extension services in Ethiopia.

Vaccines, crop production, soil and water conservations, and vegetable production services

Dominated by cattle population, the current study area is known for its varieties of livestock production like goat, sheep, horse, donkey, and mule (Figure 5.2). The figure shows increasing trends of the number of livestock in the woreda in 2017 total was 276,713 animals and in 2018 total of 296148. Vaccination and treatment of livestock among agricultural extension service delivery packages. It is very critical to keep sample heads animal health.

Figure 5.2: Livestock population of the study area (2017/2018)



Source: Woreda Animal Health Office (2017; 2018)

Results of Table 5.2 show that out of the total 387 sample heads who participated in the current study, 249(64.34%) of them respond accessed to the provision of vaccination for their livestock 98(44.55%) once per year, 96(43.64%) twice per year and 26(11.82%) three and above per year 12 months before this study. However,138(35.66%) of samples found non-accessed to animal vaccination extension service. When triangulated with secondary data sources from Woreda Health Office (2017) it was found that there are a total of 19 animal health staff and 3 C-type and 4 D-type animal health infrastructure in the woreda. For the provision of vaccinations is was found that in 2017 a total of 67,546 animals were vaccinated, i.e., 32,841 animals vaccinated pest and CBPP, 20,208 animals vaccinated blackleg, 2,486 animals vaccinated Hemorrhagic septicemia, and 12,011 animals vaccinated anthrax implying that only 24.4% of livestock were vaccinated in the woreda in 2017 alone. A total of 209,167(75.6%) livestock were not vaccinated in the same reporting year. In 2018, a total of 296,148 (100%) animals i.e, 26,250 animals vaccinated blackleg, 37,500 animals vaccinated Hemorrhagic septicemia, and

12,000 animals vaccinated anthrax, and others 220,398 in the woreda; besides, in 2017 16,500 animals treated against Trypanosomiasis, 196, 000 animals treated against the internal parasite, 38,880 treated against the external parasite, 36,500 animals undertook operation and in 2018 16,500 animals treated against Trypanosomiasis, 190,000 animals treated against the internal parasite, 60,000 treated against the external parasite, 150 animals undertook operation (Woreda Health Office,2018).

Besides, animal production, crop production is another key livelihood source of rural households in the study area. Related extension services are also necessary to enhance the production and productivity of sample households. Respondents are asked whether they are accessed or not by such type of extension service. Accordingly, while 149(38.50%) respond non-accessed 238(61.50%) respond accessed to crop production extension services in 114(56.44%) once per year, 48(23.76%) twice per year, and 40(19.80%) three and above per year in the last 12 months before this study. Study area sample households' access to adopted soil and/ or water conservation practices-related extension service is also essentially required agricultural extension package. Because soil conservation practices using either biological or physical conservation practices or both enable households' farmland from serious erosion that could abandon soil fertility. Losses of soil fertility of rural households' farmland have a direct negative impact on their production and productivity. Similarly, water conservation practices have also profound contributions to rural households' productivity and production and above environmental sustainability. Indeed, 226/58.40% sample households respond accessed to such extension services

Coupled with crop and animal productions related agricultural extension services to rural households' their access to vegetable production-related extension services have also a significant role in securing rural households' survival/food security and balanced diet/nutritional security at the household level and in Rural households. From the same Table 5.2, 222(57.36%) sample households found access to vegetable production-related agricultural extension services in the woreda. Took place on vegetable farm plots of rural households in Gamo Negero and Balbala Sorgo Kebeles. Accordingly, through Agricultural Growth Program/AGP II, 20-25 rural households were organized to promote Avocado plant and other vegetable production (Picture

5.1, below) on Balbala river that crosses two adjacent kebeles (Gamo Negero and Balbala Sorgo) and at the end flows to Fincha'a Lake.

Picture 5.1: Gamo Negero and Balbala Sorgo rural households' Avocado plant



Source: Picture taken by the researcher during data collection (November 2019)

Irrigation use, feeding technique, use of organic manures, and poultry production services

Rural households' access to irrigation use-related extension service is also a very critical component of the full extension package. According to Woreda Irrigation Office (2018) in Jimma Geneti woreda, the main source of water for irrigation practice is surface water (river such as Sayel and Jabo rivers in Hunde Gudina kebele, Jarra river in Lalisa Biya kebele, Gida river in Dambu Genbo, and Charo Gobeno kebeles, Wandi river in Charo Gobeno kebele, Jawe river in Gidami Dabsho kebele, Balbala river in Gamo Negero and Balbala Sorgo kebeles, and other rivers and springs), traditional schemes developed by individual farmers, flood recession, modern schemes developed by the government, and pump schemes for commercial purpose. Accordingly, 218(56.33%) respond that they are accessed to irrigation use extension service. Irrigation activities in the woreda have a mitigating role against the negative impacts of insufficient rainfall. As 277(71.58%) sample households MPI severely poor, availability of several potential rivers [flows into Fincha'a Lake] for irrigation in the woreda seems paradoxical and revealed underutilization of such rivers for large scale irrigation uses.

Accessing rural households to animal feeding technique-related extension service matters most for sample households who have cattle and small animals for household consumption during festivals and/or commercial purposes. Good quality livestock and small animals depend on their type, frequency, and quality of feed supply to them by owners themselves. In the woreda,218(56.33%) sample households responded they are accessed to feeding technique extension services once per year (83/72.17%), twice per year (18/15.65%), and 14(12.17%) sample households are accessed three times and above per year 12 months before the current study. Moreover, as part of agricultural extension services 217(56.07%) and 193 (49.87%) sample households responded accessed to the use of organic manures and modern poultry production extension services respectively. However, 170(43.93%) and 194(50.13%) non-accessed to the use of organic manures and modern poultry production extension services respectively.

Lack of accessing rural households to use of organic manures [manure is organic matter that is used as organic fertilizer in agriculture where most manure consists of animal feces; other sources include compost and green manure] related extension services undoubtedly impacted the production and productivity of sample households in the study. Besides, it encourages sample households' excessive dependency on inorganic fertilizers (UREA and DAP). In turn, could impact the health of sample households and the long-term fertility of their farmland. Still, the lack of intensive extension services to sample households on modern poultry production could have its contribution of sample households stay in MPI severely poor and less participation in other livelihood options. The climate change issue and variability in weather don't guarantee sample households' sustainable livelihood sources. Thus, due emphasis to access sample households to use of organic manures and modern poultry production shouldn't be an issue circumvented for tomorrow and other days. Urgent extension services are required, too.

Dipping technique[43]*, modern fattening, and beekeeping and credit services*

Rural households' access to dipping technique-related extension services is another type of agricultural extension package. Livestock is the crucial asset of sample households' in the study. Apart from the presence of internal animal diseases like blackleg, Hemorrhagic septicemia, and

[43] **Dipping technique:** *is the immersion of the livestock in mixed chemicals against external animal parasites like ticks*

anthrax in the woreda, external animal parasites like ticks are common in the woreda that can be effectively controlled through the dipping technique. In a brief sense, a plunge dip (or simply, a dip) is a bath designed to immerse livestock in liquid pesticide (control pests or other treatment. Typically a dip is designed as a narrow channel about the width of the animal (Picture 5.2) through which the animals walk, immersing them in the progressively deeper liquid until the animal is completely immersed (apart from its head so it can breathe).

Picture 5.2: Cattle being treated against ticks in a plunge dip



Source: https://en.wikipedia.org/wiki/Plunge_dip

Then the channel becomes progressively shallower until the animal exits. Because many animals can walk through the channel one after another, it is an efficient method of delivering pesticide or other liquid treatments to a large herd. Despite the merit of the dipping technique (control ticks), the majority of sample households' (221/57.11%) found non-accessed to such a crucial agricultural extension package. Such lack of agricultural extension service raised a concern about the effective implementation of the national participatory extension system strategy in the woreda. The woreda animal health office is the sole responsible government body for the provision of the dipping technique.

Animal fattening [cow/shoat] extension service has two objectives: fattening for commercial purposes, for consumption purposes, and usage of in farming activities like plow with oxen. Animal fattening is most popular for commercial purposes to earn better financial income for the sale of these animals. In the study area, traditionally rural households undertake to fatten their animals by extra land left for open grazing and using salt combined with agricultural products. A combination of local animal fattening and the scientific method of modern animal fattening seems indispensable. In this case, accessing rural households' modern animal fattening technique in the form of extension service is unquestionable. However, out of 387 sample households' involved in this study majority of them (231(59.69%) responded non-accessed.

Weather problem, milking technique, and dairy production services

In Jimma Geneti woreda there are different agricultural calendars (Table 5.3) like March-April months are agricultural calendars for land clearing by sample households in the woreda. Sowing (planting) activities are carried in the months from May-August. However, months from June-August are for weed control. Harvesting is usually carried out from December-January followed by storing from January-February.

Table 5.3: Jimma Geneti woreda agricultural calendars

No.	Activities	Month (Operational months)
1	Land clearing	March, April
2	Sowing (planting)	May, June, July & August
3	Weeding	June, July, August
4	Harvesting	December, January
5	Storing	January & February

Source: Woreda Agriculture and Natural Resource office (2017/2018)

Agricultural calendars go cyclically as described above. However, rural households of the study area have been impacted by weather problems during these seasons, due to the weather variations (untimely rain, heavy rain, floods, shortage of rain, delay for sawing, or other problems). Through weather-related extension services, development agents are responsible for timely alerting sample households before the loss of any agricultural products. Sample households are asked whether they are accessed to weather problem-related agricultural extension services during the two years preceding this study. Results of Table 5.1, above show that 137(35.40%) sample households report they are accessed of which 83(72.17%) households accessed once per year, 18(15.65%) accessed twice and 14(12.17%) accessed three and above per year. However, the majority of sample households (250/64.60%) responded non-accessed to

weather-related agricultural extension services in two years before this study. Such lack of basic weather-related agricultural extension services by the majority of sample households put under question the effectiveness of full packages of extension services that could be used as a shred of reasonable evidence to infer that weather problems have potentially impacted agriculture and livestock productions of the majority of sample households.

Milking technique and modern dairy production-related extension services are other potential agricultural extension packages required to be delivered to rural households. Apart from agricultural production, Jimma Geneti woreda is well known for its animal production. For examples, secondary data source revealed that were 126, 194 in 2017 and 132,508 in 2018 cattle population in the woreda (Figure 5.2). Besides results of Figure 5.2 cross-reading of primary data presented in Table 5.4 (below) with Table 5.1 (above) results show that the majority of sample household (226/58.40%) owned local cow (low and poor quality milk and dairy yield) and only 20(5.17%) sample households owned cross breed cow (high and good quality milk and dairy yield)(Table 5.4).

Table 5.4: Summary statistics: Types, Number (TLU), and equivalent value (ETB) livestock holding

Types of livestock	Livestock ownership Observation, N (%)			Number of livestock owned (Mean) in TLU					Mean equivalent value of livestock owned (Mean) in ETB				
	YES	NO	TOTAL	Obs	Mean	SD	Min	Max	Obs	Mean	SD	Min	Max
Local Cow	226(58.40)	161(41.60)	387	387	.584	.494	0	1	253	11,601	6,560	600	32,000
CBW@	20(5.17)	367(94.83)	387	387	.052	.223	0	1	12	16,500	12,755	2,000	50,000

@CBC: Crossbreed cow, Source: Own computation from field survey (2019)

For sample households access to related agricultural extension services on milking techniques and modern dairy production, regardless of the presence of the large livestock population in the study area Table 5.1 result revealed that the majority of sample households (251/64.86%) and 253 (65.37%) are non-accessed to such extension services in the last two years preceding this study, suggesting that more due emphasis is given to weed control related agricultural extension service delivery (only 99/25.58% sample households are non-accessed but most of them (288/74.42%) are accessed). While it is important to give due emphasis to agricultural production (weed control extension service), rural households of the study area access to milking technique and modern dairy production extension services have paramount importance in enhancing their get rid of multidimensional poverty, enhancing their choices of alternative livelihood strategies and, thereby, ensure their sustainable livelihood sources. Otherwise, better households in terms of their multidimensional poverty status and alternative livelihood sources

could relapse to MPI severely poor or stray in such dehumanizing phenomenon. That is, the full package of agricultural extension services is indispensable in the study area. For the detailed lists of what "full agricultural extension service packages" comprises (MoA, 2019:13).

Access to market linkage and farm book extension services

Rural households' linkage to nearby markets has a profound contribution for rural households to get their fruits from such tiresome agricultural activities. Development agents are the frontline agricultural staff responsible for increasing rural households' access to agricultural extension services for both subsistence and commercial productions by rural households. The aim is to increase agricultural production and productivity. In the woreda, most of the rural households' agricultural production is substance-oriented production. Surplus agricultural products are reserved for either the next calendar seed or a small proportion taken to nearby markets in exchange for their children's education, family health, and fertilizer cost. Linking rural households is to market is expected to be one of the components of agricultural extension service delivery in the woreda. According to the primary data collected from 387 samples who participated in this study, only 89(23%) respond they accessed market linkage once per year (59/64.84%), twice per year (19/20.88%), and three and above per year (13/14.29%).

The federal ministry participatory agricultural extension document gave due emphasis to the market-oriented production system (MoA, 2019). However, the majority of sample households (298/77%) unacessed to market linkage extension services in the woreda. Consistent finding related to market linkage shows that insufficient understanding of market-oriented production system, limited focus on strategic commodities in the extension services, limited knowledge and skills of extension staff to facilitate value chain development, ineffective linkage among value chain actors, and limited access to market information and collective marketing hampered the effectiveness of market-related agricultural extension services in Ethiopia (MoA & NR, 2017).

Access to farm-book-related extension service is among the twenty-four extension packages expected to be delivered to sample households of the study area. Farm-book is a novel information communication tool for the agricultural extension that enables extension agents to assess the productivity and profitability of farming enterprises in a faster and more reliable manner, to increase farmers' incomes, and achieve food security (Tana & McNamara, 2016). Sample households are asked to respond to this type of agricultural extension service. An

interesting result shows that rural households of the study area accessed farm-book service very insignificantly (only 51(13.18% accessed), where the majority (336/86.82%) unacessed.

Due to the current skill gap of development agents in the woreda, the financial capability of the woreda to avail farm-book to development agents, and above all difficulty of access to the internet in rural Jimma Geneti woreda, the researcher doubt and reserved to accept the response of 51 sample households. Let alone at the woreda level, even at the national and regional level such new ICT not yet institutionalized in the agricultural extension system. This can be evidenced by the document of federal MoA & NR (2017) that states poor utilization of ICT-based extension services is one of the challenges of agricultural extension services. In Sub-Saharan Africa, with all its challenges, South Africa has started the application of farm-book by development agents in the country (Tana & McNamara, 2016) that Ethiopia should learn from the experiences of South Africa.

Overall, from the above descriptive results and discussions, most sample households in the study area are found non-accessed to multiple crucial agricultural extension services like weather problem (250.64.60%), credit service (248/64.08%), dipping technique (221/57.11%), milking technique (251/64.86%), modern poultry production (194/50.13%), modern beekeeping production (233/60.21%), market linkage (298/77%), modern dairy production (65.37%), animal fattening (231/59.69%), and farm book (336/86.82%). Besides, while the majority of sample households are accessed to some specific extension services, low and inequitable distribution of agricultural extension services among sample households observed.

Challenges of Agricultural Extension Service and Support Strategies

There are several contributing challenges grouped as agricultural knowledge and information system challenges, institutional challenges, and other challenges related to FTCs, gender, market, and farmer's orientation challenges presented and discussed next, respectively.

Agricultural knowledge & information systems

Agricultural knowledge & information systems-related challenges are among the challenges that hampered the effectiveness of agricultural extension services in Ethiopia in the general and current study area in particular. Some of the agricultural knowledge and information challenges include unhealthy perception of farmers towards agricultural extension services, public sector-

based extension delivery approach. i.e. lack or the limited number of private sectors, ineffective dissemination of agricultural technologies, weak links between agricultural research and farmers extension problems, inadequate consideration to farmers needs and priorities in research agenda setting and extension package development, delay or untimely provision of extension services, and low education level of farmers (Qamar, 2005; Moris, 1991; Asfaw *et al*., 2012; MAFC, 2007; Abdullah & Samah, 2013; MoA & NR, 2017) (Table 5.5).

Table 5.5: Agricultural knowledge & information systems challenges

Agricultural knowledge & information systems challenge to ensure effective agricultural services in Jimma Geneti woreda	Response options (5-Point Likert Scale)										Total
	5.Strongly agree		4.Agree		3.Undecided		2.Disagree		1.Strongly disagree		
	N	%	N	%	N	%	N	%	N	%	
Unhealthy perception of farmers towards agricultural extension services	130	33.77	60	15.58	31	8.05	39	10.13	125	32.47	385
Public sector-based extension delivery approach. i.e. lack or limited number of private sectors	130	34.03	84	21.99	43	11.26	71	18.59	54	14.14	382
Ineffective dissemination of agricultural technologies	164	43.04	81	21.26	24	6.30	34	8.92	78	20.47	381
Weak links between agricultural research and farmers extension problems	175	45.69	70	18.28	28	7.31	48	12.53	62	16.19	383
Inadequate consideration to farmers needs and priorities in research agenda setting and extension package development	150	39.27	63	16.49	22	5.76	69	18.06	78	20.42	382
Delay or untimely provision of extension services	122	31.69	60	15.58	34	8.83	66	17.14	103	26.75	385
Low education level of farmers	124	32.46	83	21.73	38	9.95	44	11.52	93	24.35	382

Source: Computed from own field survey (2019)

Table 5.5, above revealed that the unhealthy perception of farmers towards agricultural extension services in the study area is strongly agreed by 130(33.77%) sample households. On contrary, 125(32.47%) strongly disagreed that the unhealthy perception of farmers towards agricultural extension services in the study area is a challenge to promote effective agricultural extension services. Unhealthy perceptions of farmers towards agricultural extension services are mostly manifested by their non-adopting such services. No matter the extreme opinions of current respondents, extension literature (Qamar, 2005; Abdullah & Samah, 2013) consistently reported that rural households' weak perception, i.e., due to lack of need-based agricultural extension services (Haynes *et al*., 2010; GFRAS, 2012; Syngenta Foundation of Sustainable Agriculture, 2016) unwillingness to adopt modern agricultural extension services could affect its success in contributing towards household-level food security. During imperial periods (1930- 1973) for instance, scholars like Kassa (2003) and Gebremedhin *et al*. (2006) reported that unsustainability of the extension programs and projects (WADU, CADU, and MPP, etc.), agricultural extensions are known as the Comprehensive Package Program (CPP) and the

Minimum Package Program (MPP) were mainly donor-driven initiatives targeting wealthy smallholders and those engaged in commercial agriculture, lack of common perceptions between technology generators and extension personnel made ineffective agricultural service delivery in the country. As a way forward, Mvuna (2010) suggests one of the most effective ways to strengthen the extension services could be, if and only if, farmers have a positive perception and appreciate the significance of the extension services in their localities.

Public sector-based extension delivery approach. i.e., lack or the limited number of private sectors is reported by 130 (34.03%) as a challenge to effective agricultural extension services in the study area. Different scholars found consistent findings that a unilateral approach to agricultural extension services to the end-users could affect its effectiveness. For example, inadequate manpower, limited finances, one-way communication, and insufficient or even absence of monitoring and evaluation were a challenge to agricultural extension services in Ethiopia during the Imperial periods (Kassa, 2003; Gebremedhin *et al*., 2006). Besides, public delivery and public finance which essentially comprises the traditional government agricultural extension greatly diminished outreach and constrained by a lack of sufficient funding and lack of need-based approach consequently affect its effectiveness (Anderson and Crowder, 2000). Depending on their ideological orientation, agricultural extension service delivery in Ethiopia [imperial, "Derge" and FDRE] is highly dominated by public delivery and financing (Kassa, 2003; Gebremedhin *et al*., 2006; Tilahun, 2008; Spielman *et al*., 2010; Davis *et al*., 2010). To ensure food security, a government-dominated agricultural extension service delivery and financing was reported in "ineffective" (Webb *et al.*, 1992 as cited in Abduselam, 2017) and "futile"(Tilahun, 1999) and hence searching for an appropriate blend of public and private sector roles is required to accelerate and implement effective agricultural extension services at the national and Jimma Geneti woreda levels. Besides, one of the most effective ways to strengthen the extension services is to bring about ownership of the extension service by farmers and make extension workers more accountable (Mvuna,2010).

Ineffective dissemination and delay or untimely provision of extension services are also strongly agreed by 164(43.04%) and 122(31.69%) of sample households as a challenge to effective extension service delivery, respectively. Especially, delay in agricultural inputs (fertilizers and high yield variety seeds) supply and broken seeds, Spielman *et al*. (2010)

reported consistent finding. Furthermore, weak links between agricultural research and farmers is another challenge that is strongly agreed by 175(45.69%) sample households as a cause of ineffective agricultural extension service delivery. Several consistent findings were reported by Kassa (2003), Gebremedhin *et al*. (2006), MoA & NR (2017), and Fentahun *et al*. (2017). Inadequate consideration of farmers' needs and priorities in research agenda setting and extension package development is another challenge. Previous studies show that inadequate representation and participation of farmers during the imperial period was a challenge to agricultural extension services in Ethiopia (Kassa, 2003; Gebremedhin *et al*., 2006). Current primary data also revealed that inadequate consideration to farmers' needs and priorities in research agenda setting and extension package development is strongly agreed by 150(39.27%) sample households as a challenge to effective implementation of agricultural extension services in the study area. The low education level of farmers to quickly adopt modern agricultural extension services is also strongly agreed by 124(32.46%) sample households as a challenge to the effectiveness of agricultural extension service delivery. Integrated Functional Adult Literacy (IFAL) could a potential opportunity to improve the literacy level of sample households. This in turn requires a coordination effort between woreda agriculture and natural resource and education offices in the study area.

Institutional challenges

Institutional challenges such as **i**nstitutional arrangements, coordination, and linkages among key agricultural development partners related challenges/problems (include lack of vibrant linkage and poor alignments, lack of coordination and communication between agricultural sectors and HLIs/ATVETs, and weak responsibility and accountability system in linkage platform), human resource development-related challenges/problems (include limited demand-based training at HLIs and ATVET, poor staffing and high staff turnover, and lack of clear chain of command) and monitoring, evaluation &learning related challenges/problems 9include weak monitoring, learning, and evaluation system and weak accountability and responsibility system) are some of the institutional challenges of effective agricultural extension service delivery (Qamar, 2005; Moris, 1991; Asfaw *et al*., 2012; MAFC, 2007; Abdullah & Samah, 2013; MoA & NR, 2017) (Table 5.6).

Table 5.6: Institutional challenges

Institutional challenges to ensure effective agricultural services in Jimma Geneti woreda	Response options (5-Point Likert Scale)										Total
	5.Strongly agree		4.Agree		3.Undecided		2.Disagree		1.Strongly disagree		
	N	%	N	%	N	%	N	%	N	%	
Institutional arrangements, coordination, and linkages among key agricultural development partners related challenges/problems											
Lack of vibrant linkage and poor alignments	167	43.60	94	24.54	16	4.18	42	10.97	64	16.71	383
Lack of coordination and communication between agricultural sectors and HLIs/ATVETs	185	48.30	77	20.10	16	4.18	52	13.58	53	13.84	383
Weak responsibility and accountability system in linkage platform.	172	45.62	62	16.45	24	6.37	60	15.92	58	15.38	376
Human resource development-related challenges/problems											
Limited demand based training at HLIs and ATVET,	148	39.15	60	15.87	16	4.23	53	14.02	101	26.72	378
Poor staffing and high staff turnover	147	38.99	59	15.65	27	7.16	68	18.04	76	20.16	377
Lack of clear chain of command.	164	43.62	68	18.09	28	7.45	52	3.83	64	17.02	376
Monitoring, evaluation &learning related challenges/problems											
Weak monitoring, learning and evaluation system	177	46.70	51	13.46	20	5.28	50	13.19	81	21.37	379
Weak accountability and responsibility system are identified as a measure bottle	170	44.74	56	14.74	21	5.53	53	13.95	80	21.05	380

Source: Computed from own field survey (2019)

Institutional arrangements, coordination, and linkages among key agricultural development partners' related challenges/problems include lack of vibrant linkage and poor alignments, lack of coordination and communication between agricultural sectors and HLIs/ATVETs, and weak responsibility and accountability system in linkage platform. Table 7.6, above revealed that lack of vibrant linkage and poor alignments, lack of coordination and communication between agricultural sectors and HLIs/ATVETs, and weak responsibility and accountability system in linkage platform are strongly agreed by 167(43.60%), 185(48.30%) and 172(45.62%) sample households, respectively that these challenges affected the implementations of full packages of agricultural extension services in Jimma Geneti woreda. During the imperial period, because the agricultural extension was donor-driven, Kassa (2003) and Gebremedhin *et al*. (2006) similarly reported that the extension system was one-way communication and insufficient during this period. During "Derge" regime, because agricultural development was primarily anchored in the ideological orientation of the military government (primacy to cooperatives and state farms led), individual peasant producers were largely deprived of access to credit services and improved inputs revealed that expediting agricultural development proved futile during "Derge" regime(Tilahun, 1999). Federal MoA & NR (2017) have reported consistent findings with the current results, i.e., lack of vibrant linkage and poor alignments, lack of coordination and

communication between agricultural sectors and HLIs/ATVETs, and weak responsibility and accountability system in linkage platform are some of the major challenges affecting Ethiopia's agricultural extension service delivery. Hence, the discussions imply that to fully implement effective agricultural extension services to rural households and bring about the desired change, it is essential to share roles and responsibilities among implementing partners, individuals, and leadership at all levels. Sharing roles and responsibilities are not an end by itself unless accountability measures are put in place at different levels. To this end, agricultural extension staff, leadership, as well as professionals, should be accountable for the shared tasks and responsibilities.

Human resource development-related challenges/problems include limited demand-based training at higher learning institutions/HLIs and agricultural technical and vocation education and training/ATVET, poor staffing and high staff turnover, and lack of clear chain of command. As shown in Table 5.6, the above problems related to agricultural extension human resource is another challenge. In the current study, results also show that limited demand-based training at higher learning institutions/HLIs and agricultural technical and vocation education and training/ATVET, poor staffing and high staff turnover, and lack of clear chain of command are strongly agreed by 148(39.15%), 147(38.99%), and 164(43.625) respondents, respectively that these factors have been among the challenges of rural households' access to full packages of agricultural extension services in the woreda. In Ethiopia, government-led- Agricultural extension has long-standing history: imperial period extensions (Kassa, 2003; Gebremedhin *et al*., 2006; Ketsela, 2006a; Abate, 2007), "Derge" regime extensions (Davis *et al*., 2010) and extension since1991 (MoA & NR, 2017). The challenges of the agricultural extension are also deep-rooted to these historical periods of the country. For example, inadequate manpower of agricultural extension during the Imperial period was a big challenge (Kassa, 2003; Gebremedhin *et al*., 2006). During the "Derge" regime, Degife & Nega (2000) wrote that the limited number of workers was a critical challenge to agricultural extension. Furthermore, the federal MoA & NR (2017) states that the lack of an effective human resource development system is found a challenge for the effectiveness of agricultural extension services in the country since 1991. All the above discussions suggest a needing for the development of modernized agriculture and extension system that requires a competent, energetic, and dynamic workforce in the sector both at the national and woreda level.

Monitoring, evaluation & learning-related challenges/problems include weak monitoring, learning, and evaluation system and weak accountability and responsibility system: Table 7.6, above revealed that weak monitoring, learning, and evaluation system and weak accountability and responsibility system are strongly agreed by 177(46.70%) and 170(44.74%) sample households, respectively that they are also a challenge to an effective intervention of rural households' access to full packages of agricultural extension services. Similar studies by Kassa (2003) and Gebremedhin *et al*. (2006) revealed the absence of monitoring and evaluation of agricultural extension services during the imperial periods.

That is, agricultural extensions known as the Comprehensive Package Program (CPP) and the Minimum Package Program (MPP) during imperial periods were mainly donor-driven initiatives targeting wealthy smallholders revealing a lack of monitoring and evaluation system (Davis *et al*., 2010; Fentahun *et al*., 2017). Since 1991, Federal MoA & NR (2017) reported consistent findings, too. In fact, at all its intervention levels, rural households' access to full packages of agricultural extension service has its implementation plan. Monitoring, evaluation & learning has to be one of the integral components of the detailed implementation plan of the service. Such monitoring, evaluation & learning plan has several merits. With the monitoring plan, it is possible to assess the success of the service at different levels of the monitoring ladder-like input monitoring, activity monitoring output monitoring, and outcome monitoring. Besides, the achievement of the objective of the services could be assessed using mid-term evaluation, terminal evaluation, and post-evaluation tools. However, the learning gained from the implementation of the rural households' access to full packages of agricultural extension services could be used as a scale-up of the services in the wider context.

The monitoring, evaluation, and learning gained from the implementation of the rural households' access to full packages of agricultural extension services could be ineffective without exercising participatory monitoring, evaluation, and learning activities that involve all the relevant stakeholders in general and the rural households (end-users) in particular. Such a participatory approach to extension service monitoring and evaluation shoulders responsibility and accountability on all stakeholders and enhance its effectiveness. These descriptions suggest the need for participatory monitoring, evaluation, and scale-up of the lessons gained from the

services, otherwise open doors to other subsequent challenges that require other support mechanisms and strategies with huge costs.

Other challenges and support mechanisms/strategies

In the preceding sub-section of this chapter, multiple challenges have been hampered the effectiveness of rural households' access to agricultural extension services in the study area. This section also identified other challenges and corresponding support mechanisms for ensuring agricultural extension services. To capture the opinion of sample households about which support mechanisms could enhance the effectiveness of agricultural extension services in the study area, nine different support mechanisms/strategies such as empowering extension workers, gender equality in extension services, linking extension services to food security dimension, availability of diverse, nutrient-dense and market-oriented foods, diverse diet, stability, utilization of nutrients, WASH services and pluralistic and need-based agricultural extension services were identified from the related literature (Annex5.2).

FTC-related challenges and support mechanism/strategy: Sample households' of the study are requested to respond to the availability of FTC training in or around their kebele. Out of the total 370 sample households, 287(77.57%) responded "Yes" and 83(22.43%) responded "No". Another related question on the status of coordination of FTC training was raised. Out of 383 respondents, while 260(67.89%) of them strongly disagreed, 123(32.11%) disagree with the statement that says strong coordination of FTC training that show us the presence of several challenges within the FTCs that contributed to the ineffectiveness of agricultural extension services in the woreda. Federal MoA & NR (2017) national agricultural extension strategy document identified several challenges of agricultural extension services in the country, for example, limited involvement of farmers in farmers' training center/FTC management, insufficient resources for FTCs, and most FTCs have no long-term plans for sustainability. In 2019, through questionnaire primary data was collected from sample households from twelve *kebeles* to see whether these challenges are also the cases of Jimma Geneti woreda or not. Results of Annex 7.2 show that 240 (62.99%), 206 (54.65%), and 207(54.05%) of the respondents are strongly agreed there exist limited involvement of farmers in farmers' training center/FTC management, insufficient resources for FTCs, and most FTCs have no long-term plans for sustainability in the woreda, respectively. In fact, in the agricultural extension system,

the major objective of the FTCs are to be hubs of knowledge and information sharing [specifically promote improved technologies, good practices, and self-managed FTCs] between farmers, extension agents, and agricultural research institutions. They serve as an entry point for rural farmers' behavioral changes, thereby, paves the way towards modern and commercial agriculture. Nevertheless, in a situation where there exists limited involvement of farmers in farmers' training center/FTC management, insufficient resources for FTCs, and no long-term plans for sustainability by FTCs, no doubt that the effectiveness of agricultural extension services at the household level is futile and ineffective. Ineffectiveness of agricultural extension services in the woreda could result in food insecurity at the household level.

Effectiveness of FTCs in general and agricultural extension services, in particular, could be meaningless unless otherwise, supported by well-paid, skilled, trained, and experienced agricultural extension workers if not, could aggravate the challenges of the present status of FTCs in the woreda described in the above paragraph. As agricultural development workers are in the womb of the local community, sample households strongly agreed that lower salary level and fewer resources for field agricultural extension agents (257(66.75%), untrained and unequipped extension agents in the villages (83/21.84%), lack or less frequency of extension agents contact with rural households (130/33.85%), most extension agents view their role primarily as distributing fertilizer and credit (97/25.39%), and inadequate incentives to motivate and retain extension workers (168/44.44%) affected the effectiveness of the agricultural extension services in the woreda. Similar studies on challenges of the effectiveness of extension services were also reported by Benor *et al*.(1984), Moris (1991), Qamar (2005), Asfaw *et al*. (2012), Wambura *et al*. (2012), and MoA & NR (2017). For example, Moris (1991) pointed out that a lower salary level and fewer resources for field extension agents as compared to those at the "headquarters" represent the major factors that lower the effectiveness and efficiency of extension systems in most developing countries.

Concerning the support mechanism/strategy related to extension workers out of the total 381 responses, 299(78.48%) of them strongly agreed that well empowerment of agricultural extension workers could ensure the effectiveness of agricultural extension services in the woreda. Indeed, agricultural extension agents are the frontline staff of agricultural development intervention programs. They are responsible to build the capacity of rural farmers, through

training, demonstrations, and extension services. They are also a response to bridge the information flow between agriculture office/ research institutions and the end-users of agricultural extension. Despite these facts, agricultural extension workers are unskilled and lack the practical experience to effectively implement the agricultural extension packages. As a result, agricultural extension services are ineffective in ensuring food security at national and households' levels in Ethiopia (Abduselam, 2017). Hence, empowerment of agricultural extension workers' through their access to capacity and technical building training, incentives, better salary, transport facilities, housing, and others could be among the measures that could curb the current low status of agricultural extension services in the woreda. Mwangi (1998) and Rivera *et al*. (2001) reported similar findings that empowerment of extension workers contributed to the extension services. Nevertheless, on the other end of the Likert Scale only 22(5.77%) sample households strongly disagreed that it couldn't.

