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Research Article

Understanding the root causes of livelihood vulnerability in Ethiopia's rural households: an empirical study to inform policymakers

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Abstract

This study applies the Sustainable Livelihoods Framework (SLF) as an analytical tool to assess the root causes of livelihood vulnerability with special emphasis on four rural districts of Ethiopia. A multi-stage sampling is used to collect cross-sectional data from 471 households through self-administered questionnaire. Livelihood Capacity Index (LCI) is constructed from five livelihood capitals to estimate households' livelihood vulnerability. The study finds majority of rural households with below-average LCI due to limited access to physical and natural capitals; education, healthcare, and agriculture services, drought-prone location, limited access to irrigation, and weak community-based networks are revealed as the root causes for livelihood vulnerability. Finally, this study suggests integrated livelihood capacity building efforts and expansion of the scope and efficacy of public interventions as policy measures.

Keywords: Rural households, livelihood assets, livelihood vulnerability, public policy

1. INTRODUCTION

Social vulnerability encompasses the socio-economic and demographic factors that affect the resilience capacities of a society (Chambers, 1989; Adger, 1996; Lawaland Arokoyu, 2015). Similar to social vulnerability, livelihood vulnerability can be operationalized as the inability of households to withstand adverse impacts from multiple stressors to which their lives and livelihoods are exposed. In a normal circumstance, livelihood vulnerability can adversely affect rural households who have limited access to livelihood assets. In economic perspective, poverty is generally recognized as one of the most important causes of livelihood vulnerabilities because the

poor tend to have lower coping capacities than the rest of the population and thus bear a disproportionate burden of any shocks (Nuruzzaman, 2016). However, vulnerability makes poverty principally painful and difficult to escape (Sisay et al., 2016). According to Sisay et al., (2016), unlike poverty, vulnerability reflects households' future prospects and it is an ex-ante anticipation of the household's welfare. Understanding vulnerability helps practitioners and policymakers to better understand future trajectories for different groups, and thus design and target public interventions effectively (Moret, 2014). Dercon (2001) reveals that poverty is measured at a point in time, as 'a snapshot', but vulnerability is essentially forward-looking, using the information at a particular point in time. The magnitude to which rural households are rich in their own and common livelihood assets determines their ability to recover from the pains of livelihood vulnerability. Nevertheless, to a predominantly rural society where their economic life is fully intersected with agriculture; neither sustaining once livelihood assets nor recovering from adverse livelihood vulnerability is an easy process. The International Labor Organization estimates that of the total employment, agriculture remains the largest (59%) employer in Sub-Saharan Africa (McCullough, 2015). Even, in case of Ethiopia, the actual percentage of the labor force engaged in agriculture is much higher at 85% (Mohajan, 2013). According to the World Bank (2013) report, over the past six decades, Ethiopia has been susceptible to El Niño-driven drought which occurs every ten years. Serious droughts and often famine, either widespread or localized, have happened several times and affected millions of people.

Though Ethiopia owns the potential of arable land, millions of livestock, potential rivers for irrigation, and massive labor resources; it is yet clustered among the least developed countries. About 29% of its population was still living below the national poverty line. The UNDP's HDI (2011) ranks Ethiopia 174th out of 187 countries, a slight improvement over 2003 (Prunier and Ficquet 2015). Over 7.8 million people are food-insecure (Sabates and Devereux, 2018). In the fiscal year of 2018/19, USAID's Office of Food for Peace targeted more than 9.35 million Ethiopians who are under urgent need for food and nutrition assistance (Anderson and Elisabeth 2015). Political instability is additional challenge aggravating the size of the insecure population. The Global Report on Internal Displacement (2019) indicates that since mid-2018, the proportion of internally displaced persons have grown over 2.9 million as a result of droughts, flooding, and inter-communal conflicts or combination of these factors. Despite remaining a low-income country, Ethiopia has made significant strides in reducing poverty through a combination of rapid

economic growth, fiscal policy, and significant investment in pro-poor sectors such as education, agriculture, and health (Anderson and Elisabeth, 2015). However, rural inhabitants suffer most due to limited access to basic social services and economic infrastructures such as education, health, veterinary service, and safe water. As a result, the multidimensionality of livelihood vulnerability has been devastating to the rural economy for centuries.

As far as the scope of vulnerability analysis, previous studies have been assumed livelihood and social vulnerability as a sector-wise challenge and special emphasize is given to particular risk and livelihood insecurity. What looks to be missing from related studies conducted on vulnerability to-date is that linking the concept of livelihood vulnerability to public policy. Factors related to social protection services which were ignored in previous studies are determined as elements of social determinants to estimate their contribution on mitigating livelihood vulnerability. Likewise, to address the limitations observed on identifying the root causes of livelihood vulnerability, this study focuses on assessing the livelihood capacity and state of livelihood vulnerability of rural households. Assessing the causes of livelihood vulnerability is the principal step for immediate policy intervention and can serve as a planning tool during the policy-making because livelihood vulnerability signals the evidence to develop a particular public intervention. The root causes of livelihood vulnerability may diverge according to the nature of livelihoods where the lives of rural households are rooted. A livelihood comprises the capabilities, assets including both material and social resources and activities required for a means of living (Chambers and Conway, 1992; IDS, 1996). In this case, livelihood assets can empower households' ability to respond against the causes of livelihood vulnerability and other extreme risks. As the ability to respond to livelihood vulnerability depends on households' livelihood capacity, this paper seeks to examine the root causes of livelihood vulnerability that obstruct households' access to livelihood assets.

The main objective of this study is to assess the root causes of livelihood vulnerability among rural households. To achieve this, the study examines the livelihood capacities of these households, explores the underlying factors driving their vulnerability, and analyzes how these factors interact and relate to one another.

2. MATERIALS AND METHODS

2.1. Description of the study area

Tigray is an autonomous region of Ethiopia neighbored by Eritrea to the north, Sudan to the west, Afar Region to the east, and Amhara Region to the Southern direction. This region has been the

front of many internal and external wars in the history of Ethiopia. The target study area, Eastern zone is among the seven administrative zones of Tigray which is surrounded by the Afar region on the East, South-Eastern Zone on the South, Central Zone on the West, and Eritrea on the North. The Population and Housing Census report projected the population of Eastern Zone to be 755,343, with rural share 80.2% and urban share 19.8% in the total population (CSA, 2013). The climate of this Zone is classified into High-land representing 73.4 %, Mid-land 12.6% and low-land 14% of the geographical area. The altitudes of the area range from 1500 – 3200 Meters above sea level and the average annual rainfall ranges from 400 - 800mm (Desalegn, 2013). In comparison to other Zones, Eastern Zone is found naturally drought-prone (Gebru et al., 2018) and has limited farming land. Moreover, the socio-economic situation of this Zone has been distressed for over 20 years due to cross border conflicts and nearby geopolitical instability with Eritrea. Besides, the environment is characterized by unsuitable farming land, deforestation, and less soil fertility. In this environment, the farming system is traditional and rains mainly start from June and end in mid of September.

