

Factors Affecting the Level of Rural Households Livelihood Diversification in Gamo Zone, Southern Ethiopia

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Livelihood diversification is enchanting a significant effect in generating household's income. The livelihood diversification includes: on-farm, non-farm and off-farm strategies which are undertaken to get extra income and moderate hazard and insecurity. The purpose of this study was to examine the factors affecting the level of rural household livelihood diversification in Gamo Zone, Southern Ethiopia. The study was conducted by using a cross-sectional research design. It is a quantitative dominant concurrent mixed research methodology where the qualitative research is complemented with interpretations and triangulation. By applying multi-stage random sampling technique, a sample size of 400 household heads from 6 sample villages was selected and data were collected using interview schedule and via key informant interviews and focus group discussions. Descriptive statistics were analyzed and presented by using tables, graphs and figures while chi-square-test

and F-test were employed to make statistical inferences. Tobit model was employed to identify the intensity of factors affecting of rural household's livelihood diversification. Out of the 14 hypothesized explanatory variables, 6 variables namely age, education, access to extension, media access, distance to urban centers and training were found to have significant effect in rural household livelihood diversification decision. Therefore, the findings of this imply that rural households' development policies should consider these factors in designing rural household livelihood diversification strategy.

Keywords: Livelihood; diversification; strategy; factors; Gamo; Ethiopia.

1. INTRODUCTION

Livelihood diversification is a process by which rural households build an increasingly various group of activities and assets in order to survive and/or improve their standards of living [1,2]. Livelihood diversification therefore, refers to attempts by individuals and households to find new ways to raise incomes and reduce environmental risk, which differ sharply by the degree of freedom of choice (to diversify or not), and the reversibility of the outcome [3]. Rural households' world-wide engage in a variety of farm and non-farm activities to generate income [4,5,6].

Livelihood strategies are the combination of activities that people choose to undertake in order to achieve their livelihood goals. They include productive activities, investment strategies and reproductive choices. A major influence on people's choice of livelihood strategies is their access to assets and the policies, institutions and processes that affect their ability to use these assets in order to achieve positive livelihood outcomes. Livelihoods approaches try to understand the strategies pursued and the factors behind people's decisions, to reinforce the positive aspects of these strategies and mitigate against constraints [7,8,9].

According to Titay [10] rural livelihood diversification a common phenomenon where rural households engage in multiple activities (either on-farm or off-farm, agricultural or non-agricultural) in order to survive and to improve their standard of living. Hence, Livelihood strategies and choices have been steadily increasing Sub-Saharan Africa's in the last decade [11]. Similarly, Loison [12] classified the components of rural livelihood diversification by sector as farm or non-farm, by function as wage employment or self-employment or by location as on-farm or off-farm activities.

In Africa also, various studies have shown that while most rural households are involved in agricultural activities as their main source of livelihood, they also engage in other income generating activities to augment their main source of income [13]. A study conducted in Kamba district and Gamo Zone Ethiopia indicated that non-farm livelihood diversification activities could become good-looking alternatives to farming families' income. The study also indicated that only focusing on agricultural production may not be enough to generate sufficient and secure livelihoods.

Recently, evidences show that Ethiopia's rural people are vulnerable to poverty, food insecurity, limited access to social and health services, and limited options for livelihoods diversification and security. Due to this, their ability to lead a sustainable livelihood is challenged. Some Ethiopians are often unable to achieve household food security as a result of unreliable sources of income, instability in their livelihood strategy options and lack of diversified livelihoods [14].

The increasing importance of rural livelihood diversification in Ethiopia has drawn the attention of various scholars in recent years. For instance, Fassil and Elias [14] and Melkamu and Mesfin, [15] has shown the determinants of off-farm income diversification and its effect on rural household poverty in Gamo Zone Chench, Kamba, and Mirab Abaya district. However, these studies have missed key issues regarding the extent and level of livelihood diversification roles to income improvement based on sound theoretical concepts and methodology rigorous. Hence, this paper is aimed at addressing such knowledge and methodological gaps in this particular research targeted areas. Specifically this paper explores factors affecting the level of rural household livelihood diversification in Gamo Zone, Southern Ethiopia.

2. RESEARCH METHODOLOGY

2.1 Description of the Study Area

The study was conducted in Gamo zone, kamba and Arbaminch zuria districts which is located in Southern Ethiopia. Gamo Zone has a total area of 6460.11 km² and consists of 14 districts and the elevation of the Zone ranges from 600 to 3300 msl. The topography of the land characterizes an undulating feature that favors the existence of different climatic zones in the area. The total population of the Zone is estimated about 1,597,767 with a population density of 80 inhabitants per kilometer square. The total population estimation of the Kamba district is 201, 697 which is about 9.76 percent of the zonal population. From the total population of the district, about 49.31 percent were females. And the total population estimation of the Arbaminchzuria district is 206,814 in 2020. Of which 103,341 (49.97 percent) are men and 103,478 (50.03 percent) are women [16].