Gender, youth, and nutrition mainstreaming related challenges/problems and support mechanisms/strategies: Equality between men and women facilitate the effectiveness of extension services. However, gender blind delivery of agricultural extension could hamper its effectiveness (Gurmessa *et al*., 2011; Cathetine *et al*., 2012). Similarly, in the study area Table 10.7, above show that poor gender and youth mainstreaming in extension programs planning, implementation, and monitoring, learning and evaluation (186/48.56%), shortage of gender-disaggregated data (138.35.94%), socio-cultural constraints (149/38.9-), and inadequate nutrition-sensitive extension service (183/47.78%) strongly agreed that among other challenges affecting the effectiveness of extension delivery in the woreda. Similarly, it was reported that because of the inability of women to access the necessary agricultural inputs and services, female farmers produce 23% less per hectare than their male counterparts in Ethiopia (MoA & NR, 2017).

Working towards gender equality /gender transformative approach in agricultural extension services is found as another support mechanism/strategy used to increase the effectiveness of agricultural extension services. The approach provides opportunities to women with non-food supports such as tools, technology, and training expected to reduce workloads of women, so that, able to effectively accessed to access agricultural extension services like their male counterparts. Despite 13(3.43%) strongly disagreed, results of the current study also revealed that 271(70.94%) sample households strongly agreed to the statement working towards gender

equality /gender transformative approach in agricultural extension services could support the effectiveness of agricultural extension services in the woreda. Besides, such support has multiple impacts in the form of significant availability of food security, nutritional security, and livelihood security (GFRAS, 2015; 2016).

Market linkage and value chain development-related challenges/problems and support mechanisms/strategies: The success of promoting improved technologies, good agricultural production, and productivity, and leading to poverty reduction, livelihood diversification, and livelihood security is difficult without due consideration of value addition and marketing to agricultural products. Agricultural extension researchers and organizations (Mattee, 1994; Mvuna, 2010; Churi *et al*., 2012; Wambura *et al*., 2012; MoA & NR, 2017) identified several indicators of rural households' market linkage and value chain development-related challenges that have been contributing to the ineffectiveness of agricultural extension services delivery that aimed to improve the well-being of rural households such as insufficient understanding of market-oriented production system, limited focus on strategic commodities in the extension services, limited knowledge and skills of extension staff to facilitate value chain development, ineffective linkage among value chain actors, and limited access to market information and collective marketing. Similarly, the Ministry of Agriculture Food Security and Cooperatives/MAFC of Tanzania (2007) reported that Tanzania suffers from low agricultural productivity due to many factors including an inadequate extension system leading to ineffective dissemination of technologies, poor market linkages, weak links between research and extension, and inadequate government support. In Ethiopia, weak market linkage and value chain development affected the effectiveness of agricultural extension services in the country (MoA & NR, 2017). Cognizant to the previous studies, sample households of the study area strongly agreed that insufficient understanding of market-oriented production system, limited focus on strategic commodities in the extension services, limited knowledge and skills of extension staff to facilitate value chain development, ineffective linkage among value chain actors, and limited access to market information and collective marketing have been among the other factors that contributed to the ineffectiveness of agricultural extension service delivery system in Jimma Geneti woreda.

As a response strategy, *building agricultural extension services on food security dimensions* was one of the support mechanisms to ensure the effectiveness of agricultural extension service in

the woreda. Within the context of the four pillars of food security (availability dimension, access dimension, utilization dimension, and stability dimension) FAO (2006) strongly underscored the integration of agricultural extension services within these food security dimensions could enhance its effectiveness. Sample households' opinion scale also revealed the same. For example, out of the total 379 respondents of this specific item 290(76.52%) strongly agreed to FAO (2006) that encompassing agricultural extension service to food security dimension support its effectiveness. Even though it is not automatic, the integration of agricultural extension services to food security dimensions can be done on different platforms. For example, *improving the availability of diverse, nutrient-dense, and market-oriented foods* [availability dimension and utilization dimension] are among the others. Such support strategy is strongly agreed by 284(74.54%) respondents of the study area that it contributes to the effectiveness of agricultural extension services. Indeed, according to FAO, IFAD, & WFP (2013), rural people in low-income countries are more likely to consume monotonous diets with inadequate diversity. This is not exceptional in the study area that sample households consume monotonous diets (Teff in common) with limited nutritional values. Besides, sample households of the study area produce crops and rear animals some even with no market demand. These factors could discourage rural households in general and affect the effectiveness of extension services, suggesting the need for integrating the availability of diverse, nutrient-dense, and market-oriented foods within the rural agricultural extension services in the study area. Bushamuka *et al*. (2005) and MoA & NR (2017) found consistent findings.

Integration of agricultural extension services to access dimension of food security (*improving access to diverse diet*) is another platform to ensure its effectiveness. Most sample households of the study area (268/70.53%) strongly agreed with this statement. Access to a diverse diet as a mechanism of ensuring the effectiveness of agricultural extension services is about rural households' ability to secure foods required to meet their dietary needs or nutritional security needs. This suggests us that if due emphasis to the production of diverse diet by rural households is given the demand for such products could also increase. In turn, demand for related agricultural extension services increased, too. By implication having integrated production and access to a diverse diet, the effectiveness of rural agricultural extension services in the woreda could be enhanced. In other words, if extension development agents increase awareness of rural households to produce diverse diets or nutrient-dense foods and create

market linkages for these products, the success of agricultural extension services could be also increased. Only 10(2.63%) responded strongly disagreed with this mechanism.

As an alternative support mechanism, *safeguarding stability* (stability dimension of food security) is also strongly agreed by (289/75.85%) sample households. It is about the ability of a rural household to access diverse foods required for the healthy and active living of all members throughout the year. Beyond its merit [safeguarding stability dimension of food security] to facilitate the effectiveness of agricultural extension service, this support mechanism strongly agreed by the majority of the sample households of the study area helps to enhance food insecurity of rural households during lean periods (June, July, and August) by encouraging them to produce diverse foods through rainwater harvesting, drip irrigation, water management practices and varietal selection throughout the year. A similar support mechanism was suggested by other studies (Bardhan, 1980; SPRING, 2016, MoA & NR, 2017).

FAO (2006) suggests *optimal utilization of nutrients* as a support mechanism to facilitate the effectiveness of agricultural extension services. This suggestion is found strongly agreed by (293/76.70%) of sample households of the study area, implying that through awareness creation to rural households about their unique nutritional needs, by integrating the idea of optimal utilization of nutrients rich food to agricultural extension packages, it could motivate them to adopt extension packages. *Water, Sanitation, and Hygiene (WASH) services* as a support mechanism were suggested by WHO (2015) and SPRING (2016) as an alternative mechanism of ensuring agricultural extension service delivery. Similarly, 291(76.58%) sample households strongly agreed to the suggestion of WHO (2015) and SPRING (2016) that it could help in promoting the effectiveness of the extension services. The logic behind this support mechanism is that insufficient access to clean water, inadequate sanitation, and lack of appropriate hygiene practices in rural areas could result in infectious diseases, thereby; hamper the food utilization dimension of agricultural extension service delivery. That is water, sanitation, and hygiene services should be an integral component of agricultural extension services in the woreda. By implication, integration of WASH services to agricultural extension services for rural households could curb the problem that potentially enhances the success of agricultural extension services.

Farmers oriented and stakeholder extension services related challenges/problems: an Agricultural extension service in Ethiopia has a long-standing history. That is, commenced in the 1950s, "government-led- Agricultural extension programs in Ethiopia was started during the imperial period" (Kassa, 2003; Gebremedhin *et al*., 2006; Abate, 2007). Since then, it has been challenged by several bottleneck problems. Limited involvement of different stakeholders in the provision of extension services, low cooperation, and collaboration between public and NGOs in extension services provisions, and poor involvement of cooperatives in extension service delivery (MoA & NR, 2017) are among the others that have been contributing to the ineffectiveness of agricultural extension service delivery in the country, evidenced by the increased number of food-insecure households in the country reported by (Abduselam,2017) who assessed the food security situation in Ethiopia.

In Jimma Geneti woreda, farmers oriented and multi-stakeholder extension services related challenges/problems such as limited involvement of different stakeholders in the provision of extension services, low cooperation, and collaboration between public and NGOs in extension services provisions, and poor involvement of cooperatives in extension service delivery are also among the challenges that constrained the effectiveness of agricultural extension services, strongly agreed by 214(55.73%), 192(50.26%) and 197(51.30%), respectively. The result is consistent with the Federal MoA & NR (2017) agricultural extension strategy that suggested: "effective agricultural extension system needs to use a broad range of actors to provide inclusive extension services to improve the livelihoods of smallholders"(p.v). This support mechanism is broadly known as *pluralistic and need-based agricultural extension service* delivery. A total of 291(76.58%) sample households of the study area strongly agreed that pluralistic and need-based agricultural extension service delivery support mechanism could facilitate the effectiveness of agricultural extension services in the study area.

In light of the above discussion, Haynes *et al*.(2010) underscored that agricultural extension should not be the unilateral channel for dissemination of information from research to the farmer but should take the role of capacity building through education and developing knowledge in partnership with farmers. Similarly, agricultural extension services should be the function of providing need- and demand-based knowledge in agronomic techniques and skills (Syngenta Foundation of Sustainable Agriculture, 2016), in such a way effective agricultural

extension service improve rural households' livelihoods and well-being(GFRAS, 2012:2), thereby, eliminating extreme rural multidimensional poverty and illuminating their lives sustainably. Furthermore, John (2014) underpin that the extension service has been required for the transformation of subsistence farming to modern and commercial agriculture. As a result the auther states that agricultural extension services delivered to rural households have a paramount importance in ensuring their food security, generation of wealth and employment opportunities and above reducing rural poverty.Nevertheless, besides several challenges and problems that hampered the effectiveness of agricultural extension delivery in the study area, multiple determinants factors are also identified, analyzed, results and discussions made as follows.

5.5.2. Determinants of Access to Agricultural Extension Services

Screening Risk Factors (Diagnosis Tests)

There were two separate tests of multicollinearity assumption of the logit model. First, diagnosis test of multicollinearity assumptions for fifteen discrete variables using pairwise correlation STATA command. The researcher has made a diagnostic test for the following eight discrete variables. Annex 5.3 examined bilateral relationships between eight different discrete independent variables. This was done using coefficients of contingency [chi-square /χ^2 based measure of association]. If the same Table verifies the degree of associations among dummy explanatory variables (greater than 0.75), the parameter estimate would seriously be affected by the presence of multicollinearity among variables, however, in the case of the current study there was no value of 0.75 or above that indicates a stronger relationship between dummy or explanatory variables, no serious multicollinearity problem. Second, Variance Inflation Factor was used to test multicollinearity assumptions for five continuous variables (Annex 5.4). Looking into the same Table the estimated values of VIF reveals no multicollinearity ("rule of thumb" of VIF<10 in each predicator variables) showing that the assumption of the logit model was met and possible to trust coefficients and P-value in the analysis of the determinants of rural households' access to agricultural extension services. That is, the logit model was fitted to the current data.

The Classification Table

As described above the logit model fitted the current data. Apart from the multicollinearity analysis for the logit model, the classification table tells us how good the fitted model is for prediction purposes. The following table shows the classification table for the fitted model. As

we can see from Annex 5.5, out of the 387 samples included in the analysis, 86.30 percent of them are correctly classified based on their household) characteristics. Thus, the overall rate of correct classification is estimated to be 89.29, with 95.93% (118/123=95.93%) of the participants correctly classified (specificity) and only 41.18% (7/17= 41.18%) of the non-participants correctly classified (sensitivity). As expected, classification is sensitive to the relative sizes of each component group, and always favors classification into the larger group.

Determinants of Access to Agricultural Extension Services

Table 5.7 shows the result of the logit model. It reports both logistic regression coefficients together with their odds ratio at the last column. Because the magnitude of the logistic regression coefficients doesn't convey any social or economic significance, it is always preferable either to interpret the marginal effect estimates or the odds ratio estimates. In this thesis case, odds ratio and marginal effects estimates are interpreted.

Table 5.7: Determinants of rural households' access to agricultural extension services

Independent variables (Xs) (A)	**Coefficients (B)**			**Odds ratios (C)**		**Marginal effects(D)**	
	βs	Std. Err.	p>/z/	or	p>/z/	dy/dx	p>/z/
Age of HH heads	.0127726	.0160038	0.425	1.012854	0.425	.0020102	0.423
Capability to work	1.425914	.9107956	0.117	4.161659	0.117	.2244121	0.118
Kebele/"ganda" of the HH head	-1.815848	.7395186	0.014**	.1626999	0.014	-.3890995	0.031
Religion/"amanta" of HH head	-.1237071	.3223473	0.701	.8836386	0.701	-.0194983	0.701
Literacy level of the HH head	.2399538	.3750056	0.522	1.27119	0.522	.0392587	0.538
Access to agricultural training	1.681034	.3545659	0.000***	5.371104	0.000	.3147721	0.000
Credit service	.9718305	.381744	0.011**	2.642778	0.011	.1410055	0.005
Irrigation use	1.358492	.3602289	0.000***	3.890324	0.000	.2248749	0.000
Distance to input supply	.012245	.3308045	0.970	1.01232	0.970	.0019261	0.970
Access to telephone	1.058168	.3427553	0.002***	2.881089	0.002	.1672882	0.002
Livestock holding (TLU)	-.0141782	.0359645	0.693	.9859218	0.693	-.0022314	0.694
Poverty	.12225	.2174835	0.574	1.130037	0.574	.0192399	0.574
Constant	-3.434707	1.364806	0.012	.0322349	0.012		

Note: ***, **, * significant at 1% (for significant p-value<0.01), 5% (for significant 0.01<p-value<0.05), and 10% (for significant p-value>0.05), respectively Source: Computed from own field survey (2019)

Hence, based on the results of Table 5.7 further assessment of the model was made to check the null hypothesis that state as:

* Null hypothesis (H0): *always for all model slope coefficients are equal to zero or independent variables jointly measure nothing, i.e H0=0*
* Alternative hypothesis (H1): *not equal to zero*

We used equation 5.3 to compute the unknown restricted livelihood ratio. That is, ln L0 = n[P1 ln P1 + (1 − P1) ln(1 − P1)] where ln L0 is the unknown restricted livelihood ratio of the model, n is the sample size (equals to 387), p1 is dependent variable equal to 0.7235 and 1-p1 is dependent variable equals to 0.2765 and 1-p1ln1-p1 is equal to -35545=-0.58962 and hence the value for ln L0 equals to -228.182, lnLR equals to -141.38254 and LR equals to 173.60. We rejected H0 because the computed model value (173.60) at 12 degrees of freedom is greater than the critical value (26.217 at 99% confidence interval level) from the chi-square distribution table, implying that the alternative hypothesis is true. That means the coefficients of the model are statistically different from zero revealing that the model is accepted.

Results of Table 5.7 show that Kebele/"ganda" of the HH head has negative (β=-1.815848) and significant (p-value=0.014<0.05 at 5% significant level) that has influenced rural household heads access to agricultural extension services, implying that the log of odds of being non-accessed increases by 16.3%, other factors constant. The marginal effect -.3890995 indicates that due to location differences the probability of HHs' access to agricultural extension services decreases by 38.9% implying that location (kebele/village) is an important determinant of the likelihood of receiving agricultural extension services by rural households. On the contrary, Arias et al. (2016) who states as households' location/kebele in Haiti was assumed to be positively and significantly influence their access to agricultural extension services, other factors remain constant. Furthermore, it was expected that rural households' access to agricultural extension training has a positive (β= 1.681034) and significant (p-value=0.000<0.05) association with rural households' access to agricultural extension services.

Receiving agricultural training has a positive and significant effect on rural households' access to agri-extension services. Thus, the log of odds of a household accessing agri-extension services increases with a household receiving agricultural training than a household that did not receive any. The marginal effects(dy/dx) 0.3147721 indicates that as HHs' access to AET increases by one more unit, their the probability of access to AES increases by 31.4%. This might be so because prior and general training on agricultural issues and equipping farmers with agricultural knowledge, skills, and attitudes paves the way to proper access of the same to agricultural extension services. Indeed, the finding is consistent with previous results (Morris, 1991; Belay & Abebaw, 2004; Abdellah &Abdul-Rahaman, 2016; Aris et al., 2016). Therefore, emphasis

should be given to agricultural training as a way forward to enhancing access to and use of agricultural extension services.

Rural households' access to credit services was expected to have a positive and significant association with their access to agricultural extension services. As expected results revealed that rural households' access to credit service has positive (β=.9718305) and significant (p-value=0.011<0.05 at 1% significant level) that has influenced rural household heads access to agricultural extension services, implying that the log of odds of being non-accessed increases by 264%, other factors constant. The marginal effect .1410055 indicates that as the households' access to credit services increases by one more unit, the probability of being accessed to agricultural extension services also increases by 14%. Irrigation use by rural households' was expected to have a positive and significant association with rural households' access to agricultural extension services. As expected results revealed that rural households' access to irrigation has positive (β=1.358492) and significant (p-value=0.000<0.05 at 1% significant level) that has influenced rural household heads access to agricultural extension services, implying that the log of odds of being non-accessed increases by 389%, other factors constant. The marginal effect .2248749 indicates that as the households' access to irrigation use increases by one more unit, the probability of being accessed to agricultural extension services also increases by 22.5%.

Finally, it was hypothesized that rural households' having telephone has a positive and significant association with their access to agricultural extension services. As expected results revealed that rural households' access to telephone has positive (β=1.058168) and significant (p-value=0.002<0.05 at 5% significant level) that has influenced rural household heads access to agricultural extension services, implying that the log of odds of being non-accessed increases by 288%, other factors constant. The marginal effect.1672882 indicates that as the households' access to telephone increases by one more unit, the probability of being accessed to agricultural extension services also increases by 16.7%. Similar findings were reported by FAO (2009), Munyua *et al*. (2009), and World Bank (2011).

5.6. Key Results, Conclusions and Recommendations

5.6.1. Key Results

1. Modern agricultural development is one of the strategic focuses of rural development. In

other words, rural households' access to agricultural extension services has a pivotal role in increasing their production and productivity. In a situation where access to agricultural extension services to rural households not, need-based and participatory, success in production, productivity, and food security is ineffective. Thus, to describe its state and to identify the determinants of rural households' access to agricultural extension service were among the specific objectives of this study. Accordingly, some of the key results were identified. For example, sample households' self-report on primary data collected through survey questionnaire show that out of the total 387 samples 113(30.21%) of them were not access to agricultural extension training and 107(28.69%) were not accessed to full packages of agricultural extension services implying that rural households' access to agricultural extension services was not as it ought to be in the study woreda.

2. Concerning the constraints of the rural households' low access to agricultural extension services, it was found that 54(14.79%) responded emanated from development agents' limited knowledge of agricultural extension service delivery, lower salary level, and fewer resources for field agricultural extension agents (66.75%), and 130 (34.03%) reported that it originated from dominant public sector-based extension delivery approach (i.e. lack or the limited number of private sectors) that implied limited know-how of DAs, lower salary level and fewer resources, and public/government-oriented extension system in the woreda were contributed to the ineffectiveness of agricultural extension services, other factors constant.

3. Besides, results of the binary logistic regression model show that Kebele of the HH head, access to agricultural extension training, access to credit service, irrigation use, and households' having telephone were determinant factors that significantly contributed to the low status of sample households access to agricultural extension services in the woreda.

5.6.2. Conclusions

Based on the above results, the following conclusions are drawn:

1. Limited access of rural households to agricultural extension training and agricultural extension services.
2. Several factors contributed to rural households' access to agricultural extension training and agricultural extension services in the study Woreda.

5.6.3. Recommendations

Based on the above key results and conclusions draw, the following recommendations are made:

1. Before its uses in agricultural education to rural areas, the concept of the extension was deep-rooted in the educational development sector where outreach college lecturers extend knowledge from a center of learning to those in need of this knowledge (for example, urban industrial workers in England). Since then, it has been used as means of bringing positive behavioral changes amongst farmers in agricultural sectors through the application of modern agricultural inputs aiming to increase their production and productivity.

   Despite the merits of agricultural extension services to rural households, studies confirmed that the service was ineffective in many developing countries. Several determinants were contributed to its ineffectiveness. To analyze the status and determinants of rural households' access to agricultural extension services in the current study woreda, results witnessed that it was found sample households were not access to full packages of agricultural extension services. As rural households are in need to pro-actively get full packages of the agricultural extension services, this demand and empirical results call for the local and regional agricultural extension offices to carefully follow and implement the new participatory extension program of Ethiopia developed by the federal ministry of agriculture in 2011. In this case, the federal ministry of agriculture especially the extension directorate is strongly encouraged to establish effective monitoring and evaluation system.

2. Concerning the constraints/determinants of the rural households' low access to agricultural extension services, it was empirically evidenced that the limited know-how of DAs, their lower salary level, and fewer resources was among the others. Because rural households require knowledgeable, motivated, and resourceful development agents, concerned government bodies should access development agents to frequent in-service extension training programs, so that, front-line development workers get updated with the prevailing changes in the agricultural extension sector. By improving their working environment and their performance in serving rural households, development agents' salary increment, housing services, and equipped with full extension resources could be taken as instrumental mechanisms of long-hours and frequent contacts of development agents with rural households.

3. Besides, results of the binary logistic regression model show that Kebele of the HH head, access to agricultural extension training, access to credit service, irrigation use, and households' having telephone were determinant factors that significantly contributed to the low status of sample households access to agricultural extension services in the woreda. Thus, due attention should be given by concerned bodies to these determinant variables. This could be possible by decentralizing extension training service delivery in the kebele than long travels of households to FTCs. It could be also possible to make extension service delivery more effective than its present status by linking rural households' access to micro-credit services and fair and reasonable distribution of irrigation land mostly in the hands of a few households in Gudetu Jimma, Kalala Didimtu, Chara Gobeno, Damu Genbo, Lalisa Biya, Hagaya and Hunde Gudina kebeles. In undertaking the above policy measures the no doubt that the use of improved tools and agricultural inputs by rural households could increase their production and productivity, decreases their severe multidimensional poverty, enhance their participation in alternative livelihood strategies, and also decreases their current state being in a fragile end of the multidimensional livelihood security.

CHAPTER SIX
ANALYSIS OF THE STATISTICAL ASSOCIATION BETWEEN RURAL HOUSEHOLDS' LIVELIHOODS, POVERTY, AND ACCESS TO AGRICULTURAL EXTENSION SERVICES IN JIMMA GENETI WOREDA[44]

Abstract: *This study was conducted in rural villages of Ethiopia. It aimed to analyze the statistical association between rural multidimensional poverty, livelihoods, and access to agricultural extension services. A cross-sectional household-level primary data were collected from 387 samples. Both descriptive and inferential statistics were used to analyze the data. Results show that no statistical significance differences between sample head choices of livelihood strategies and multidimensional poverty categories, access to agricultural extension services, and multidimensional livelihood security and food security indices. However, a Sadik post-hoc test result showed the presence of statistically significant differences between sample heads who participated in off-farm vis-à-vis on-farm activities only but not between the rest. Hence, it is possible to conclude that there exists an inverse association between rural households' choices of livelihood strategies and multidimensional poverty, access to agricultural extension services, and multidimensional poverty. Thus, rural development policies that incorporate choices of enumerative livelihood strategies and pluralistic agricultural extension services to rural households' are required. Furthermore, the study concludes sample heads who pursued plausible livelihood strategies are found in a state of well-protected multidimensional livelihood security and hence policies that create a synergy between choices of livelihood strategies and multidimensional livelihood security should be in place.*

Keywords: Rural households, Poverty, Livelihoods, Agricultural extension services, ANOVA, Jimma Geneti woreda (Ethiopia)

6.1.Introduction

Poverty reduction, livelihood improvement, and access to agricultural extension services are the critical challenges of rural households. One way or the other, these variables have a statistical relationship. That is, different studies show that there is a statistical association between agricultural extension services/livelihood security likelihood diversification/poverty, agricultural extension services/poverty, and livelihood diversification/livelihood security. For example, concerning the association between agricultural extension services/livelihood security, Farrington *et al*.(2002) state that agricultural extension services are a major factor in enhancing livelihood insecurity of rural households in six- countries (Bolivia, Colombia, India, Nicaragua, Uganda, and Vietnam). Similarly, Abdallah and Abdul-Rahman (2016) witnessed that agricultural extension services to smallholder farmers play an important role in contributing to

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their livelihoods improvement and rural development in Ghana. Another study by Umeh & Ekwenegne (2017) also shows that agricultural extension plays a significant role in household livelihood security in rural Nigeria. These studies imply the need for attention to agricultural extension services to rural households.

To, likelihood diversification/poverty, Chuong *et al*. (2015) state that diversification reduces poverty in Vietnam. They computed the SID values and income for the poorest and richest households. Results show that poorest households SID (.51) and income (7,914) in 2004 and SID (.34) and income (6,808) in 2006 and for richest households' SID (.41) and income (83,257) in 2004 and SID (.40) and income (86,775) in 2006 implying that while poor households tend to be more diversified richer seems to be more specialized in Vietnam. Consistent results were also reported by Carney (1998), Moser (1980), World Bank (2000), FAO (2001), Losch *et al*. (2012), and Mensah (2014). Concerning the association between agricultural extension services/poverty, Mvuna (2010) witnessed that "extension services are crucial in enabling producers to realize agricultural development towards poverty reduction and overall development" (p.116). Also, extension service through the transformation of subsistence farming to modern and commercial agriculture, promote household poverty reduction (John, 2014). For example, Abdallah and Abdul-Rahman (2016) show that agricultural extension services to smallholder farmers play an important role in contributing to poverty reduction in Ghana. In rural Nigeria, Umeh & Ekwenegne (2017) mention that agricultural extensions play significant roles in household poverty reduction. Similarly, increased fertilizer use reduced poverty in Ethiopia (Ayele, 2008). Furthermore, Girma & Temesgen (2018) states that "the use of high yield variety seeds increases by one, the more the probability of not being poor increases by 13.41%" in Ethiopia" (P:26). These imply that in Ethiopia poverty reduction should be among the top government priority areas of development intervention (CSA, 2012).

The other perspective is the nexus between livelihood diversification and its impacts on livelihood security. That means rural households' livelihood diversification can improve household livelihood security (Ellis, 1999). For instance, farm activities and livelihood assets are vital for rural households' livelihood security. Similarly, farm activities play important role in increasing livelihood security (Barrett *et al*. 2001), and such farm activities have multiple livelihood security implications (Yaro, 2006). The other evidence also shows that livelihood assets (financial capital) applied to many activities are critical for rural households' livelihood

security (Barrett & Reardon, 2000). By implications of the above reviews show that there exists, a strong association between the two variables. For example, livelihood diversification helps households combat instability in income, increases the likelihood, and reduces vulnerability, thereby, ensure their livelihood security in general (Choung *et al*., 2015) in the long run. The rest of the sections include section 6.2 reviews the results of previous studies. Section 6.3 presents a specific objective and basic question. Section 6.4 presents One-way ANOVA used to analyze statistical associations between the variables. Section 6.5 presents the results and discussions. Finally, section 6.6 concludes and recommends.

6.2.Empirical review

The study conducted by Abdallah and Abdul-Rahman (2016) revealed that through the roles played by agricultural extension services to smallholder farmers, agriculture is the backbone of the Ghanaian economy as it plays an important role in contributing to poverty reduction. Similarly, Agricultural Development Programs (ADP) play the role of extension and input delivery services in the agricultural sector, thereby, have been playing significant roles in household poverty reduction in rural Nigeria (Umeh & Ekwenegne, 2017). In South Africa, extension and advisory services lead to productivity growth in agriculture, improvement in quality and competitiveness in agriculture, increase in market share of agriculture, output growth in agriculture, and increase in farmers' income which will ultimately lead to poverty reduction and good livelihood in South Africa (Ijatuyi et al., 2017). Furthermore, according to World Bank (2015) when weather and prices are good, increased fertilizer use reduced poverty in Ethiopia. Meaning, there is a significant association between the use of fertilizer and poverty reduction when the conditions are right (good rains and high prices) and no association between fertilizer use and poverty in other years. This was evidenced by the regression results that suggest under the right conditions, a 10% increase in fertilizer use would reduce poverty by 0.4% (World Bank, 2015: 61). All the above synthesis of different works of literature on Ethiopian studies suggest that other things remain constant, through need-based rural households' access to agricultural extension services, huge poverty reduction efforts required from Ethiopia to make poverty a history.

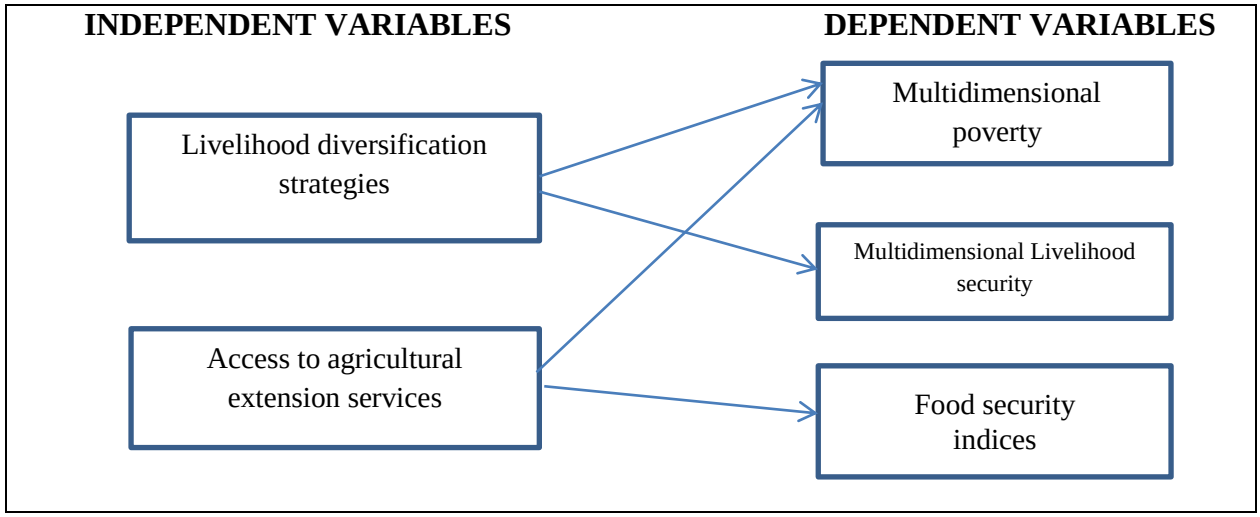
Moreover, agricultural extension and food security scenario is another perspective to establish a possible association between the two variables. Here, the vision of agricultural extension is

serving the public for food security[45]. In other words, John (2014) underpin that the extension service has been required for the transformation of subsistence farming to modern and commercial agriculture, thereby, it is critically important in promoting household food security. For example, In Ghana, the study by Abdallah and Abdul-Rahman (2016) also revealed that through the roles played by agricultural extension services to smallholder farmers, agriculture plays an important role in contributing to food security. Besides, Agricultural Development Programs (ADP) play the role of extension and input delivery services in the agricultural sector, thereby, have been playing significant roles in household food security in rural Nigeria (Umeh & Ekwenegne, 2017). In Ethiopia, Tigabu & Gebeyehu (2018) undertook the study on "Agricultural Extension Service and Technology Adoption for Food and Nutrition Security: Evidence from Ethiopia" found that agricultural extension services and technology adoption have a statistically significant and positive impact on food security and nutritional security of rural households in Ethiopia. The authors identified some of the important/need areas of agricultural extension services most benefiting the rural households in Ethiopia as irrigation need, soil conservation need, planting seeds in a row, improved seed varieties, pesticides, inorganic fertilizers, and organic fertilizers. Furthermore, Girma & Temesgen (2018) state that "farmers who use high yield variety seeds get more yields per hectare and more income which lifted them above the poverty line with the marginal effect corresponding to the improved seed is 0.14, suggesting that as "the use of high yield variety seeds increases by one, the more the probability of not being poor increases by 13.41 %"(p.26). However, given such roles of agricultural extension services in contributing to household-level food security, despite agricultural extension services have a long-standing history in Ethiopia, its contributions to food security for "all people all time" (FAO, 2009) were not as it ought to be. That is, over the imperial regime, Derge regimes and since 1991 to the present, the contribution of agricultural extension services to household-level food security was found "ineffective" and "proved futile" (Degife & Nega; 2000; Tilahun, 1999 and see, Catley et al., 2016; DFID, 2014; Webb et al., 1992 as cited in Abduselam, 2017: 93). Jimma Geneti woreda is one of the woredas of the Oromia regional state (Ethiopia).

[45] Food security: Food for all people all the times (FAO, 2009)

In synthesis of the above review the major statement of the problems include rural households in a state of vicious circles of multidimensional poverty, non-rewarding choices of livelihood strategies, serious depletion of multidimensional livelihood security, and low access to participatory, need-based, and pluralistic agricultural extension services that instigated for further scholarly studies on establishing statistical association between variables other than socio-economic variables. The current study is unexceptional. However, gaps between the previous studies and current study show that statistical association between other socio-economic variables and rural households' poverty, livelihoods, and access to agricultural extension services dominated the literature. Other gap shows none of the previous studies have established an association between rural households' general asset index and multidimensional poverty categories, choices of livelihood strategies and multidimensional poverty categories, choices of livelihood strategies and multidimensional livelihood security, access to agricultural extension services and multidimensional poverty categories, and access to agricultural extension service and food security index. Based on the above review, the following conceptual framework was established between five major perspectives (Figure 6.1).

Figure 6.1: Conceptual framework of a statistical association between variables



Source: Own conceptual framework (2019)

6.3. Specific objective and Basic Question

To fill the above gaps, the following specific objective achieved and corresponding basic question answered:

To examine the statistical relationship between dependent variables of the current study.

a. Are there any statistically significant differences between the categories of each independent variable in impacting dependent variables?