2.2. Research Methods

This study adopts a multistage sampling method to decide the geographic, administrative location and the target population (Bryman, 2016). Four districts were purposefully selected using a cluster sampling to collect primary data from rural households. A proportionate probability sampling method was employed at *Kebele* level to select 471 target participants. In a multi-stage sampling technique, the sample size was calculated following the equation (Equ. 1) suggested by Bryman (2016).

$$n = \frac{N{Z_{\alpha/2}}^2 P(1-P)}{e^2(N-1)+{Z_{\alpha/2}}^2 P(1-P)} \quad \text{.....Equ. 1}$$

where, n = for sample size, N = Population size, Z = confidence level (95% or 1.96 Z score), e = sampling error and P = proportion of population (0.5) and ${Z_{\alpha/2}}^2$ is the critical value of normal distribution at $\alpha/2$ (for a confidence level of 95%, α is 0.05 and the critical value is 1.96) (Bryman 2016).

According to the conceptual framework of this study, constituents of rural livelihoods comprise not only income but also public institutions, gender relations and property rights necessary to support the rural households. Therefore, the role of selected public institutions in supporting rural households is systematically appraised. The study adopts a multi-facet approach where qualitative and quantitative research methods are used in combination. It particularly proceeds through convenience sequences such as assessing households' demographic profile, measuring livelihood

assets and conducting resilience analysis to explore the root causes of livelihood vulnerability at the household level.

The socioeconomic tendencies and households' access to basic social services are aggregated using mini-max normalization procedure. Information related to livelihood assets is averaged, weighted, and converted into livelihood indices using statistical formulas to measure rural households' access to livelihood assets. Under the SLF, households' human, social, physical, financial and natural capitals are measured as livelihood assets. A total of 21 indicators and 31 sub-indicators of livelihood assets are collectively aggregated into five capitals and then indexed into Livelihood Capacity Index. To measure these livelihood assets, a sequential process such as indicator selection, selection of analysis scale, assessment of indicator measurement error, data normalization (UNDP, 2010), scaling, weighting, and aggregation assumed by Eric (2014) is followed (Equ. 2).

$$\mathbf{VI} = \frac{\mathbf{Vi - Xmin}}{\mathbf{Max - Xmin}} \quad \text{..... (Equ. 2)}$$

Where, VI: Indicator score I, vi: Original score value of an indicator I (I = 1, 2, 3 …), Xmin: the lowest values, and Xmax: the highest value obtained from the households.

In addition to that, the following linear equation to calculate LCI (Equ. 3).

$$\boldsymbol{LCI} = \frac{\sum_{\mathbf{i=0}}^{\mathbf{N}} \mathbf{SCi} * \mathbf{ni}}{\mathbf{N}} \quad \text{..... (Equ. 3)}$$

Where, LCI: Livelihood Capacity Index, SCi: score of sub-component (capital i), ni: number of indictors in sub-component I, and N donates to the five livelihood capitals. In this case, LCI is ranged between zero and one denoting most and least vulnerable, respectively.

2.3. Theoretical Framework

In the evidence-based culture of policy-making, Sustainable Livelihoods Framework (SLF) is a multidimensional framework that guides policy-makers to make a rational decision (DFID, 1999). Unlike the SLF shown in Figure 1, the Sustainable Rural Livelihoods (SRLF) determines agricultural intensification, livelihood diversification, and migration as major livelihood strategies. Likewise, both SLF and SRLF have slight similarities as social vulnerability is a fundamental concept to human-environment studies (Rygel, 2006) and depends on the nature of the risk and community's resilience capacity to respond in both frameworks.

Unlike other frameworks, the SLF which adopted as the analytical framework to this study connects livelihood vulnerability, livelihood assets, public policy, and livelihood outcomes

together. On the left side of the framework, the vulnerability context that involves both internal and external factors is shown to analyze the root causes of livelihood vulnerability. Literarily, vulnerability context is assessed in terms of any extreme shocks that happened due to economic, social, political, and environmental factors changed on related trends and seasonality. The pentagon shows the key factors affecting the choice of livelihood strategies where the livelihood capacity of households is rooted. In connection to the conceptual linkage between SLF and public policy, Brock, (1999) argues that the conceptualization of assets can expand the way households describe important elements of their livelihoods, into the language of policymakers and the framework has a robust focus in public institutions where demand-driven policies are transformed into action. Access and entitlement to the livelihood assets are governed by local institutional processes that extend beyond those of the national government and its legal frameworks (Rahman and Hickey, 2020). Likewise, LCI measures the outcome of livelihood assets which would be used further to evaluate the impact of policy intervention on sustaining rural livelihoods.

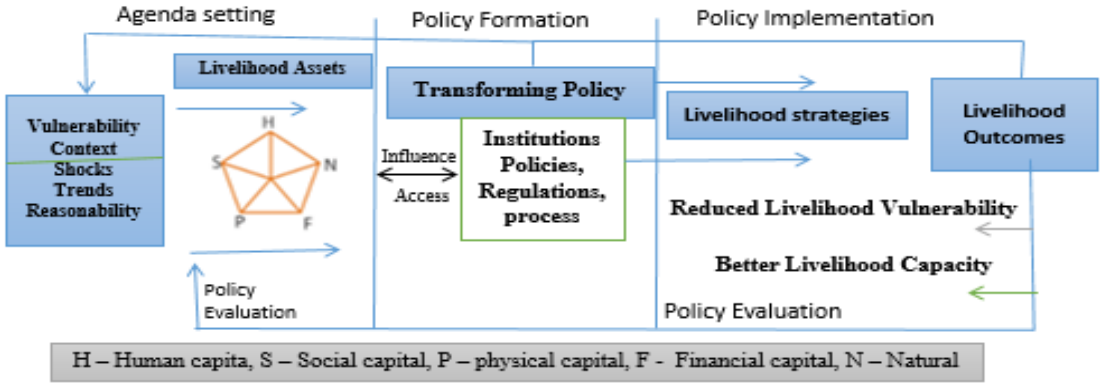


Figure 1. Sustainable Livelihood Framework (SLF). Adapted from Carney, 1998; DFID, 1999, and 2008

There is an increasingly urgent need for a more holistic understanding of livelihood vulnerability to meaningfully inform local decision-making (Rahman and Hickey, 2020). In line to the major development pillars of the national rural development policy and strategy of Ethiopia, the SLF shows the ultimate policy outcomes to mitigate livelihood vulnerability. Rural households are the primary source of information to apply SLF at every phase of public policy-making. The SLF emerged as a means for a more effective and relevant poverty reduction strategy through understanding poverty from the perspective of the poor (Neely et al., 2004). Moreover, the Food and Agriculture Organization of the United Nations has built upon the SLF to find ways and means to improve the sustainable livelihoods of rural dwellers.