2.2 Sampling Techniques and Sample Size Determination

In order to select a representative sample of household heads in the study area a multi-stage random sampling technique was applied. Hence, to select the two districts' out of fourteen Zonal districts' purposive sampling technique was used on similar of agro-ecologic zone (high land, midland and low land). Besides they have common characteristics of income generating activities like on-farm, non-farm and off-farm activities. In this manner in the first stage, two districts namely; Kamba and Arbaminch Zuria were selected among fourteen districts' to find out factors affecting the intensity of rural household livelihood diversification in Gamo Zone, Southern Ethiopia.

In the second stage, six villages namely; Balta Toylo, Lae Geta Fudale, Otolu from Kamba district; Ganta Merice, Ganta Bonke, and Chano Dorga from Arbaminch Zuria district have been selected based on stratified random sampling technique to consider three agro-ecological zones (high land, mid land and low land). In the third stage, the sample households were selected by using a systematic random sampling technique from each village.

In order to determine the representative sample sizes for the total target population of this study, Yamane [18] formula was applied.

$$n = \frac{N}{1 + N(e)^2} \quad n = \frac{20,000}{1 + 20,000(0.05)^2} \quad n = 400$$

Based on this formula out of total population 20,000 households 400 sample household respondents were selected from six villages by systematic sampling technique, the numbers of male and female headed households in the sample were 288 and 112 respectively, while equal population proportion sample size was taken from the two districts.

2.3 Methods of Data Collection

The study was used both primary and secondary data sources. Primary data were collected by key applying interview schedule, key informant interview, and focus group discussion checklist. Secondary data were gathered from published and unpublished sources. The study was applied a semi-structured household interview schedule for the household survey to analyze the variables. The study was also used checklists for observation, key informant interview and group discussion to ensure complementary and improvement of data validity and reliability.

2.4 Methods of Data Analysis

This study used descriptive statistics and econometric models to analyze the data from sample households in the study area. Thematic and content analysis was done to interpret qualitative data.

2.4.1 Descriptive analysis

Simple descriptive analysis (mean and standard deviation) was carried out to analyze the data collected from respondent households. The researchers also used inferential statistics like F-test and chi-square test to test the difference and association of the socioeconomic, situational, institutional, and vulnerability factors of rural farm households.

2.4.2 Livelihood diversity index (LDI)

Livelihood Diversity Index (LDI) was used in this study for estimation of the status and level of livelihood diversification. LDI considers both the number of income sources and the proportion of income gained from the sources. An outcome of zero showed the complete specialization or only engaging in farm, and the level of diversification increases as LDI close to one. This means the income of the households did not depend on a

single livelihood strategy. There were some income-generating livelihood strategies, and the proportion of income gained from these sources was not influenced by a single livelihood strategy. There were various indicators and indices can be used to measure the extent of livelihood diversification. The most widely used measures included Livelihood Diversity Index (LDI), Herfindahl index, Ogive index, Entropy index, Modified Entropy index, Composite Entropy index [19]. LDI was widely used because of its computational simplicity, robustness and wider applicability [19]. Hence, it was used in this study as below:

$$LDI_{i=1}^N = 1 - \sum_{i=1}^N p_i^2 \quad (1)$$

N = total number of income sources, i.e. on-farm, on-farm plus off-farm, and their combinations (on-farm plus off-farm plus non-farm) P_i = proportion of income sources coming from the i^{th} source LDI is always between 0 and 1, if $P_i = 1$ then LDI = 0, this implied that no diversification

or reliant on only one income source. In other words, if $P_i = 0$, then LDI =1, this implied perfect diversification of income sources. In general, the closer the value of LDI to zero, the less degree of diversification and the further LDI from zero, the more diversified livelihood income sources.

2.4.3 Econometrics model

Tobit regression model was used to examine the factors that affecting the level of livelihood diversification of rural Households in the study area. The value of livelihood diversification index ranges between zero and one. OLS estimates can't censor the variables and thus, an OLS estimate is not appropriate to find the parameters. Hence, tobit model, also called a censored regression model, is employed in this study to estimate linear relationships between variables when there is either left- or right-censoring in the dependent variable [20].