6.4.Methods

Both descriptive statistics (summarize data letting one number stand for a group of numbers) that include cross-tabulations were employed. Besides, to establish statistical association between variables inferential statistics (inferring about the population based on sample information/data) like one-sample t-test (z-score, z-test, and t-test), two samples tests (independent t-test and dependent t-test) were inapplicable. That is, these t-tests don't fit with the three and above samples. There are three potential reasons why t-tests are inapplicable:

1. The means to compare, the more t-tests are required and multiple t-tests are very tedious to analyze the results. For example, three groups (A, B, and C) requires at least three separate t-score computations that are tiresome to analyze each,
2. When two means are compared at a time, the rest of the means are ignored. For example, when sample group A and sample group B are compared sample group C is ignored, and
3. When computing two means at a time and making possible pair-wise comparisons, the probability of rejecting the null hypothesis (H0) when it is True is increasing, that is, commit Type I or α error.

As a result, to establish a statistical relationship between variables shown under Figure 6.1(above) didn't use either of the t-tests rather ANOVA/F-test was used to analyze the data. Because ANOVA/F-test techniques solve the above problems for samples having three and above groups. In this study, One-Way ANOVA was used to test whether there exist statistical significance differences between the above-mentioned variables. Because On-Way ANOVA test is used to test the differences/variances or equality among means for a single independent variable and when there are three or more sample group means (mean 1 for group 1, mean 2 to group 2, and mean 3 for group 3). However, before employing one-way ANOVA, following Lund Research Ltd. (2018) three assumptions were tested. For example, no outliers assumption was tested using graph box STATA command, normality assumption was tested using Shapiro-Wilk test, and homogeneity of variances was tested using Bartlett test. Then, one-way ANOVA was employed to see statistically significant differences between the variables. Then, by slightly modifying Myers *et al*. (2010), ANOVA involves partitioning the variability of all the scores into two components, or *sums of squares*. These in turn are divided by their degrees of freedom to

form *mean squares*. The ratio of mean squares, the *F ratio*, provides a test of the hypothesis that all the treatments have the same effect. In what follows, this study considers each of these aspects of the ANOVA (has five steps):

STEP 1: Sums of squares (SS): Given the sample computational formula for standard deviation (s) is written as:

$$\sum X^2 - \frac{(\sum x)^2}{n} = s^2(n-1) \quad \text{……..……..……(6.1)}$$

Where, *X= observations, n= sample size, s= sample standard deviation, to the left of the equation (6.1) is the sum of squares between groups (SS_B), and to the right of the equal sign of equation (8.1) is the sum of squares within groups (SS_W).*

Sum of squares between groups (SS_B)

Let,

- mean scores from each groups=$\bar{x}_1$, $\bar{x}_2$, $\bar{x}_3$
- Number of subjects= n_1,n_2,n_3
- Grand mean/ mean of all data ($\bar{x}_{Gm}$)=$\frac{\sum X_1}{n_1} + \frac{\sum X_2}{n_2} + \frac{\sum X_3}{n_3}$

$$SS_B = SS_{BGM1} + SS_{BGM2} + SS_{BGM3} + \ldots + SS_{BGMi}$$

$$SS_B = n_1(\bar{x}_1 - \bar{x}_{GM1})^2 + n_2(\bar{x}_2 - \bar{x}_{GM2})^2 + n_3(\bar{x}_3 - \bar{x}_{GM3})^2 + \ldots + n_i(\bar{x}_i - \bar{x}_{GMi})2$$

$$SSB = \sum_{i=1}^{n} ni(\bar{x}i - \bar{x}GMi)2 \quad \text{……(6.2)}$$

If the number of groups (K) is 3, equation (8.2) can be re-written as follows:

$$SSB = SS_{B1} + SS_{B2} + SS_{B3} \quad \text{……(6.3)}$$

The between-groups degrees of freedom (Df_B) for the *between-groups sum of squares (SS_B)* is *n* times the numerator of the variance of the *K* group means about the grand mean and is distributed on **$Df_B = K - 1$.**

Sum of squares within groups (SS_W)

From the left equal sign of equation (8.1), the sum of squares within groups (SS_W) is written as:

$$SSW = \sum_{i=1}^{n} s2i(ni - 1) \quad \text{……(6.4)}$$

Wheres, SS_W= sum of squares within groups, s^2= sample standard deviation, n=sample size

The within-groups degrees of freedom[46] *(Df_W)* is given by **$Df_W = N = K$,** where, N is the total number of subjects, i.e, $n_1+n_2+n_3$. Hence, in ANOVA scores can vary because of the effects of

46 Degree of freedom: *Degrees of freedom are the number of independent values that a statistical analysis can estimate ot it is the number of values that are free to vary as you estimate parameters.*

the independent variable and because of the effects of uncontrolled nuisance/iteration variables. Hence, the correct definition of ANOVA after Fisher known as F-test was given as:

$$VT = VB + VW \quad \text{.....(6.5)}$$

Where, V_T= *Variance total,* V_B=*Variance between groups (e.g., variation between non-accessed to extension group and access to an extension group, and* V_W=*Variance within groups(e.g., variation between non-accessed group or variation between the accessed group.* However, if there are no differences/variances means, VB is equal to VB.

STEP 2: Mean of squares (MS): is variance found by dividing the sum of squares (step 1) of a variable by the corresponding degree of freedom. Accordingly, the mean of squares between groups (MS^2_B) is given by equation (6.6):

$$\text{MS2B} = \frac{SSB}{DfB}$$

$$\text{MS2B} = \frac{\sum ni(\bar{x}i - \bar{x}Gm)2}{K-1} \quad \text{.....(6.6)}$$

Whereas, mean of squares within groups (MS^2_W) is given by equation (8.7):

$$\text{MS2W} = \frac{SSW}{DfW}$$

$$\text{MS2W} = \frac{\sum S2i(\text{ ni}-1)}{N-K} \quad \text{.....(6.7)}$$

STEP 3: F-test: This is known as Fisher –test or F-ratio that is a statistical test used to compute the variance for three or more means. It refers to the ratio of the mean square between groups (numerator) (equation 8.6) and means square within groups (denominator) equation (6.7). That is,

$$F = \frac{MS2B}{MS2W} \quad \text{.....(6.8)}$$

STEP 4: ANOVA summary Table: is used to summarize the results of the ANOVA test (Table 6.1)

Table 6.1: Sample summary table to summarize the results of the ANOVA test

Source of variation	Sum of squares	Degrees of freedom	Mean of squares	F
Between groups	SS_B	K-1	MS^2B	$F = \frac{\text{MS2B}}{\text{MS2W}}$
Within groups (errors)	SS_W	N-K	MS^2W	-
Total	$SS_T = SS_B + SS_W$	DfT= (K-1)-(N-K)	-	-

STEP 5: Post-hoc comparisons between means: if F-test/ANOVA shows a significant difference, post-Hoc comparison/analysis could be used. The most common post-hoc tests are Mean square significance difference (**MSD**), Scheffe test (**Fs**)- a test used after ANOVA, if H0 is

rejected, to locate the significance o the difference between the means, Tukey test (q)- a test used to make a pairwise comparison of means between samples. Because these post-hoc tests are highly conservative, the study proposed the moderate one known as Sadik post-hoc pairwise comparison test with equal variance. However, no any post hoc-pairwise comparision was made because the null hypothesis (no significant difference) accepted.

6.5.Results and Discussions

6.5.1.Nexus Between Choices of Livelihood Strategies Vis-À-Vis Poverty

On-farm activities vs poverty categories: As shown in Table 6.2, below sample households of the study area are engaged in multidimensional and heterogeneous on-farm activities such as crop production, animal husbandry, livestock products, poultry production, modern beekeeping, crop and animal production, and animal husbandry, crop production, animal husbandry and livestock products and all except beekeeping. The Table also revealed the nexus between on-farm livelihood activities and the number of households categorized into different MPI categories. Table 6.2 results show that out of the total 363 sample households persuaded on-farm livelihood sources, 261 MPI severely poor, 51 MPI poor, 50 MPI vulnerable and only 1 household is found MPI non-poor, implying that the traditional on-farm livelihood activities of the sample households have contributed to their multidimensional poor.

The potential reasons that agriculture/on-farm livelihood activities fail to guarantee rural households' sustainable livelihood and trapped into poor status are discussed by agriculture skeptics such as Fikiru (2008), Jirstrom *et al*. (2010), and Jimma Geneti Woreda Agriculture and Natural Resource Conservation Office (2017;2018). In the past decades, similar studies such as FOA (2001), Little *et al*. (2001), Yaro (2006), World Bank (2007), Losch *et al*. (2012), Ifejika *et al*. (2014), Mensah (2014), Hao *et al*. (2015), Dzanku (2015), Chuong *et al*. (2015). Sarah (2015), Wan *et al*. (2016), Liao *et al*. (2017), and Hua *et al*. (2017) revealed that livelihood diversification can offer a pathway for rural households' to be out of poverty.

That is, diversifying on-farm activities to other rural livelihood options of rural households of the study area or combination of on-farmactivities with others could enable them to reduce their being MPI poor. The results show the presence of an association between the status of sample households' on-farm activities and their implications on multidimensional poverty status. Thus,

according to Ellis (2000a; 2000b), rural households' livelihood diversification is a matter of necessity but not a choice. The current study holds a similar position with Ellis (2000a; 2000b).

Table 6.2: Households' on-farm livelihood activities vs multidimensional poverty categories (N=363)

Rural households' on-farm livelihood activities	Rural households' MDP categories				Total
	MPI sever	MPI poor	MPI vulnerable	MPI non-poor	
Crop production (Teff, Maize, Wheat, Nouge, Bean, Barely)	110	16	20	0	146
Animal husbandry(cattle, sheep, Goat, Donkey, Horse	3	0	3	0	6
Livestock products (Skimmed milk, Butter, Cheese)	4	3	1	0	8
Poultry production	9	1	2	0	12
Modern beekeeping	1	1	1	0	3
Crop production and animal husbandry	48	13	9	0	70
Crop production, animal husbandry, and livestock products	27	7	6	0	40
All except beekeeping	59	10	8	1	78
Total	261	51	50	1	363

Source: Computed from field survey (2019)

Non-farm activities vs poverty categories: A few sample households' of the current study area engaged in non-farm livelihood activities. Contrary to on-farm activities, non-farm activities are taking place outside on-farm activities (Ellis, 1998; Barrett *et al*., 2001; Haggblade *et al*., 2007; Fikiru, 2008; Yizengaw *et al*., 2015).

Table 6.3: Households' non-farm livelihood activities vs multidimensional poverty categories (N=103)

Rural households' non-farm livelihood activities	Rural households' MDP categories				Total
	MPI sever	MPI poor	MPI vulnerable	MPI non-poor	
Non-agricultural activities (trading)	24	12	13	0	49
Handcraft activities (weaving, carpentry and house mudding)	24	0	2	0	26
Trading (grain, local drinks, soft drinks, and small ruminants)	18	5	5	0	28
Total	66	17	20	0	103

Source: Computed from field survey (2019)

Results of Table 6.3 above show that rural households' engagement in such non-farm activities could reduce their vulnerability to multidimensional poverty. For example, as stipulated in Table 6.3, out of the total 103 sample households engaged in heterogeneous non-farm activities, results show that 66 MPI was severely poor, 17 MPI poor, and 20 MPI vulnerable, implying that sample households who persuaded non-farm livelihood activities are by far less in several distributions

across different MPI categories than those sample households' solely engaged on on-farm livelihood activities, off-farm activities and sending migrants outside. Furthermore, because of the nature of non-farm activities generating cash income and subsequent capital investments. World Bank (2015) reported consistent results. Both results can be used for policymakers' informed decision-making. That is, results inform due consideration of non-farm activities in designing poverty reduction strategies. The major reason is that rural households' engagement on-farm activities alone couldn't achieve zero extreme poverty.

Off-farm activities vs poverty categories: Off-farm livelihood activities are divided into two such as wage employment that is based on the exchange of a wage or salary and whereas self-employment is a sale of labor services to oneself, rather than working for an employer that pays a wage or salary (Barrett *et al*., 2001; Ellis, 1998; Haggblade *et al*., 2007; Yizengaw, *et al*., 2015; Fikiru, 2008). Table 4, below show sample households' off-farm activities vis-a-vis its effect on their multidimensional poverty status. Results show that out of the total 124 sample households engaged in off-farm activities, 79 MPI severely poor, 20 MPI poor, and 25 MPI vulnerable, implying that off-farm livelihood activities have a more significant role in reducing multidimensional poverty by far than on-farm activities. Sample households' diversification of on-farm activities to off-farm activates is found more advantageous in the speeding risk of MPI severely poor, MPI poor, and MPI vulnerable. The result could give a clue to policymakers to consider off-farm activities as rural poverty reduction strategies than solely giving due emphasis to agriculture alone.

Table 6.4: Households' off-farm livelihood activities vs multidimensional poverty categories (N=103)

Rural households' off-farm livelihood activities	Rural households' MDP categories				Total
	MPI sever	MPI poor	MPI vulnerable	MPI non-poor	
Wage employment (sell of labor service to an employer in exchange for wage or salary)	5	2	2	0	9
Self-employment (sell of labor service to oneself rather than working for an employer)	74	18	23	0	115
Total	79	20	25	0	124

Source: Computed from field survey (2019)

Out-migration vs poverty categories: Both in and out-migration have been inherent components of the rural development process. In the migration literature (Haberfeld *et al*., 1999; Kothari, 2002; Baby, 2005) some evidence considered migration can reduce rural households' poverty

status. In another woreda, by increasing their income, saving, and investment out-migration reduce the poverty status of those households sending migrants as compared to those not sending, otherwise poor. For example, in the current study area, out of the total 386 sample households, Table 5, below show that the majority of them (339) reported not sent any member abroad as compared to sending households (47). In terms of MPI status, the majority of the sample households who failed to send members outside found MPI severely poor (246) as compared to those 31 households MPI severely poor. This is because a large number of sample households' dependence only on on-farm livelihood sources, lack of consequent flow of remittances potential resulted in unprecedented multidimensional deprivation of sample households. This implies out-migration has a significant role in reducing rural households' multidimensional poverty status, otherwise MPI poor. Several studies like Losch *et al*. (2012), World Bank (2015), and World Economic Forum (2017). Nevertheless, due to the shortage of workforce during peak agricultural plowing, report the consistent result of the role of out-migration in rural poverty reduction sowing, and harvesting periods, the researcher has a concern that seasonal out-migration perpetuate rural households' poverty in the study area.

Table 6.5: Households family member out-migration vs multidimensional poverty categories (N=386)

Rural households' Sending migrants based livelihood sources	Rural households' MDP categories				Total
	MPI sever	MPI poor	MPI vulnerable	MPI non-poor	
No	246	44	48	1	339
Yes	31	10	6	0	47
Total	277	54	54	1	386

Source: Computed from field survey (2019)

In the preceding paragraphs, results revealed a need for policy considerations of the nexus between rural households' livelihood activities (on-farm, non-farm, off-farm, and out-migration) and multidimensional poverty. That is, the result revealed a lack of complementary alternative sources of livelihood (non-farm, off-farm, out-migration, and a combination) to on-farm livelihood activities trapped rural households being MPI severely poor. In other words, livelihood diversification could have a significant role in increasing poor households' income and reduce their MPI severely. However, Ellis (1999) worried about the negative consequences of rural households' livelihood diversification: diversification may widen disparities between incomes of rural poor and better-offs, result in the stagnation of farm outputs, and may favor males over women. The researcher shared Ellis's (1999) concern; however, such negative consequences of the rural livelihood diversification could be solved through the proper/effective

rural agricultural extension and rural development policies and strategies. A rural development policy that reverses the status quo of the poor and rich is a matter of both expanding inequality and shifting the multidimensional poverty between the poor and rich. Furthermore, to respond to the question is there any statistical significance diffirences between sample households' choices of livelihood strategies vis-a-vis poverty categories one-way ANOVA was performed between the dependent variable (poverty categories) and independent variable (choices of livelihood strategies). First, to see whether the data meets or fails the assumptions of one-way ANOVA (no significant outliers assumption, normality assumption, and homogeneity of variances assumption) (Lund Research Ltd, 2018) were tested and found there are no detected possible potential outliers in the dataset that reduce the accuracy of the result and hence the data met the assumption of one-way ANOVA (Annex 6.1). The same results are found for the rest of the test of no significant outliers assumtions of one-way ANOVA (Annexes 6.2, 6.3, and 6.4).

Normality assumption is the second assumption of one-way ANOVA. Results of Shapiro-Wilk test of normality for one-way ANOVA revealed that there is insignificant difference between groups, i.e. normal distribution of dependent variable [EXPECTED) for off-farm activities (p=0.25559>0.05) and on-farm + non-farm activities(P=0.18055>0.05) and hence normality assumption was met. However, there was a significant distribution of a dependent variable (i.e. abnormal/skewed) for on-farm activities (p=0.04355<0.005) and non-farm activities (p=0.00050<0.05) choices of livelihood strategies of the households revealing swekness suggesting tolerance so long as in both off-farm and on-farm +non-farm activities' normality assumption was met.

Table 6.6: Shapiro-Wilk test of normality assumption of on-way ANOVA for independent variable choices of livelihood strategies and dependent variable deprivation score

by **s4**_q79, sort:swilk poverty					
Shapiro	Obs	Wilk W test	for normal	data	Prob>z
Variable		W	V	z	
s4_q79 = On-farm activities					
ds	237	0.98792	2.090	1.711	0.04355
s4_q79 = Non-farm activities					
ds	46	0.89307	4.710	3.289	0.00050
s4_q79 = Off-farm activities					
ds	47	0.96959	1.362	0.657	0.25559
On-farm + No-farm activities					
ds	57	0.97068	1.530	0.913	0.18055
	387	3.82126	9.692	6.57	0.48019

Source: Computed from own field survey (2019)

The third assumption of one-way ANOVA tested was its homogeneity of variances. STATA version 14.0 was capable to produce this result (Table 6.7, below: Bartlett's test for equal variances, $\chi 2=0.094>0.05$) implying that the homogeneity assumption was met because of the expected insignificant p-value (H_0: insignificant, H1: significant). Once the three assumptions (no outliers, normal, and homogeneity) of one-way ANOVA were tested and met the researcher run STATA version14.0 one way-ANOVA test of significance of deprivation score of households of the study area by independent variable choices of livelihood strategies.

Table 6.7: One-way ANOVA test of statistical significance of summary of sample households' choices of livelihood strategies by their deprivation score (N=387)

LH primary occupations	Summary of Deprivation score				
	Mean	Std. Dev.	Freq.		
On-farm activities	.64130802	.16932186	237		
Non-farm activities	.50152174	.21448613	46		
Off-farm activities	.54085107	.1865689	47		
On-farm + non-farm activities	.56298246	.20203398	57		
Total	.60095607	.18918934	387		
	Analysis of Variance				
Source	**SS**	**df**	**MS**	**F**	**Prob > F**
Between groups	1.09269926	3	.364233085	10.96	0.0000
Within groups	12.7232465	383	.033219965		
Total	13.8159458	386	.035792606		
Bartlett's test for equal variances: chi2(3) = 6.3853 Prob>chi2 = 0.094					

Source: Computed from own field survey (2019)

Results were depicted in Table 6.7, above. Looking at the same Table, above, participants were classified into four groups: on-farm activities (n1=237), non-farm activities (n2=46), off-farm activities (n3=47), and on-farm + non-farm activities (n4=57), no missing value observed. Result revealed that there is no statistically significant difference (at 5% level) among choices of livelihood strategies of household heads in terms of their multidimensional poverty status as determined by one-way ANOVA (F (3,383) = 10.96, $\chi 2$ = 0.094>0.05), therefore, no post-hoc pairwise comparisons analysis was required between the means of the four groups.

6.5.2. Nexus Between Choices of Livelihood Strategies Vis-À-Vis Multidimensional Livelihood Security Index:

Table 6.8, below revealed that out of the total 237 sample households participated in on-farm activities alone, the majority of them (80) found low multidimensional livelihood security index as camped to another number of sample households in the same category (i.e, low composite livelihood security index), implying that the fewer choices of livelihood strategies (e.g. on-farm

only), the more sample households in a state of extreme fragile composite multidimensional livelihood security index. The result also revealed the nexus between rural households' state of their choices of livelihood storages and the state of their composite livelihood security. That is, as a part of current income-earning opportunities, rural households' multiple sources of livelihood strategies have a long-term impact on their wide livelihood security that combat instability in income, thereby, reduce vulnerability and maintain their composite livelihood security. Consistent findings were reported by Ellis (1999; 2000a), Barret & Reardon (2000), Barret *et al*. (2001), Yaro (2006), and Choung *et al*. (2015).

Table 6.8: Cross-tabulation between sample households' choices of livelihood strategies vis-a-vis composite livelihood security indices (N=387)

Livelihood primary occupations	MLHSIcategories			
	Low MLHSI (1)	Medium MLHSI (2)	Well protected MLHSI (3)	Total
On-farm activities	80	6	151	237
Non-farm activities	10	0	36	46
Off-farm activities	7	0	40	47
On-farm + non-farm activities	15	0	42	57
Total	112	6	269	387

Source: Computed from own field survey (2019)

Furthermore, to respond to the question is there any statistical significance between sample households' choices of livelihood strategies vis-a-vis their composite livelihood security index one-way ANOVA was performed between the dependent variable (composite livelihood security index) and independent variable (choices of livelihood strategies). First, to see whether the data meets or fails the assumptions of one-way ANOVA (normality assumption, and homogeneity of variances assumption) were tested. Normality assumption is the second assumption of one-way ANOVA (Table 6.9).

Table 6.9: Shapiro-Wilk test of normality assumption of one-way ANOVA for independent variable choices of livelihood strategies and dependent multidimensional livelihood security index categories

by s4_q79, sort:swilk MLHSI categories					
Shapiro	Obs	Wilk W test	for normal	data	Prob>z
Variable		W	V	z	
s4_q79 = On-farm activities					
MLHSI categories	237	0.99548	0.783	-0.568	0.71510
s4_q79 = Non-farm activities					
MLHSI categories	46	0.91165	3.892	2.884	0.00196
s4_q79 = Off-farm activities					
MLHSI categories	47	0.82403	7.884	4.387	0.00001
On-farm + No-farm activities					
MLHSI categories	57	0.95599	2.296	1.786	0.03701
	387	3.68715	14.855	8.489	0.75408

Source: Computed from own field survey (2019)

Results of Shapiro-Wilk test of normality for one-way ANOVA revealed that there is insignificant difference between groups, i.e. normal distribution of dependent variable [EXPECTED) for off-farm activities (p=0.25559>0.05) and on-farm + non-farm activities(P=0.18055>0.05) and hence normality assumption was met. However, there was a significant distribution of a dependent variable (i.e abnormal/skewed) for on-farm activities (p=0.04355<0.005) and non-farm activities (p=0.00050<0.05) choices of livelihood strategies of the households suggesting tolerance so long as in both off-farm and on-farm +non-farm activities' normality assumption was met. Normality assumption is the second assumption of one-way ANOVA. Results of Shapiro-Wilk test of normality for one-way ANOVA revealed that there is insignificant difference between groups, i.e. normal distribution of dependent variable [EXPECTED) for on-farm activities (p=0.25559>0.05), hence normality assumption was met.

However, there was a significant distribution of a dependent variable/abnormal for non-farm activities (p=0.00196<0.005),off-farm activities(p=0.00001<0.05), and on-farm+ non-farm activities (p=0.03701<0.05) choices of livelihood strategies of the households suggesting tolerance so long as in on-farm activities alone normality assumption was met. The third assumption of one-way ANOVA tested was its homogeneity of variance. STATA version 1340 was capable to produce this result (Table 6.10, below: Bartlett's test for equal variances, $\chi 2$=0.139>0.05) implying that the homogeneity assumption was met because of the expected insignificant p-value (H_0: insignificant, H1: significant).

Table 6.10: One-way ANOVA test of statistical significance of summary of sample households' choices of livelihood strategies by their MLHSIcategories (N=387)

Livelihood primary occupations	Summary of Deprivation score				
	Mean	Std. Dev.	Freq.		
On-farm activities	2.2995781	.94270158	237		
Non-farm activities	2.5652174	.83405766	46		
Off-farm activities	2.7021277	.71974916	47		
On-farm + non-farm activities	2.4736842	.88852332	57		
Total	2.4056848	.90666429	387		
	Analysis of Variance				
Source	**SS**	**df**	**MS**	**F**	**Prob > F**
Between groups	8.23287436	3	2.74429145	3.40	0.0179
Within groups	309.074619	383	.80698334		
Total	317.307494	386	.822040139		
Bartlett's test for equal variances: chi2(3) = 5.4996 Prob>chi2 = 0.139					

Source: Computed from own field survey (2019)

Once the three assumptions (no outliers, normal, and homogeneity) of one-way ANOA were tested and met the researcher run the STATA 14 one-way-ANOVA test of significance of composite multidimensional livelihood security index of households of the study area by independent variable choices of livelihood strategies. Looking at Table 8.10, above, participants were classified into three groups: on-farm activities (n1=237), non-farm activities (n2=46), off-farm activities (n3=47) and on-farm+ non-farm activities (n4=57), no missing value observed. Result revealed that there is a statistically significant difference (at 5% level) among choices of livelihood strategies of household heads in terms of their composite multidimensional livelihood security index status as determined by one-way ANOVA (F (3,383) = 3.40, $\chi 2$= 0.139>0.05), therefore, no post-hoc pairwise comparisons analysis was required between the means of the four groups.

6.5.3.Nexus Between Access to Agricultural Extension Services Vis-À-Vis Poverty:

Access to agricultural extension services vs poverty categories: Agricultural extension is the promotion of technology. It is also an exchange of knowledge/information sharing. Yet more, agricultural extension is about advice given to rural farmers. Indeed, the three concepts do have a common goal, i.e., helping rural families to solve their immediate problems and improve their lives. Rural households' improvement of living standards could be analyzed from their multidimensional poverty status. Thus, Table 6.11, below depicted the cross-tabulation of rural households' access to agricultural extension services and their multidimensional poverty status. It revealed that out of the total 373 households responded to the item related to their access to agricultural extension services (in the last 12 months preceding this study), results show that 266 of them are accessed and 107 of them are non-accessed. Results of the ample households non-accessed to agricultural extension distribution across four multidimensional poverty categories show that 83 MPI severely poor, 10 MPI poor, and 14 MPI vulnerable, implying that lack of access to agricultural extension services trapped them to be multidimensional poor. In other words, rural households' lack of access to agricultural extension services does have a strong association with their multidimensional poverty status. Different scholars such as Mvuna (2010), John (2014), Abdallah & Abdul-Rahman (2016), Umeh & Ekwenegne (2017), Ijatuyi, *et al*. (2017), and World Bank (2015) that state a "10% increase in fertilizer use would reduce poverty by 0.4%" (p: 61). Both studies recall another policy consideration on the linkage between lack of agricultural extension services and poverty reduction strategies. That means a policy that

incorporates rural households' access to need-based and participatory agricultural extension service [that encourage mouth-to-mouth passage of information, as well as physical demonstrations of innovations and improved methods] in poverty reduction strategies is required.

Table 6.11: Households access to agricultural extension services vs multidimensional poverty (N=372)

Rural households' Access to agricultural extension services	Rural households' MDP categories				Total
	MPI sever	MPI poor	MPI vulnerable	MPI non-poor	
Accessed	185	42	38	1	266
Non-accessed	83	10	14	0	107
Total	268	52	52	1	373

Source: Computed from field survey (2019)

Furthermore, to respond to the question is there any statistical significance between sample households' poverty vis-a-vis access to agricultural extension services one-way ANOVA was performed between an independent variable (access to agricultural extension services) and the dependent variable (poverty). First, to see whether the data meets or fails the assumptions of one-way ANOVA (normality assumption, and homogeneity of variances assumption) were tested. Normality assumption is the second assumption of one-way ANOVA. The normality assumption of the one-way ANOVA result was presented in Table 8.12, below. Results revealed that there is an insignificant difference between groups, i.e. normal distribution of dependent variable [EXPECTED) for non-accessed (p=0. 0.12847>0.05) and hence normality assumption was met. However, there was a significant distribution of a dependent variable (i.e. abnormal/skewed) for accessed (p=0.00064<0.05) households revealing sleekness suggesting tolerance so long as in non-accessed normality assumption was met.

Table 6.12: Shapiro-Wilk test of normality assumption of one-way ANOVA for independent variable access to agricultural extension services and dependent variable poverty

by s4_q140, sort:swilk deprivation score					
Shapiro	Obs	Wilk W test	for normal	data	Prob>z
Variable		W	V	z	
s4_q140 = otherwise					
ds	107	0.98096	1.664	1.134	0.12847
s4_q140 = have access to					
ds	280	0.98022	3.964	3.222	0.00064

Source: Computed from own field survey (2019

The third assumption of one-way ANOVA tested was its homogeneity of variances. STATA version 14.0 was capable to produce this result (Table 6.13, below: Bartlett's test for equal

variances, $\chi 2=0.727>0.05$) implying that the homogeneity assumption was met because of the expected insignificant p-value (H_0: insignificant, H1: significant).

Table 6.13: One-way ANOVA test of statistical significance of summary of sample households' access to agricultural extension services and by their poverty (N=387)

Access to agricultural extension services	Summary of Deprivation score				
	Mean	Std. Dev.	Freq.		
Non-accessed	.62859813	.19250801	107		
Accessed	.59039286	.18717535	280		
Total	.60095607	.18918934	387		
	Analysis of Variance				
Source	**SS**	**df**	**MS**	**F**	**Prob > F**
Between groups	.112999755	1	.112999755	3.17	0.0756
Within groups	13.702946	385	.035592068		
Total	13.8159458	386	.035792606		
Bartlett's test for equal variances: chi2(1) = 0.1218 Prob>chi2 = 0.727					

Source: Computed from own field survey (2019)

Once the three assumptions (no outliers, normal, and homogeneity) of one-way ANOA were tested and met the researcher run the Stata version14 one way-ANOVA test of significance of deprivation score of households of the study area by independent variable access to agricultural extension services. Result revealed that there is no statistically significant difference (at 5% level) among sample households access to agricultural extension services in terms of their poverty status as determined by one-way ANOVA (F (1,385= 3.17, $\chi 2 = 0.727>0.05$), therefore, no post-hoc pairwise comparisons analysis was required between the means of the two groups (Table 6.13, above).

6.5.4. Nexus Between Access to Agricultural Extension Services and Food Security Indices:

Table 6.14: Cross-tabulation of sample households' access to agricultural extension services vis-à-vis their food security indices

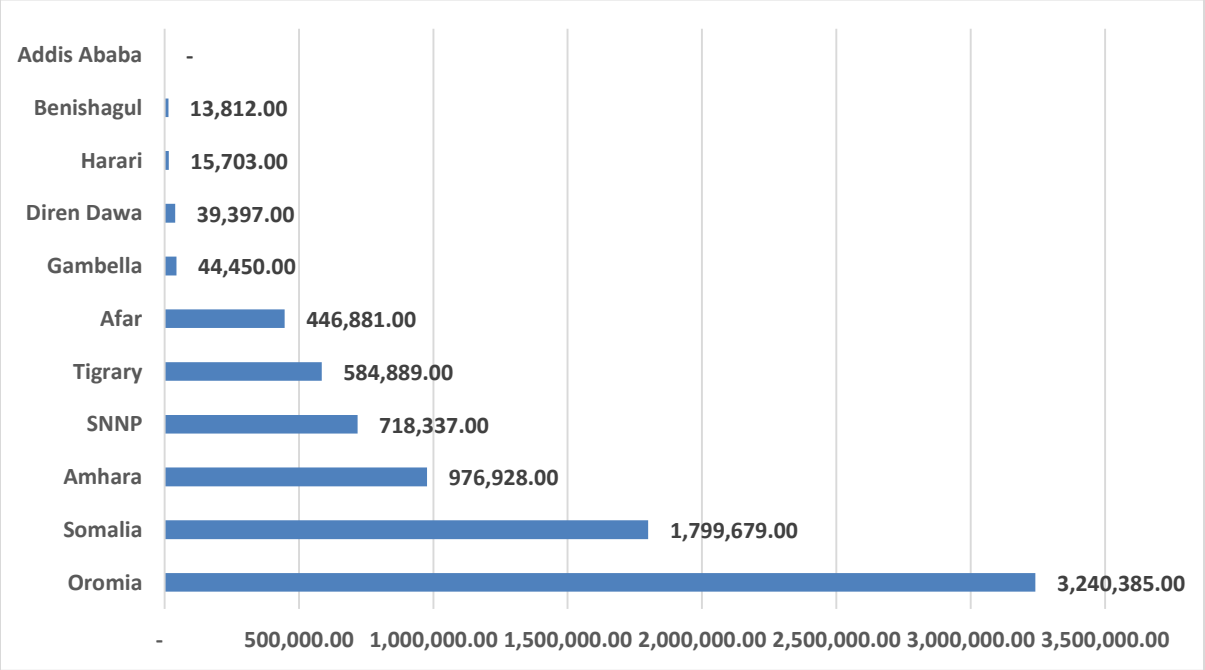
Access to agricultural extension	Food security indices categories				
	Severely food insecure (mean FSI<2.0)	Food insecure (mean FSI ≥2 &<3.0)	Moderate food secured(mean FSI ≥3.0 & > 3.5)	Highly food secured (mean FSI≥3.5)	Total
Accessed	22	105	83	70	280
Non-accessed	8	29	27	43	107
Total	30	134	110	113	387

Source: Computed from own field survey (2019)

The nexus between agricultural extension service and food security can be described as the contribution of rural households' access to agricultural extension services to their food security status. As shown in Table 6.14, above out of the total 280 sample households' access to agricultural extension services, the majority of them (70 households) were found highly food secured as

compared to 43 households being non-accessed, implying that the more rural households' access to agricultural extension services the more they are food secured. On contrary, ineffective agricultural extension services could result in a food security deficit (Fentahun *et al*., 2017). Abduselam (2017) reported a consistent finding that states the major food crisis in Northern Ethiopia (Wollo & Tigray in 1953) during the Imperial period was due to negligence given to agricultural extension services. During the Derge regime, Tilahun (1999) and Degife & Nega (2000) also reported the ineffectiveness of agricultural extension services revealing food crisis in parts of Eastern Harare, SNNPR, and Bale lowlands between 1973-74, Wolayta, Kambata & Hadiya between 1984-85 & Tigray, Wollo & Gonder between 1987-88 (Abduselam,2017). According to the National Disaster & Risk Management Commission of Ethiopia/NDRMC (2018), below was the acute food insecurity crisis in Ethiopia during the EPRDF regime:

Figure 8.2: Acute food insecurity crisis in Ethiopia by region and city administrations (2018)



Source: National Disaster & Risk Management Commission of Ethiopia (2018:10)

As shown in Figure 6.2, above except for Addis Ababa city administration, all regions including Dire Dawa city administration, there was acute food insecurity crisis in Ethiopia (highest in Oromia) revealing the nexus between access to agricultural extension services and its contribution to food security. Keeping other factors constant, the major factor for the ineffectiveness of agricultural extension services in Ethiopia was due to its being traditionally been financed and provided almost entirely by the public sector (Spielman *et al*.,2010) and a

blend of public and private was recommended. Furthermore, to respond to the question is there any statistical significance between sample households' access to agricultural extension services vis-a-vis food security indices one-way ANOVA was performed between the dependent variable (access to agricultural extension services and independent variable food security indices). First, to see whether the data meets or fails the assumptions of one-way ANOVA (normality assumption, and homogeneity of variances assumption) were tested.