3. RESULTS AND DISCUSSIONS

3.1 Demographic profile of households and family members

Regarding the gender of household heads, 362 respondents reported that their households were male-headed, while the remaining 109 were headed by females. A majority of household heads (70.3%) were married, whereas 9% were unmarried and 13% were divorced. Among the surveyed heads of household, about 56% had attended primary school and 44% were illiterate. Nuruzzaman (2016) highlights the importance of education in understanding new adaptation technologies, accessing warning information, and improving resilience and recovery. Thus, illiterate household heads are likely to have limited access to new technologies and information. The average family size of male-headed households was 5.12 persons, compared to 4.86 persons in female-headed households. The age of household heads ranged from 27 to 82 years, with an average of 47 years. Both the family size and age distribution align with the findings of the Ethiopian Rural Socioeconomic Survey conducted by the CSA (2013), which reported national and regional average household sizes of 5.1 and 4.8 persons, respectively.

The target respondents were requested to provide the gender, age and educational profile and current location of their household members. Concerning their education profile, while 208 and 264 members were found under the age of less than 7 years and illiterate respectively, the majority of household members were ever enrolled in modern education and reached up to the university level. Even though the majority of members were living with their family, a significant proportion of family members such as either father, mother, brother, or sister left their home or country for different purposes. Among these, while 191 members were living in some parts of Ethiopia for employment, military service, education and other purposes, 75 members have been living out of Ethiopia for different reasons during the time of the survey.

3.2. Socio-economic Aspects

The pioneer researchers (Dye, 1976; Easton, 1965) in their system model of policy analysis argue that the socio-economic character of a society determines the nature of the political system, which in turn is responsible for policy-making (Cook and Scioli, 1972). In this study, socio-economic status, which determines the livelihood capacity of households, is used to address the livelihood vulnerability. As socio-economic factors, physical infrastructure, estimated annual income from off-farm and on-farm activities, household assets, ownership of livestock, access to farming land

and treated water, accessibility to rural credit, and membership of community-based social networks are presented and discussed in this sub-section.

3.3.Location

Households located far from main roads or towns generally have limited access to markets and basic public services, which are typically concentrated in administrative centers. As shown in Table 1, households in Irob and Hawuzen districts are relatively distant from major roads and towns, resulting in higher average transport costs. In Gulo Mekeda, respondents reported spending at least 30 birr on transport when available, or otherwise traveling about 40 km to reach the nearest town. Among rural households, 45% traveled to town on foot, likely due to short distances, limited transport options, or inability to afford transport costs. Regardless of their ability to pay, greater distance from roads and towns increases the likelihood of vulnerability due to unequal access to essential public services.

Table 1. Access of the Rural Households to Roads and Towns

Item	**Location (District)**							
	Irob		Ganta Afeshum		Gulo Mekeda		Hawuzen	
	Max	Min	Max	Min	Max	Min	Max	Min
Distance from home to the road in KM	31.00	.20	21.0	.03	24.0	.25	27.0	.20
Distance from home to the town in KM	36.00	1.00	22.0	.02	30.0	2.00	22.0	1.0
Average Transport cost in Birr	25.0	.0	26.0	.0	30.0	.0	22.0	.0
Mode of transport	N	%	N	%	N	%	N	%
On foot	54	47.0	57	54.3	48	35.3	9	7.8
By minibus	61	53.0	46	43.8	88	64.7	105	91.3

Table 2 presents the average distance to public institutions in kilometers and measures how long the rural households of Eastern Zone had to travel to get basic public services. Across these rural districts where the survey was conducted, the respondents from Irob travel a long distance to get basic services from bureau of labor and social affairs and bureau of agriculture while households living in Gulo Mekeda are forced to travel nearly 12.9 km seeking healthcare services and the household members (students) traveled at least 15 km to reach primary schools. Distance from home to health centers and home to schools have a direct impact on the health and education affairs of the community. If secondary schools are not available nearby, students are forced to discontinue their education more often due to lack of accommodation and excess of seasonal farming activities.

According to the information obtained through key informant interviews from the education sector, long home to school distance is observed as the principal reason to increase dropout statues of students in both elementary and secondary schools.

Table 2. Physical Infrastructure of Rural Households

Average Distance to	**Location**				
	Irob	Ganta Afeshum	Gulo Mekeda	Hawuzen	Aggregate
Bureau of LSA in Km	19.53	8.34	11.82	9.56	12.3
Bureau of agriculture in Km	15.97	4.82	7.76	8.39	9.2
Health center	8.00	4.74	12.98	6.62	8.0
Elementary school	6.42	4.62	15.14	5.09	7.8
Secondary school	11.85	7.83	20.25	6.64	11.6

3.4.Livelihoods and Sources of Income

Rural households have to use available cereal products, livestock and other assets as a source of income to realize their livelihood goals. The average annual income presented in Figure 2, is the sum of estimated annual income earned from various sources mainly from off-farm activities such as wage, monthly salary, remittance, pension, and trade; livestock such as the estimated value of oxen, cows, goats, sheep, donkeys, and mules, cereal products such as the estimated value of barley, maize, sorghum, *taff*, pules and vegetables; public work or direct support of the government. The total annual income is divided by the household size to compute the per capita income of each household member. Hence, during the time of this survey, the highest average annual income (54,545.8 Birr) and average annual income per household member (4,490 birr) were likely earned by those households located at Ganta Afeshum. Of most respondents located in all districts, livestock and cereal products were found to be the major sources of income. These diversified sources of income determine the ability of households to sustain their livelihood assets. The SLF defines livelihoods as the capabilities, assets and activities required for a means of living. It can be concluded from the data shown in Figure 2 that livestock, cereal products, off-farm activities and government support are the main sources of livelihood assets of rural households.