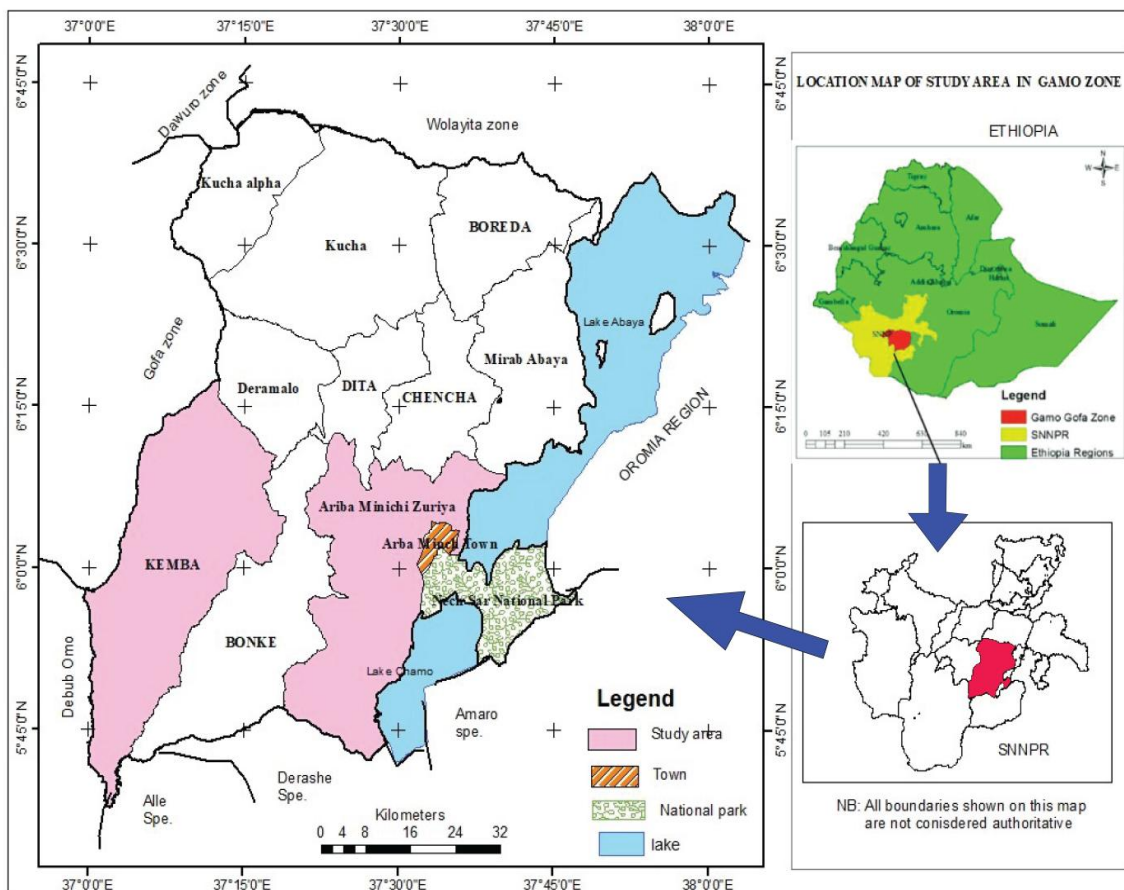


Fig. 1. The geographical location of the study area

Source: BoFED, SNNPRS [17]

The following Tobit model was employed;

$$LDI^* = \beta_0 + \beta_1 Age + \beta_2 Sex + \beta_3 Edu-HH_Head + \beta_4 Family\ Size + \beta_5 Household\ size + \beta_6 Distance_market + \beta_7 Urban-Distance + \beta_8 Extention\ use + \beta_9 Credit\ Users + \beta_{10} Media\ Access + \beta_{11} Land\ size + \beta_{12} Training + \beta_{13} Improved\ seed\ use + \beta_{14} Crop\ fail + \mu$$

if SDI* >0 = 0 Otherwise

Where,

LDI * = Livelihood diversification index

β_0 = Intercept

β_1 --- β_n = Vector of parameter estimate

μ_i = Error term, which is normally distributed with mean zero and constant variance

In order to address the intensity of livelihood diversification of rural households' income diversification index was used as dependent variable while the determinant factor was also measured by using explanatory variables which include socio-demographic, economic, institutional, situational and vulnerability contexts.

Tobit model was used to analyze the intensity of livelihood diversification of rural households as it permits the dependent variable to have zero value [21]. In addition, the study had applied the censored observation which indicates the probability range between 0 and 1. Zero values of livelihood diversified correspond to censored observations while positive values correspond to actual relations. Tobit estimation which uses the maximum likelihood estimation would therefore

be used to examine the intensity of households in livelihood diversification. With this, tobit model was adopted to determine the intensity of households in livelihood diversification as a dependent variable of the model. Statistical software, STATA-13 was used to analyze the data. The explanatory variables used in the model are stated in Table 3. Specification of tobit model is generally expressed as follows:

$$y_i^* = \beta x_i + \mu_i \approx (0, \sigma^2) \quad i = 1 \dots n \quad (1)$$

$$y_i = y_i^* \quad \text{if} \quad y_i^* > 0$$

$$y_i = 0 \quad \text{if} \quad y_i^* \leq 0$$

Where, y_i is the censored dependent variable, representing rural households' participation in livelihood diversification, y_i^* is the latent dependent variable indicating the extent or the intensity of participation or the share of livelihood diversification of change in income, x_i is a vector of explanatory variables, β is the corresponding vector of parameters, μ_i is the model error term is assumed to be independently distributed with zero mean and constant variance (σ^2).