Normality assumption is the second assumption of one-way ANOVA. The normality assumption was done using the "Shapiro-Wilk test of normality" using STATA version 14.0. Results of the normality assumption (Table 6.15) of one-way ANOVA revealed that there is an insignificant difference between groups, i.e. normal distribution of dependent variable [EXPECTED) for non-accessed (p=0.12979>0.05) and for accessed (p=0.46427>0.05) hence normality assumption was met.

Table 6.15: Shapiro-Wilk test of normality assumption of one-way ANOVA for independent variable access to agricultural extension services and dependent food security indices

by **s4**_q140, sort:swilk hlsFSctegories					
Shapiro	Obs	Wilk W test	for normal	data	Prob>z
Variable		W	V	z	
s4_q140 = otherwise					
hlsFS categories	107	0.98101	1.659	1.127	0.12979
s4_q140 = have access to					
hlsFS categories	280	0.99482	1.039	0.090	0.46427

Source: Computed from own field survey (2019)

The third assumption of one-way ANOVA tested was its homogeneity of variances. STATA version 14.0 was capable to produce this result (Table 6.16, below: Bartlett's test for equal variances, P=0.4230.05) implying that the homogeneity assumption was met because of the expected insignificant p-value (H_0: insignificant, H1: significant). Once the three assumptions (no outliers, normal and homogeneous) of one-way ANOVA were tested and met the researcher run the Stata version14 one-way-ANOVA test of significance of food security indices of households of the study area by independent variable access to agricultural extension services. Results were depicted in Table 8.16, above. Looking at the same Table, participants were classified into two groups: non-accessed (n1=107) and accessed (n2=280), no missing value observed. Result revealed that there is no statistically significant difference (at 5% level) among

access to agricultural extension services of household heads in terms of their food security indices status as determined by one-way ANOVA (F (1,385) = 6.00, p = 0.423>0.05), therefore, no post-hoc pairwise comparisons analysis was required between the means of the two groups.

Table 6.16: One-way ANOVA test of statistical significance of summary of sample households' access to agricultural extension services and by their food security indices (N=387)

Access to agricultural extension services	Summary of hlsFS categories				
	Mean	Std. Dev.	Freq.		
Non-accessed	2.9813084	.99034307	107		
Accessed	2.7178571	.92885005	280		
Total	2.7906977	.95229	387		
	Analysis of Variance				
Source	**SS**	**df**	**MS**	**F**	**Prob > F**
Between groups	5.9813084	1	5.37318052	6.00	0.0147
Within groups	344.673331	385	.895255405		
Total	350.046512	386	.906856248		
Bartlett's test for equal variances: chi2(1) = 0.6410 Prob>chi2 = 0.423					

Source: Computed from own field survey (2019)

6.6. Key Results, Conclusions and Recommendations

6.6.1. Key Results

Based on the results of the one-way ANOVA, the following key results indentified:

1. Result revealed that there is no statistically significant difference (at 5% level) among choices of livelihood strategies of household heads in terms of their multidimensional poverty status as determined by one-way ANOVA (F (3,383) = 10.96, $\chi 2$ = 0.094>0.05), therefore, no post-hoc pairwise comparisons analysis was required between the means of the four groups.
2. Result revealed that there is a statistically significant difference (at 5% level) among choices of livelihood strategies of household heads in terms of their composite multidimensional livelihood security index status as determined by one-way ANOVA (F (3,383) = 3.40, $\chi 2$= 0.139>0.05), therefore, no post-hoc pairwise comparisons analysis was required between the means of the four groups.
3. Result revealed that there is no statistically significant difference (at 5% level) among sample households access to agricultural extension services in terms of their poverty status as determined by one-way ANOVA (F (1,385= 3.17, $\chi 2$ = 0.727>0.05), therefore, no post-hoc pairwise comparisons analysis was required between the means of the two groups.

4. Result revealed that there is no statistically significant difference (at 5% level) among access to agricultural extension services of household heads in terms of their food security indices status as determined by one-way ANOVA (F (1,385) = 6.00, p = 0.423>0.05), therefore, no post-hoc pairwise comparisons analysis was required between the means of the two groups.

6.6.2.Conclusion

Based on the above four key results of the study, it is possible to conclude that, as hypothesized no statistically significant differences among groups of independent variables having impacted respective dependent variables. That is, consistent with the presumption, results of the one-way ANOVA evidenced that no statistically significant differences between ALL groups.

6.6.3.Recommendation

Based on the above key results conclusion draw, it is now possible recommend due attention of policy researchers to establish a statistical relationship among dependent variables like rural poverty, livelihoods, and access to agricultural extension services than their merely draw of conclusions based on other socio-economic independent variables only.

CHAPTER SEVEN
OVERALL SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

7.1.Introduction

The major objective of the study was to analyze the status and determinants of rural households' livelihoods, poverty, and access to agricultural extension services in Jimma Geneti Woreda, Ethiopia. Given the delimitation (Jimma Geneti woreda) and, now, it is possible to declare that the study is completed; completion in the sense of achieving all specific objectives and answering each specific research questions of the study. Thus, beginning with the introduction, the final chapter of the study summarized the overall basics (instigation, specific objectives and questions, significances, limitations & constraints, philosophical worldview, methodologies, designs, sampling, and data analysis techniques) of the study (section 7.2). Section 7.3 presents the overall conclusions and recommensions. Finally, limitations and future research area (section 7.4) closed the write-ups of this dissertation.

7.2.Overall summary

Rural households' livelihoods, povertyand their access to agricultural extension services were the three thematic areas covered by this study. Methodological gaps in rural households' livelihood, and a wider consideration of livelihood security, poverty analysis, and low access to agricultural extension services instigated the study. The specific objectives include: to describe the status of rural households' livelihood systems and strategies of livelihood diversification, to study multidimensional livelihood security, to describe the status of rural poverty, to investigate determinants of choices of livelihood strategies, to investigate factors affecting multidimensional livelihood security, to examine factors contributing to rural poverty, to identify determinants of access to agricultural extension services and to examine nexus between dependent variables were the specific objectives of the study.

Furthermore, the study attempted to respond to different specific questions. The study was felt significant because it contributes to academic knowledge, general public awareness, and micro-level data input for government policy formulation regarding the status and determinants of rural households' livelihoods, poverty, and access to agricultural extension services. It was also believed that it gives some suggestions for researchers who want to pursue further study on similar thematic areas. Above all, the study was exclusively significant for its alternative

methodological contributions to rural poverty analysis and igniting the need for the wider consideration of livelihood security of rural households.

Pragmatist philosophical worldview (i.e, quantitative of positivism and qualitative of constructivism) governed the study. Based on Creswell (2009) mixed research methodology (quantitative and qualitative) was employed. Micro-level cross-sectional, descriptive research, qualitative case study, and explanatory or causal research designs were the research designs used for the study. Krejcie & Morgan's (1970) sample size determination formula was used to include a total of 387 survey samples. Multistage sampling techniques (purposive, availability, proportional, and simple random samplings) were used to include a total of 387 rural households in the study. However, using purposive sampling techniques 6 rural households for the unstructured interview, 72 for the structured interview, and 12 for FGD were involved in the participatory poverty analysis.

Primary and secondary data sources set up the data set. And was analyzed using descriptive statistics, inferential statistics, and econometric models for the quantitative part. However, the participatory poverty index (PPI) and participatory scoring matrix were used in the qualitative data analysis. Both SPSS version 24.0, STATA version 13.0 & 14.0, and Microsoft excel were among the support software used. Indeed, Such a pragmatist philosophical worldview, mixed research designs, multiple-stage sampling techniques, and various data analysis techniques enabled the researcher to capture a comprehensive picture of rural households' poverty, livelihoods, and their access to agricultural extension services where its conclusions were drawn in the subsequent section.

7.3. Overall Conclusions and Recommendations

The following overall conclusions and recommendations are made:

1. In the study area, it was found that there exist unequal rural livelihood asset capitals among households. Besides, on-farm activities have been dominating rural households' livelihood sources. Given the challenges of climate change, it is possible to conclude that sample households' of Jimma Geneti woreda dependence on on-farm activates only doesn't sustainably guarantee their future livelihood sources. Thus, the woreda Agriculture and Natural Resource Conservation, irrigation, and Trade offices are recommended to increase the

awareness of rural households engaged in on-farm activities only to diversify their livelihood sources to non-farm, off-farm and a combination of these livelihood activities.

2. Food and nutritional livelihood security analysis dominated livelihood security literature. Nevertheless, several pieces of evidence show that rural households state of food and nutritional security found in a state of serious threat. Hence, it is possible to conclude that unless future studies focused on rural households' multidimensional livelihood security analysis followed by concert actions, rural households' state of food and nuterional security could be worsen than ever. Thus, civil society organizations in general and government offices at all levels concerning rural households' livelihood security are recommended to employ its analysis using multidimensional livelihood security. As such approach is a means; actions that enhance rural households' multidimensional livelihood security issues should be in place.

3. When poverty is estimated using the multidimensional approach, sample households were highly deprived in cooking fuel indicator, school attendance indicator, and least deprived in nutrition child indicator implying that sample households of the study area were deprived in all the three dimensions of multidimensional poverty. Hence, woreda water, mineral, and energy office should give priority to rural households to get access to rural electrification program. Likewise, the woreda education office is recommended to create out-of-school children's access to quality education. This can be possible by constructing new classrooms and satellite schools in distant villages. The woreda health office is also recommended to create awareness for rural parents to feed their children nutritious diets. This can be possible through the village-level health extension workers.

4. However, when poverty is measured using a participatory approach, results show that the qualitative approach to poverty analysis captured detailed poverty dimensions and corresponding indicators. Thus, it is possible to conclude that the participation of rural households' who experienced poverty enables development planners and decision-makers to identify micro-level poverty dimensions and indicators. Hence, alongside with monetary approach to poverty assessment, the regional and federal government offices working on

poverty reduction are recommended to employ a combination of poverty measures like multidimensional and participatory poverty approaches.

5. Rural households' access to agricultural extension services found a challenge. Hence, it is possible to conclude as, unless otherwise, rural households get access to need-based and pluralistic agricultural extension services, food security, nutritional security, multidimensional livelihood security, and above all sustainable rural development could be ineffective and futile. Hence, local, regional, and federal government agriculture offices should make the agricultural extension service delivery more need-based, participatory, and pluralistic. Furthermore, these government offices are also recommended to create a linkage between farmers and agricultural research institutions.

7.4. Limitations and Future Research Areas

7.4.1. Limitations of the Study

During the study period, Jimma Geneti Woreda was under strict military control/command post. Free movement was very challenging. As a result, the number of days to collect both the quantitative and qualitative data was unnecessarily elongated that it has financial implication on the self-sponsored researcher of the current study. The researcher has overcome such limitations by having smooth communication and repeated explanations of the objective of the study to woreda officials (woreda administration head and agriculture office head).

Jimma Geneti Woreda has twelve highly scattered rural kebeles. Access to some rural kebeles like Adi Leka Tulu Chali kebele, Hunde Gudina kebele, Hagaya kebele, and Lalisa Biya Kebele was very challenging due to the lack of access road to the kebeles. The researcher has overcome access challenges by using distance walking deep into the rural kebeles. The researcher is a self-sponsored student at Addis Ababa University. A financial constraint for the successful completion of his study was another limitation. The researcher has overcome his financial challenge by selling his own private house. Besides, the researcher has kindly requested Jimma Geneti woreda agriculture and natural resource office for the voluntary data collection by respective data enumerators/development agents in each kebele.

Date analysis of this study was done with the technical support of SPSS and STATA exports. COVID-19 is an infectious disease caused by a newly discovered coronavirus. Since COVID-19

cases were reported in Ethiopia, self-quarantine in fear of this pandemic. As a result, the smooth communication and face-to-face discussion with the SPSS and STATA experts was halted for several months of 2020 and beyond. YouTube, self-run of the soft wares, and telephone conversations were used as coping strategies to this particular limitation of the study. In June 2020, the sudden death of prominent Oromo singer the late Haccalu Hundessa was announced. The government shutdowns internet access. The researcher's online communications with the center of rural development, advisors, and journal publishers were interrupted for long weeks. Both COVID-19 (state of emergency) and the death of late Haccalu Hundessa (internet shutdown) caused a prolonged delay in the quantitative data analysis period and qualitative data collection (June 2020) and analysis. However, other activities were done at home.

7.4.2. Future Research Areas

Hoping that future research could give due attention, a few areas remained uncovered in this study. These are:

National or cross-country level studies: As the study was geographically delimited to the Jimma Geneti woreda, the study failed to cover the macro-level analysis. Thus, the researcher suggests future researchers pick up the status and determinants of rural households' livelihoods, poverty, and access to agricultural extension services at the national level and/or comparative analysis of these themes across different regional states .or as an international study in East Africa. The researcher suggested this as the future potential of the research topic due to repeated regret letters from the journal publishers that the current study failed to do cross-country analysis. It was also due to the need for wider and global analysis on the themes suggested.

Wider rural livelihood security analysis**:** Ample works have been done on the state of rural households' food security and nutritional security and determinants but not in a wider livelihood security context. Chapter six of this study has contributed meagerly to the status and determinants of rural households' multidimensional livelihood security. An index called multidimensional livelihood security was developed from seven livelihood security domains. But seems not to suffice in the need for rural development practitioners and researchers to enhance unresolved rural households' overall livelihood security issue. Taking this study as a way forward the researcher suggests them to undertake a national-level study on the status and determinants of rural households' multidimensional livelihood security. The potential research

topics could be two: *Adapting sustainable livelihood framework (From asset Pentagon to asset Hexagon)* and/or *move from narrow consideration to multidimensional rural households' livelihood security analysis*.

Post-estimation of deprivation in MPI indicators: Alemeseged (2016) investigates the determinants of the deprivation in MPI indicators. Similarly, this study has identified the major determinants of MPI indicators proposed by Alikre & Jahan (2018) but not included in this report. Thus, future researchers are proposed to investigate the significant determinants of MPI indicators proposed by Alkire & Jahan (2018). The topic could be framed as *determinants of newly revised 2018 global MPI indicators.*

Vulnerability analysis: This study was an entirely ex-post study (backward-looking for actual results) but not an ex-ante study (forward-looking based on forecasts. Thus, future researchers are encouraged to undertake both ex-post and ex-ante studies on rural households' poverty, livelihoods, and their access to agricultural extension services. Such studies could enable planners and policymakers to reduce and prevent rural households' from becoming multidimensional poor and enhance well protections of their multidimensional livelihood security.

Alternative rural poverty analysis: Indeed, the monetary approach to rural poverty analysis has a long-standing history. The identifications of the poor from non-poor rural households have been based on a controversial poverty line. However, there has been a growing number of development practitioners who claimed the non-considerations of the voices of the poor people to analyze their poverty status that outsiders. A glimpse of work was done by this study on rural poverty analysis using a participatory poverty analysis approach. An index called the participatory poverty index (PPI) was constructed based on the voices and full consent of 90 purposively sampled households. Hover ever assumed insufficient in the participatory poverty analysis literature. The researcher also recommended this methodology, too to be used by future poverty researchers in combination with economic and/or multidimensional poverty analysis approaches. It enables a researcher to comprehensively capture rural households' poverty data and design effective poverty reduction strategies. The research topic could be *a comparative analysis of economic, multidimensional, and participatory poverty studies.*

Pluralistic agricultural extension services: The high payoff input model (Roggers, 1995) and Diffusion of Information theory (Dercon & Douglas, 2014) guide this study on analysis of rural heads' access to agricultural extension services and its determinants. Both focused on the capacity of public, private, and research institutions to produce new technological knowledge, the capacity of the industrial sector to produce new technological inputs, and the capacity of households' access and use new technological inputs effectively. This study doesn't cover all elements of the theories rather exclusively focused on rural households' access to agricultural extension services. Future researches also informed to study on remaining elements like public/private partnership, industrial sectors' production, and households' utilization of agricultural extension inputs of the DoI theory. Future research can frame the topic as *the effectiveness of DoI theory; analysis of the status and determinants of public/private partnership, industrial sectors' production, and households' utilization of agricultural extension inputs in Ethiopia* (open for modification)

Establishing nexus between variables: In this study, an attempt was made to establish nexus between various dependent variables, for examples nexus between access to agricultural extension services/food security indices, livelihood strategies/poverty, livelihood strategies/ multidimensional livelihood security index, and nexus between accesses to agricultural extension services/poverty categories. One-way ANOVA revealed that there is no significant relationship (H0:insignificant) accepted. In this study, nexus between rural households' access to agricultural extension services and their food security dimensions (availability, access, and utilization, and stability dimensions) was uncovered. However, as indicated above a glimpse of the relationship between these access to agricultural extension services and food security indices was established and found no statistical differences. Future research could also look in such perspectives; otherwise, suggest agricultural economist and/or food security researchers. Furthermore, integrated functional adult education (IFAL) is one of the new contributions of the Federal Ministry of Education since 1991. It was simply adult education where the delivery of education is not integrated with functional adult literacy. As most of the rural household heads are adults and their improved literacy status has a determining role in adopting agricultural technologies and poverty reduction future researchers are also suggested to undertake a study. The study title could be *nexus between rural households' access to agricultural extension services and food*

security dimensions (availability, access, utilization, and stability). The potential research topic could be *statistical relationships between rural households' access to agricultural extension services and integrated functional adult literacy/IFAL.*

Panel data: Previous studies like Levine *et al*.(2012), Bruck & Sindu (2013), World Bank (2016), and Seff & Jolliffe(2016) have conducted the status and determinants of rural households using panel data. However, this study was based on micro-level cross-sectional data. No panel data was used in any chapters of the study. Therefore, the researcher suggests future researchers use panel data and examine the dynamics of rural households' choices of livelihood strategies, wider consideration of livelihood security, poverty, and their access to agricultural extension services.

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LIST OF ANNEXES

Annex 2.1: Variables and their descriptions/ measurement for analyzing rural households LHDs (N=387)

S/N	Variable name	Variable code	Variable type	Value	Expected sign	References
		Definitions of dependent variables				
Y0	on-farm only	Y=0	Categorical	if the choice lays in on-farm only		
Y1	non-farm only	Y=1	Categorical	if the choice lays in non-farm only		
Y2	off-farm only	Y=2	Categorical	if the choice lays in off-farm only		
Y3	on-farm + non-farm only	Y=4	Categorical	if the choice lays in on-farm + non-farm only		
		Definitions of independent variables				
X1	Place of residence/ kebele	S2_q8	Categorical	Twelve kebeles in the woreda	+/-	Khatun & Roy (2012), Ahmed *et al*. (2018)
X2	Sex of HH head	S2_q12	Dummy	1 if male and 0 if female	+/-	Seble (2014), Yizengaw *et al*. (2015, Ahmed *et al*. (2018), Chuong *et al*., (2015)
X3	Age of the HH head	Age	Continuous	1=if less than 35, 2=if 35-64, 3= if 64+ years old	+/-	Khatun & Roy (2012), Chuong *et al*. (2015)
X4	Family size	F_size	Continuous	1 =if less than 4, 2= if 4-8, 3= if 64+ years old	+/-	Reardon (1997), Khatun & Roy (2012), Ahmed *et al*. (2018)
X5	Education	Educatio n	Ordinal	1= if never attain any primary, 2= if primary, 3= if secondary, 4=if above secondary	+/-	Seble (2014), Khatun & Roy (2012), Ahmed *et al*. (2018), Dai *et al*. (2020)
X6	Livestock holding (TLU)	TLU	Continuous	Livestock holding size in TLU	+/-	Toulmin (1992), Amare & Belaineh (2012), Seble (2014), Yizengaw *et al*. (2015), Adugna (2008), Yisehak *et al*. (2014)
X7	Dependency ratio	DR	Continuous	The ratio of dependent to independents	+/-	
X8	Marital status	S2_q15	Categorical	1= if single, 2= if married, 3= if divorced, 4= if widowed, 5= if separated, 6= if polygamy	+	
X9	Membership in cooperatives	S4_q62	Dummy	1 if HHs is a member of cooperative and 0 otherwise	+/-	Khatun & Roy (2012), Ahmed *et al*. (2018)
X10	Saving	S4_q69	Dummy	1 if a HH has saved and 0 otherwise	+	Ahmed *et al*.(2018)
X11	Landholding (Hectare)	S4_q75	Continuous	The total land size in hectare(2012 EC)	+/-	Seble (2014), Kebede *et al*. *(*2014), Adugna (2008), Fikru (2008), Yizengaw *et al*. (2015), Ahmed *et al* (2018)
X12	Market distance	S4_q52	Continuous	Distance to the nearest market in Km	-	Amare & Belayneh (2012), Seble (2014) ,Yizengaw *et al*. (2015)
X13	Shocks experienced	s4_q39	Dummy	1= yes other wise 0	-	
X14	Access to agricultural extension	S4_q133	Dummy	1 if HHs is accessed to agricultural extension services and 0 otherwise	+/-	Khatun & Roy (2012)

Annex 2.2: Major/key variables in the computation of rural household's asset index score

Six types of asset (A)	Asset variables (B)= 81	Modality (C)=191 categories	Dimension 1: coord (re--weights)(D)	Based on egen value Decision for key asset indicators
Human capital	Literacy status (s3_q17)	Able to read	0.547	Key indicator
		Able to write	0.353	
		Able to read, write & do simple arithmetic	-0.374	
		Able to do simple arithmetic	2.197	
	Vocational skill training (s4_q44)	No	0.996	Key indicator
		Yes	-0.396	
	Other special skills other than farming (s4_q46)	No	0.559	Key indicator
		Yes	-0.826	
	Handcraft making skill (s4_q47_1)	No	0.316	Key indicator
		Yes	-0.795	
	Local veterinary skill(s4_q47_2)	No	0.049	Key indicator
		Yes	-2.624	
	Local health skill(s4_q47_3)	No	0.068	Key indicator
		Yes	-3.621	
	Any serious health problem (s4_q48)	No	-0.099	Key indicator
		Yes	0.138	
	Perceived health status (s4_q50)	Extremely bad	1.067	Key indicator
		Bad	3.520	
		Average	-0.084	
		Good	-0.144	
		Extremely good	-0.812	
		Average egen value /cutoff point	0.038	
Physical capital	Agricultural physical assets owned:			
	Durable consumer goods			
	Tent (s4_q51C_1)	No	0.556	Key indicator
		Yes	-0.821	
	Chair (s4_q51C_2)	No	2.941	Key indicator
		Yes	-0.364	
	Public infrastructures owned:			
	Water scheme (s4_q51D_3)	No	0.615	Key indicator
		Yes	-0.531	
		Average egen value /cutoff point	0.36	
Social capital	Types of social groups:			
	Debo (s4_q58_1)	No	1.514	Key indicator
		Yes	-0.416	
	Equib (s4_q58_4)	No	0.724	Key indicator
		Yes	-1.952	
	1 to 5 (s4_q58_5)	No	2.929	Key indicator
		Yes	-1.037	
	Self-help group (s4_q58_6)	No	0.734	Key indicator
		Yes	-0.835	
	Level of participation in social group:			
	Equib (s4_q59_4)	Low	0.795	Key indicator
		Medium	-1.671	
		High	-0.825	
	1 to 5 (s4_q59_5)	Low	3.340	Key indicator
		Medium	-1.149	
		High	-0.902	
	SHG (s4_q59_6)	Low	1.570	Key indicator
		Medium	-0.605	
		High	-1.303	
		Average egen value /cutoff point	0.319	
	Types of livestock owned:			
	Goat (s4_q54_1)	No	0.557	Key indicator
		Yes	-1.433	
	Ox (s4_q54_2)	No	1.955	Key indicator

Six types of asset (A)	Asset variables (B)= 81	Modality (C)=191 categories	Dimension 1: coord (re--weights)(D)	Based on egen value Decision for key asset indicators
Financial capital		Yes	-0.984	
	Horse (s4_q54_3)	No	0.252	Key indicator
		Yes	-0.510	
	Local Cow (s4_q54_4)	No	2.299	Key indicator
		Yes	-1.230	
	Heifer (s4_q54_7)	No	2.189	Key indicator
		Yes	-2.072	
	Calf (s4_q54_8)	No	2.139	Key indicator
		Yes	-2.024	
	Sheep (s4_q54_9)	No	1.376	Key indicator
		Yes	-1.565	
	Donkey (s4_q54_10)	No	1.140	Key indicator
		Yes	-2.744	
	Bull (s4_q54_11)	No	0.962	Key indicator
		Yes	-2.923	
	Chicken (s4_q54_12)	No	1.759	Key indicator
		Yes	-2.000	
	Sources of financial income :			
	Daily wage (q66-5)	No	0.323	Key indicator
		Yes	-2.192	
	Sell of livestock /oxen, sheep, goat, hen(q66-13)	No	1.182	Key indicator
		Yes	-0.480	
	Financial saving (s4_q69)	No	2.098	Key indicator
		Yes	-0.797	
		Average egen value /cutoff point	0.205	
	Land management practices:			
	Fallowing/field rotation(q144_1)	No	1.464	Key indicator
		Yes	-1.793	
	Manure (q144_3)	No	2.823	Key indicator
		Yes	-1.702	
	Inter-cropping(q144_5)	No	0.622	Key indicator
		Yes	-1.185	
	Soil conservation practices:			
	Terracing(q145_1)	No	1.389	
		Yes	-1.364	Key indicator
	Tree planting(q145_2)	No	1.532	Key indicator
		Yes	-1.298	
	Soil or stone band(q145_3)	No	1.067	Key indicator
		Yes	-2.120	
	Contour plough (q145_5)	No	3.014	Key indicator
		Yes	-0.993	
	Strip cultivation(q145_6)	No	1.102	Key indicator
		Yes	-1.164	
		Average egen value /cutoff point	0.879	
Information capital	Radio (s4_q38_1)	No	0.489	Key indicator
		Yes	-0.364	
	Farm-book(s4_q141_21)	No	0.162	Key indicator
		Yes	-0.906	
	Telephone(s4_q152)	No	0.056	Key indicator
		Yes	-0.711	
	Internet in the field(s4_q153)	No	0.298	Key indicator
		Yes	-1.459	
		Average egen value /cutoff point	0.801	

Notes: *Key variables: Out of the total 76 variables, 43 variables and 94 categories having average egen value of each capital asset were considered in the composite or general asset index score of households (GAISi)*

Source: Own computation from field survey (2019)

Annex 2.3: Hausman test for Independence of Irrelevant Alternatives (IIA)

hausman . dallcats, alleqs constant

	---- Coefficients ----		(b-B) Difference	sqrt(diag (V_b-V_B)) S.E.
	(b) .	(B) dallcats		
Non_farm_activities_only|				
Sex of HH head (s3_q12)	.9021304	0.6575456	0.2445848	.
age	-.565736	-0.6113341	0.0455981	.
Family size (F_size)	-.3619632	-0.2084777	-0.1534855	0.0726789
Education	.0690645	0.0185327	0.0505318	.
Livestock holding (TLU)	-.0230526	0.0113006	-0.0343532	0.0059326
Dependency ratio (DR)	2.127031	2.324192	-0.1971611	0.0758575
Marital status of HH head (s3_q15)	.6986928	0.6343823	0.0643106	.
Cooperative member (s4_q62)	.8334417	0.9501161	-0.1166743	0.2679659
Saving (s4_q69)	-.9449069	-0.600393	-0.3445139	0.1931688
Landholding in hect(s4_q75)	-.0433984	-0.1463169	0.1029186	.
Distance from market (s4_q52)	-.7686981	-0.5993188	-0.1693793	.
Shocks encountered (s4_q39)	-.9578814	-0.5638243	-0.3940572	0.2882367
Access to agricultural training (s4_q133)	.5953779	0.8086817	-0.2133038	0.2551297
_cons	-1.549433	-4.844181	3.294747	1.379151
Off_farm_activities_only|				
Sex of HH head (s3_q12)	1.747797	0.2486019	1.499195	.
age	1.102455	1.232469	-0.1300133	.
Family size (F_size)	0.0088683	0.0939816	-0.0851133	.
Education	1.654317	1.716308	-0.0619907	.
Livestock holding (TLU)	-0.0307933	0.0228915	-0.0536848	0.0146207
Dependency ratio (DR)	1.792934	2.410431	-0.6174973	.
Marital status of HH head (s3_q15)	0.7319282	0.4253949	0.3065333	0.0762161
Cooperative member (s4_q62)	-2.344811	-1.700449	-0.644362	.
Saving (s4_q69)	-0.5794691	-0.0241253	-0.5553438	.
Landholding in hect(s4_q75)	0.1199422	0.1000995	0.0198427	.
Distance from market (s4_q52)	-0.5066144	-0.4115254	-0.095089	.
Shocks encountered (s4_q39)	0.0958625	0.4655738	-0.3697113	.
Access to agricultural training (s4_q133)	1.467226	1.366883	0.1003428	0.3279601
_cons	-10.67379	-15.22349	4.549704	0.6912367

b = consistent under Ho and Ha; obtained from mlogit
B = inconsistent under Ha, efficient under Ho; obtained from mlogit

Test: Ho: difference in coefficients not systematic

chi2(28) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= -12.42 chi2<0 ==> model fitted on these data fails to meet the Asymptotic assumptions of the Hausman test; see suest for a generalized test

Source: Own computation from field survey (2019)

Annex 2.4: Small and Hsiao (1985) IIA test

```
. smhsiao s4_q79,elim(1)

Iteration 0:   log likelihood = -422.45174

Multinomial logistic regression                 Number of obs   =        387
                                                LR chi2(0)      =       0.00
                                                Prob > chi2     =          .
Log likelihood = -422.45174                     Pseudo R2       =     0.0000

------------------------------------------------------------------------------
      s4_q79 |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
Non-farm a~y |
       _cons |  -1.639419   .1611165   -10.18   0.000    -1.955201   -1.323636
-------------+----------------------------------------------------------------
Off-farm a~y |
       _cons |  -1.617913   .1596747   -10.13   0.000    -1.930869   -1.304956
-------------+----------------------------------------------------------------
On-farm + ~s |
       _cons |  -1.425009   .1475238    -9.66   0.000     -1.71415   -1.135868
------------------------------------------------------------------------------
(s4_q79==On-farm activities only is the base outcome)

Small-Hsiao Test of IIA
----------------------

  LnL for weighted average of coeffients in two half-samples: -8.9e+01
  LnL based on restricted model (s4_q79==1 omitted):          -8.7e+01
  Test chi2(1) =  2.791, Pr = 0.0948

. smhsiao s4_q79,elim(2)

Iteration 0:   log likelihood = -422.45174

Multinomial logistic regression                 Number of obs   =        387
                                                LR chi2(0)      =       0.00
                                                Prob > chi2     =          .
Log likelihood = -422.45174                     Pseudo R2       =     0.0000

------------------------------------------------------------------------------
      s4_q79 |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
Non-farm a~y |
       _cons |  -1.639419   .1611165   -10.18   0.000    -1.955201   -1.323636
-------------+----------------------------------------------------------------
Off-farm a~y |
       _cons |  -1.617913   .1596747   -10.13   0.000    -1.930869   -1.304956
-------------+----------------------------------------------------------------
On-farm + ~s |
       _cons |  -1.425009   .1475238    -9.66   0.000     -1.71415   -1.135868
------------------------------------------------------------------------------
(s4_q79==On-farm activities only is the base outcome)

Small-Hsiao Test of IIA
----------------------

  LnL for weighted average of coeffients in two half-samples: -1.5e+02
  LnL based on restricted model (s4_q79==2 omitted):          -1.5e+02
  Test chi2(1) =  4.222, Pr = 0.0399
```

```
. smhsiao s4_q79,elim(3)

Iteration 0:   log likelihood = -422.45174

Multinomial logistic regression                 Number of obs   =        387
                                                LR chi2(0)      =       0.00
                                                Prob > chi2     =          .
Log likelihood = -422.45174                     Pseudo R2       =     0.0000

------------------------------------------------------------------------------
      s4_q79 |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
Non-farm a~y |
       _cons |  -1.639419   .1611165   -10.18   0.000    -1.955201   -1.323636
-------------+----------------------------------------------------------------
Off-farm a~y |
       _cons |  -1.617913   .1596747   -10.13   0.000    -1.930869   -1.304956
-------------+----------------------------------------------------------------
On-farm + ~s |
       _cons |  -1.425009   .1475238    -9.66   0.000     -1.71415   -1.135868
------------------------------------------------------------------------------
(s4_q79==On-farm activities only is the base outcome)

Small-Hsiao Test of IIA
----------------------

  LnL for weighted average of coeffients in two half-samples: -1.4e+02
  LnL based on restricted model (s4_q79==3 omitted):          -1.4e+02
  Test chi2(1) =  0.439, Pr = 0.5078

. smhsiao s4_q79,elim(4)

Iteration 0:   log likelihood = -422.45174

Multinomial logistic regression                 Number of obs   =        387
                                                LR chi2(0)      =       0.00
                                                Prob > chi2     =          .
Log likelihood = -422.45174                     Pseudo R2       =     0.0000

------------------------------------------------------------------------------
      s4_q79 |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
Non-farm a~y |
       _cons |  -1.639419   .1611165   -10.18   0.000    -1.955201   -1.323636
-------------+----------------------------------------------------------------
Off-farm a~y |
       _cons |  -1.617913   .1596747   -10.13   0.000    -1.930869   -1.304956
-------------+----------------------------------------------------------------
On-farm + ~s |
       _cons |  -1.425009   .1475238    -9.66   0.000     -1.71415   -1.135868
------------------------------------------------------------------------------
(s4_q79==On-farm activities only is the base outcome)

Small-Hsiao Test of IIA
----------------------

  LnL for weighted average of coeffients in two half-samples: -1.6e+02
  LnL based on restricted model (s4_q79==4 omitted):          -1.5e+02
  Test chi2(1) =  7.130, Pr = 0.0076
```