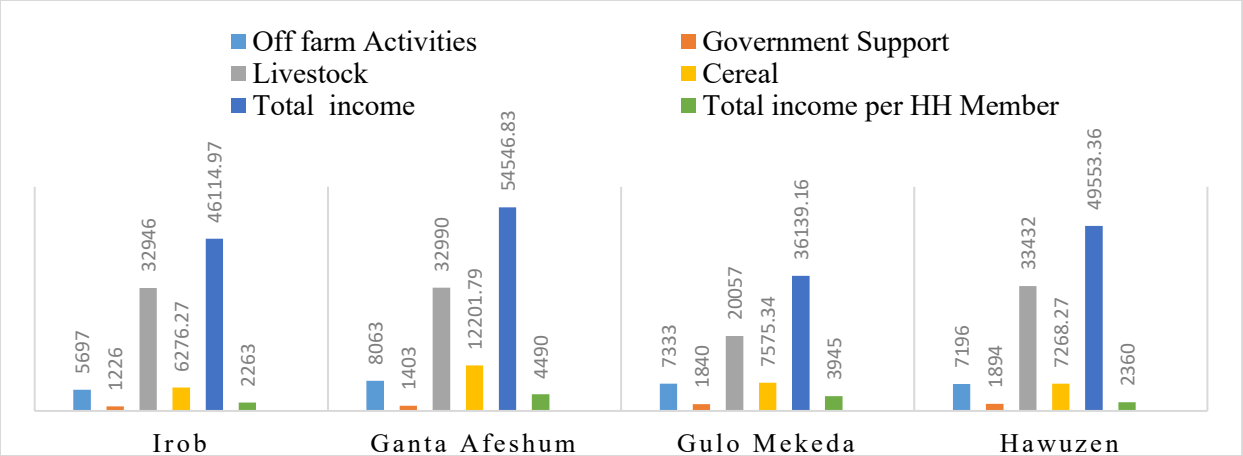


Figure 2. District-wise average income from various sources

In addition to the average annual income shown in Figure 3, the Lorenz curve shown in Figure 3 presents the state of gross income inequality among the households. With nearly overlapped distance from the line of perfect equality, the Lorenz curve of each districts indicates that there is no significant difference of gross income inequality across the districts. The extent of inequality can be measured by the Gini index, which visually is defined as the area between the Lorenz curve and the 45-degree line, divided by the total area under the 45-degree line (McKay, 2002). The Gini index ranges from zero to one which donate perfect equality and perfect inequality, respectively. Accordingly, the Gini indexes for Erob, Ganta Afeshum, Gulo Mekeda, and Hawuzen are estimated to be 0.259, 0.241, 0.256, and 0.246, respectively. In comparative to Tura, and Assefa, (2017) who revealed 0.3386 Gini coefficient among cereal crops producers in Oromia region, the gap of income distributions observed across the rural households and districts is likely small.

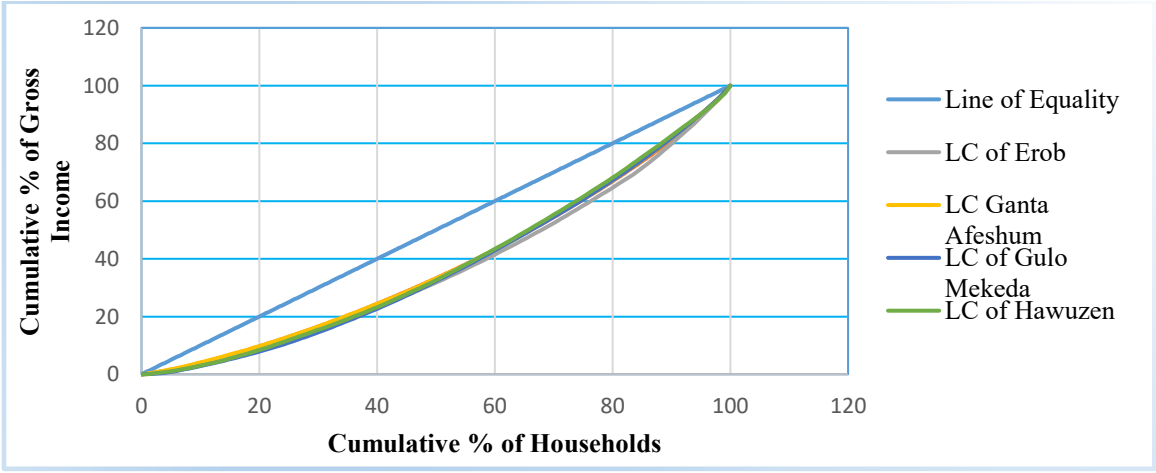


Figure 3. District-wise Gross income distribution (Lorenz Curve)

3.5. Households' Housing Structure

Survey results show that most rural households lived in two-room houses. About 62% had mud walls, 27% wood, and 10.8% a mix of both (Table 3). While most roofs were covered with iron sheets, 30.4% were thatched - an indicator of lower economic status or temporary residence. Housing characteristics such as number of rooms, roof type, and construction materials served as key physical indicators of household wellbeing.

Table 3. Housing Structure of the Households

Gender of HH head	**Number of rooms**						**Average**
	1	2	3	4	5	6	
Male	34	177	123	25	2	1	2.41
Female	7	72	21	9	0	0	2.29
Total	41	249	144	34	2	1	2.3

Kitchen location	**N**	**%**	**Cooking material**	**N**	**%**	**House compound**	**N**	**%**	**Cattle housing**	**N**	**%**
Separate	180	38.2	Electricity	37	7.9	Wood	75	15.9	Separated	121	25.7
Inside	289	61.4	Firewood or dung	434	92.1	Stone	396	84.1	Mixed	349	74.1

The number of rooms ranged from one to six, with male-headed households averaging more rooms than female-headed ones. Most households had unseparated kitchens and relied on firewood or animal dung for cooking, and only 7.9% had electricity. Although 84% lived in stone-compounded houses, 74% remained vulnerable to hygiene-related diseases due to unseparated cattle housing. Overall, wealthier households had more rooms, stone compounds, separate kitchens and cattle shelters, and electricity access, while poorer households had fewer rooms, traditional compounds, and relied on biomass for energy.

3.6.Ownership of Livestock and Related Assets

At subsistent economic life, livestock possession is the most critical livelihood asset to address the livelihood vulnerability. The information concerning the number of livestock and average livestock owning per household are summarized in Table 4 as the physical capital of rural households. According to Tagel (2012), ownership of livestock is one of the basic assets in the Ethiopian rural economy. In the area where traditional farming is the only agricultural practice, farmers need minimum two oxen to cultivate their land properly. Muthyalu (2013) reveals that having a greater number of oxen was positively associated with cultivating larger farming land. In this study area, there was an unequal distribution of oxen per household. The average number of oxen owned per household was found to be 1.26, which is slightly lower than the average oxen

holding per household (1.35) identified by Tinsaye (2016) in Kilte Awulaelo district of Eastern Zone. Table 4 indicates that the respondents had 6 sheep and 8 goats per household on average and very few households had pack animals. According to the information obtained through the interview, in terms of their essentiality to plough land, oxen and cows were found the scarcest livestock. As a farming strategy, households who own one ox would use cow or donkey to plough their land, or seek rent from other neighborhoods at 100-250 ETH Birr per ox. As an additional strategy, a household with a single ox seeks other *Melafnity* (partner) with extra or single ox to plough land in a cooperative manner.