3. RESULTS AND DISCUSSION

This chapter presents results of descriptive and econometric analysis of the study. Descriptive analysis was used to describe characteristics of household on livelihood diversification strategies. Econometric analysis was used to identify intensity and factors affecting the livelihood diversification in the study area.

Table1. Hypothesized explanatory variables of Intensity and factors affecting the livelihood diversification

S/N	Variables	Description and measurements of variables	Expected Result
1	AGE	Age households in years	-ve
2	SEX	1 if male and 0 if female	+ ve
3	FAMILYSIZE	The family size number increases	+ve
4	EDUCYEAR	The education level of houses increases	+ve
5	FAMILYSIZE	The family size number increase	+ve
6	ACCESSTOEXTENTION	Access to extension (1 if yes 0 if no)	+ve
7	CREDIUSE	Access to credit (1 if yes 0 if no)	+ve
8	DISTANCEKM	Distance to largest market in km	-ve
9	DISTANCEUK	Distance to largest urban in km	-ve
10	MEDIAACCESS	Access to media (1 if yes 0 if no)	+ve
11	LEANDSIZE	The total land size in hectare at large	+ve
12	TRAINLD	LD training (1=if HHs received training and 0 other wise)	+ve
13	SEEDIMPROVED	Improved seed use (1 if yes 0 if no)	+ve
14	CROPFAL	Exposure to crop fail (1 if yes 0 if no)	+ve

3.1 Household Characteristics

Age (AGE): The age of the household is one of the influencing factors in different livelihood diversification strategies [22]. Table 1 below indicates that the mean age value of the pooled sample was 42.96, with a standard deviation of 11.49. The average age of respondents engaged in on-farm, on-farm + off-farm, on-farm + non-farm and on-farm + off-farm + non-farm livelihood diversification strategies were 42.05, 44.30, 42.95 and 42.05, respectively. The F - test result shows no significant association in the household head's age category and the four livelihood diversification strategies pursued.

Education Level (EDUCYEAR): The relationship between education and the choice of livelihood diversification strategies of the households was hypothesized positively. As shown in Table 1, the study also confirms that the mean years of school attained by sampled household heads was found to be 1.36, with a standard deviation of 0.557. Moreover, the mean value of education shows the variation in the education level among four livelihoods diversifying household categories, which was 1.12, 1.83, 1.95, and 1.54 for on-farm, on-farm plus off-farm, on-farm plus non-farm, and on-farm plus off-farm plus non-farm households, respectively. The F-test analysis also shows that there is a significant statistical association among the four livelihood diversification strategies and educational level attained by household head at less than 1% probability level. This showed that the better the educational status, the more informed the farmers would be to decide and choose to diversify their livelihood diversification strategy to increase their income. The focus group discussions also confirmed that education is a powerful instrument to enhance households' livelihood diversification strategies. Focus group discussants also confirmed that household heads whose have the higher levels of qualification are much more likely to have livelihood diversification strategies. This study result is in line with Seble [22] who studied in *Artuma Fursi district, Oromia Special Zone, Ethiopia*.

Family Size (FAMILYSIZE): This study hypothesized a link between family size and livelihood diversification strategy positively. As shown in Table 1, the average mean of household family size was 6.5 persons for pooled sample. The mean value of household family size shows the variation in household family sizes among four livelihood diversification strategy categories, which were 6.35, 6.62, 6.40,

and 6.85 for on-farm, on-farm plus off-farm, on-farm plus non-farm and on-farm plus off-farm plus non-farm households, respectively. The F-test was statistically not significant.

Distance to Market (DISTANCEKM): Access to the market was measured in kilometers that the household has to travel to get to the market where almost all farmers in the area buy farm inputs and sell their farm produces. While this study tried to be observed the relationship between livelihood diversification and the distance to the farthest town/market was hypothesized negatively related. Based on Table 1, although the average distance to the nearest market of the sample household was 6.99 km, the mean distance to the nearest market of households on on-farm alone was 7.48km with a standard deviation of 4.92 were as 8.61km, 6.31km and 5.26km ha is the mean distance to the nearest market of households for those pursuing on-farm plus off-farm, on-farm plus non-farm, on-farm plus off-farm plus non-farm strategies, respectively. The F-test analysis showed a statistically significant association among four livelihood diversification strategies pursuers regarding distance to market at a 1% probability level (Table 1). This indicates that the households' who have physical proximity to market have a great opportunity to choose different livelihood diversification strategies to generate better income. This result was similar to Riithi [2]. Similarly, market distance negatively affected household's income diversification strategies in Ethiopia [23, 24, 25]. Gecho [23] as market distance increased from home, farmers' livelihood diversification was discouraged in *Wolaita Zone, Southern Ethiopia*.