Source: Own computation from field survey (2019)

Annex 2.5: Contingency Coefficients for categorical independent variables/ multicollinearity

Variables	Farming system	Sex	Education	Remittance	Saving	Access to credit	Access to Irrigation	Member in cooperative	Access to agr. extent.
Farming	1.000								
Sex of HH	0.0315	1.000							
Education	0.0487	0.1665	1.000						
Remittance	-0.0495	-0.1320	0.0394	1.000					
Saving	0.0791	0.0356	0.1590	0.1018	1.000				
Credit	0.1512	0.0420	0.1272	-0.0318	0.1092	1.000			
Irrigation	0.2692	-0.0014	0.0966	0.0233	0.2513	0.3442	1.000		
Cooperatives	0.03174	0.0317	0.1315	-0.0263	0.3473	0.0641	0.3210	1.000	
Extension	-0.3174	-0.0072	-0.158	-0.0035	-0.2811	-0.2102	-0.5885	-0.2565	1.000

Source: Own computation from field survey (2019)

Annex 2.6: Variance Inflation Factor for continuous independent variables/ multicollinearity

Continuous explanatory Variables	VIF	Tolerance= 1/VIF
Livestock holding(of HH head TLU)	1.15	0.868048
Landholding/hectare(of HH headS4_Q75)	1.12	0.896242
Family size of HH head/(F_size)	1.07	0.934798
Age of the HH head(age)	1.05	0.949878
Market distance of HH head(s4_q52)	1.07	0.979923
Mean VIF	1.08	

Source: Own computation from field survey (2019)

Annex 2.7: Multinomial logit regression of livelihood strategies choices

Variables (A)	CHOICES OF RURAL LIVELIHOOD STRATEGIES																	
	Non_farm_activities_only strategy						Off_farm_activities_only strategy						On-farm + Non_farm_activities_only strategy					
	Coeffiecients(β) (B)		Relative risk ratio(RRR)[C]		Marginal effect (dy/dx)(D)		Coeffiecients(s)(E)		Relative risk ratio(RRR)(F)		Marginal effect (dy/dx)(G)		Coeffiecients(βs)(H)		Relative risk ratio(RRR)(I)		Marginal effect (dy/dx)(J)	
	Coef	P>/Z)	RRR	P>/Z)	dy/dx	P>/Z)	Coef	P>/Z)	RRR	P>/Z)	dy/dx	P>/Z)	Coef	P>/Z)	RRR	P>/Z)	dy/dx	P>/Z)
Residence/ kebele	.1971647	0.090	1.217945	0.090	.0089818	0.150	.5189864	0.001[1]	1.680324	0.001	.011348	0.044	.0890475	0.242	1.093133	0.242	.0075142	0.418
Sex of HH head	.6575456	0.622	1.930049	0.622	.0376834	0.298	.2486019	0.852	1.282231	0.852	.0104098	0.626	-1.43518	0.035[4]	.2380724	0.035	-.2549769	0.071
Age of the HH head	-.6113341	0.409	.5426265	0.409	-.0331937	0.382	1.232469	0.308	3.429686	0.308	.029282	0.310	-.0676801	0.908	.9345594	0.908	-.007476	0.914
Family size	-.2084777	0.691	.8118191	0.691	-.008678	0.747	.0939816	0.863	1.09854	0.863	.0034388	0.778	-.3058753	0.421	.7364784	0.421	-.03569	0.425
Education	.0185327	0.972	1.018705	0.972	-.0053456	0.842	1.716308	0.007[3]	5.563948	0.007	.0376084	0.091	.5204515	0.124	1.682787	0.124	.0571562	0.166
Livestock holding (TLU)	.0113006	0.893	1.011365	0.893	.0000682	0.988	.0228915	0.779	1.023156	0.779	.000301	0.870	.0632476	0.192	1.065291	0.192	.007489	0.187
Dependency ratio	2.324192	0.140	10.21842	0.140	.1203833	0.153	2.410431	0.200	11.13876	0.200	.0528412	0.264	-.1836382	0.897	.8322368	0.897	-.0484012	0.776
Marital status	.6343823	0.045[6]	1.885857	0.045	.0266479	0.124	.4253949	0.229	1.530195	0.229	.0063414	0.471	.7813568	0.004[2]	2.184434	0.004	.0881714	0.007
Membership in cooperatives	.9501161	0.354	2.58601	0.354	.0436349	0.184	-1.700449	0.040[5]	.1826016	0.040	-.0673678	0.266	-.2779156	0.696	.7573607	0.696	-.0304804	0.742
Saving	-.600393	0.416	.548596	0.416	-.0378848	0.434	-0.241253	0.977	.9761633	0.977	-.0005829	0.975	.2932487	0.646	1.340776	0.646	.0389906	0.571
Landholding (Hectare)	-.1463169	0.623	.8638839	0.623	-.006477	0.674	.1000995	0.650	1.105281	0.650	.0030519	0.542	-.1710336	0.416	.8427933	0.416	-.0198807	0.426
Market distance	-.5993188	0.183	.5491856	0.183	-.0334428	0.170	-.4115254	0.408	.61626387	0.409	-.0097074	0.399	.3187642	0.513	1.375427	0.513	.0446283	0.440
Shocks experienced	-.5638243	0.469	.5690288	0.469	-.0416624	0.485	.4655738	0.693	1.592928	0.693	.0087421	0.660	.5041249	0.521	1.655536	0.521	.0563443	0.412
Access to agricultural extension	.8086817	0.269	2.244947	0.269	.0408302	0.292	1.366883	0.091	3.923103	0.091	.0303422	0.191	-.0171516	0.978	.9829946	0.978	-.0129313	0.862
Constant	-4.844181	0.095	.0078741	0.095	.		-15.22349	0.001	2.45e-07	0.001			-3.961113	0.097	.0190414	0.097		

Notes: ***, **, * significant at 1% (for significant p-value<0.01), 5% (for significant 0.01<p-value<0.05), and 10% (for significant p-value>0.05), respectively

- **1-6:** Determinant variables with the smallest p-value are considered the most determinant. In other words, significant variables from smallest p-value to biggest, show most significant variables accordingly: the smallest the p-value, the most significant explanatory variable, i.e., to be most significant, the p-value has to be closer to zero
- Odds/relative risk ratio(RRR)=p(of choosing outcome category/p(of choosing base category)

Source: Own computation from field survey (2019)

Annex 3.1: Final multiple correspondence analysis rescaled weights

Indicators (A)	Modalities/ Categories (B)	Dimension_1 [rescaled weights] (C)	Standard deviation(D)	Major/key indicators (E)
FOOD SECURITY DIMENSION (Weight=9.42)				
Frequency of food items consumed (7 days): Injera/grain (s4_q90_1)	Once/day	1.450	0.71	Not key variable/omitted
	Twice/day	0.388		
	Three times	-1.534		
	None at all	1.286		
Bread/grain (s4_q90_2)	Once/day	0.127	1.35	Key variable
	Twice/day	-0.275		
	Three times	1.704		
	None at all	-0.489		
Wat/pulses (s4_q90_3)	Once/day	1.920	0.92	Not key variable/omitted
	Twice/day	0.244		
	Three times	-1.977		
	None at all	1.497		
Oil/oil seeds or processed oil (s4_q90_4)	Once/day	2.294	0.98	Not key variable/omitted
	Twice/day	-0.466		
	Three times	-0.066		
	None at all	0.203		
Meat including chicken (s4_q90_5)	Once/day	0.870	1.06	Key variable
	Twice/day	0.516		
	Three times	1.284		
	None at all	-0.299		
Milk (s4_q90_6)	Once/day	0.965	1.17	Key variable
	Twice/day	0.796		
	Three times	2.140		
	None at all	-0.447		
Butter (s4_q90_7)	Once/day	0.227	1.23	Key variable
	Twice/day	-0.479		
	Three times	1.913		
	None at all	-0.117		
Egg (s4_q90_8)	Once/day	0.949	1.18	Key variable
	Twice/day	-0.185		
	Three times	1.611		
	None at all	-0.346		
Potato (s4_q90_9)	Once/day	0.860	1.33	Key variable
	Twice/day	-1.737		
	Three times	1.671		
	None at all	-0.355		
Vegetables/Tomato, carrot, Kosta (4_q90_10)	Once/day	1.079	1.20	Key variable
	Twice/day	-0.613		
	Three times	1.451		
	None at all	-0.285		
Fruits/orange, Banana, Avocado (s4_q90_11)	Once/day	0.791	0.93	Not key variable/omitted
	Twice/day	0.309		
	Three times	2.473		
	None at all	-0.163		
Spices/Salt and Zinjibil (s4_q90_12)	Once/day	1.754	1.11	Key variable
	Twice/day	-0.794		
	Three times	-1.648		
	None at all	1.275		
Beverages /Tella, Areke, Soft drinks (s4_q90_13)	Once/day	0.825	1.31	Key variable
	Twice/day	-0.787		
	Three times	-1.873		
	None at all	0.057		
	Average/eigenvalue /cut oof point		**≥ 1.11**	
Ownership of house/dwelling (s4_q110)	HABITAT SECURITY DIMENSION (Weight=9.94)			
	Own house	-0.046	0.43	Key variable
	Rented house	0.870		
	Given relatives	0.668		
Transort facilities (s4_q113)	No	0.949	0.48	Key variable
	Yes	-1.070		
Means of transportation (s4_q114)	Horse	-0.424	1.14	Key variable
	Mule	1.619		
	Donkey	0.212		
	Vehicle	0.140		
	Average/eigenvalue /cut off point		**0.69**	

Indicators (A)	Modalities/ Categories (B)	Dimension_1 [rescaled weights] (C)	Standard deviation(D)	Major/key indicators (E)
EMPOWERMENT SECURITY DIMENSION (Weight=8.00)				
Participation in community service(s4_q115)	No	2.182	0.36	
	Yes	-0.077		
Access to service giving organizations (s4_q117)	No	0.947	0.45	Key variable
	Yes	-0.232		
Participation in local planning (s4_q119)	No	-1.979	0.47	Key variable
	Yes	0.915		
	Average/eigenvalue /cut off point		**0.43**	
OCCUPATIONAL SECURITY DIMENSION (Weight=9.45)				
Employment status (s4_q127)	Regular	-0.137	1.30	Key variable
	Seasonal	1.856		
	Not able to work	-0.538		
	Daily labor	-0.358		
Job according to education (s4_q128)	No	-0.305	0.49	Key variable
	Yes	0.586		
Satisfaction with the present working environment (s4_q129)	No	1.096	0.50	Key variable
	Yes	-0.789		
	Average/eigenvalue /cut off point		**0.76**	
ENVIRONMENTAL SECURITY DIMENSION (Weight=4.70)				
Extent of environmental pollution: Soil pollution (4_q130_1)	Very much	0.558	0.67	Not key variable/omitted
	Somewhat	-0.687		
	Negligible	1.472		
Water pollution (s4_q130_2)	Very much	0.604	0.71	Key variable
	Somewhat	-0.963		
	Negligible	1.436		
Air pollution (s4_q130_3)	Very much	1.565	0.71	Key variable
	Somewhat	-1.069		
	Negligible	0.850		
Soil erosion (s4_q130_4)	Very much	-0.218	0.73	Key variable
	Somewhat	0.013		
	Negligible	0.578		
Ground water storage (s4_q130_5)	Very much	0.878	0.71	Key variable
	Somewhat	-0.960		
	Negligible	1.286		
Flood or drought prone condition (s4_q130_6)	Very much	-0.165	0.75	Key variable
	Somewhat	-0.351		
	Negligible	1.207		
	Average/eigenvalue /cut off point		**0.71**	
WATER SECURITY DIMENSION (Weight=4.78)				
ACCESS TO : Pipe water (s4_q33_1)	No	0.057	0.47	Key variable
	Yes	-0.152		
Public water (s4_q33_2)	No	-0.326	0.50	Key variable
	Yes	0.227		
Borehole without hand pump (s4_q33_3)	No	-0.177	0.40	Not key variable/omitted
	Yes	0.620		
Borehole with hand pump (s4_q33_4)	No	-0.455	0.45	Not key variable/omitted
	Yes	1.517		
Distance from safe drinking water /30 minutes round (s4_q34)	No	-0.566	0.50	Key variable
	Yes	0.576		
SOURCES: Rain water (s4_q35_1)	No	0.990	048	Key variable
	Yes	-1.327		
Spring water (s4_q35_5)	No	0.556	0.50	Key variable
	Yes	-0.373		
	Average/eigenvalue /cut off point		**≥ 0.47**	
COMMUNITY PARTICIPATION SECURITY DIMENSION (Weight=6. 12)				
Participation in: Government organizations (s4_q132)	Gov.organization	1.378	1.45	Key variable
	Self- Help group	0.661		
	NGO groups	1.112		
	Tribal organ.	0.478		
Land management practices: Fallowing/field rotation (q144_1)	No	-1.209	0.49	Key variable
	Yes	1.801		
Crop rotation (q144_2)	No	-2.760	0.47	Not key variable/omitted
	Yes	1.039		
Manure (q144_3)	No	-2.143	0.50	Key variable
	Yes	1.245		

Indicators (A)	Modalities/ Categories (B)	Dimension_1 [rescaled weights] (C)	Standard deviation(D)	Major/key indicators (E)
Use of chemical fertilizer (q144_4)	No	-2.000	0.49	Key variable
	Yes	1.000		
Inter-cropping (q144_5)	No	-0.711	0.46	Not key variable/omitted
	Yes	1.737		
Soil conservation practices: Terracing (q145_1)	No	-1.484		Key variable
	Yes	1.562		
Tree planting (q145_2)	No	-1.438		Key variable
	Yes	1.366		
Soil or stone band (q145_3)	No	-0.976		Not key variable/omitted
	Yes	1.743		
Furrowing (q145_4)	No	-2.345		Not key variable/omitted
	Yes	1.218		
Counter plow (q145_5)	No	-3.153		Not key variable/omitted
	Yes	1.039		
Strip cultivation (q145_6)	No	-1.127		Key variable
	Yes	1.270		
	Average/eigenvalue /cut off point		.56/>0.47	

Notes:

1. While the scale values/weights (Rc) of each livelihood security dimension was computed by using formula Rc=2.357Rj-7.01 weights of each livelihood security was computed using MCA.
2. Modalities/categories with positive scores increase sample households' livelihood security status, while those negative scores reduce it.

Source: Own computation (2019)

Annex 3.2: Guilford (1954) Normalized Rank Order methods and procedures

The normalized Rank Order method suggested by Guilford (1954) requires some systematic procedures. These are:

- *Judge's rating/ frequencies of ranks:* As per the Guilford (1954) Normalized Rank Order Method, seven dimensions of sample households multidimensional livelihood security index/MLHSI were ranked by the judges according to their perceived significance in determining the status of their livelihood security. The ranking was obtained from 40 judges who are the experts in the field of Social Science, Agricultural Extension Education, and Rural Development. A format containing the seven livelihood security dimensions was handed over personally to the judges for ranking (1 to 7) dimensions according to their relevance to rural households. The rankings given by all 30 judges to the 7 livelihood security dimensions were summarized and presented in Table A (columns B-H).

Thus, based on the perceived importance of the seven livelihood security dimensions to rural households, the 30 judges ranked these livelihood security dimensions. In the first rank, Table A revealed the frequencies of the correct rank order of the seven livelihood security dimensions given by the 30 Judges. Accordingly, out of the 30 judges, 12 judges ranked occupational security dimension, 11 judges ranked food security dimension and 7 judges ranked empowerment security dimension in the first rank. No judges ranked first the other three livelihood security dimensions in the first order. In the second rank, with different frequencies of judges, except the economic security dimension, the six livelihood security dimensions are ranked in the second order. For examples, out of the 30 judges, 8 judges ranked food security dimension, 7 judges ranked occupational security, 6 judges ranked empowerment security dimension, 4 judges ranked community participation dimension, 3 judges ranked habitat security dimension and 2 judges ranked environmental security dimension as second important to rural households. It goes the same for ranks from third to seventh. Table A, below also depicted the sum of the frequencies found in the rows and columns of the respective LHS dimensions (symbolized as **∑fji).**

Table A: The frequencies of ranks as given by judges for seven dimensions of livelihood security by using the Normalized Rank Order method suggested by *Guilford (*1954)

(A)	Frequencies of the seven Dimensions of sample households Multidimensional LHSAI							(I)
r_i	(B)	(C)	(ED	*(E)*	(F)	(G)	(H)	∑fji
	FoSD	*HaSD*	*EmSD*	*OcSD*	*EnSD*	*WaSD*	*CoPD*	
1	11	0	7	12	0	0	0	30
2	8	3	6	7	2	0	4	30
3	7	5	3	6	2	3	4	30
4	3	3	5	4	2	3	10	30
5	1	6	7	0	5	4	7	30
6	0	1	2	1	10	14	2	30
7	0	12	0	0	9	6	3	30
∑fji	30	30	30	30	30	30	30	210

Where,

- r_i = Correct Rank order,
- ∑fji = Sum of row & column freq.
- FoSD: Food security dimension
- HaSD: Habitat security dimension
- EmSD: Empowerment security dimension
- OcSD: Occupational security *dimension*
- EnSD: Environmental security dimension
- WaSD: Water security dimension
- CoP: Comm. participation dimension

Source: Own computation from field survey (2019)

- *Calculation of proportions (p-values):* Here, the middle area of each livelihood security dimension is required. It is designated by P-values, meaning, the proportion (p-value) is the centile value that indicated the area of the dimensions in the normal distribution. To calculate the proportions (p-values) of each livelihood security dimensions, the extension of Table A by column B- R_i (Rank value of dimension i in the reverse order as 7 to 1) and column K- proportions (p-values) is required (see, Table 9.3 column K).

Table B: The frequencies of ranks as given by judges and proportions (p-values) of the seven dimensions of livelihood security by using the Normalized Rank Order method suggested by *Guilford (*1954)

(A)	(B)	Frequencies of the seven Dimensions of sample households Multidimensional LHSAI							(J)	(K)
r_i	Ri	(C) FoSD	(C) *HaSD*	(E) *EmSD*	*(F) OcSD*	(G) *EnSD*	(H) *EcSD*	(I) *CoPD*	∑fji	Proportion (P values)
1	7	11	0	7	12	0	0	0	30	92.86 (highest)
2	6	8	3	6	7	2	0	4	30	78.57
3	5	7	5	3	6	2	3	4	30	64.29
4	4	3	3	5	4	2	3	10	30	50.00
5	3	1	6	7	0	5	4	7	30	35.71
6	2	0	1	2	1	10	14	2	30	21.43
7	1	0	12	0	0	9	6	3	30	7.14
∑fji		30	30	30	30	30	30	30	210	350
$P = \frac{(Ri-0.5)100}{n}$,n=7 Equation (9.1)		92.286	78.57	64.29	50	35.71	21.43	7.14		

Where: *R_i = Reverse rank order,* ***P****= centile values that indicated the area of the seven livelihood security dimensions in the normal distribution,* ***R_i*** *= Rank value of 7 livelihood security dimension i in the reverse order(7 to 1),* ***n*** *= number of livelihood security dimensions (7) ranked by the judges.*

Source: Own computation from field survey (2019)

Table B, above revealed both the frequencies and proportions (p-values) of the seven livelihood security dimensions. From Table 9.4, the proportions of each livelihood security dimension were worked out for the ranks assigned by all the judges. Accordingly, the p-value of food security dimension, habitat security dimension, empowerment security dimension, occupational security dimension, environmental security dimension, economic security dimension and community participation were calculated as 92.2 (highest p-value), 78.57,64.29,50,35.71,21.43, and 7.14 ,respectively (see, Table C, column K ,above). The table also revealed the sum of all the p-values of each livelihood security dimension equals 350.

- *Determining C value of respective ranks:* To determine and insert C values of respective ranks, on another column (L) has to be extended on the right side of Table B (see, Table C, below). Thus, the C values were determined for each correct rank order (ri of the column from the table - M (Guilford 1954, p.557). These values can be traced by putting the finger on the column extreme left of Table-M, on the number which indicates the number of stimuli used in the experiment. In the case of this experiment, the numbers of dimensions were 7 thus the number of stimuli to be ranked as 7. While moving the finger from this number 7 towards the right, stop at the number which indicates the rank (ri, 7). Above the rank number, you can find the respective C value 4 for rank 7 and this can be entered in table C under the letter C of column L. The same procedure may be adapted in finding out the C values for all the ranks (ri) from table-M of Guilford (1954).

Table C: Frequencies, p-values, and C values of livelihood security dimensions

(A)	(B)	Frequencies of the seven Dimensions of sample households Multidimensional LHSAI							(J)	(K)	(L)
r_i	Ri	(C) FoSD	(D) *HaSD*	(E) *EmSD*	*(F) OcSD*	(G) *EnSD*	(H *EcSD*	(I) *CoPD*	∑fji	Proportion (P values)	C value Correct rank
1	7	11	0	7	12	0	0	0	30	92.86	8
2	6	8	3	6	7	2	0	4	30	78.57	7
3	5	7	5	3	6	2	3	4	30	64.29	6
4	4	3	3	5	4	2	3	10	30	50.00	6
5	3	1	6	7	0	5	4	7	30	35.71	5
6	2	0	1	2	1	10	14	2	30	21.43	5
7	1	0	12	0	0	9	6	3	30	7.14	4
∑fji		30	30	30	30	30	30	30	210	350	41
P-values		92.286	78.57	64.29	50	35.71	21.43	7.14			

Source: Own computation from field survey (2019)

- *Calculating the mean of each livelihood dimension (Rj):* To calculate the mean of each livelihood security dimension (Rj), once has to first find the product of each livelihood security dimension frequencies by C values, then sum and enter the same in the row against ∑ (F_{ji} C). Finally, divide ∑ (F_{ji} C) by ∑ (fji) (see, Table E). Results show that mean value and corresponding rank order of the are food security dimension (Rj=6.97, ranked 2nd), habitat security dimension (Rj=5.07, ranked 5th), empowerment security dimension (Rj=6.37, ranked 3rd), occupational security dimension (Rj=7.00, ranked 1st), environmental security dimension (Rj=4.97, ranked 6th), water security dimension (Rj=5.00, ranked 7th) and community participation (Rj=5.00, ranked 4th), implying that occupational security dimension followed by food security dimension is most important to rural households, as ranked by 30 judges (see, Table D, Rj row and judges rank row).

Table D: Frequencies, p-values, C values, and mean (Rj) of each livelihood security dimensions

(A)	(B)	Product of frequencies and C values of the seven Dimensions of sample households Multidimensional LHSAI							(J)	(K)	(L)
r_i	Ri	(C) FoSD	(D) *HaSD*	(E) *EmSD*	*(F) OcSD*	(G) *EnSD*	(H *WaSD*	(I) *CoPD*	∑fji	Proportion (P values)	C value Correct rank
1	7	11x8=88	0x8=0	7x8=56	12x8=96	0x8=0	0x8=0	0x8=0	30	92.86	8
2	6	8x7=56	3x7=21	6x7=42	7x7=49	2x7=1	0x7=0	4x7=28	30	78.57	7
3	5	7x6=42	5x6=30	3x6=18	6x6=36	2x6=1	3x6=18	4x6=24	30	64.29	6
4	4	3x6=18	3x6=18	5x6=30	4x6=24	2x6=1	3x6=18	10x6=6	30	50.00	6
5	3	1x5=5	6x5=30	7x5=35	0x5=0	5x5=2	4x5=20	7x5=35	30	35.71	5
6	2	0x5=0	1x5=5	2x5=1=	1x5=5	10x5=	14x5=7	2x5=10	30	21.43	5
7	1	0x4=0	12x4=4	0x4=0	0x4=0	9x4=3	6x4=24	3x4=12	30	7.14	4
∑fji		30	30	30	30	30	30	30	210	350	41
P-values		92.286	78.57	64.29	50	35.71	21.43	7.14			
∑ (fji *C)		209	152	191	210	149	150	169			
$Rj = \frac{\sum (fji * C)}{\sum (fji)}$ Equation (9.2)		**6.97**	**5.07**	**6.37**	**7.00**	**4.97**	**5.00**	**5.57**			
Judges Rank of Rj		**2nd**	**5th**	**3rd**	**1st**	**6th**	**7th**	**4th**			

Source: Own computation from field survey (2019)

- *Calculating the scale value (R_c) or weighting*: To calculate the scale value or weights of each livelihood security dimension, the Normalized Rank Order method suggested by *Guilford (*1954) follows systematic

procedures. As presented above, such a series of procedures like judge's rating/ frequencies of ranks, calculation of proportions (p-values), determination of C value of respective ranks, Calculations of the mean of each livelihood dimension (Rj) were carried out so far. Both the above systematic procedures resulted to capture the values of the mean of each livelihood security dimension (Rj) because the final computation of the scale value or weights of each livelihood security required it (*see*, Rc= 2.357Rj-7.01 formula). Once the value of the mean of each livelihood security dimension (Rj) is obtained, it is now possible to calculate the scale values/weights of each livelihood security dimension using the same equation. Results show that the scale value/weights of food security dimension (Rc= 9.42), habitat security dimension (Rc=4.94), empowerment security dimension (Rc=8.00), occupational security dimension (Rc=9.45), environmental security dimension (Rc=4.70), water security dimension (Rc=4.78) and community participation dimension (Rc=6.12)(see, Table E, below).

Table E: Frequencies, p-values, C values, mean (Rj), and scale values/weights (Rc) of each livelihood security dimensions

(A)	(B)	Product of frequencies and C values of the seven Dimensions of sample households Multidimensional LHSAI							(J)	(K)	(L)
r_i	Ri	(C) FoSD	(D) *HaSD*	(E) *EmSD*	*(F) OcSD*	(G) *EnSD*	(H *WaSD*	(I) *CoPD*	∑fji	Proportion (P values)	C value Correct rank
1	7	11x8=88	0x8=0	7x8=56	12x8=96	0x8=0	0x8=0	0x8=0	30	92.86	8
2	6	8x7=56	3x7=21	6x7=42	7x7=49	2x7=14	0x7=0	4x7=28	30	78.57	7
3	5	7x6=42	5x6=30	3x6=18	6x6=36	2x6=12	3x6=18	4x6=24	30	64.29	6
4	4	3x6=18	3x6=18	5x6=30	4x6=24	2x6=12	3x6=18	10x6=60	30	50.00	6
5	3	1x5=5	6x5=30	7x5=35	0x5=0	5x5=25	4x5=20	7x5=35	30	35.71	5
6	2	0x5=0	1x5=5	2x5=10	1x5=5	10x5=50	14x5=70	2x5=10	30	21.43	5
7	1	0x4=0	12x4=48	0x4=0	0x4=0	9x4=36	6x4=24	3x4=12	30	7.14	4
∑fji		30	30	30	30	30	30	30	210	350	41
P-values		92.286	78.57	64.29	50	35.71	21.43	7.14			
∑ (fji *C)		209	152	191	210	149	150	169			
$Rj = \frac{\sum (fji * C)}{\sum (fji)}$		6.97	5.07	6.37	7.00	4.97	5.00	5.57			
Judges Rank of Rj		2^{nd}	5^{th}	3^{rd}	1^{st}	6^{th}	7^{th}	4^{th}			
Rc=2.357Rj-7.01 Equation (9.3)		**9.42**	**4.94**	**8.00**	**9.45**	**4.70**	**4.78**	**6.12**		∑Rc	47.41

Where: $\boldsymbol{R_c}$*= Scale value of weighting of each livelihood dimension,* $\boldsymbol{R_j}$*= mean of each livelihood dimension*

Source: Own computation from field survey (2019)

Annex 3.3: Variables and their descriptions/ measurement for analyzing rural households LHS (N=387)

Variables	Nature	Value/description/measurement	Expected	Sources
Dependent variable				
MLHSI categories				
Independent variables				
Socio-economic				
Agroecology/farming	Categorical	1=if highland, 2= if plain area , 3= if	+	
Age of the HHs head	Continuous	Number/actual age of head (yrs)	+/-	Akter (2012)
Sex of HH heads	Dummy	1 if male and 0 if female	+/-	Akter (2012)
Households size	Continuous	Number of people/persons in a household	+/-	Rahman & Akter (2014); Akter (2012)
Marital status	Dummy	1 if married and 0 otherwise	+/-	Akter (2012)
Literacy status	Ordinal	1= if able to read, 2= if able to write, 3= if able to read, write, & do simple arithmetic, 4=if able to do simple arithmetic, 5= if illiterate	+	
Dependency ratio	Continuous	The ratio of the dependents to independents	+/-	Akter (2012) and Rahman & Akter (2012; 2014).
Landholding	Continuous	Total land size per person own land	+/-	
Livestock holding	Continuous	Total land size in TLU	+/-	
Credit services	Dummy	1 if HH has access to credit and 0	+	
Cooperative member	Dummy	1 if HHs is a member of cooperative,	+/-	

Source: Akter (2012) and Rahman & Akter (2012; 2014)

Annex 4.1: Contingency coefficients of categorical independent variables

Variable	s2_q7	s2_q8	s3_q12	s3_q15	Education	s3_q17	s3_q18	s3_q19	s4_q72	s4_q84	s4_q69	s4_q141_7	s4_q141_8	s4_q62	s4_q133
s2_q7	1.0000														
s2_q8	-0.1290	1.0000													
s3_q12	0.0315	0.0640	1.0000												
s3_q15	-0.0189	0.2052	-0.0693	1.0000											
Education	0.0487	0.0057	0.1665	-0.0548	1.0000										
s3_q17	0.0918	-0.2375	-0.1155	-0.1197	0.0435	1.0000									
s3_q18	-0.0156	-0.0154	0.0811	-0.1108	-0.0469	-0.1084	1.0000								
s3_q19	0.0489	0.0961	0.0426	0.1057	-0.0316	-0.0064	-0.1047	1.0000							
s4_q72	-0.0560	0.0872	-0.0431	0.0163	-0.0799	-0.0558	0.1212	0.0634	1.0000						
s4_q84	-0.0495	-0.0612	-0.1320	-0.0087	0.0394	0.0968	-0.0111	-0.0438	-0.0303	1.0000					
s4_q69	0.0791	-0.2913	0.0356	0.0911	0.1590	0.1877	-0.0308	0.0449	-0.2093	-0.1018	1.0000				
s4_q141_7	0.1512	0.0292	0.0420	0.1266	0.1272	-0.1036	-0.1163	0.1070	-0.0610	-0.0318	0.1092	1.0000			
s4_q141_8	0.2692	-0.2795	-0.0014	0.1156	0.0966	0.0914	-0.1275	0.0552	-0.1734	0.0233	0.2513	0.3442	1.0000		
s4_q62	0.0371	-0.3251	0.0317	0.0202	0.1315	0.2056	-0.0361	0.0117	-0.1892	-0.0263	0.3473	0.0641	0.3210	1.0000	
s4_q133	-0.3174	0.3075	-0.0072	-0.0574	-0.1158	-0.1891	0.1951	-0.0262	0.1891	-0.0035	-0.2811	-0.2102	-0.5885	-0.2562	1.0000

Source: Computed from own field survey (2019)

Key notes:

Agro-ecology/farming system (s2-q7)	Education	Agricultural employment status (s4-q72)	Access to irrigation (s4-q141_8)
Place of residence/kebele (s2-q8)	Literacy status of HH head (s3-q17)	Access to remittance (s4-q84)	Membership in cooperatives(s4-q62)
Sex of HH head (s3-q12)	Religion of the HH head (s3-q18)	Saving (s4-q69)	Access to agricultural extension(s4-q133)
Marital status of HH head (s3-q15)	Ethnicity of the HH head (s3-q19)	Access to credit (s4-q141_7)	

Annex 4.2: Results of Variance Inflation Factor

Variables	VIF	Tolerarnce=1/VIF
Farm size (Hect)	1.12	0.892144
Livestock (TLU)	1.11	0.896997
Age	1.11	0.898460
Family size	1.07	0.930912
Dependency ratio	1.03	0.971327
Mean VIF	1.09	

Source: Computed from own field survey (2019)