Table 4. Summary of Livestock Ownership

Quantity of	N	Min	Max	Sum	Mean
Ox	470	0	3	592	1.26
Cow	401	0	6	479	1.19
Sheep	371	0	32	2443	6.58
Goat	160	0	31	1311	8.19
Donkey	238	0	4	307	1.29
Mule	17	0	1	10	.59
Horse	7	0	1	2	.29
Camel	12	0	1	7	.58
Hens	372	0	37	3085	8.29

3.7.Households' Access to Farming Land

Land serves as a basis for the socio-economic foundation for the overwhelming majority of people in Ethiopia. It has far-reaching implications for the wider national economy and politics (Srur, 2014). Concerning the pattern of farming land, our survey shows that all the target respondents had likely equitable access to at least one hectare of farming land. This equitable land distribution is supposed to be the outcome of the land reform. Article 40/3 of the Ethiopian Constitution (FDRE, 1995) deals with the right to land ownership, as well as natural resources, and FDRE Proclamation No. 456/2005 confirms land as a state and public resource which cannot be sold or exchanged. However, the land utilization potential of rural households is significantly dependent on the number of oxen owned. Those who own a pair of oxen would have better access to extra farming land from their neighborhoods on rent. In the study area, the size of farming land is measured by the number of *tsimdi* where one hectare is equivalent to four *tsimdi*. In this case, *Tsimdi* is an area of farming land that can be ploughed by a pair of oxen in a day approximately equivalent to a quarter of one hectare (Tagel, 2012). Table 5 shows that the average size of own farming land per household was 1.32 hectares. The average size of operational land holdings (OLHs) increases with the increase in the number of oxen. As against 1.248 ha of land operated by the households without any bullock, the households having three bullocks were reported to have

2.30 hectares of cultivated land. A majority of households held 1-2 bullocks. The rent-in land also increases with the increase in the number of oxen, while the opposite is observed in the case of rent-out land. Finally, the average size of irrigated land indicates that the majority of the rural households had no access to irrigation facilities.

Table 5. Distribution of the households by OLHs and number of oxen possessed (N = 471)

Number of Oxen	**Own Farming Land**		**Rent-in Land**		**Rent-out land**		**Average Size of Operational Holding (ha)**	**Irrigated Land**	
	% of HHs	Average Size (ha)	% of HHs	Average Size (ha)	% of HHs	Average Size (ha)		% of HHs	Average Size (ha)
0	15.71	1.0878	15.50	0.3733	15.71	0.2128	1.2483	15.71	0.0524
1	45.22	1.1473	45.22	0.2448	45.22	0.0789	1.3132	45.22	0.0627
2	36.10	1.6044	36	0.3397	36	0.0735	1.8706	36	0.0574
3	2.76	2.0385	2.76	1.0385	2.76	0.769	2.308	2.76	0.769
Total	100	1.3279	100	0.3212	100	0.0980	1.5511	100	0.0595

The district wise distribution of farming land among rural households is reported in Lorenz Curve (Figure 4). Accordingly, the Gini indexes of land distribution among rural households located in Erob, Ganta Afeshum, Gulo Mekeda, and Hawuzen are estimated to be 0.167, 0.330, 0.252, and 0.296, respectively. This Gini Indexes apart with the distance of the Lorenz curve from the line of perfect equality shown in Figure 4, indicate that closely narrow inequality of access to farming land is observed among the households located in Erob *Woreda*. In contradiction to Article 40/3 of the Ethiopian Constitution (FDRE, 1995) which deals about the equal right to land ownership, wide inequality of land holding is observed in Ganta Afeshum and Gulo Mekeda *Woredas*. Nevertheless, the overall Gini Index of land inequality of this study area is likely small in comparative to the land inequality of Amhara and Tigray regions estimated by Headey et al. (2014) to be 0.43 and 0.41, respectively.

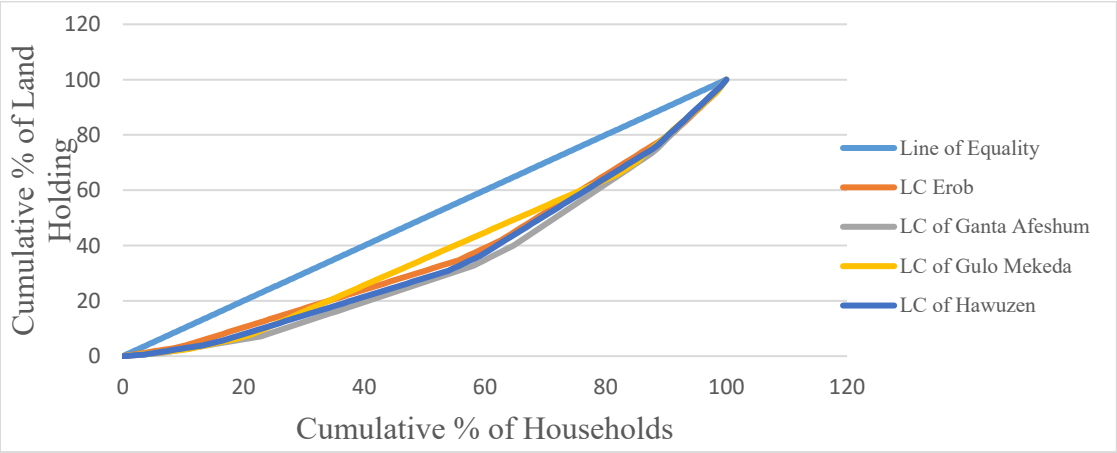


Figure 4. District-wise Land Distribution (Lorenz Curve)

3.8.Households' Income from Cereal Crops and Access to the Treated Water

To rural households, whose income is dependent on subsistent agriculture, cereal crops are cultivated for consumption and are supposed as the main source of livelihood assets. The respondents were requested to provide their estimated agricultural production in cereal crops per hectare of farming land, fruits, and vegetables they cultivated during the fiscal year of 2017/18. Table 6 shows that 27.4% of respondents, located in low land environmental ecology, cultivated less than two quintiles of barley, maize, and sorghum each over one hectare of farming land. About 40.1% of middle highlanders and 32.5% of highlanders obtained 1.35 quintals of *taff* and 1.89 and 1.74 quintals of barley crops per one hectare of land, respectively. Except barely which is cultivated with slight variation over these ecological locations, maize, sorghum and *taff* relatively cultivated better in middle and highlands than in low lands. The households located in all agro-ecologies were also found cultivating pulses crops, potatoes, onions and other vegetables for their consumption. Ethiopia is characterized by the existence of many agro-ecological zones, which differ in terms of rainfall, soil types, altitude and the like (MoFED, 2003). Most of the time, products such as tomatoes, potatoes, onion and other vegetables are cultivated in middle highlands and highlands areas in the winter season through irrigation. However, due to limited access to irrigated land, the rural households reported likely insignificant results in their average production of cereal products.

Table 6. Agricultural production in Kgs per hectare of land by agro-ecologies (N=471)

Agro-ecology	% of HHs	Barley	Maize	Sorghum	*Taff*	Pulses	Tomato	Potato	Onion	Vegetable
Low land	27.4	185.5	107	153.4	66	28	89.6	46.4	25.7	25.4
Middle	40.1	188.9	53.7	55.1	135	58.7	56.6	22.5	59.1	23.5
Highland	32.5	174.3	131.3	124.1	136	55.8	72.5	35.3	55.6	60.7
Total/Av	100	182.9	123.8	97.3	112.	49.3	71.3	33.9	48.3	37.1

As a natural capital, surface water resource is a community asset used for both livestock and households' consumption. Scarcity of water was observed in Gulo Mekeda and Irob as 17.60%\and 23.50% of respondents respectively had access to treated surface water (Figure 5). Except in Hawuzen, many respondents from *Irob, Ganta Afeshum and Gulo Mekeda* were not having sufficient access to treated surface water. The proportion of respondents in these three districts, who had access to surface water, was found with very low as compared to the Tigray where rural water coverage was reported to be 62% (REST, 2016). This finding suggests that those, who did not have access to treated water, are forced to travel a long distance to get safe water for their

livestock and households' consumption. Not only this, as the result of lack of access to safe water, rural people especially children are supposed to be vulnerable to water-borne diseases.