Distance to Urban (DISTANCEURB): Rural-Urban linkage is significant to rural households to deliver their products and buy different inputs for the income generation. Hence, distance to urban or town significantly influences livelihood diversification and increases non-farm employment prospects for rural households. In this study the average distance to the nearest urban centre of the sample household was 13.38km, the mean distance to the nearest urban of households on on-farm alone was 14.44km with a standard deviation of 6.96 were as 13.25km, 14.33km and 9.91km ha is the mean distance to nearest urban of households for those pursuing on-farm plus off-farm, on-farm plus non-farm, on-farm plus off-farm plus non-farm strategies, respectively. The F-test analysis result showed a statistically significant association between access to the urban centre

and livelihood diversification strategies at a 1% probability level (Table 1). This implies that the nearest urban centre for rural farmers contributes to income generating and encourage to participate in livelihood diversification strategies. This result was in line with Riithi [2].

Land Holding Size (LANDSIZE): Landholding size is a fundamental asset for the majority of the rural livelihoods. Therefore, having a large farmland size, this study was hypothesized to negatively affect livelihood diversification strategies since the farmer relies on crop production rather than going for off/ non-farm to satisfy livelihood. The average land size for sample household heads was 1.09ha. The mean landholding size of on-farm alone was 1.06 with a standard deviation of 1.02 was 0.78, 1.25, and 1.21ha is the mean landholding for those pursuing on-farm plus off-farm, on-farm plus non-farm, and on-farm plus off-farm plus non-farm strategies, respectively. The statistical analysis also showed that there was a statistically significant association among livelihood diversification strategies employed by households at a 1% probability level with respect to land size (Table 2). This implies that the households who had large land size were not involved in livelihood diversification strategies. The key informants stated that the main means of accessing lands in the study area are acquisition from family gift, inheritance, land renting, crop land sharing and a combination of these. In this way ownership larger amount of land size support household food and other financial requirements and not forces them to look for other livelihood strategies to earn income. Group discussions also stated that the large land size rural farm households were not forced to look livelihood diversification strategies to earn additional income. In similarly, Yishak [9] indicated that having large farmland-sized household heads was less diversified than small farm size holders.

Livestock Ownership Production (TLU): Livestock is highly related to the day to day life of the Gamo people. The nature of their environment area is favourable for livestock production. Table 1 below shows that the sample households possessed mean livestock of 1.12 with a standard deviation of 0.36 tropical livestock units (TLU). The on-farm, on-farm plus off-farm, on-farm plus non-farm, and on-farm plus off-farm plus non-farm households involved in livelihood diversification strategies possess 1.10, 1.00, 1.12, and 1.23TLU of mean livestock, respectively. This implies that the households

who have the larger mean value of TLU were participated in livelihood diversification strategies because of they had earn more money from livestock sales. Key informants stated that livestock serve as a draught power, transportation service, and provides meat, milk, yoghurt, and cheese to diversify livelihood. The statistical F-test revealed a significant association between the four livelihood diversification strategy categories at a 1% probability level in TLU. This result was in line with Seble [22].

Sex (SEX): A higher proportion (91.7%) of male headed households was pursued on-farm plus off-farm plus non-farm category. The Chi-square result, however, showed that there is no significant statistical association between sex and livelihood diversification strategies (Table 2).

Access to Extension (EXTENSION): The following Table 2 illustrates that sample households who have access to extension service involved in on-farm strategy was 91.2% and 60.7% of households access to extension service were involved in on-farm plus off-farm plus non-farm strategies. This mean that those who have access into extension service have more likely to make on farm strategy than non-extension users. The statistical analysis result also shows a significant statistical association between access to extension and livelihood diversification strategies at a 1% probability level. In contrary, Seble [22] indicated in the study that The statistical analysis result showed no significant relationship between extension access and four livelihood diversification strategies in *Artuma Furssi District, Oromia Special Zone*.

Credit Users (CREDITUSE): Farmers use credit primarily to buy agricultural inputs, and to invest in farm-farm activities that supplement their farm income. Households who have access and able to afford credit will be able to excel livelihood diversification. Table 2 below shows that the respondents responded that 76.75% of households were not received credit for livelihood diversification strategies. Only 23.25% of respondents were received credit for livelihood diversification strategies. When we compared the categories, 22.6%, 20%, 19%, and 28.6% of off-farm, on-farm plus off-farm, on-farm plus non-farm, and combination of on-farm plus off-farm plus non-farm received credit, respectively. The chi-square test also confirmed that there is no significant association between credit users and participation in four livelihood diversification strategies.