Annex 4.3: Concept mapping and results of cross-case analysis

Issues raised	Key informants and FGD participants (purposively sampled)						Cross-case analysis
	DAY 1 (KI_1) TESFA M	DAY 2 (KI_2) Taniru wife F	DAY 3 (KI_3) Ayele	DAY 4 (KI_4) Karse M	DAY 5 (KI_5) Gerbiba.	DAY 6 (KI_6) Gobene	
Big issue:	Rural Poverty	Rural Poverty	Rural Poverty	Rural Poverty	Rural Poverty	Rural Poverty	
Specific issues							
What is poverty?	Children drop-out **(I)** PWD, traffic accident **(I)** No vaccination **(I)** Lack water **(I)** Input price increase **(I)** Lack extension **(I)** No trading **(I)** No monthly salary **(I)** No house made of CIS **(NPO)** Overcrowded house (NPO) Income < ETB 50 p/d(I) No perm.t employment (**I**) Child 5 to 17 Hired (**I**) Daughter faced FGM **I**) Forced marriage (I) No decision making (**I**) No mini-supermarket(I) Firewood (I) Cut tree (I) No waste disposal (NPO) No conservation (I)	Ill HIV/AIDs/ Hepatitis B (I) Children drop-out **(I)** No vaccination **(I)** Non-functional(H_2O) **(NPO)** Input price increase **(I)** No info on HIV/AIDS **(I)** No fish production **(I)** No monthly salary **(I)** Member trafficked **(I)** House faced erosion (**I**) Income < ETB 50 p/d(I) Child 5 to 17 Hired (**I**) No maternity leave (I) Not member parliament(I) Forced marriage (I) No decis. making (F1,2) No rural pharmacy (I) Firewood (I) Cut tree (I) No waste disposal (NPO) No conservation (I)	Not joined HEIs **(I)** Ill TB, mortality **(I)** No vaccination **(I)** Lack water (**I**) No saving (I) Lack extension **(I)** No trading **(I)** No month salary (I) House faced erosion (F) No house CIS **(NPO)** No employment (**I**) Violence (I) Punishment (I) Early marriage(I) Disparity (F) No rural road(O) No pharmacy (I) Firewood (I) Cut tree (I)	ll malaria (I) No Birth control (I) No IFAL **(I)** No vaccination **(I)** Open defecation (O) Input price increase **(I)** No info on HIV/AIDS **(I)** No fish production **(I)** No monthly salary **(I)** Member trafficked **(I)** Overcrowded house (NPO) Income < ETB 50 p/d(I) No perm.t employment (**I**) No maternity leave (I) Not member parliament(I) Punishment (I) Disparity (**I**) No mini-supermarket(I) Firewood (I) Cut tree (I)	Not joined HEIs **(I)** Suicide, No insurance **(I)** No vaccination **(I)** Lack water (**I**) No saving (I) Lack extension **(I)** No trading **(I)** No monthly salary **(I)** No has made of CIS **(NPO)** House faced erosion (**I**) Income < ETB 50 p/d(I) No employment (**I**) Child 5 to 17 Hired (**I**) No maternity leave (I) Violence (I) Early marriage(I) No rural pharmacy (I Firewood (I) Cut tree (I)	Fire incidence, No social protection service **(I)** No vaccination **(I)** No electricity (O) Input price increase **(I)** No info on HIV/AIDS **(I)** No fish production**(I)** No monthly salary **(I)** No has made of CIS **(NPO)** Overcrowded house (NPO) Income < ETB 50 p/d(I) No perm.t employment (F1,2) Child 5 to 17 Hired (**I**) The daughter faced FGM (F1,2) Not member parliament(I) Forced marriage (I) No mini-supermarket(I) Firewood (I) Cut tree (I) No waste disposal (NPO) No conservation (I)	**DIMENSIONS/6** ▪ Health (D) ▪ Education (D) ▪ Living standard (D) ▪ Livelihood (D) ▪ Empowerment (D) ▪ Environment (D)
Who is poor? Household characterized by ….	Education/ drop-out **(I)** Health/PWD, traffic **(I)** Health/vaccination **(I)** Living standard/ water **(I)** LH/shock/input price increase **(I)** LH/extension service **(I)** LH//NFA trading **(I)** LH/OFF/ monthly salary **(I)** Economic/Income < ETB 50 p/d(I) Economic/perm.t employment (**I**) Economic/Child labor (**I**) Empowerment/FGM (**I**) Empowerment/forced marriage (I) Empowerment/decision making (**I**) Infrastructure/supermarket(I) Environment/air pollution (I) Environment/deforestation (**I**) Environment/conservation (I)	Health/HIV/AIDs (I) Health// Hepatitis B (I) Education/ drop-out **(F)** Health/vaccination **(I)** LH/shock/input price **(I)** Info capital/COVID-19 **(I)** LH/on-farm fish **(I)** LH/ Off salary **(I)** LH/ migration/traffic**(I)** Housing/Hazard erosion. (**I)** Economic/Income (I) Economic/ child labor (F1,2) Empowerment/maternity leave (I) Empowerment/ member parliament(I) Empowerment/forced marriage (I) Empowerment/decision making (F1,2) Infrastructure/ rural pharmacy (I) Environment/air pollution (I) Environment/conservation (I)	Education/HEIs **(I)** Health/TB (I) Health/mortality **(I)** Health/vaccine.**(I)** LS/water (**I**) LH/Financial capital (I) LH/ extension **(I)** LH/non-farm **(I)** LH/Off-farm (I) Housing/Hazard (**I**) Econo.c/P.emplot (F1,2) Emp/phy. voil. (I) Emp/Punishment (I) Emp. early marr.(I) Emp./disparity (**I**) Inf/pharmacy (I) Ent/air pollution (I) Ent/deforestation (I)	Health/malaria (I) Health/Birth control (I) Education/IFAL **(I)** Health/vaccination **(I)** LH/shock **(I)** LH/Inf.capital (I) LH/on-farm **(I)** LH/off-farm **(I)** LH/migration **(I)** Economic/income (I) Econo./ perm. empl. (**I**) Empt/ matern. leave (I) Empt mem. Parliament.t(I) Empt/punishment (I) Empt/gen.r disparity (**I**) Infra/supermarket(I) Ent/air pollution (I) Ent/deforestation (I)	Education/HEIs **(I)** Health/suicide (I) Health/insurance (I) Health/vaccine.on **(I)** LS/water (**I**) LH/Finan.l capital (I) LH/extension **(I)** LH/non-farm **(I)** LH/off-farm **(I)** Housing/Hazard (**I**) Economic/income (I) Economic/p.empt (**I**) Eco./child labor (**I**) Empt/mater. leave (I) Empt/violence (I) Empt/ early marr.e(I) Inf/ pharmacy (I Ent/tal pollution (I) Ent/deforestation(I)	Health/Fire (I) Health/ soc.l prot.(I) Health/ vaccine.n **(I)** LS/shock**(I)** LH/Inf.capital (I) LH/on-farm **(I)** LH/ off-farm **(I)** Finan.l cap.l/Income (I) Eco./perm.t empl. (**I**) Eco/child labor (**I**) Empt/FGM (**I**) Empt/ mem.r parl.t(I) Empt/ forced mar.ge (I) Inf/supermarket(I) Ent/air pollution (I) Ent/deforestation (**I**) Ent/conservation (I)	**INDICATORS/17** Categorized under 6 dimensions ▪ .**Health (2):** Mortality/animal, Vaccination/animal ▪ **Education (3):** Drop-out, higher education & IFAL ▪ **Living standard (4):** Drinking water, Sanitation, Electricity, and Housing ▪ **Livelihood (3):** Shock, Extension service, On-farm, & Migration ▪ **Empowerment (3):** FGM, Physical violence and Decision making ▪ **Enviroment (2):** Deforestation & Conservation

Code: KI: Key informant, I-Interview, NPO-non-participatory observation, and D-Document review

Source: Interview, observation, and document review data (2019)

Annex 4.4: Results of PPA participatory scoring matrix on the prevalence & severity of rural poverty according to their degree of perceived importance to participants of FGD

A	B		C					D	E	F	G
S/N	Determinants/rural HHs are poor because of ….	Unit	Using 10-seeds techniques score provided by 12 FGD participants						**Severity**		
			Strong sever (5)	Sever (4)	Undecided (3)	Not sever (2)	Strongly Not sever (1)	Total scores= n* seed	Mean score=D/12	Max. scores out of 5	% mean score= (E /F)*100%
1	Old age	Year		12hhs(***** *****)				**120**	10.00	4	250.00
2	Illness	Status		12hhs(***** *****)				**120**	10.00	4	250.00
3	Lack of farm land	Hect	10hhs(***** *****)					**120**	10.00	5	200.00
4	A few livestock	No	12hhs(***** *****)					**120**	10.00	5	200.00
5	Being women headed	Sex	12hhs(***** *****)					**120**	10.00	5	200.00
6	Expensive inputs	ETB	11hhs(***** *****)	+1hh(***** ****)				**119**	9.92	5	198.33
7	Lack of irrigable land	Hect	10hhs(***** *****)	+ 1hh(***** **)	+ 1hh(****)			**111**	9.25	5	185.00
8	Death of oxen	No	9hhs(***** *****)	+1hh(***** **)	+1hh(****)	+1hh(**)		**103**	8.58	5	171.67
9	Lack of agr.l income	ETB/yr	9hhs(*****)	+ 1hh(***** *****)	+1hh(****)			**59**	4.92	3	163.89
10	Lack of saving (cash)	ETB	1hh(****)	+1hh(***** **)	+8hhs(***** *****)	+1hh(**)	+1hh(***)	**96**	8.00	5	160.00
11	Lack of road access	Km	8hhs(***** *****)	+1hh(***** **)	+1hh(****)	+1hh(**)	+1hh(***)	**96**	8.00	5	160.00
12	Poor soil fertility	Hect/any	8hhs(***** *****)	+ 1hh(***** **)	+1hh(****)	+1hh(**)	+1hh(***)	**96**	8.00	5	160.00
13	Poor extension service	Frequ.	7hhs(***** ***)	+1hh(***** *)	+2hhs(****)	+1hh(**)	+1hh(***)	**75**	6.25	4	156.25
14	Lack of education	Grade	1hh(****)	+5hhs(***** *****)	+ 2hhs(**)	+3hhs(****)	+1hh(***)	**73**	6.08	4	152.08
15	Being unmarried	Status	3hhs(***** ****)	+4hhs(***** ***)	+ 1hh(****)	+2hs(***** *)	2hhs(*****)	**85**	7.08	5	141.67
16	Swampy farm land	Hect	6hhs(***** *****)	+3hh(*****)	+1hh(**)	+1hh(*)	+1hh(***)	**81**	6.75	5	135.00
17	A large number of dependents		5hhs(***** *****)	+ 2hh(***** ***)	+ 1hh(****)	+ 3hh(**)	+ 1hh(***)	**79**	6.58	5	131.67
18	Lack of trading skill	Skill	2hs(****)	+ 6hhs(**)	+2hhs(***** *****)	+1hh(**)	+1hh(***)	**45**	3.75	3	125.00
19	Lack of composite making skill	Skill	4hhs(***)	+4hhs(***** *****)	+2hhs(*)	+1hh(**)	+1hh(***)	**59**	4.92	4	122.92
20	Being ex-soldiers	No	2hhs(***)		+1hh(****)	+1hh(**)	8hhs(***)	**41**	3.42	3	113.89
21	Loss of harvest	Qtl	6hhs(***** **)	+ 1hh(*** **)	+ 2hhs(***)	+1hh(**)	+2hhs(*)	**57**	4.75	5	95.00
22	Non-cooperative member	No	3hhs(*****)	+ 6hhs(***)	+ 1hh(****)	+1hh(**)	+1hh(***)	**42**	3.50	5	70.00
23	Lack of working habit	Behavior	2hhs(*****)	+ 3hhs(**)	+ 2hhs(*****)	+ 2hhs(****)	+ 1hh(***)	**37**	3.08	5	61.67
24	Lack of credit/big interest	access	7hhs(**)	+2hhs(*****)	+ 1hh(**)	+1hh(**)	+1hh(*)	**29**	2.42	4	60.42

Notes:

1. Asterisks (*) represented participatory rural appraisal (PRA) 10 seeds
2. The more the determinant scored the highest its degree to determine poverty status

Source: Computed from PPA field exercise (2019)

Annex 3.4: 30 Judges ranking of the 7 livelihood security (LHS) dimensions

ADDIS ABABA UNIVERSITY
COLLEGE OF DEVELOPMENT STUDIES
CENTER FOR RURAL DEVELOPMENT, Ph.D. PROGRAM

Dear respondents,

My name is Tariku Kassa. I am a Ph.D. candidate at Addis Ababa University. This study will devote itself to investigate *"The determinants of rural households' poverty, livelihoods, and access to agricultural extension services in Jimma Geneti Woreda"* in partial fulfillment of the degree of Doctor of Philosophy in development studies (rural development). The questionnaire has four major parts: **The first** part is about general instructions; the **second** part is about identification/code; the **Third** part is about demographic and socio-economic data, and the **Fourth** part is about survey a questionnaire is ranking of the seven livelihood security dimensions. The information to be collected through this questionnaire will be used strictly for academic purposes and highly confidential. Therefore, I kindly request you to rank all the seven livelihood security dimensions frankly and honestly? Thank you in advance for your valuable time to complete this questionnaire

PART I: GENERAL INSTRUCTION TO THE JUDGES

1. Readout carefully the instruction
2. To ensure that all the seven livelihood security dimensions are ranked, please, check it again
3. Don't write your name and addresses anywhere.

PART II: IDENTIFICATON

Instruction: In responding to the items below, please, use "□" mark or circle the options or write your responses as appropriate

S/N	Question	Response option/space provided to write	Code
4.	What is your kebele?		□

PART III: DEMOGRAPHIC AND SOCIO-ECONOMIC CHARACTERISTICS OF THE RESPONDENT

Instruction: In responding to the items below, please, use circle or "□" mark or write your responses as appropriate in the space provided

S/N	Question	Response option/space provided to write	Code
5.	What is the name of your institution? Write in the space provided	……..	□
6.	What is your sex?	1= Male 0=Female	□
7.	What is your age?	……..Years old	□
8.	What is your completed education level?	1= Diploma 2=BA/MSc 3=MA/Msc and above	□
9.	What is your area of specialization? Write in the space	…….	□

4.1. PART IV: 30 J JUDGES RANKING OF THE 7 LIVELIHOOD SECURITY DIMENSIONS

Instruction: Based on your perceived significances of the following 7 rural households livelihood security dimensions to rural households in Jimma Geneti woreda, please, give a rank to in the space provided to the right of the table below.

Note: 1st rank is given to the dimension most important to rural households and 7th to the very least important to rural HHs)

Livelihood security dimensions	Rank
FoSD: **Food security** dimension	……
HaSD: **Habitat security** dimension	……
EmSD: **Empowerment security** dimension	……
OcSD: **Occupational security** *dimension*	……
EnSD: **Environmental security** dimension	……
EcSD: **Economic security** dimension	……
CoP: **Community participation** dimension	……

=== THE END ===

THANK YOU SO MUCH ONCE AGAIN FOR YOUR VALUABLE TIME AND ENERGY

GOD BLESSES YOU!!

Annex 3.5. Diagnosis test (**c**ontingency coefficients of categorical independent variables)

Variables	AE	Sex	MSB	LS	CS	CM
Agro-ecology (AE)	1					
Sex of HH head (	0.0315	1				
Marital status-binary (MSB)	0.088	0.181	1			
Literacy status (LS)	0.0918	-0.1155	0.0415	1		
Credit service (CS)	0.1512	0.042	-0.1099	-0.1036	1	
Cooperative member (CM)	0.0371	0.0317	-0.042	0.2056	0.0641	1

Annex 3.6. Diagnosis test (continuous variables (no multicollinearity) using VIF)

Variable	VIF	Tolerance=1/VIF
Livestock holding in (TLU)	1.14	0.880471
Landholding in hectare	1.11	0.897747
Family size of the HH head	1.07	0.934229
Age of the HH head	1.06	0.945266
Dependency Ratio	1.01	0.986380
Mean VIF	1.08	

Annex 5.1: Variables and their descriptions/ measurement for analyzing rural households' access to AEs (N=387)

Variables	Nature	Value/Description/Measurement	Expected sign	References
DEPENDENT VARIABLE				
Access to agricultural extension	Dummy	1 if accessed and 0		
INDEPENDENT VARIABLES				
Age of the HHs head	Continuous	Number /actual age in years	Negative	Yurttaş & Atsan (2006), Abdallah &Abdul-Rahaman (2016), Umeh & Ekwengene (2017)
Capability to work	Dummy	1 if capable 0 otherwise	Positive	Arias et al. (2016)
Kebele/"ganda" /location of the	Categorical		Negative	
Religion/"amanta" of HH head	Categorical		Negative	
The literacy level of the HH	Categorical		Positive	
Access to agricultural training	Dummy	1 if trained 0 otherwise	Positive	Arias et al. (2016)
Access to credit service	Dummy	1 if user0 otherwise	Positive	
Access to irrigation use	Dummy	1 if user 0 otherwise	Positive	
Distance to input supply	Continuous		Positive	Arias et al. (2016), Abdallah & Abdul-Rahaman (2016)
Access to telephone	Dummy	1 if accessed 0 otherwise	Positive	
Livestock holding (TLU)			Positive	Yurttaş & Atsan (2006)
Poverty			Negative	Mvuna (2010)

Annex 5.2: Other challenges (FTCs, gender, market, and farmers' orientation challenges)

Other challenges and support mechanisms/strategies to ensure effective agricultural services in Jimma Geneti woreda	Response options (5-Point Likert Scale)										Total
	5.Strongly agree		4.Agree		3.Undecided		2.Disagree		1.Strongly disagree		
	N	%	N	%	N	%	N	%	N	%	
FTC related challenges											
Limited involvement of farmers in FTC management	240	62.99	29	7.61	8	2.10	38	9.97	66	17.32	381
Insufficient resources for FTCs	206	54.65	94	24.48	13	3.39	35	9.11	35	9.11	384
Most FTCs have no long-term plans for sustainability	207	54.05	50	13.05	22	5.74	51	13.32	53	13.84	383
Lower salary level and fewer resources for field agricultural extension agents	257	66.75	54	14.03	21	5.45	18	4.68	35	9.09	385
Untrained and unequipped extension agents in the villages	83	21.84	43	11.32	38	10.00	57	15.00	159	41.84	380
Lack or less frequency of extension agents contact with rural households	130	33.85	45	11.72	31	8.07	73	19.1	105	27.34	384
Despite their role to support farmers, most extension agents view their role primary as distributing fertilizer and credit	97	25.39	47	12.30	20	5.24	50	13.09	168	43.98	382
Inadequate incentives to motivate and retain DAs	168	44.44	29	7.67	34	8.99	47	12.43	100	26.46	378
Gender-related challenges											
Poor gender and youth mainstreaming in extension programs planning, implementation and in monitoring, learning and evaluation	186	48.56	95	24.80	32	8.36	29	7.57	41	10.70	383
Shortage of gender disaggregated data,	138	35.94	112	29.17	35	9.11	45	11.72	54	14.06	384
Socio-cultural constraints	149	38.90	90	23.50	41	10.70	67	17.49	36	9.40	383
Inadequate nutrition sensitive extension service,	183	47.78	59	15.40	26	6.79	57	14.88	58	15.14	383
Market-related challenges											
Insufficient understanding of market-oriented production system	223	5.07	60	15.63	26	6.77	31	8.07	44	11.46	384
Limited focus on strategic commodities in the extension services	155	40.58	102	26.70	26	6.81	58	15.18	41	10.73	382
Limited knowledge and skills of extension staff to facilitate value chain development,	134	35.36	49	12.93	27	7.12	64	16.89	105	27.70	370
Ineffective linkage among value chain actors	127	33.51	74	19.53	34	8.97	63	16.62	81	21.37	379
Limited access to market information and collective marketing,	190	49.74	96	25.12	24	6.28	24	6.28	48	12.57	382
Farmer's oriented challenges											
Limited involvement of different stakeholders in the provision of extension services	214	55.73	56	14.58	15	3.91	51	13.28	48	12.50	384
Low cooperation and collaboration between public and NGOs in extension services provisions	192	50.26	75	19.63	32	8.38	30	7.85	53	13.87	382
Poor involvement of cooperatives in extension service delivery	197	51.30	94	24.48	10	2.60	35	9.11	48	12.50	384
Support mechanisms/strategies											
Empower extension workers	299	78.48	32	8.4	17	4.46	11	2.89	22	5.77	381
Working towards gender equality /gender transformative approach in agricultural extension services	271	70.94	52	13.61	19	4.97	15	3.93	25	6.54	382
Building agricultural extension services on food security dimensions	290	76.52	55	14.51	11	2.9	10	2.64	13	3.43	370
Improving the availability of diverse, nutrient-dense and market –oriented foods	284	74.54	58	15.22	18	4.72	15	3.94	6	1.57	381
Improving access to diverse diet	268	70.53	80	21.05	14	3.68	8	2.11	10	2.63	380
Safeguarding stability	289	75.85	52	13.65	21	5.51	7	1.84	12	3.15	381
Optimal utilization of nutrients	293	76.70	51	13.35	15	3.93	10	2.62	13	3.40	382
WASH services	275	72.18	68	17.85	14	3.67	11	2.89	13	3.41	381
Pluralistic and need-based agricultural extension services	291	76.58	49	12.89	21	5.53	8	2.11	11	2.89	380

Source: Computed from own field survey (2019)

Annex 5.3: Contingency coefficients of categorical independent variables

Categorical variables	Kebele	Religion	Literacy	S4_ q133	S4_ q141_7	S4_ q141_8	S4_ q151	Poverty
Kebele	1.000							
Religion	0.0952	1.000						
Literacy	-0.0310	0.0095	1.000					
Access to agri.l training	-0.4347	-0.1020	0. 0947	1.000				
Access to credit service	-0.2286	0.0883	0. 1020	0.1965	1.000			
Access to irrigation use	-0.3281	0.2683	0.0883	0.5575	0.3442	1.000		
Access to telephone	-0.0671	0.2098	0.2683	0.0107	0.0642	0.0850	1.000	
Poverty	-0. 1027	-0.04278	-0. 1323	0.0578	-0.0339	0.0602	-0.0327	1.000

Note: No $\chi 2$ (chi-square value) grater 0.75 implies that no serious multicollinearity problem between discrete independent variables

Source: Computed from own field survey (2019)

Annex 5.4: Results of Variance Inflation Factor

Continuous variables	VIF	1/VIF
TLU	1.06	0.941021
Sq_150(distance from input supply store)	1.05	0.952708
Age	1.01	0.987599
Dependency ratio (DR)	1.01	0.992236
Mean VIF	1.03	

Note: No VIF grater 10 implies that no serious multicollinearity problem between continuous independent variables

Source: Computed from own field survey (2019)

Annex 5.5: Classification table of the logit model

Logistic model for access to agricultural extension services

Classified	True		Total
	Observed positive (D)	Observed negative (-D)	
Predicted positive (above cutoff)	A=266	B=38	304
Predicted negative (below cutoff)	C=14	D=69	83
	280	107	387

Classified + if predicted Pr(D) >= .5

Total D defined as access to agricultural extension services !=0

Sensitivity = **(A/A+C)*100%** = (266/266+14))*100%= Pr(+1 D) = 95.00%

Specificity=**(D/D+B)*100%** =(69/69+38)*100%= Pr(-1 ~D) = 64.49%

Positive predictive value Pr(DI +) =87.50%

Negative predictive value Pr(~DI -) =83.13%

False + rate for value D Pr(+1 ~D) = 35.51%

False – rate for value D Pr(-1 D) = 5.00%

False + for classified + Pr(~DI +) =12.50%

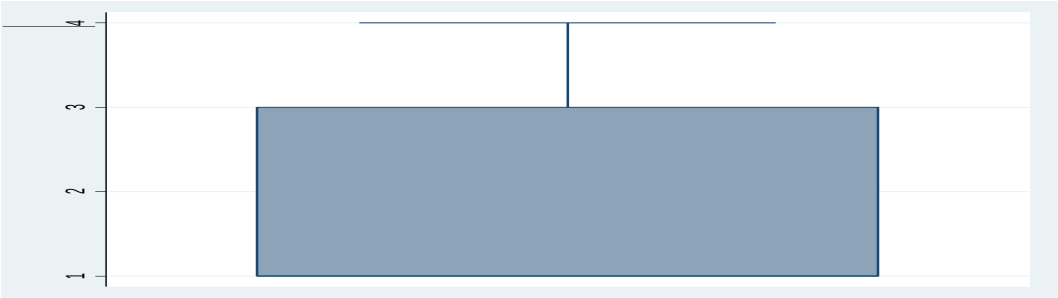
False - for classified - Pr(DI -) =16.87%

Correctly classified **86.56%**

Note: **+**(predicted positive above cutoff), **-**(predicted negative below cutoff), **D**(observed positive) and-**D**(observed negative)

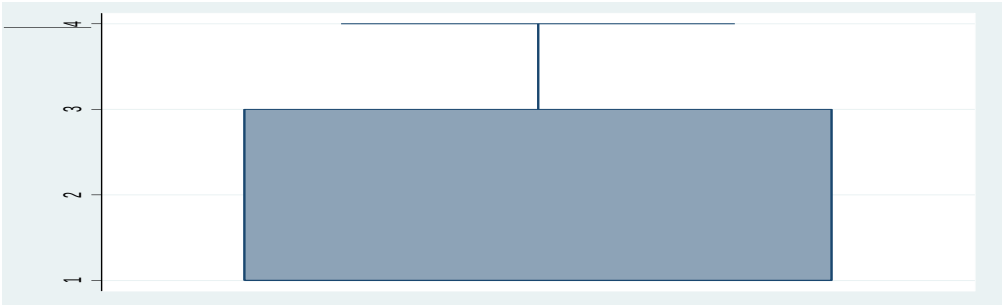
Source: Computed from own field survey (2019)

Annex 6.1: Test of no significant outliers' assumption of one-way ANOVA



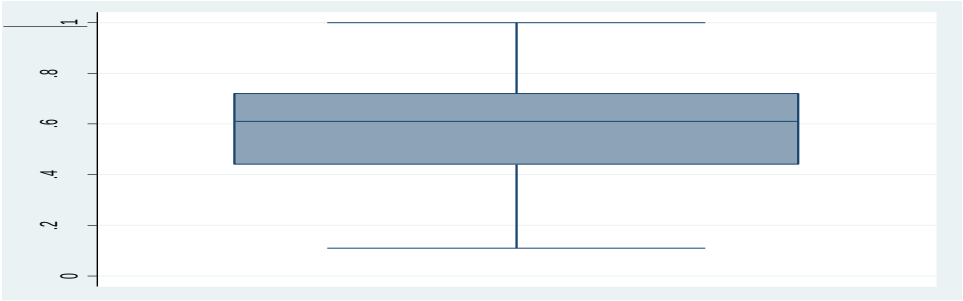
Source: Computed from own field survey (2019)

Annex 6.2: Test of no significant outliers' assumption of one-way ANOVA



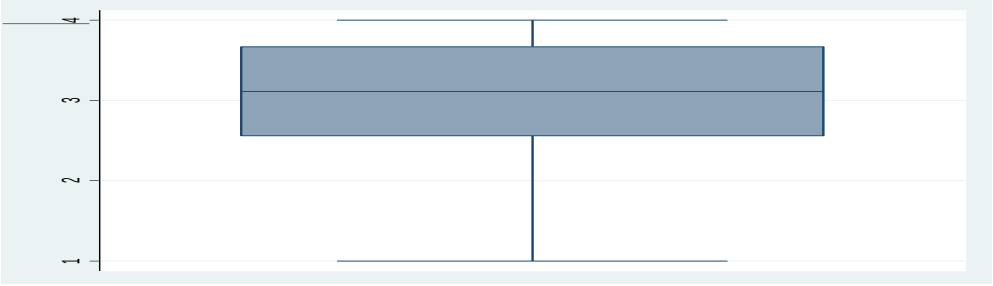
Source: Computed from own field survey (2019)

Annex 6.3: Test of no significant outliers assumption of one-way ANOVA



Source: Computed from own field survey (2019)

Annex 6.4: Test of no significant outliers' assumption of one-way ANOVA



Source: Computed from own field survey (2019)

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ANNEX A: PILAGIARISM ASSESSMENT REPORT

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Sources included in the report

W	URL: https://www.eajournals.org/journals/international-journal-agricultural-extension-rural-development-studies-ijaerds/vol-8-issue-1-2021/analysis-of-the-status-and-determinants-of-rural-households-access-to-agricultural-extension-services-the-case-ff-jimma-geneti-woreda-oromia-regional-state-ethiopia/ Fetched: 5/26/2021 3:46:00 PM	25
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SA	**University of Addis Ababa / Tadesse thesis-1.pdf** Document Tadesse thesis-1.pdf (D77617910) Submitted by: mesalemamo@gmail.com Receiver: mesay.mulugeta1.aauni@analysis.urkund.com	5
J	**Determinants of livelihood diversification strategies: The case of smallholder rural farm households in Debre Elias Woreda, East Gojjam Zone, Ethiopia** URL: 2728a3b1-c0b8-4eef-9ede-04837b21f2f9 Fetched: 2/26/2019 12:38:45 PM	9
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W	URL: https://ir.bdu.edu.et/bitstream/handle/123456789/10087/Beyadegie%20final%20poverty%20Thesis.pdf?sequence=1&isAllowed=y Fetched: 12/5/2020 3:16:28 PM	1
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W	URL: http://ijcrt.org/papers/IJCRT2006027.pdf Fetched: 1/8/2021 10:00:42 AM	5
J	**Determinants and its extent of rural poverty in Ethiopia: Evidence from Doyogena District, Southern part of Ethiopia** URL: 022b3dd4-0454-4da6-ab62-9c4fc0030625 Fetched: 2/28/2019 2:40:22 PM	16
	Rural Household Livelihood Strategies: Options and Determinants in the Case of Wolaita Zone,	

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W	URL: https://www.researchgate.net/publication/342467472_The_Role_of_Rural_Livelihood_Diversification_Strategies_for_Household_Food_Security_in_Southern_Ethiopia_Empirical_Evidence_from_Kecha_Bira_District_of_Kembata_Tembaro_Zone Fetched: 9/16/2020 1:58:46 AM	6
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Name of the Center: Center for Rural Development Program of study: Regular Program level(Masters/PhD): PhD Please, check one: Regular/Continuing

Name of the Adviser/s: Dr Abrham Seyoum and Dr Alemseged Gerezgiher

Topic of the dissertation/thesis : Analysis of the Status and Determinants of Rural Households Poverty, Livelihoods, and Access to Agricultural Extension Services: The Case of Jimma Geneti Woreda, oromia Regional State, Ethiopi

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Matched text vs changed text

	Matched text	Changed text	Page
1/90	to agricultural extension services in the current study area. Weak links between agricultural research and farmers extension problems, lack of coordination and communication between agricultural sectors and higher learning institutions, and lower salary level and fewer resources for field agricultural extension agents are found the major potential reasons/challenges that make sample households'	Unchanged because it is own publication available at: https://www.eajournals.org/journals/international-journal-agricultural-extension-rural-developmen	190
2/90	Kebele/"ganda" of the household head, access to agricultural extension training, access to credit service, irrigation use, and rural households' having a telephone were found the major determinant factors. Thus,	Unchanged because it is own publication available at: https://www.eajournals.org/journals/international-journal-agricultural-extension-rural-developmen	190
3/90	can cope with and recover from stress and shocks, maintain or enhance its capabilities and assets and provide sustainable livelihood opportunities for the next generation and which contributes net benefits to other livelihoods at the local and global levels and in the long and short term.	Different authors like Champers & Conway (1992), Scoones (1998), Carney et al., (1999), and Ellis (2000b) state that rural livelihood is sustainable when it contend with and recuperate from stress and , thereby, didn't compromise the future of the next generation	2
4/90	offers a strong option for spurring growth, overcoming poverty and enhancing food security World Bank (2008). Agriculture is the	For instance, agriculture 'optimist' views for example as claimed by World bank (2008) Agriculture is the foundation of rural livelihoods that is speed growth, reduce poverty, and ensure food security.	2
5/90	GDP, more than 80% of employment opportunities and over 90% of the foreign exchange earnings	the Federal Ministry of Agriculture of Ethiopia (2010) reported that Agriculture in Ethiopia has been the significant contributor to national GDP, unemployment reduction and earning foreign currencies.	3
6/90	kebele dummy, marital status, literacy status, farm size, and membership to cooperatives of	Unchanged because it is own publication available at: SSRN: https://ssrn.com/abstract=3819745	13
7/90	in Jimma Geneti woreda (Ethiopia). A mixed-methods approach is used to achieve the research objective. Primary data are collected from 387 randomly selected rural households using survey questionnaires. In	Unchanged because it is own publication available at: SSRN: https://ssrn.com/abstract=3819745	13
8/90	results of the regression analysis indicated that kebele dummy, marital status, literacy status, farm size, and membership to cooperatives of households are found	Unchanged because it is own publication available at: SSRN: https://ssrn.com/abstract=3819745	13
11/90	that the log of the odds of being multidimensional poor decreases with the	Unchanged because it is own publication available at: SSRN: https://ssrn.com/abstract=3819745	13
13/90	increases by one more unit, the probability of being non-poor increases by 18.48%	Unchanged because it is own publication available at: SSRN: https://ssrn.com/abstract=3819745	13
12/90	that the log of the odds of being multidimensional poor decreases with the	Unchanged because it is own publication available at: SSRN: https://ssrn.com/abstract=3819745	13
17/90	increases by one more unit, the probability of being non-poor by 18.48%	Unchanged because it is own publication available at: SSRN: https://ssrn.com/abstract=3819745	13
14/90	Thus, based on the above results it is possible to conclude that	Unchanged because it is own publication available at: https://www.eajournals.org/journals/international-journal-agricultural-extension-rural-developmen	190