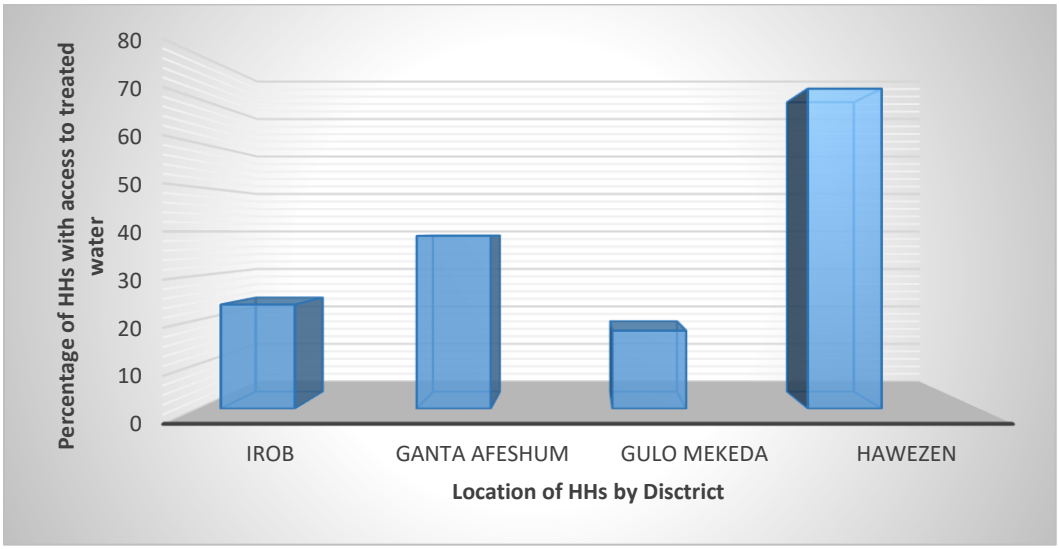


Figure 5. District-wise percentage of households with access to the treated surface water

3.9.Access to Rural Finance

As it is shown in Table 7 below, only 37.37% of the total households reported having access to rural credit services and the majority of the households responded that they had no access to rural credit services from any formal sources. Among those having access to the rural financial services, 74.4% used Dedebit Credit and Saving Institution as a major source of loan, while very few respondents used the Government and other local cooperatives as a source of loan. The accessibility of DECSI as a major source of loan to rural households was previously confirmed by Desalegn (2015). Moreover, the result on the type of loan revealed that among those who availed loan, 45.5% borrowed in cash and 55.5% in-kind, more likely for buying ox, cow, goat, sheep or other livestock (86.9%) and for consumption purpose (13.1%). In contrary to this limited access to loans, the information obtained through the interview exposed that there was forceful conditionality of delivering modern agricultural inputs and loans at the local agriculture sector. On the other hand, 62.63% of respondents, who had no access to financial services, unfair interest, inaccessibility and unnecessary bureaucracy were among the major reasons to utmost 51.53%, 34.91% and 13.56% of respondents, respectively. Not only formal financial institutions, it is also common to use informal community-based associations as a source of credits in this study area. The table also indicates that overall, female-headed households had relatively lower access to the credit services than their male counterparts.

Table 7. Households' Access to Institutional Loans by Gender of the Household Heads

Variables		Gender of HH Head		Total
		Male	Female	
Access to loan	Yes (%)	37.85	35.78	37.37
	No (%)	62.15	64.2)	62.63
	Total No. of HHs	362	109	471
Loan source (Major creditors)	Dedebit CSI (%)	78.83	58.97	74.43
	Government (%)	9.49	7.69	9.10
	Other sources (%)	11.68	33.33	16.48
	Total No. of HHs having access to finance	137	39	176
Loan type	Cash (%)	53.28	17.95	45.45
	In-kind (%)	46.72	82.05	55.55
Purpose of loan	Buying food (%)	14.60	7.69	13.07
	Buying livestock (%)	85.40	92.31	86.93
The reason for not having to loan	Unfair interest rate (%)	54.22	42.86	51.53
	Lack of access (%)	32.89	41.43	34.91
	Unnecessary bureaucracy (%)	12.89	15.71	13.56

In Ethiopia or Tigray in particular, *Equb, Idir, Mahber* and other forms of community-based networks are commonly practiced everywhere. While Equb is an association of people having common objectives of mobilizing resources, especially finance, and distributing it to members on a rotating basis (Emana, 2009); Idir is is an association of people that have the objective of providing social and economic insurance for the members in the events of death, accident, damages to property. In the literature, the *Equb* and *Idir* are conceived as a form of traditional savings institution (Aredo, 1993). In this study area, these traditional cooperatives have multiple purposes in promoting indigenous social protection schemes at the community level. For instance, the role of Idir in minimizing women's challenges is summarized in Teshome et al., (2014) as women's *Idir(s)* are the viable basis in the creation of social network which plays crucial roles in providing solutions to social and economic challenges women are facing. Some of the benefits which are provided to members by the *Idir* and not by credit cooperatives are culturally appropriate social interactions and solidarity among the participant (Aredo, 1993). According to the information presented in Figure 6, 85% and 74% of the sample respondents located in Gulo Mekeda and Hawuzen districts were actively engaged in their local social cooperative network called *Equb*. Likewise, the majority households were found members in community-based social protection committee. Conversely, the majority of respondents located in Hawuzen, Gulo Mekeda and Ganta Afeshu, were not active participants in *Equb* and seasonal labor. Considering its socio-economic benefit, during ploughing, harvesting and other seasonal works in a teamwork locally

called *Wefera* (cooperative work), only a few respondents were found active participants in seasonal labor.