Table 2. Associationship between profile characteristics (continuous variables) and livelihood diversification strategies

Variables	On- farm (239)		On-farm + Off-farm (35)		On-farm + Non-farm (42)		On-farm + Off-farm + Non-farm (84)		F-test value	P-value
	Mean	SD	Mean	SD	Mean	SD	Mean	SD		
AGE	42.02	11.21	44.30	11.79	42.95	11.49	42.05	11.21	1.557	.200
EDUCYEAR	1.12	0.34	1.83	0.66	1.95	0.58	1.54	0.56	45.306	.000***
FAMILYSIZE	6.35	2.72	6.62	2.92	6.40	3.14	6.85	2.62	0.712	0.545
DISTANCEKM	7.48	4.92	8.61	6.10	6.31	3.86	5.26	3.73	6.310	.000***
DISTANCURB	14.44	6.96	13.25	6.66	14.33	8.64	9.91	7.87	8.183	.000***
LANDSIZE	1.08	1.02	0.78	.55	1.25	0.75	1.21	0.74	2.319	.075*
TLU	1.10	0.35	1.00	0.00	1.12	0.32	11.23	0,44	7.087	.000***

***, significant at 1% probability level. Source: Own survey results (2021)

Table 3. Associations hip between profile characteristics (discrete variables) and livelihood diversification strategies

Categories	Livelihood Diversification Strategies								χ2-value
	On-farm		On + Off-farm		On + Non-farm		On + off + Non-farm		
	N	%	N	%	N	%	N	%	
0=No	42	17.6	4	11.4	5	11.9	7	8.3	4.892ns
1=Yes	197	82.4	31	88.6	37	88.1	77	91.7	
0=No	21	8.8	1	2.9	9	21.4	33	39.3	48.561***
1=Yes	218	91.2	34	97.1	33	78.6	51	60.7	
0=No	185	77.4	28	80.0	34	81.0	60	71.4	2.013ns
1=Yes	54	22.6	7	20.0	8	19.0	24	28.6	
0=No	119	49.8	15	42.9	21	50.0	11	13.1	35.960***
1=Yes	120	50.2	20	47.1	21	50.0	73	86.9	
0=No	156	65.3	23	65.7	14	33.3	32	38.1	29.392***
1=Yes	83	34.7	12	34.3	28	66.7	52	61.9	
0=No	156	65.3	24	68.6	14	33.3	45	53.6	17.683***
1=Yes	83	34.7	11	31.4	28	66.7	39	46.4	
0=No	26	10.9	3	8.6	11	26.2	3	3.6	15.125***
1=Yes	213	89.1	32	91.4	31	73.8	81	94.4	

***, significant at 1 % probability level. Source: Own survey results (2021)

Media Usage (MEDIAACCESS): This study revealed that more than half (58.5%) of rural household respondents have utilized media use to get information in order to diversify their livelihood diversification strategies to enhance their income. This shows that more usage of media has encouraged farmers to diversify their livelihood strategies. The chi-square test also confirmed that there is a significant association between media usage and livelihood diversification strategies at a 1% probability level (Table 2). Similarly, Yizengaw et al. [26] indicated the study in *Debre Elias district, East Gojjam Zone, Ethiopia*.

Participation in Training (TRAINLD): Farmers who had access to livelihood diversification training are expected to have positive influences on participation in livelihood diversification strategies. The results of this indicate that 66.7% and 61.9% of households did get training pursued on-farm plus non-farm and on-farm plus off-farm plus non-farm livelihood diversification strategies, respectively. Close to 34.7% of respondents of household heads did get training to augment their livelihood using on-farm strategies. The chi-square test also confirmed that there is a significant association between participated in training households and participation in livelihood diversification strategies at a 1% probability level (Table 2). This infers that those participants did get training was more knowledge to diversify their livelihood than those participants didn't get training. The result was similar to *Agarfa district Oromia Region, Ethiopia* [27].

Improved Seed Use (SEEDIMPROVED): For improvements in farm household productivity and income, farm technologies, like improved seeds, play an essential role. Table 2 showed that the respondents responded that 68.6% and 53.6% of household heads diversified on-farm plus off-farm and on-farm plus off-farm plus non-farm livelihood diversification strategies were used improved seed, respectively. About 31.4% and 46.4% of respondents who pursued on-farm plus off-farm and on-farm plus off-farm plus non-farm livelihood diversification strategies, respectively were not used improved seed. The Chi-square test also implied that there was a significant association between improved seed users of households and participation in livelihood diversification strategies at a 1% probability level. This implies that households who used improve seed may increase the productivity of the farm to generate more income for their livelihood diversification strategies.