15/90	the status and determinants of rural households' access to extension services in the case of Jimma Gebeti Woreda (A mixed-methods approach is used. Primary data are collected from 387 samples. And inferential statistics and logit models are used to analyze the data. Results	Unchanged because it is own publication available at: https://www.eajournals.org/journals/international-journal-agricultural-extension-rural-developmen	190
16/90	Livelihood strategies are the combination of activities that people choose to undertake in order to achieve their livelihood goals (Ellis and Allison, 2004).	According to Ellis and Allison (2004) rural livelihood strategies are an amalgamation of different rural livelihood sources persuaded by them for their survival that include on-farm, non-farm, off-farm, and/or a combination of these activities	116
20/90	contingency coefficients were used to test the degree of multicollinearity and association among	According to Doyo et al. (2018) the degree of multicollinearity and association among discrete and dummy explanatory variables were tested using contingency coefficients.	119
27/90	As a rule of thumb, if the VIF of a variable exceeds 10, that variable is said to be highly collinear [28].	Variance Inflection Factor exceeding 10 imply presence of serious multicollearity between continuous variables	124
22/90	offers a strong option for spurring growth, overcoming poverty and enhancing food security	several studies done by Gordon & Craig (2001), Haggblade et al. (2005), Davis (2004), World Bank (2008), and MOA (2010) show that agriculture have multiple roles of which it enhances economic growth, reduces poverty, and could ensure food security	136
23/90	As a rule of thumb, if the VIF of a variable exceeds 10, that variable is said to be highly collinear [28].	According to Gujarati (2003) VIF having a value greater than 10 imply presence of serious multicolliarity problem between among continuous variables	143
24/90	The parameter estimates of the multinomial logit model give only the direction of the effect of explanatory variables on the dependent variable, the estimates neither stand for the actual size of change nor the Chilot (2007). However	Concerning the coefficients (βs) of the mlogit, Chilot (2007) states that it neither stand for actual size of change nor probabilities rather it only provide the direction of the effect of the independent variables on the dependent variable.	144
28/90	Abstract Effective, comprehensive, need-based, and participatory agricultural extension service is a major factor in improving the income and welfare of rural households. However, it has been reported that ineffective, non-comprehensive, and not need-based in many developing countries. The study analyzed the status and determinants of rural households' access to agricultural extension services in the case Jimma Gebeti Woreda (Ethiopia). A mixed-methods approach is used. Primary data are collected from 387 samples. Descriptive and inferential statistics and logit models are used to analyze the data. Results revealed that there are	Unchanged because it is own publication available at: https://www.eajournals.org/journals/international-journal-agricultural-extension-rural-developmen	190
29/90	sample heads to agricultural extension services in the current study area. Weak links between agricultural research and farmers extension problems, lack of coordination and communication between agricultural sectors and higher learning institutions, and lower salary level and fewer resources for field agricultural extension agents are found the major potential reasons/challenges that make sample households' unaccessed. Furthermore, Kebele/"ganda" of the household head, access to agricultural extension training, access to credit service, irrigation use, and rural households' having a telephone were found the major determinant factors. Thus, based on the above results it is possible to conclude that rural households' access to agricultural extension services is not as it ought to be. Above it is found that the extension delivery is mostly non-participatory. Therefore, policy majors that could avert the above challenges and determinants are recommended like for example, empowering extension	Unchanged because it is own publication available at: https://www.eajournals.org/journals/international-journal-agricultural-extension-rural-developmen	190

	workers and delivering pluralistic and need-based agricultural extension services. Keywords: access to agricultural extension services, households, logit model (Ethiopia)		
30/90	the Status and Determinants of Rural Households' Access to Agricultural Extension Services	Unchanged because it is own publication available at: https://www.eajournals.org/journals/international-journal-agricultural-extension-rural-developmen	190
31/90	Analysis of the Status and Determinants of Rural Households' Access to Agricultural Extension Services: The	Unchanged because it is own publication available at: https://www.eajournals.org/journals/international-journal-agricultural-extension-rural-developmen	190
32/90	of rural households' access to agricultural extension services in the	Unchanged because it is own publication available at: https://www.eajournals.org/journals/international-journal-agricultural-extension-rural-developmen	190
34/90	and lower salary level and fewer resources for field agricultural extension agents	Unchanged because it is own publication available at: https://www.eajournals.org/journals/international-journal-agricultural-extension-rural-developmen	190
35/90	large family size and the growth of population causing the shortage and scarcity of cultivable land.	big number of families and population surge that significantly contribute to scare farmland, poor agricultural lands fertility and others	198
36/90	loss of soil fertility are over cultivation and overgrazing of agricultural lands. Moreover, the lack of farmland management practices		
37/90	more pressure on scarce land and it in return aggravate youth immigration from the area	more pressure on scarce farm land, in return, perpetuate rural-to-rural migration or rural -to- town migration.	198
38/90	the gradual loss of land productivity particularly depletion of soil fertility and hence the low yield and low productivity of agricultural production increase the problem of household poverty	the major constraints of rural agriculture in study area include "the gradual loss of land productivity particularly depletion of soil fertility and hence the low yield and low productivity of agricultural production increase the problem of household poverty"(Woreda Finance and Economic Development Office, 2017:18).	198
39/90	the Status and Determinants of Rural Households' Access to Agricultural Extension Services:	Unchanged because it is own publication available at: https://www.eajournals.org/journals/international-journal-agricultural-extension-rural-developmen	190
40/90	of rural households' access to agricultural extension services in the	Unchanged because it is own publication available at: https://www.eajournals.org/journals/international-journal-agricultural-extension-rural-developmen	190
41/90	lower salary level and fewer resources for field agricultural extension agents	Unchanged because it is own publication available at: https://www.eajournals.org/journals/international-journal-agricultural-extension-rural-developmen	190
54/90	is critically important in promoting household food security, wealth and employment creation and poverty reduction.	John (2014) states that agricultural extension services delivered to rural households have a paramount importance in ensuring their food security, generation of wealth and employment opportunities and above reducing rural poverty.	237
44/90	Analysis of the Status and Determinants of Rural Households' Access to Agricultural Extension Services:	Unchanged because it is own publication available at: https://www.eajournals.org/journals/international-journal-agricultural-extension-rural-developmen	190

45/90	The marginal effect, 0.184796, indicates that as the total tropical livestock holding increases by one more unit, the probability of being non-	Unchanged because it is own publication available at: SSRN: https://ssrn.com/abstract=3819745	13
46/90	The marginal effect, 0.184796, indicates that as the total tropical livestock holding increases by one more unit, the probability of being non-	Unchanged because it is own publication available at: SSRN: https://ssrn.com/abstract=3819745	13
47/90	The marginal effect, 0.184796, indicates that as the total tropical livestock holding increases by one more unit, the probability of being non-	Unchanged because it is own publication available at: SSRN: https://ssrn.com/abstract=3819745	13
48/90	lower salary level and fewer resources for field agricultural extension agents	Unchanged because it is own publication available at: https://www.eajournals.org/journals/international-journal-agricultural-extension-rural-developmen	190
49/90	the status and determinants of rural households' access to agricultural extension services in the	Unchanged because it is own publication available at: https://www.eajournals.org/journals/international-journal-agricultural-extension-rural-developmen	190
50/90	Kebele/"ganda" of the household head, access to agricultural extension training, access to credit service, irrigation use, and rural households' having a telephone were found the major determinant factors.	Unchanged because it is own publication available at: https://www.eajournals.org/journals/international-journal-agricultural-extension-rural-developmen	190
51/90	Primary data are collected from 387 samples. Descriptive and inferential statistics and logit models are used to analyze the data. Results revealed that	Unchanged because it is own publication available at: https://www.eajournals.org/journals/international-journal-agricultural-extension-rural-developmen	190
52/90	the Use of High yield variety seeds increases by one, the more the probability of not being poor increases by 13.41 %;	Girma & Temesgen (2018) state that "…the use of high yield variety seeds increases by one, the more the probability of not being poor increases by 13.41 %"(p.26).	240
53/90	Poverty reduction in Ethiopia requires nothing more than breaking the vicious circle of poverty in the agrarian sector of the economy (CSA, 2012). The	in Ethiopia poverty reduction should be among the top government priority areas of development intervention (CSA, 2012).	240
55/90	Poverty reduction in Ethiopia requires nothing more than breaking the vicious circle of poverty	Huge poverty reduction efforts required from Ethiopia to make poverty a history.	241
56/90	Use of high yield variety seeds (impseed) In line with prior expectation, this variable is also significant at less than 5% level of significance and	Girma & Temesgen (2018) state that "farmers who use high yield variety seeds get more yields per hectare and more income which lifted them above the poverty line with the marginal effect corresponding to the improved seed is 0.14, suggesting that as the use of high yield variety seeds increases by one, the more the probability of not being poor increases by 13.41 %"(p.26).	242
57/90	inversely related probability of being poor. Those farmers who use HYV seeds get more yields per hectare and more income which lifted them above		
58/90	poverty line. The marginal effect corresponding to the improved seed is –0.144017,		
59/90	that as the Use of High yield variety seeds increases by one, the more the probability of not being poor increases by 13.41 %; assuming other things are held constant.		
60/90	on farm ; 1 on farm + non-farm ; 2 on farm + off farm ; 3 on farm + off farm +non-farm	1 On-farm activities only, 2 Non-farm activities only, 3 Off-farm activities only, and 4 On-farm and non-farm activities only	135
69/90	SS df MS F Prob< F Between groups 42429003 157 270248.4 Total 46029575 159 289494.2	Unchanged because it is own accepted publication available at: https://academicjournals.org/journal/JAERD/article-in-pressabstract/statistical_association_between_rural_households_poverty_livelihoods_and_agricultural_extension_services_the_case_of_jimma_geneti_wore	239

		da_ethiopia	
62/90	Analysis of the Status and Determinants of Rural Households' Access to Agricultural Extension Services:	Unchanged because it is own publication available at: https://www.eajournals.org/journals/international-journal-agricultural-extension-rural-developmen	190
63/90	the Status and Determinants of Rural Households' Access to Agricultural Extension Services: The Case ff Jimma Geneti Woreda	Unchanged because it is own publication available at: https://www.eajournals.org/journals/international-journal-agricultural-extension-rural-developmen	190
64/90	the Status and Determinants of Rural Households' Access to Agricultural Extension Services:	Unchanged because it is own publication available at: https://www.eajournals.org/journals/international-journal-agricultural-extension-rural-developmen	190
65/90	the Status and Determinants of Rural Households' Access to Agricultural Extension Services: The	Unchanged because it is own publication available at: https://www.eajournals.org/journals/international-journal-agricultural-extension-rural-developmen	190
66/90	Adugna E (2008). Livelihood strategies and food security in Wolayta, Southern Ethiopia: The case of Boloso Sore district.	Unchanged because it is available in the reference section of this dissertation.	271
67/90	Ahmed M. T, Bhandari .H, Gordoncillo P. U, Quicoy C. B, and Carnaje G.P. 2018. Factors affecting extent of rural livelihood diversification in selected areas of Bangladesh.	Unchanged because it is available in the reference section of this dissertation.	271
68/90	Foster, J. (2011). Counting and multidimensional poverty measurement Journal of Public Economics	Unchanged because it is available in the reference section of this dissertation.	272
72/90	Alkire, S, and M.E. Santos. 2010. Acute Multidimensional Poverty: A New Index for Developing Countries. Background paper	Unchanged because it is available in the reference section of this dissertation.	272
70/90	Santos, M. E. (2014). 'Measuring Acute Poverty in the Developing World: Robustness and Scope of the Multidimensional Poverty index World Development, 59 , Alkire, S., & Santos, M. E. (2010). Acute Multidimensional Poverty:	Unchanged because it is available in the reference section of this dissertation.	272
71/90	in the Developing World: Robustness and Scope of the Multidimensional Poverty Index. World Development, 59 ,	Unchanged because it is available in the reference section of this dissertation.	272
74/90	Fanifosi, E. G. (2017). An analysis of multidimensional poverty and its determinants in rural Nigeria.	Unchanged because it is available in the reference section of this dissertation.	272
80/90	Vol 53, Amare D., Belaineh L., (2013), Determinants of income diversification among rural households: The case of smallholder farmers in Fedis district, Eastern Hararghe zone, Ethiopia. Journal of Development and Agricultural Economics	Unchanged because it is available in the reference section of this dissertation.	272
90/90	O.A. 2010. Determinants of Rural Poverty in Nigeria: Evidence from Smallholder Farmers in South-western Nigeria. Journal of Science and Technology Education Research, 1(4): 85- 91.	Unchanged because it is available in the reference section of this dissertation.	273
75/90	livelihood assets, strategies and outcomes in drought-prone areas of the Amhara Region, Ethiopia: Case Study Lay Gaint District. Afr. J. Agric. Res. 8(46):5716-5727. Available online at http://www.academicjournals.org/ AJAR.	Unchanged because it is available in the reference section of this dissertation.	273
76/90	of the African Association of Agricultural Economists, September 22-25, 2013, Hammamet, Tunisia. URL: http://ageconsearch.umn.edu.	Unchanged because it is available in the reference section of this dissertation.	274
77/90	of the African Association of Agricultural Economists, September 22-25, 2013, Hammamet, Tunisia. URL: http://ageconsearch.umn.edu. Social Science Research Network.	Unchanged because it is available in the reference section of this dissertation.	274

78/90	Devereux S (2000). social safety nets for poverty alleviation in southern Africa. A Research Report for the Department for International Development ESCOR Report R7017	Unchanged because it is available in the reference section of this dissertation.	284
79/90	Survey of the Ethiopian Economy: Review of post reform developments (1992/93-1997-98/, Addis Ababa	Unchanged because it is available in the reference section of this dissertation.	301
81/90	Wambura, R., Acker, D., & Mwasyete, K. 2012. Extension systems in Tanzania: Identifying gaps in research (Background papers for collaborative research workshop). Retrieved from https://docs.google.com/file/d/0B0k_cmRaulGQQXZHdkk3bEZfNTg/edit?pli=1	Unchanged because it is available in the reference section of this dissertation. The only change that can be made is …(2012).	302
82/90	lower salary level and fewer resources for field agricultural extension agents	Unchanged because it is own publication available at: https://www.eajournals.org/journals/international-journal-agricultural-extension-rural-developmen	190
83/90	Tariku Kassa Ambaye , Abrham Siyoum Tsehay and Alemseged Gerezgiher Hailu (2021) Application of Ordered Logit Model to Analyze Determinants of Rural Households Multidimensional Poverty in Western Ethiopia, International Journal of Development and Economic Sustainability, Vol.9, No.1, pp. 18-62	Unchanged because it is own publication available at: SSRN: https://ssrn.com/abstract=3819745	13
84/90	Tariku Kassa Ambaye , Abrham Siyoum Tsehay and Alemseged Gerezgiher Hailu (2021)	Unchanged because it is own publication available at: SSRN: https://ssrn.com/abstract=3819745	13
85/90	Tariku Kassa Ambaye , Abrham Siyoum Tsehay and Alemseged Gerezgiher Hailu (2021)	Unchanged because it is own publication available at: SSRN: https://ssrn.com/abstract=3819745	13
86/90	Tariku Kassa Ambaye , Abrham Siyoum Tsehay and Alemseged Gerezgiher Hailu (2021)	Unchanged because it is own publication available at: SSRN: https://ssrn.com/abstract=3819745	13
87/90	Tariku Kassa Ambaye , Abrham Siyoum Tsehay and Alemseged Gerezgiher Hailu (2021): The Application of	Unchanged because it is own publication available at: SSRN: https://ssrn.com/abstract=3819745	13
88/90	Analysis of the Status and Determinants of Rural Households' Access to Agricultural Extension Services: The Case ff Jimma Geneti Woreda, Oromia Regional Ethiopia -	Unchanged because it is own publication available at: https://www.eajournals.org/journals/international-journal-agricultural-extension-rural-developmen	190
89/90	Tariku Kassa Ambaye , Abrham Siyoum Tsehay and Alemseged Gerezgiher Hailu (2021)	Unchanged because it is own publication available at: SSRN: https://ssrn.com/abstract=3819745 https://www.eajournals.org/journals/international-journal-agricultural-extension-rural-developmen	13 190

ANNEX B: Household survey questionnaire

ADDIS ABABA UNIVERSITY COLLEGE OF DEVELOPMENT STUDIES CENTER FOR RURALDEVELOPMENT PHD PROGRAM

Dear respondents,

My name is Tariku Kassa. I am PhD candidate at Addis Ababa University. This study will devote itself to investigate *"The determinants of rural households' poverty, livelihoods, and access to agricultural extension services in Jimma Geneti Woreda"* in partial fulfillment of the degree of Doctor of Philosophy in development studies (rural development). The questionnaire has four major parts: **First** part is about general instructions; **Second** part is about identification/code; **Third** part is about demographic and socio-economic data; and **Fourth** part is about survey questionnaires of both closed-ended and open-ended types. The information to be collected through this questionnaire will be used strictly for academic purposes and highly confidential. Therefore, I kindly request you to respond to all items frankly and honestly? Thank you in advance for your valuable time to complete this questionnaire

PART I: GENERAL INTRUCTION TO THE ENMURATORS (DATA COLECTORS)

10. Read out carefully the instruction of each statement of the items
11. In some items, Multiple response/more than one answer is possible when it is necessary
12. To ensure that all questions are responded, completed, and legible, please, check each items
13. Don't write the names and address of the respondents anywhere.

PART II: IDENTIFICATON

Instruction: In responding to the items below, please, use "□" mark or circle the options or write your responses as appropriate

S/N	Question	Response option/space provided to write	Code
14.	Name of the enumerator		□
15.	Date of the data collection		□
16.	According to agro-ecology/farming system, where you located?	1. *Highland* (where there are no Teff & Maize production in the kebele) 2. *Plain area* (there are Teff & Maize production in the kebele) 3. *Coastal area* of Fincha'a Lake (there are Teff, Maize & fishing production in the kebele/island)	□
17.	What is your kebele?		□
18.	What is your "Gote"?		□
19.	Household code		□

PART III: DEMOGRAPHIC AND SOCIO-ECONOMIC CHARACTERSTICS OF THE RESIPONDENT

Instruction: In responding to the items below, please, use circle or "□" mark or write your responses as appropriate in the space provided

S/N	Question	Response option/space provided to write	Code
20.	Are you the head of the household?	1= Yes 0= No	□
21.	What is your sex?	1= Male 0=Female	□
22.	What is your age?	……..Years old	□
23.	What is the total number of family size including you?)	Male**…..**Female**……..**Total**……**	□
24.	What is your marital status?	1= Single 4=Widowed 2=Married 5=Separated 3=Divorced 6=Polygamy	□
25.	What is your completed education level?	1=Never attain any school 5= Secondary compete 2=Primary incomplete 6=Secondary compete 3=Primary complete 7=Technical/vocational 4= Secondary incomplete 8=Diploma and above	□
26.	What is your literacy status?	1=Abe to read 4= Able to do simple arithmetic 2= Able to write 5=Illiterate 3=Able to read, write, and do simple arithmetic	□
27.	What is your religion?	1= Waaqeffataa 3= Muslim 5=Catholic 2= Orthodox 4= Non-follower 6= Protestant	□
28.	What about your ethnicity?	1=Oromo 3= Tigeray 2=Amhara 4=Other, specify……	□
29.	Do you capable to work/economically active?	1=Yes (SKIP to 21) 0=No(SKIP to 22)	□
30.	If you are economically active, what are your type(s) of employment? (Multiple response is possible)	1= Farmer 4=Trader 7=Petty trader 2=Professional 5=Pensioner 8=Other……. 3=Carpenter 6= Casual laborer	□
31.	Why you are unable to work/ economically inactive?	1= Sick Aged 3= Disable 5= Aged and sick 2= Aged 4= Below age 6=Other, specify**..**	□
32.	Number of non-working household members?	1=Male……. 2=Female…….3=Total …….	□

PART IV: CLOSED-ENDED AND OPEN-ENDED TYPE QUESTIONNAIRES

Instruction: To respond to the items below, please, use circle or "□" mark or write your responses as appropriate in the space provided

4.2. Rural household's multidimensional poverty (See, column E and F)

A	B	C	D	E	F	G
S/N	**Dimensions**	**Deprivation indicators**	**SDG AREA**	**Question**	**Response option**	**Code**
1	**HEALTH**	*Nutrition/adult*	SDG 2	33. Is there any adult under 70 years of age undernourished in the family?	1=Yes 0=No	□
		Nutrition(child)	SDG 2	34. Is there any child undernourished in the family?	1=Yes 0=No	□
		Child mortality	SDG 3	35. Is there any child died in the family in the five-year period preceding this survey?	1=Yes 0=No	□
2	**EDUCATION**	*Years of schooling*	SDG 4	36. No household member aged seven years older has completed 8 years of schooling?	1=Yes 0=No	□
		School attendance	SDG 4	37. Is there any school-aged child who is not attending school up to grade 8?	1=Yes (SKIP TO NEXT) 0=No	□
				38. What are the possible reasons for children not attending school?(Multiple response is possible)	1= Distant school 2=Unwillingness 3=Financial problems 4=Disability 5=Help family in farming Other, specify…….	□
3	**STANDARD OF LIVING**	*Cooking fuel*	SDG 7	39. You cooks with		
				▪ Dung	1=Yes 0=No	□
				▪ Wood	1=Yes 0=No	□
				▪ Charcoal	1=Yes 0=No	□
				▪ Kerosene	1=Yes 0=No	□
				▪ Biogas	1=Yes 0=No	□
		Sanitation	SDG 11	40. Your sanitation facility is not improved?	1=Yes 0=No	□
				41. Your sanitation facility is improved but shared with other household?	1=Yes 0=No	□
		Drinking water	SDG 6	42. You don't have access to improved drinking water (according to SDG guidelines):		
				▪ Pipe water	1=Yes 0=No	□
				▪ Public water	1=Yes 0=No	□
				▪ Borehole without hand pump	1=Yes 0=No	□
				▪ Borehole with hand pump	1=Yes 0=No	□
				▪ Hand dug wall	1=Yes 0=No	□
				43. If item # 31 is "Yes", safe drinking water is at least a 30-minute walk from home, round trip?	1=Yes 0=No	□
				44. If item # 31 is "No", your source of drinking water include:		
				▪ Rainwater	1=Yes 0=No	□
				▪ Dam	1=Yes 0=No	□
				▪ Pond	1=Yes 0=No	□
				▪ Lake	1=Yes 0=No	□
				▪ Spring water	1=Yes 0=No	□
				▪ Running river/stream	1=Yes 0=No	□
				▪ Ground water	1=Yes 0=No	□
		Electricity	SDG 7	45. What are your source of energy for lighting in the night:		
				▪ Biogas	1=Yes 0=No	□
				▪ Solar energy	1=Yes 0=No	□

A	B	C	D	E	F	G
S/N	Dimensions	Deprivation indicators	SDG AREA	Question	Response option	Code
				▪ Generator	1=Yes 0=No	□
				▪ Other, specify		□
				46. About your housing conditions:		
				Your residency room/house is separated from :		□
				▪ Kitchen	1=Yes 0=No	□
				▪ Animal residency	1=Yes 0=No	□
				What is the type of roofing material you used in the construction of the house?		
				▪ Plastic sheets cover	1=Yes 0=No	□
				▪ Grass cover	1=Yes 0=No	□
		Housing	SDG 11	▪ Stone or slate	1=Yes 0=No	□
				▪ Corrugated Iron Sheet	1=Yes 0=No	□
				What is the type of wall material you used in the construction of the house?		
				▪ Plastic sheets	1=Yes 0=No	□
				▪ Wood /timber wall	1=Yes 0=No	□
	STANDARD OF LIVING …CTD			▪ Mud wall	1=Yes 0=No	□
				▪ Corrugated Iron sheets	1=Yes 0=No	□
				▪ Hallow concrete blocks	1=Yes 0=No	□
				What is the type of floor material you used in the construction of the house?		
				▪ Mud	1=Yes 0=No	□
				▪ Wood	1=Yes 0=No	□
				▪ Cement with concrete	1=Yes 0=No	□
				47. Do you own assets like:		
				▪ Radio	1=Yes 0=No	□
				▪ Telephone	1=Yes 0=No	□
		Assets	SDG 1	▪ Computer	1=Yes 0=No	□
				▪ Animal cart	1=Yes 0=No	□
				▪ Bicycle	1=Yes 0=No	□
				▪ Motorbike	1=Yes 0=No	□
				▪ Refrigerator	1=Yes 0=No	□
				▪ Car	1=Yes 0=No	□
				▪ Truck	1=Yes 0=No	□

4.3. Rural household livelihoods (livelihood diversification, migration and livelihood security)

A/. Livelihood diversification

A 1/. Types, frequency and coping strategies of shocks faced by rural households

Instruction: In responding to the items below, please, use circle or "□" mark or write your responses as appropriate in the space provided

48. Over the last 2 years, do you face any shock (s)? 1= Yes [SKIP TO NEXT] 0=N0

S/N	Question	Response option	41. How often the household faced the shock? (number of occurrences)			Code
			Once/year	Twice/year	Three & above/year	
49.	In the last 2 years, what are the types of shocks do you experienced :					
	▪ Drought shock?	1=Yes 0=No				□
	▪ Death shock of any household member?	1=Yes 0=No				□
	▪ Illness shock?	1=Yes 0=No				□
	▪ Death shock of any household's livestock?	1=Yes 0=No				□
	▪ Livestock disease shock?	1=Yes 0=No				□
	▪ Pests shock on your crop in the field?	1=Yes 0=No				□
	▪ Pests shock on your crop in the storage?	1=Yes 0=No				□
	▪ Input price increase shock?	1=Yes 0=No				□
	▪ Decreasing shock of output price?	1=Yes 0=No				□
	▪ Hailed rainfall/frosts shock	1=Yes 0=No				□
	▪ Soil erosion shock	1=Yes 0=No				□

S/N	Question	Response option	41. How often the household faced the shock? (number of occurrences)			Code
			Once/year	Twice/year	Three & above/year	
	▪ Income reduction shock	1=Yes 0=No				□
	▪ Water borne disease shock	1=Yes 0=No				□
	▪ Please, list other shocks, if any					□
42	What coping strategies do you used, when faced shocks? (Multiple response is possible)	Response option	43. Please, rank from most to least frequently used coping strategies			
	▪ Reducing the frequency and quality of food consumed?	1=Yes 0=No				□
	▪ Sold fixed asset	1=Yes 0=No				□
	▪ Reliance on relief support	1=Yes 0=No				□
	▪ Solid livestock	1=Yes 0=No				□
	▪ With draw savings	1=Yes 0=No				□
	▪ Drop out children from school	1=Yes 0=No				□
	▪ Sold firewood	1=Yes 0=No				□
	▪ Sold charcoal	1=Yes 0=No				□
	▪ Money borrow	1=Yes 0=No				□
	▪ Food borrow from relatives	1=Yes 0=No				□
	▪ Food borrow from neighbors	1=Yes 0=No				□
	▪ Send children to work outside household	1=Yes 0=No				□
	▪ Sold crop stock	1=Yes 0=No				□
	▪ Send children to relatives	1=Yes 0=No				□
	▪ Migration to town	1=Yes 0=No				□
	▪ Migration to abroad	1=Yes 0=No				□
	▪ Consumed reserved seed for next	1=Yes 0=No				□
	▪ No coping response	1=Yes 0=No				□
	▪ Other coping strategies, specify					

A 2/. Household's major assets ownership (5 types of assets)

Instruction: In responding to the items below, please, use circle or "□" mark or write your responses as appropriate in the space provided

ASSET TYPE	Questions	Response option	Code
1.Human capital	44. Do you take any vocational training in the last two years?	1=Yes 0=No [SKIP TO NEXT]	□
	45. What are the reasons that make you not to take vocational trainings? (Multiple response is possible]	1=Training center is too far 2=Training is useless 3=Lack of information Other, specify…….	□
	46. Do you any special skill, other than farming?	1=Yes [SKIP TO NEXT] 0=No	□
	47. What types of skills do the household owned?		
	▪ Handcraft making	1=Yes 0=No	□
	▪ Trained local veterinary service provider	1=Yes 0=No	□
	▪ Local health provider	1=Yes 0=No	□
	▪ Others, specify		□
	48. Do you have any serious health problems in the last 12 months?	1=Yes (SKIP to next) 0=No	□
	49. If "Yes", please, list the types of health problems you have been facing in the last 12 months?	1…… 2…… 3……	□
	50. Generally, what is your perceived health status?	1=Extremely bad 4=Good 2=Bad 5= Extremely good 3=Average	□
	51. Which of the following physical capital do you own or get accessible?		
	Agricultural physical assets like:		

ASSET TYPE	Questions	Response option	Code
2.Physical capital	▪ Tractor	1=Yes 0=No	□
	▪ Combiner	1=Yes 0=No	□
	▪ Generator for irrigation use	1=Yes 0=No	□
	Durable consumer goods like:		
	▪ Television	1=Yes 0=No	□
	▪ Radio	1=Yes 0=No	□
Physical capital ..ctd	▪ Tent	1=Yes 0=No	□
	▪ Chair	1=Yes 0=No	□
	Public infrastructures like:		
	▪ Primary school	1=Yes 0=No	□
	▪ Health post	1=Yes 0=No	□
	▪ Water scheme	1=Yes 0=No	□
	52. How far is your residence from the nearest market?	1= Distant (greater than 20Km and above 2= Closer (less than 20Km)	□
	53. Do you own your livestock?	1=Yes (SKIP to next table) 0=No	□

54. Type of livestock household owned	Responses		55. Number of livestock owned	56. Equivalent value of livestock in Birr
▪ Goat	1=Yes	0=No		
▪ Ox	1=Yes	0=No		
▪ Horse	1=Yes	0=No		
▪ Local Cow	1=Yes	0=No		
▪ Cross breed Cow	1=Yes	0=No		
▪ Mule	1=Yes	0=No		
▪ Heifer	1=Yes	0=No		
▪ Calf	1=Yes	0=No		
▪ Sheep	1=Yes	0=No		
▪ Donkey	1=Yes	0=No		
▪ Bull	1=Yes	0=No		
▪ Chicken	1=Yes	0=No		
▪ Camel	1=Yes	0=No		
			Total=	Total=

ASSET TYPE	Question	Response option/space provided to write	Code
3. Social capital	57. Do you member of any social group in the kebele ?	1=Yes (SKIP to next) 0=No	□
	58. In which of the following social groups do you get participated in? (Multiple responses are possible	*1="Debo"* 4="*Equib*" 2="*Idir"* / 5=1 to 5 3= Mahber 6=SHG 7=I don't have	□
	59. How do you evaluate your level of participation in these social groups?		
	▪ Debo	1=Low 2=Medium 3=High	□
	▪ Idir	1=Low 2=Medium 3=High	□
	▪ Mahber	1=Low 2=Medium 3=High	□
	▪ Equib	1=Low 2=Medium 3=High	□
	▪ Self-help group	1=Low 2=Medium 3=High	□
	60. What kind of supports do you get from such social group during periods of shocks or crisis or challenges faced?		
	□ Farming in "*Dabo*"	1=Yes 0=No	□
	□ House construction	1=Yes 0=No	□
	□ Food/grain support	1=Yes 0=No	□
	□ Financial support	1=Yes 0=No	□
	□ Other support (write)		□

	61. Do you agree that the involvement of the household in social groups help improve the household's livelihoods?	5= Strongly agree 2=Disagree 4=Agree 1= Strongly disagree 3= Undecided	
	62. Are you member of the cooperative?	1= Yes (SKIP to next) 0=No	
	63. What is the name of the cooperative? (write)		
	64. What are some your benefits being member of cooperative?	1…….. 2…… 3…… 4…….. 5…….. 6…….	
4.Financial capital	65. Do you have any financial income?	1= Yes (SKIP to next) 0=No	
	66. What are the sources of your financial incomes (Multiple response is possible)?	1= House construction 2= Masonry work 3= Painting work 4= Monthly salary 5=Daily wage 6= Petty trade 7= Sell of trees 8= Sell of child labor 9= Rent of land 10= Rent/sell of machinery &equipment 11= Sewing 12= Sell of crop products (teff, barely ,maize) 13= Sell of livestock (Oxen, sheep, goat, hen) 14= Credit services	
	67. What is your total financial income in the last 12 months?	ETB……	
	68. For what purpose(s) you spent your financial incomes in the last 12 months? (Multiple response is possible)	1= Buy food 2= Social ceremony 3= Agricultural inputs like fertilizer 4 = Government tax 5= Family education cost 6= Family health cost 7= Small business Other, specify……..	
	69. Do you own financial saving?	1= Yes (SKIP to next) 0=No	
	70. Where did you have saved?(Multiple response is possible)	1= In own house 2= In the bank 3= In micro-finance	
	71. How much you have saved in the last 12 months?	ETB…….	
5.Natural capital	72. What is your agricultural employment status?	1= Employed in farming (SKIP to next) 2= Unemployed in farming	
	73. So, do have agricultural/farmland?	1= Yes (SKIP to next) 0=No	
	74. What are the source(s) of your agricultural farmland? (Multiple response is possible)	1= Inherited land from families 2= Shared with relatives 3= Through land redistribution 4= Sharecropped	
	75. What is the size of your land in hectare?(write)	……hectare	
	76. Do you face any constraints with your land in the last 12 months?	1= Yes (SKIP to next) 0=No	
	77. On your farmland, what are the major constraints you faced in the last 12 months?(Multiple response is possible)	1= Wildlife attack 5= Drought/water scarcity 2=Salinity 6= Frost 3= Waterlogging 4= High concentration of stones on the top soil	
78. In your opinion, what do you think that constrained/determined rural household's livelihood diversification (Multiple response is possible)		1= Lack of access to mass media 2=Urban linkage 3=Distance from town 4=Lack of training/skill development	
	A 3/. Livelihoods strategies		

79.	What is your livelihood primary occupation?	1= On-farm activities only (SKIP to 80) 2= Non-farm activities only (SKIP to 81) 3=Off-farm activities only (SKIP to 82) 4= On-farm + Non-farm activities 5= On-farm + Off-farm activities 6= Non-farm + Off-farm 7=On-farm + Non-farm+ Off-farm activities	
	A 4/. Livelihood activities		
80.	Which one of the following is your On-farm livelihood activity in the last 12 months? (Multiple response is possible)	1= Crop production (Teff, Maize, Wheat, Nouge, Bean, Barely) 2= Animal husbandry(cattle, sheep, Goat, Donkey, Horse) 3= Livestock products (Skimmed milk, Butter, Cheese) 4=Poultry production 5=Modern beekeeping	
81.	Which one of the following is your Non-farm livelihood activity in the last 12 months? (Multiple response is possible)	1= Non-agricultural activities(trading) 2= Handcraft activities(Weaving, Carpentry, House mudding) 3=Trading (grain, local drinks, soft drinks, small ruminants)	
82.	Which one of the following is your Off-farm livelihood activity in the last 12 months? (Multiple response is possible)	1=Wage employment: Sell of labor service to employer in exchange for wage or salary 2= Self- employment: Sell of labor services to oneself rather than working for an employer	
	A 5/. Household's major livelihood diversification constraining factors		
83.	What are the major constraining/limiting factors of rural household's livelihood diversification? (Multiple response is possible)	1= Lack of rural road network 2= Lack of rural transport facilities 3= Poor asset base 4= Lack of infrastructures 5=Lack of credit services 6= Lack of awareness 7=Lack of training	

B/. Migration as the source of livelihood diversifications

S/N	Question	Response option/space provided to write		Code
84.	Is there any household member migrated abroad?	1= Yes (SKIP to next) 0=No		
85.	Why he/she migrated abroad? (Multiple responses are possible):	**Push factors** **1=** Limited farm size to share 2= Climate change 3= Lack of irrigable land to share 4= Crop failure 5= Scarcity of food 6= Lack of agricultural employment 7= Political instability 8= Lack of non-agricultural employment 9= Lack of basic services 10= Lack of off-farm employments	**Pull factors:** **1=** Wages 2= Weather and climate 3= Infrastructures 4= Provisions of basic services 5= Job opportunities 6= Quality of life 7= Food and cloth security/supply 8= New technologies 9=Political stability	
86.	What kind of relationship do you have with the migrant?			
87.	In the last 12 months, what is the total remittances you received?	ETB……..		