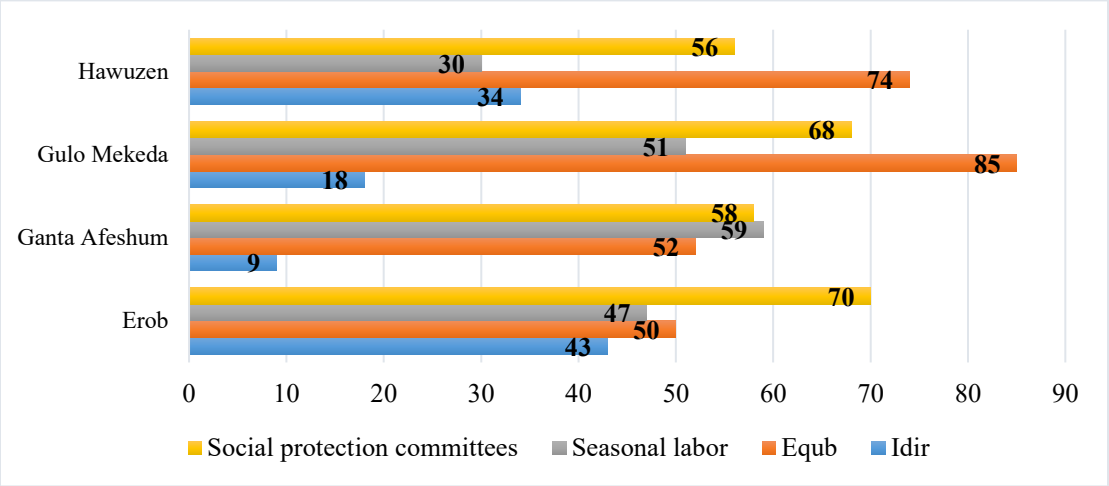


Figure 6. District-wise households' membership in social networks in percent (%)

3.10. Measuring the Livelihood Capacity Index (LCI)

Exploring the root causes of livelihood vulnerability and resilience capacity of rural households are the coinciding objectives of this study. To achieve these objectives, statistical equations are applied to aggregate each livelihood asset into LCI. Human Capital is the combined factor of government support, working skills, the gender of household heads, access to education and health services. Social capital measures the impact of active participation in local social networks, political violence, and ownership of communication tools. These local networks are informal associations where rural households organize themselves to help each other. In the context of SLF, natural capital is used to describe the stocks of natural resources such as farming land, forest, and wild products from which further resources and services useful for livelihoods can be developed (UNDP, 2017). To calculate the financial capital, households' income, access to credit and insurance are measured at the household level. Moreover, housing structure, farming equipment and ownership of livestock are surveyed and weighted to estimate the physical capital. The five livelihood capitals are statistically combined and indexed with equal weight. In this case, the aggregate LCI is ranged in between Zero and One denoting most and least vulnerable households, respectively. The average score of the LCI shown in Appendix I indicates that the majority of rural households had no enough access to livelihood assets. Despite they have scored above average in their human, social and financial capitals, the majority of households had scored below average

LCI due to their limited access to natural capital and physical capital with insignificant variance across their location.

According to the SLF, a livelihood is sustainable when it can recover from stresses and shocks (Carney, 1998; FAO and ILO, 2009). However, the value of the composite LCI (0.48) shows that the rural households had low ownership of the livelihood assets regardless of their location. Moreover, the aggregate results represent that the livelihood capacity of these households was more dependent on financial, social and human capitals and more vulnerable on their physical and natural capitals. Hence, taking these pieces of evidence into account, the households scoring below 0.5 in their livelihood capitals are supposed to be weak to escape, recover or anticipate the potential impacts of the livelihood vulnerability.

3.11. Determinants of the Livelihood Vulnerability: The Logistic Regression Analysis

A binary logistic regression is used as a statistical technique to understand the root causes of livelihood vulnerability among rural households. To run the regression, LCI is recoded into a dummy dependent variable of Zero and One to symbolize below and above average livelihood capacity taking 0.5 as a threshold-point. The explanatory variables shown in Table 8 were hypothesized as important factors to determine households' livelihood capacity. The estimated coefficient of the gender of the household head is found to be insignificant in showing the gender-wise difference in the dependent variable. The negative coefficient of the age of household heads indicates that rural households headed by younger family members are supposed to hold better livelihood capacity. This result is found consistent with Leza and Kuma, (2015) who demonstrate that the rural households in Wolaita Zone headed by young heads have more likely to be innovative to engage in multidimensional livelihood strategies. Among the demographic variables, household size is found to be statistically significant and positively associated with livelihood capacity. This demonstrates that the increase in family size by one household member increases the chance of households' access to livelihood assets by nearly 22%. This result confirms the productivity of large family size in securing their livelihood capacity by participating in multiple livelihood strategies. The coefficient for wage earned from agricultural works and wealth of livestock explain the positive and statistically significant effect in determining livelihood capacity. Contrarily, ownership of mobile, membership in health insurance, access to irrigation, availability of modern agricultural inputs and effect of the flood are found to be insignificant estimators for livelihood

capacity. Access to TVET, WICI, and microcredit institutions are found to be significant interventions in affecting the livelihood capacity of beneficiaries when the coefficients on any community-level conflict indicate a significant negative impact on the livelihood capacity.

Table 8. Factors affecting Livelihood Capacity: Logistic Regression Results

Explanatory variables	Nature	B	S.E.	Wald	Sig.	Exp(B)
Gender of HH head	Dummy	.970	.275	12.395	.000	2.637
Age of HH head	Continuous	-.031	.012	7.033	.008	.969
HH Size	Continuous	.223	.071	10.017	.002	1.250
Ownership of mobile	Dummy	.505	.267	3.576	.059	1.657
Ln of estimated agricultural wage	Continuous	.405	.108	14.015	.000	1.499
Ln of the estimated value of livestock in Birr	Continuous	.375	.164	5.212	.022	1.455
Any training from nearby TVET center	Dummy	.857	.257	11.135	.001	2.355
Membership of Weather-Indexed Crop Insurance (WICI)	Dummy	.877	.262	11.226	.001	2.404
Membership of health insurance	Dummy	.396	.273	2.109	.146	1.486
Access to credit	Dummy	.936	.231	16.411	.000	2.551
Access to irrigation	Dummy	.265	.376	.497	.481	1.303
Availability of modern agricultural input	Dummy	.092	.274	.112	.738	1.096
Effect of flood	Dummy	-.387	.231	2.818	.093	.679
Any conflict in the community	Dummy	-.606	.243	6.235	.013	.546
Constant		-8.308	1.883	19.464	.000	.000

Significant level ***, ** and * at P<1%, P<5%, and P<10%, respectively

In addition to the logistic regression and aggregated results of livelihood capacities, the descriptive results are shown in Appendix II to indicate how selected causes of livelihood vulnerability are related to each other. The Pearson's correlation coefficient (r) measures the magnitude how one variable is associated with other variable. Accordingly, a strong negative relationship is shown between education and age (-0.475), HH size and marital status (-0.29), ownership of oxen and marital status (-0.257) and level of education (-0.151). Likewise, the level of education shows a strong positive correlation with ownership of farming land (0.608), and income condition (0.807). The negative correlation of marital status with farming land size (-0.117) and with estimated income from livestock (-0.227) show that male-headed households have more farming land and livestock than their female counterparts. Among the selected variables, ownership of oxen is found to be positively correlated with farming land size, estimated income from livestock and cereals. Access to microfinance and FSPs are found related to the mediating factors that measure the role of public interventions on supporting the livelihood capacities of rural households.