Exposure of Crop Failure (CROPFAIL): Agriculture was the most dominant livelihood strategy in terms of crop and livestock production. Most households were involved in three to four livelihood strategies [2]. Crop failure is the complete or near-complete loss of a marketable crop on a farm. Unfavourable weather conditions and pest infestation can damage or destroy crops and lower crop yields. When households were interviewed about experience of the crop failure, 89.2% of the households answered 'Yes' to a crop failure, and only 20.8% of households answered otherwise. Compared with on-farm strategy and the other two livelihood diversification strategies, the highest number and participants were on on-farm plus off-farm plus non-farm strategies (94.4%) and on-farm plus off-farm (91.4%) and respectively. The chi-square test also implied that there is a significant difference between crop failure and participation in livelihood diversification strategies at a 1% probability level (Table 2). It implies that most household heads participated in livelihood diversification strategies to cope with their exposure to crop failure. The results also indicate that different causes bring crop failure. This includes drought, flood, poor distribution of rainfall, and high temperature cause low yields by reducing the amount of organic matter in the soil, draining out soil nutrients, or limiting the accessibility to soil nutrients during critical stages of plant growth. The key informant interview results showed that there is a high crop failure in the area because of draining out soil nutrients or limiting the accessibility to soil nutrients, rainfall, flood, and lack of agricultural inputs and technology, poor agricultural practices, and climate change push farmers participate in different livelihood diversification strategies.

3.2 The Level of Livelihood Diversification among the Rural Households'

The value of LDI always falls between 0 and 1. If there is just one source of income, i.e., $p_i = 1$; then $LDI = 0$. As the number of sources increase, the shares of p_i decline, as does the sum of the squared shares, so that LDI approaches to 1. If there are k sources of income, then the value of LDI falls between zero and $1-(1/k)$. The closer the LDI value is to zero, the more will be the level of specialization, and the further it is different from zero, the more will be the level of diversification [28]. An outcome of zero value shows the complete specialization and the level of diversification increases as LDI close to one.

Table 4. Tobit regression results on factors affecting the intensity the livelihood diversification in the study area

Variables	Coefficients	dy/dx	Std.err.	Z-value	P-value
_cons	-.5926979	-	.3749602	-1.58	0.115
AGE	.007454	.0025125	.0043102	1.73	. 0.085*
SEX	.1635755	.0551354	.1537428	1.06	0.288
EDUCYEAR	.192333	.0648285	.0207836	9.25	0.000***
FAMILYSIZE	-.0054254	-.0018287	.0184052	-0.29	0.768
EXTENSION	.5653502	.1905592	.131277	4.31	0.000***
CREDITUSE	-.0379852	-.0128034	.123852	-0.31	0.759
MEDIAACCESS	.3428577	.115565	.1187465	2.89	0.004***
DISTANCEKM	-.0101301	-.0034145	.0124108	-0.82	0.415
DISTANCEURB	-.0197934	-.0066716	.0084671	-2.34	0.020**
LANDSIZE	-.0355025	-.0119666	.0650349	-0.55	0.585
TRAINLD	.3841845	.1294947	.1455372	2.64	0.009***
SEEDIMPROVED	-.148588	-.0500837	.1489811	-1.00	0.319
TLU	.0198885	.0067037	.0225692	0.88	0.379
CROPFAIL	.1453796	.0490022	.1790611	0.81	0.417
Sigma		.8078289	.052336		
Number of obs =		400			
LR chi2(14) =		155.86			
Prob > chi2 =		0.0000			
Log likelihood =		-314.2819			
Pseudo R2 =		0.1987			

Obs. summary: 239 left-censored observations at LDHHH<=0
 161 uncensored observations
 0 right-censored observations

***, **, and * significant at 1%, 5% and 10%. Source: own survey results (2021)

3.3 Factors Affecting of Rural Households' Livelihood Diversification

training were the factors which had significant contribution in determining livelihood diversification in the study areas.

Tobit model is more suitable to find the parameter estimates when effect of latent or censored sample is exhibited in the dependent variable. The independent variables used in the study were age, sex, education, family size, extension service, credit use, media access, market distance, urban distance, land size, training, improved seed use, TLU and crop fail. Multicollinearity and heteroscedasticity problem in the data set were checked before running the final Tobit model.

Age (AGE): This variable age showed to be positively and significantly affected the level of livelihood diversification at 10% significant level. Holding other factors constant, age of household heads increases by one year the marginal effect of participating in livelihood diversification increases by 0.25%. This indicates that with the age of the farm household getting increased the farmer will be getting capable to diversifying as many livelihood strategies as possible for the purpose of maximizing subsistence consumption needs. This is because, experience increases with age, and consequently, experienced persons have more prospects of diversifying livelihood strategies. Similarly, Khatun and Roy [29] and Agidew [30], indicated in the study that age has been found to have a significant and positive influence on farmers' livelihood diversification options. In contrary, Baharu [31], indicated in the study in *Kembata Tambaro Zone*, Southern Ethiopia age of the household head negatively affected the level of livelihood diversification.