88. Do you agree that, out-migration has a potential to reduce rural household poverty? (5) Strongly agree (4). Agree (3) Undecided (2) Disagree (1) Strongly disagree

C/. Rural household livelihood security (7 indicators)

Instruction: In responding to the items below, please, use circle or "□" mark or write your responses as appropriate in the space provided

Livelihood security indicators	Question	Response option	Code
1.Food security	89. Food in any kind is available to your families throughout the year [food availability dimension]	1= Yes 0=No (SKIP to 90-94)	□
	90. What is the frequency of food items consumed at household's home in the last seven days?(Multiple response is possible)		□
	▪ Injera (Grain)	1= Once/day 2= Twice/day 3= Three times 4= None at all	□
	▪ Bread (Grain)	1= Once/day 2= Twice/day 3= Three times 4= None at all	□
	▪ Wat (pulses)	1= Once/day 2= Twice/day 3= Three times 4= None at all	□
	▪ Oil (oil seeds or processed oil)	1= Once/day 2= Twice/day 3= Three times 4= None at all	□
	▪ Meat including chiken	1= Once/day 2= Twice/day 3= Three times 4= None at all	□
	▪ Milk	1= Once/day 2= Twice/day 3= Three times 4= None at all	□
	▪ Butter	1= Once/day 2= Twice/day 3= Three times 4= None at all	□
	▪ Egg	1= Once/day 2= Twice/day 3= Three times 4= None at all	□
	▪ Potato	1= Once/day 2= Twice/day 3= Three times 4= None at all	□
	▪ Vegetables(Tomato, Carrot, Kosta)	1= Once/day 2= Twice/day 3= Three times 4= None at all	□
	▪ Fruits (Orange, Banana,Avocado)	1= Once/day 2= Twice/day 3= Three times 4= None at all	□
	▪ Spices (Salt, Zinjibil)	1= Once/day 2= Twice/day 3= Three times 4= None at all	□
	▪ Beverages (Tella, Areke, Soft drinks)	1= Once/day 2= Twice/day 3= Three times 4= None at all	□
Food security …ctd	91. How often do you take meal & snack per day?	1= Always 2= Once per day 3= Twice per day 4= I don't have	□
	92. Which months of the year the household faced food shortage? (Multiple response is possible)	1= January 5= May 9= September 2= February 6= June 10= October 3= March 7= July 11= November 4= April 8= August 12=December	□
	93. What are the coping strategies for mitigating your family's food poverty? (Multiple responsible is possible)	1= Limited food 7= Borrowing from neighbor/relatives 2= No food at all 8= Working on other farms 3= Skip meal 9= Livestock disposal/ de-stocking 4= Sleeping hungry 10= Change cropping pattern 5= Children first 11= Migration to nearby towns for wage labor 6= Meal size reduction 12= Sell of small animals	□
	94. What do you think are the main reasons for being food insecure? (Multiple responses are possible):	1= Inability to produce sufficient grains 2= Inability to rear sufficient livestock 3= Meager financial incomes 4= Drought/shortage of rainfall 5= Shortage of farmland 6= Shortage of Oxen	□
2.Nutritional security	95. The quality of food available at household is good	1= Fully true 2= Partially true 3= Not true	□
	96. Number of children immunized?	1=Boys…….2=Girls…….3=Total……..	□
	97. Number of children breastfed?	1=Boys…….2=Girls…….3=Total……..	□
	98. Number of children undernourished?	1=Boys…….2=Girls…….3=Total……..	□
	99. Number of children under weighted?	1=Boys…….2=Girls…….3=Total……..	□
	100. Number of childen stunted/shortness?	1=Boys…….2=Girls…….3=Total……..	□
	101. Number of children wasted/thinness?	1=Boys…….2=Girls…….3=Total……..	□
	102. Any incidence of chronic diseases to household members in the last 12 months? (Multiple is possible)	1= Cough 2=Cold 3=Asthma 4= None of them	□
	103. Any incidence of specific diseases to household members in the last 12 months? (Multiple is possible)	1=TB 2=Diabetics 3= Heart problem 4= None of them	□

3.Health security	104. Any incidence of epidemic diseases to household members in the last 12 months? (Multiple is possible)	1=Malaria 2= Chickenpox 3= Typhoid 4=None of them	□
	105. Family who faced serious illness during the last 12 months received medical treatment in the health center?	1=Yes (SKIP to 106) 0=No (SKIP to 107)	□
	106. From where did you get money for medical treatment? (Multiple response is possible)	1=Request for payment free for treatment in government health 2=I have local community-based health insurance 3=Use reserved money	□
	107. If the household didn't go to medical institution for treatment, what are the reasons? (Multiple response is possible)	1=Absence of health center in the community 2= Lack of money to pay for health care 3= Lack of awareness about scientific health treatment 4= Lack of interest to visit health center Other, specify……	□
	108. Are there any family planning services available around your kebele?	1=Yes (SKIP TO NEXT] 0=No	□
	109. What are the family planning services available in the nearby health institutions?	1……. 4……. 2……. 5…….	□
4. Habitat security	110. What is your ownership status of the current house/dwelling?	1= Own house 2= Rented house 3= Given by relatives	□
	111. Are there toilet facilities in the house?	1=Yes 0= No	□
	112. Is there water supply to the house?	1=Yes 0= No	□
	113. Are there transport facilities to the house?	1=Yes (SKIP to 114) 0= No	□
	114. What type/means of transportation facilities available? (Multiple response is possible)	1=Horse 2= Mule 3= Donkey 4= Vehicle Other,specify…… ……..	□
5.Empowerment	115. Do you actively participated in any community services?	1=Yes (SKIP TO NEXT) 0= No	□
	116. What are the community services you actively participated?	1……4…….. 2……5……..	□
	117. Do you have access to organizations that offer services	1=Yes (SKIP TO NEXT) 0= No	□
	118. What are these organizations that offer services?	1……4…….. 2……5……..	□
	119. Do you participate in local planning process?	1=Yes (SKIP TO NEXT) 0= No	□
	120. What are these local planning processes you participated?	1……4…….. 2……5……..	□
6.Educational security	121. Household's family members education status?		□
	▪ Father	1=Illiterate 2= Primary 3= Junior 4= Secondary	□
	▪ Mother	1=Illiterate 2= Primary 3= Junior 4= Secondary	□
	▪ Son	1=Illiterate 2= Primary 3= Junior 4= Secondary	□
	▪ Daughter	1=Illiterate 2= Primary 3= Junior 4= Secondary	□
	122. Your children are getting good quality school education available	5= Strongly agree 2= Disagree 4= Agree 1= Strongly disagree 3= Undecided	□
	123. Higher education of your children is not affordable to family of the household?	5= Strongly agree 2= Disagree 4= Agree 1= Strongly disagree 3= Undecided	□
	124. You have limited access to information regarding educational opportunities for your children	5= Strongly agree 2= Disagree 4= Agree 1= Strongly disagree 3= Undecided	□
	125. Do any of your children stop his/ her studies as you cannot afford the cost of it?	1=Yes 0=No	□
	126. Do any of your children lack educational facilities?	1=Yes 0=No	□
	127. What is your employment status?	1= Regular 4= Retired 2= Seasonal 5= Daily laborer 3= Not able to work/handicap 6= Salaried worker	□

7.Occupational security	128. Do you have a job according to education?	1= Yes 0=No	□
	129. Do you satisfied with the present working environment?	1= Yes 0=No	□
8.Environmental security	130. What is the extent of environmental pollution in your kebele?		□
	▪ Soil pollution	1= Very much 2= Somewhat 3=Negligible	□
	▪ Water pollution	1= Very much 2= Somewhat 3=Negligible	□
	▪ Air pollution	1= Very much 2= Somewhat 3=Negligible	□
	▪ Soil erosion	1= Very much 2= Somewhat 3=Negligible	□
	▪ Ground water shortage	1= Very much 2= Somewhat 3=Negligible	□
	▪ Flood or drought prone condition in your farm	1= Very much 2= Somewhat 3=Negligible	□
	Availability of clean drinking water	1= Yes 0= No	□
	▪ Availability of irrigation water	1= Yes 0= No	□
	▪ Do you used inorganic fertilizer?	1= Yes 0= No	□
	▪ Do you participated in afforestation?	1= Yes 0= No	□
	▪ Do you used bio-pesticides(predatory, parasitic)	1= Yes 0= No	□
	▪ Do you adopted soil & water conservation practices?	1= Yes 0= No	□
9.Economic security . Water security	131. Embedded indicators in other section of items(please, turn over this item)		□
10.Community participation	132. In which of the following groups do you get participated?(Multiple response is possible)	1= Government organizations 2=Self- Help Groups 3=NGO groups 4=Tribal organizations	□

4.4. Rural households' access to agricultural extension services

Instruction: In responding to the items below, please, use circle or "□" mark or write your responses as appropriate in the space provided

S/N	Question	Response option					Code
133.	In the last 12 months, do you get access **to agricultural extension trainings**?	1= Accessed (SKIP to 134-137) 2=Non-accessed (SKIP to 138)					□
134.	How often the agricultural extension training was delivered in a year?	1= Once per year 2= Twice per year 3= More than twice /year 4= I don't know					□
135.	Where is the place of the agricultural extension training? (Multiple response is possible)	1=FTC 2= Kebele house 3=On farm 4= I don't know					□
136.	Do you agree that the agricultural extension training was useful?	5= Strongly agree 4= Agree 3= Undecided 2= Disagree 1=Strongly disagree					□
137.	What are the benefits did you get from such agricultural extension trainings? (Write)	1……..3…… 2……..4…….					□
138.	What are the major reasons/challenges that make you non-accessed to agricultural extension trainings?	1……...3…… 2……...4…….. 3……5……...					□
139.	What major problem/s your agricultural farm land do face? (Multiple response is possible)	1. Poor soil fertility 2. Soil erosion					□
140.	Do you accessed to **agricultural extension services** in the last 12 months?	1= Accessed (SKIP to 141-146) 2=Non-accessed (SKIP to 147)					□
141.	What are some of the agricultural extension services did you get accessed in the last 12 months?(Multiple response is possible) :	Response option		142. If "Yes", how often do you get access to these agricultural extension services?			Code
				Once/year	Twice/year	Three and above/year	
	▪ Provision of vaccine	1=Yes	0=No				□
	▪ Pest infestation	1=Yes	0=No				□
	▪ Weed control	1=Yes	0=No				□
	▪ Feeding technique	1=Yes	0=No				□
	▪ Weather problem	1=Yes	0=No				□
	▪ Modern agricultural /farm inputs	1=Yes	0=No				□
	▪ Credit services	1=Yes	0=No				□
	▪ Irrigation use	1=Yes	0=No				□
	▪ Dipping technique	1=Yes	0=No				□
	▪ Milking technique	1=Yes	0=No				□
	▪ Use of organic manures	1=Yes	0=No				□

	▪ New seed varieties	1=Yes	0=No				☐
	▪ Crop production	1=Yes	0=No				☐
	▪ Vegetables production	1=Yes	0=No				☐
	▪ Modern poultry production	1=Yes	0=No				☐
	▪ Modern beekeeping production	1=Yes	0=No				☐
	▪ Market linkage	1=Yes	0=No				☐
	▪ Adopted soil and/ or water conservation practices	1=Yes	0=No				☐
	▪ Modern dairy production	1=Yes	0=No				☐
	▪ Modern fattening [cow/shoat]	1=Yes	0=No				☐
	▪ Access to farmbook	1=Yes	0=No				☐
143.	What was the mode of delivery of agricultural extension services? (Multiple response is possible)	1=Training and visit system approach 4=Farming system approach 2=Farmer field school/FSS approach 5=Farmer-to-farmer extension/F2FE approach 3=Contract farming approach 6= Participatory extension approach/PEA 7= I don't know					☐
144.	Which of the following land management practice did the household carried out in order to maintain and replenish the soil fertility of such farmlands(Multiple response is possible):	1 Fallowing/field rotation 2. Crop rotation 3. Manuring 4. Use of chemical fertilizer 5. Inter-cropping Others, specify……..					☐
145.	Which of the following soil conservation practices the household carried out in order to maintain and replenish the soil fertility of such farmlands(Multiple response is possible):	1=Terracing 2=Tree planting 3=Soil or stone band 4=Furrowing 5= Contour ploughing 6= Strip cultivation					☐
146.	Which type of modern agricultural /farm inputs due get accessed during the past harvest years? (Multiple response is possible)	1= DAP 2=UREA Other, specify 1……. 2……. 3…….					☐
147.	Using the modern agricultural/farm inputs, what are the crops cultivated in the last harvest year? (Multiple response is possible	**Type & amount of Crops cultivated:** **Amount of fertilizer used:** 1. Teff…… quintal /year ……..Kg/hectare 2. Maize……..quintal/year ……..Kg/hectare 3. Wheat…. …quintal/year ……..Kg/hectare 4. Barely…....quintal/year ……..Kg/hectare 5. Bean……...quintal/year ……..Kg/hectare					☐
148.	What are the major reasons/challenges that make you non-accessed to modern agricultural extension services?						☐
	1. High fertilizer input cost	1= Yes	0= No				☐
	2. Lack of information	1= Yes	0= No				☐
	3. No FTC center in the village	1= Yes	0= No				☐
	4. Distance of FTC from own home	1= Yes	0= No				☐
	5. Lack of DAs	1= Yes	0= No				☐
	6. Crop production related challenges such as:						☐
	▪ Crop pests and disease	1= Yes	0= No				☐
	▪ Lack of rainfall	1= Yes	0= No				☐
	▪ Shortage of capital labor	1= Yes	0= No				☐
	▪ Shortage of land	1= Yes	0= No				☐
	▪ Shortage of capital labor and land	1= Yes	0= No				☐
	7. Livestock rearing related challenges such as:						☐
	▪ Lack of grazing land	1= Yes	0= No				☐
	▪ Lack of veterinary medicine	1= Yes	0= No				☐
	▪ Presence of animal disease	1= Yes	0= No				☐
	▪ Lack of drinking water	1= Yes	0= No				☐
	▪ Not reared livestock	1= Yes	0= No				☐
	8. Other reasons/challenges, specify	1…… 2…… 3…… 4……					☐
149.	Is there an agricultural extension input supply store around your kebele?	1= Yes (SKIP to next) 0= No					☐

150.	How far the agricultural extension input supply stores from your home?	1= Very close(less than 20Km) away from home 2= Very far (greater than 20-25 km)away from home	□
151.	Do you have access to telephone?	1= Yes 0= No	□
152.	Do you have access to internet in the field?	1= Yes (SKIP to next) 0= No	□
153.	Do you able to use internet?	1= Yes 0= No	□
154.	Do you have rearing experience?	1= Yes 0= No	□
155.	What is your perception towards agricultural technologies like fertilizer input use?	1= Strong perception 2= Medium perception 3=Weak perception (SKIP to next)	□
156.	Why weak perception?	1…… 2…… 3…… 4…… 5……..	□
157.	Is there FTC training in or around your kebele?	1= Yes (SKIP to next) 0= No	□
158.	Do you agree that the status of the coordination of FTC training is strong?	5= Strongly agree 4= Agree 3= Undecided 2= Disagree 1=Strongly disagree	□
159.	How do you judge the agricultural extension service delivery?	1=Participatory 2=Non-participatory	□
160.	Are there development extension agents in or around your kebele?	1= Yes (SKIP to next) 0= No	□
161.	What is the frequency of extension agents' visits to the households?	1= Everyday 2= Once/month 3=Twice/month 4=None at all	□
162.	Do you agree that the government support extension agents?	1= Strong support 2= Weak support 3= I don't know	□
163.	How do you evaluate the level of knowledge of DAs?	1=Knowledgeable 2=Limited knowledge 3= I don't know	□
164.	How do you evaluate the efficiency of agricultural extension system in the Woreda?	1= Strong delivery /effective system 2= Poor delivery/effective system (SKIP to next) 3= Don't know	□

165. Do you agree that the following challenges/problems affect the effectiveness of agricultural extension services to be delivered to the rural households? , where,

5. Strongly agree
4. Agree
3. Undecided
2. Disagree
1. Strongly disagree

Major challenges/problems affecting the effectiveness of agricultural extension services	**5 point response Likert scale**				
	5	**4**	**3**	**2**	**1**
FTC related challenges/problems					
▪ Limited involvement of farmers in FTC management					
▪ Insufficient resources for FTCs					
▪ Most FTCs have no long-term plans for sustainability					
▪ Lower salary level and fewer resources for field agricultural extension agents					
▪ Untrained and unequipped extension agents in the villages					
▪ Lack or less frequency of extension agents contact with rural households					
▪ Despite their role to support farmers, most extension agents view their role primary as distributing fertilizer and credit					
▪ Inadequate incentives to motivate and retain DAs					
Agricultural knowledge and information systems related challenges/problems					
▪ Unhealthy perception of farmers towards agricultural extension services					
▪ Poor utilization of ICT-based extension services					
▪ Limited access to improve agricultural knowledge, information and technologies					
▪ Public sector-based extension delivery approach. i.e. lack or limited number of private sectors					

Major challenges/problems affecting the effectiveness of agricultural extension services	5 point response Likert scale				
	5	4	3	2	1
▪ Ineffective dissemination of agricultural technologies					
▪ Weak links between agricultural research and farmers extension problems					
▪ Inadequate consideration to farmers needs and priorities in research agenda setting and extension package development					
▪ Delay or untimely provision of extension services					
▪ Low education level of farmers					
▪ Limited access to knowledge and information on agricultural risk management					
Farmers oriented and multi-actors' extension services related challenges/problems					
▪ Limited involvement of different stakeholders in the provision of extension services					
▪ Low cooperation and collaboration between public and NGOs in extension services provisions					
▪ Poor involvement of cooperatives in extension service delivery					
Market linkage and value chain development related challenges/problems					
▪ Insufficient understanding of market-oriented production system					
▪ Limited focus on strategic commodities in the extension services					
▪ Limited knowledge and skills of extension staff to facilitate value chain development,					
▪ Ineffective linkage among value chain actors					
▪ Limited access to market information and collective marketing,					
Gender, youth and nutrition mainstreaming related challenges/problems					
▪ Poor gender and youth mainstreaming in extension programs planning, implementation and in monitoring, learning and evaluation					
▪ Shortage of gender disaggregated data,					
▪ Socio-cultural constraints					
▪ Inadequate nutrition sensitive extension service,					
Environmental management and sustainability related challenges/problems					
▪ Poor linkage between natural resource management and livelihood strategies,					
▪ Limited capacity on environment and Natural Resource Management					
▪ Low access to and use of climate smart agricultural technologies and agro-metrological information					
▪ Less attention to environment sustainability in the extension advisory service,					
Institutional arrangements, coordination and linkages among key agricultural development partners related challenges/problems					
▪ Lack of vibrant linkage and poor alignments					
▪ Lack of coordination and communication between agricultural sectors and HLIs/ATVETs					
▪ Weak responsibility and accountability system in linkage platform.					
Human resource development related challenges/problems					
▪ Limited demand based training at HLIs and ATVET,					
▪ Poor staffing and high staff turnover					
▪ Lack of clear chain of command.					
Monitoring, evaluation and learning related challenges/problems					
▪ Weak monitoring, learning and evaluation system					
▪ Weak accountability and responsibility system are identified as a measure bottle					

Source: (Qamar, 2005; Moris, 1991; Asfaw *et al*., 2012; MAFC, 2007; Abdullah & Samah, 2013; MoA, 2017)

166. Do you agree that the following support mechanisms/strategies ensure the effectiveness of agricultural extension services, thereby; rural households get out of poverty and enhance their livelihoods? where,

5. Strongly agree
4. Agree
3. Undecided
2. Disagree
1. Strongly disagree

Support mechanisms/strategies to ensure the effectiveness of agricultural extension services, thereby; rural households get out of poverty and enhance their livelihoods	**5 point response Likert scale**				
	5	**4**	**3**	**2**	**1**
▪ Empower extension workers					
▪ Working towards gender equality /gender transformative approach in agricultural extension services					
▪ Building agricultural extension services on food security dimensions					
▪ Improving the availability of diverse, nutrient-dense and market –oriented foods					
▪ Improving access to diverse diet					
▪ Safeguarding stability					
▪ Optimal utilization of nutrients					
▪ WASH services					
▪ Pluralistic and need-based agricultural extension services					

Source: (Qamar & Crower, 2001; Melapit & Quisumbing, 2015; FAO, 2006; FAO, IFAD & WFP, 2013; SPRING, 2016)

=== THE END ===

THANK YOU SO MUCH ONCE AGAIN FOR YOUR VALUEABLE TIME AND ENERGY

GOD BLESS YOU!!

Annex C: Household unstructured interview (Participatory Poverty Analysis/PPA):

Households' perceived concepts of poverty and who is poor

ADDIS ABABA UNIVERSITY COLLEGE OF DEVELOPMENT STUDIES
CENTER FOR RURALDEVELOPMENT PHD PROGRAM

Dear participant of the in-depth interview,

The main objective of the study is to undertake "assessment of the status and determinants of rural household's poverty, livelihoods, and access to agricultural extension services in Jimma Geneti district" for the partial fulfillment of PhD dissertation in development studies/rural development. As the data collected through this in-depth interview is only for academic purposes, you have to be certain that there will be no part or whole of your specific personal data, ideas, and opinion will be shared to others. Also, no any *photography, filming and tape recording* rather than filed notes taking. It will be strictly confidential and feel free for the whole interview.
Concerning the parts of this interview guide, there are eight major parts and corresponding sub-parts as presented next:

Part 1: Interview procedures:
The interview procedures will follow the following steps:

1. Introducing the interviewee, so that, the interviewer has to be sure that gets the trust
2. Introducing the objective (academic) and time (1:30-2.00 hours) of the interview
3. Date and place of the interview will be as convenient to the interviewee
4. Collecting primary data from the interviewee
5. Thanking the interviewee

Part 2: Identification

6. Date of the interview ……...
7. Place of the interview……
8. Time of the interview: Start……..End…….
9. Interview code……...
10. Agro-ecology/farming system where the household is located? Please, describe it

    - Highland (where there are no Teff & Maize production in the kebele)
    - Plain area (there are Teff & Maize production in the kebele)
    - Coastal area of Fincha'a Lake (there are Teff, Maize & fishing production in the kebele/island)

11. Kebele of the household……..

Part 3: Interviewee's basic personal information

12. Are you heading the household?
13. Please, briefly describe about your self
14. Sex (Researcher: just observe)
15. Age of the household.....
16. Total number/family size of household members including household head) Male--- Female----Total------
17. How about your marital status of the household?
18. What is your educational level?
19. What about your literacy status?
20. Your religion?
21. Ethnicity?

Part 4: Rural households' poverty: for comparison of MDP and PPA results

1. Conceptualize poverty
2. Identification of the poor

Annex D: Household Interview Checklists (semi-structured interview

Construction of participatory poverty index (PPI)

ADDIS ABABA UNIVERSITY
COLLEGE OF DEVELOPMENT STUDIES
CENTER FOR RURALDEVELOPMENT
PHD PROGRAM

Dear interviewee,
My name is Tariku Kassa. I am PhD candidate at Addis Ababa University. This study will devote itself to investigate *"The determinants of rural households' poverty, livelihoods, and access to agricultural extension services in Jimma Geneti Woreda"* in partial fulfillment of the degree of Doctor of Philosophy in development studies (rural development). The interview guide has three major parts: **First** part is about identification/code; **Second** part is about demographic and socio-economic data; and **Third** part is about interview (both semi-structured and unstructured) guides. The information to be collected through this interview will be used strictly for academic purposes and highly confidential. Therefore, I kindly request you to discuss to all interview checklists frankly and honestly? Thank you in advance for your valuable time.

PART I: IDENTIFICATON

Instruction: the interviewer /researcher himself is reminded to use "□" mark or circle the options or write interviewees views as appropriate. Also, note that the details interview result (corpus data) could be captured on separate **field note**

S/N	Question	Response	Plus field notes
50.	Date of the data collection		
51.	According to agro-ecology/farming system, where you located?	5. *Highland* (where there are no Teff & Maize production in the kebele) 6. *Plain area* (there are Teff & Maize production in the kebele) 7. *Coastal area* of Fincha'a Lake (there are Teff, Maize & fishing production in the kebele/island)	
52.	What is your kebele?		

PART II: DEMOGRAPHIC AND SOCIO-ECONOMIC CHARACTERSTICS OF THE INTERVIEWEE

Instruction: the interviewer /researcher himself is reminded to use "□" mark or circle the options or write interviewees views as appropriate. Also, note that the details interview result (corpus data) could be captured on separate **field note**

S/N	Question	Response	Plus field notes
53.	Are you the head of the household?	1= Yes 0= No	
54.	What is your sex?	1= Male 0=Female	
55.	What is your age?	1. Less than 35 years old 2 35-64 years old 3 64+ year	
56.	What is the total number of family size including you?)	1. Less than 4 family size 2. 4-8 family size 3. 8+ family size	
57.	What is your marital status?	1= Single 4=Widowed 2=Married 5=Separated 3=Divorced 6=Polygamy	
58.	What is your completed education level?	1=Never attain any school 2=Primary 3= Secondary 4= Above secondary	
59.	What is your religion?	1= Waaqeffataa 3= Muslim 5=Catholic 2= Orthodox 4= Non-follower 6= Protestant	
60.	What about your ethnicity?	1=Oromo 3= Tigeray 2=Amhara 4=Other, specify……	
61.	Do you own your livestock?	1=Yes (SKIP to item 13-15) 0=No	

62. Type of livestock household owned	Responses		14. Number of livestock owned	15. Equivalent value of livestock (ETB)
Goat	1=Yes	0=No		
Ox	1=Yes	0=No		
Horse	1=Yes	0=No		
Local Cow	1=Yes	0=No		
Cross breed Cow	1=Yes	0=No		
Mule	1=Yes	0=No		
Heifer	1=Yes	0=No		
Calf	1=Yes	0=No		
Sheep	1=Yes	0=No		
Donkey	1=Yes	0=No		
Bull	1=Yes	0=No		
Chicken	1=Yes	0=No		
Camel	1=Yes	0=No		
			Total=	Total=

S/N	Question	Response	Plus field notes
16.	What is your agricultural employment status?	1= Employed in farming 0= Unemployed in farming	
17	What is the size of your land in hectare?	1= less than 0.5 hec, 2= 0.5-1 hec, 3=1-1.5hec, 4= Greater than 1.5 hec	
18	Is there any household member migrated abroad who send you a remittance?	1= Yes 0=No	
19	Do you own financial saving?	1= Yes 0=No	
20	Do you get accessed to credit service in the last 12 months?	1= Yes 0=No	
21	Do you get accessed to agricultural irrigation in the last 12 months?	1= Yes 0=No	
22	Are you member of the cooperative?	1= Yes 0=No	
23	In the last 12 months, do you get access to agricultural extension trainings?	1= Yes 0=No	

PART III: SEMI-STRUCTRED INTERVIEW GUIDE

Instruction: the interviewer /researcher himself is reminded to use "□" mark for interviewee's views . Also, note that the details interview result (corpus data) could be captured on separate **field notes**

Type of poverty (Dimension)	Poverty recognition (Indicators)	SDG AREA	Question	Responses		Plus field notes
				Yes	No	
	Mortality/animal		24 In the last five years, do you lost any animal due to animal diseases?			
	Vaccination/animal		25You have animal non-accessed to vaccination?			
Education	Drop-out	SDG 4	26 You have child drop-out of primary education?			
	Higher education		27 You have no child joined & completed from higher education institution/HEI?			
	IFAL		28 You are non-accessed to integrated functional adult literacy/IFAL?			
Living standard	Drinking water	SDG 6	29 You do not have access to improved drinking water?			
	Sanitation		30 You have been practicing open defecation (No latrine)?			
	Electricity	SDG 7	31 You don't have rural electric supply?			
Livelihood	Shock	SGD 2 SDG 1	32 In the last five years, do you face input price increase (seasonality)?			
	Extension service		33 You are non-accessed to any form of extension service?			
	On-farm livelihood		34 No member of your household involved in fishery production?			
	Migration		35 In the last five years, a household member subjected to human trafficking?			
Empowerment	FGM	SGD 5	36 Your daughters are subjected to female genital mutilation?			
	Physical violence		37 Your spouse subjected to physical violence?			
	Decision making		38 You are non-participatory in decision making on common property with spouse?			
Environments	Deforestation	SDG 11	39 In the last five years, do cut trees for charcoal, fire-wood, farm tool, & house construction?			
	Conservation		40 In the last five years, you are not practiced in soil and water conservation practices on own farmland?			

Thank you!

Annex E: Household focus group discussions (Participatory Poverty Analysis/PPA):

Households' perceived determinants of poverty

ADDIS ABABA UNIVERSITY COLLEGE OF DEVELOPMENT STUDIES
CENTER FOR RURALDEVELOPMENT PHD PROGRAM

Dear interviewee,

Thank you in advance for your valuable time. Thank you in advance for your valuable time.

My name is Tariku Kassa. I am PhD candidate at Addis Ababa University. This study will devote itself to investigate *"The determinants of rural households' poverty, livelihoods, and access to agricultural extension services in Jimma Geneti Woreda"* in partial fulfillment of the degree of Doctor of Philosophy in development studies (rural development). The focus group discussion/ participatory scoring matrix/PRA 10 seeds technique of the current study followed the following procedures:

1. List of Focus Group Discussions/FGD: Twelve rural households (one from each kebele) assumed to have comprehensive knowledge of their local area context are purposively sampled. From the outsiders (FGD facilitator/researcher and FGD note taker/assistant researcher joined the FGD participants. The latter two FGD have no control on the process except facilitation role,
2. Brain storming: Once the blessing of the elders is made and ground rules of FGD are set by the FGD participants, based on their local context, FGD facilitator/researcher asks FGD participants to identify causes/determinants of rural household's participatory poverty and FGD note take/assistant researcher write the list of causes,
3. Score for each determinants: FGD facilitator/researcher asks each FGD participant to provide score for each determinants across developed measurement indicators (eg. prevalence or severity). Table… is used for the same purpose,

Table: FGD 10-seed technique for PPA of prevalence & severity of rural poverty

Where,

- 5 (Strong sever),
- 4 (Sever),
- 3 (Undecided),
- 2 (Not sever), and
- 1(Strongly not sever),

Table : Sample table for PPA participants result on the prevalence/severity of rural poverty in the study area

Determinants	Prevalence or severity of perceived rural poverty							
	5	4	3	2	1	Total scores	Mean score	% of mean score

Source: Sample table adopted from Melaku (2016)

4. Adding scores (total scores, mean scores and % of mean scores: FGD facilitator/researcher and FGD note taker/assistant researcher quickly add the scores provided by all FGD participants.

Notes:

- Total scores = sum total of score provided by 12 FGD participants,
- Mean score is

$$\text{Mean score} = \frac{\text{Total score}}{\text{Number of score providers, i.e } 12}$$

- % of mean score from the maximum score out of 5 point (see, Melaku, 2016), and

5. Collective discussion on major determinants: FGD facilitator/researcher asks FGD participants to collectively discuss on the major determinants which the FGD participants provide highest scores: any comments are well-come! Note: The more the determinant scored the highest its degree to determine poverty status

STEP 3 consensus building, lessons & closure of participatory qualitative data collection and analysis: To get the consensus of the FGD participants, the current study followed the following two additional short procedures:

6. Consensus building & lessons: FGD facilitator/researcher asks FGD participants for the consent and approval of the FGD results on the status (STEP 1) and determinants (STEP 2) of rural poverty analyses using participatory poverty analysis (PPA) and

7. Lessons learnt and closure of the FGD: Lessons learnt from FGD exercise by participants are also captured. Finally, FGD facilitator/researcher asks elders for pray and notify END OF FGD exercise, FGD note taker submit the FGD outputs to the researcher. THANK YOU SO MUCH!