4. CONCLUSIONS

This study applied the SLF as a means of livelihood analysis to evaluate the livelihood capacity of rural households located in the northern part of Ethiopia. Most studies conducted following the

risk-based model of vulnerability conclude that poverty and livelihood vulnerability are mutually reinforcing causes. Nonetheless, other researchers argue that the generalization that the poor group of societies is socially/economically vulnerable does not help in policymaking because, to make evidence-based policy, the society at any level might be vulnerable now or in the future, no matter whether they are economically rich or poor. Several researchers agree that assessing the causes of livelihood vulnerability is the principal step for immediate policy action and can serve as indigenous evidence during policy-making, as livelihood vulnerability is signal evidence to inform and develop a particular public intervention. Farming land size and productivity of cereal crops, ownership of livestock and agro-ecological location are among the factors that determine the livelihood capacity of rural households. The households who own a pair of oxen, and own large fertile farming land have a better-off livelihood capacity. Dedebit Credit and Saving institution is found as the major source of microfinance for 37% of households. Other financial institutions are not reaching the rural areas, as about 63% of households did not have access to formal financial services. Unfair interest rates, and inaccessibility and unnecessary bureaucracy are reported to be the major reasons. This suggests that the households may have access to loans if these challenges are addressed from the financial sectors. The study finds that the majority of rural households have scored below average LCI. This research explores limited access to physical and natural assets as the major cause of livelihood vulnerability. This implies that those, who score lower LCI, are supposed to be more vulnerable than those who score a higher LCI. Specifically, poor health, education and agriculture services, drought-prone location, limited access to irrigation, lack of physical infrastructure and weak community-based social networks are the root causes that deteriorate the livelihood capacity of rural households. The lower access to the livelihood assets indicates that they are less resilient to escape from possible impacts of livelihood vulnerability.

The regression results show that while variables related to the age of household head, the effect of flood, and conflict in the community are negatively associated with livelihood capacity, the gender of household head, family size, ownership of mobile, estimated earnings from wage and livestock possessions, access to TVET, WINCI, and credit opportunity revealed to have a significant positive effect in determining the livelihood capacity of rural households. To sum up, the local, regional and federal governments are expected to make continuous and participative livelihood survey to have detail household-level evidence on the root causes of livelihood vulnerability for proactive public interventions which could sustain the livelihood security of the community.

5. Policy Implications

Based on the findings, this study suggests policy decision-makers to introduce reasonable and integrated livelihood capacity building efforts and easy reach of public schemes to the rural households with a fair distribution strategy. To enable the resilience capacity of beneficiaries, saving and credit institutions should introduce a new credit policy that offers oxen, cow, goats, and other productive assets rather than money. Considering the role of education in diversifying households' livelihood assets, the universal adult education program is advisable to all illiterate household members. Formal and informal institutional integration among agriculture, health, education and labor and social affairs sectors would play a substantial role in empowering vulnerable households. Enhancing livelihood diversification strategies can be realized by expanding the scope of direct support, public works, voluntary resettlements, and livelihood capacity building programs. To build the self-resilience capacity of vulnerable households, local public sectors can coordinate with the community-based social protection committees to conduct a participative livelihood survey to identify the challenges and opportunities of vulnerable households so that an exceptional social fund may be launched at the district level to mitigate livelihood vulnerability.

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Appendix I. District-wise Livelihood Capacity Indexes (LCI) and its Components

Components and variables of LCI	Location District				
	Erob weight	Ganta Afeshum weight	Gulo Mekeda weight	Hawuzen weight	Average
Gender of HH head	.78	.83	.70	.76	.77
HH Size	.44	.42	.44	.41	.43
Literacy	.61	.49	.60	.54	.56
Access to health	.27	.43	.18	.16	.26
Distance to Elementary school	.91	.67	.91	.97	.86
Access to TVET	.62	.78	.86	.54	.70
Adult Education	.66	.64	.15	.23	.42
Minimum Gov't support	.63	.62	.90	.43	.64
Human Capital	**.61**	**.61**	**.59**	**.51**	**.58**
Membership in social networks	.56	.54	.61	.48	.55
Any discrimination	.22	.09	.18	.10	.15
Access to information	.24	.24	.13	.24	.21
Social Capital	**.65**	**.60**	**.61**	**.55**	**.60**
Access to farming Land	.34	.32	.24	.35	.31
Access to treated Water	.23	.39	.18	.72	.38
Drought	.48	.57	.60	.53	.54
Beles Ownership	.88	.32	.47	.42	.52
Access to irrigation	.17	.06	.13	.10	.12
Natural Capital	**.35**	**.36**	**.42**	**.35**	**.37**
Estimated annual income	.32	.37	.22	.34	.31
Diversity of income	.12	.17	.16	.15	.15
Access to credit	.57	.47	.51	.40	.49
Access to health insurance	.86	.63	.73	.91	.78
Access to weather indexed crop insurance	.45	.40	.87	.59	.58
Financial Capital	**.59**	**.61**	**.67**	**.64**	**.63**
Number of Rooms	.25	.29	.28	.29	.28
Kitchen location	.32	.35	.51	.32	.37
Cooking energy	.03	.05	.06	.17	.08
Donkey cart ownership	.00	.06	.01	.08	.04
Water pump ownership	.05	.04	.01	.15	.06
Total livestock ownership	.22	.21	.12	.24	.20
Physical Capital	**.18**	**.20**	**.20**	**.25**	**.21**
LCI	**.47**	**.48**	**.49**	**.48**	0.48

Appendix II. Pearson Correlation result among selected causal factors on households' livelihood capacity (n = 471)

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13
Marital Status	-.207**												
Education	-.475**	-.095*											
Household Size	.278**	-.290**	-.058										
Distance to town in km	-.124**	.022	.060	-.034									
No. of rooms	-.046	-.074	.153**	.087	-.051								
No. of oxen	.307**	-.257**	-.153**	.212**	-.114*	.056							
Ownership of radio	.003	.006	-.023	-.126**	.051	-.009	-.196**						
Farming land size	.188**	-.117*	-.024	.196**	-.004	.051	.322**	-.108*					
Income Livestock	.321**	-.227**	-.153**	.293**	-.165**	.143**	.613**	-.230**	.408**				
Income from cereal	.145**	.074	-.171**	.040	-.105*	.098*	.153**	-.001	.018	.156**			
Social Networks	.000	.073	-.056	.000	.035	-.080	-.222**	-.202**	-.194**	-.134**	-.025		
Access to FSP	-.092*	.196**	.104*	-.222**	.010	-.035	-.256**	.056	-.104*	-.274**	-.074	-.018	
Access to credit	.096*	-.096*	-.001	.128**	.013	-.029	.141**	-.032	.049	.064	-.074	-.081	-.077

Source: Computed from own survey data, 2018