The Tobit multiplicative heteroscedasticity regression was estimated, based on the cross-sectional data gathered from the sample households, to determine the factors affecting the livelihood diversification in the study area. The estimated results of the Tobit regression and the marginal effects were presented on Table 4.

The Tobit regression results Table 4 indicated that age, education, access to extension service, media access, distance to urban centers, and

Education of households (EDUYEAR): This variable had found a positive and significant impact on livelihood diversification at 1% probability level in the study area. Marginal effect of education of household head implies that the level of livelihood diversification is likely to be increased by 6.48% for every additional year of schooling of household head. This is probably because the level of education increases an individual ability to involve more in livelihood diversification strategies which leads him or her to get more income from a different source. Moreover, educated persons also eagerly look for diversified employment types of job to generate more income. This is better explained that an educated respondent has the knowledge to diversify from farming to other alternative livelihood strategies in order to sustain livelihood compare to less educated respondents. This result is also supported by Gebrehiwot et al. [32], who reported that households are relatively better educated, have better access to technologies, and look for alternative livelihood opportunities.

Extension Use (EXTENSION): This variable result was found to be positively and significantly affected the livelihood diversification at 1% probability level. Keeping the other factors remain constant, the probability of the household's choice of livelihood diversification strategies is increased by 19.05% as the households get access to extension services. This implies that the households who have access to extension services are more likely to involve to different livelihood diversification strategies. This is in line with the findings of Eneyew and Bekele [33] which indicates that access to extension service was positively related to livelihood diversification. This result was in disagree with Schwarze and Zeller [34], who identified extension programmes as a way of developing livelihood diversification. This result was also disagree with the findings by Masoud-Ali [35], who found that in Tanzania extension services are highly significant and positively related to the likelihood of household's diversification process for both on-farm and non-farm.

Media Access (MEDIAACCESS): As expected, access to media affected the level of diversification positively and significantly at 1% probability. The expected change due to a few information frequencies of attending media causes of success on diversifying livelihood strategies, and would increase the intensity of a

household livelihood diversification strategies by 11.56%. Households who had better access to media for relevant information were found to raise their extent of on livelihood diversification strategy. This finding is in line with [36,37].

Urban Distance (DISTANCEUM): The tobit regression result also showed that the larger the distance of farmers residence to urban areas had negative and significant contribution to the level of livelihood diversification at 5% level of significance. Keeping the other factors remain constant, marginal effect of distance to urban household head implies that the level of livelihood diversification was likely to be decreased by 0.67% for every additional km of distance of household head. This implied that the nearest distance of households to urban had more access to livelihood diversification than far distance households because of different facilities like access to transportation, road and market opportunities. This result is controversial with Tagesse [38].

Participation in Training (TRAINLD): The model result indicates that the participation in training by a household influenced the probability of diversifying livelihood diversification strategies positively and significantly at 1% probability level. The results show that holding other factors constant the marginal changes in the explanatory variable (or an access participation in training) would increase the probability of adopting different livelihood diversification strategies by 12.94%. This implies that households having more participation in training are likely to be more diversified in their livelihood strategies. The probable reason of this was the training helped the household to involve more to diversify off-farm and non-farm types of strategies. This result is in line with [9].

4. CONCLUSION AND RECOMMENDATIONS

Participation in livelihood diversification is a key for households' income but in the study area participation in livelihood diversification is not as such effective. Hence, policies aimed at improving the rural livelihood diversification must concentrate on improving the factors that influence participation in off-farm and non-farm strategies. Policies should aim at strengthening the rural off-farm and non-farm sectors by targeting the young rural population since they are more likely to take up opportunities in the rural off-farm and non-farm sectors. Education is

an important issue in livelihood diversification. It is the key to success in the future and to have many opportunities in our life. So, the better the educational status, the analytical and information processing capacity of farmers increases which in turn encourage them to diversify their livelihood strategies. Access to extension has a chance to engage on farm strategy so as to increase households' income. The researcher recommends that, the special package program has to be designed so as to promote off-farm and non-farm strategies in the rural areas besides farming and should be incorporated among the major rural extension programs. Within overall livelihood diversification of households, rural road is considered to be one of the important factor which helps to increase livelihood diversification by facilitating easy access of on-farm, off-farm and non-farm products at low transportation cost to the market and improving access to basic socioeconomic services and strengthen rural-urban linkages. Hence, policy makers should be improving the provision of road access, by expanding the road network both in terms of quantity and quality, to ensure the livelihood diversification strategy.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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