The Role of Rural Livelihood Diversification Strategies for Household Food Security in Southern Ethiopia: Empirical Evidence from Kecha Bira District of Kembata Tembaro Zone

Berhanu Getinet[1,*], Tariku Lorato[2]

[1]Department of Economics, Hawassa University
[2]Department of economics, Dilla University
*Corresponding author: getbre@gmail.com

Abstract Agriculture in developing countries is unable to meet food needs of rural people. Thus, rural households engage in to different livelihood diversification activities to ensure their food needs and secure their future livelihoods. The study investigated the role of livelihood diversification strategies for rural household food security in Kembata Tembaro Zone, Southern Ethiopia with empirical evidence from Kecha Birra district with data collected from a sample of 355 households selected by multistage sampling technique. The descriptive statistics were used to identify the livelihood strategies in the study area. The finding of the study indicated that majority of the rural households (41.6%) engaged into on-farm activity. However, 22.54%, 21.41% and 14.37% practice on-farm plus off- farm; on-farm plus non-farm; and on-farm plus off-farm plus non-farm livelihood diversification activities respectively. Household food insecurity access scale (HFIAS) was used to measure food security status of households. The study result showed that 51.27% households were food insecure and the rest 48.73% were food secured. Logistic regression model was used to assess the role of livelihood diversification strategies to rural household food security. The results of the model indicated livelihood diversification strategies, Income obtained from diversification activities, Education status of the households, Total farm land size of households, Total livestock unit owned and Training and extension service are positively and significantly related to rural household food security status and improves food security status of rural households. It confirmed that livelihood diversification strategies have a positive effect and would be the best solution to reduce poverty and improve food security at household level in rural areas. Therefore, due attention should be given to strengthen livelihood diversification strategies so as to improve rural household food security.

Keywords: Rural, Livelihood diversification, role, HFIAS, Logit model, food security, southern Ethiopia

Cite This Article: Berhanu Getinet, and Tariku Lorato, "The Role of Rural Livelihood Diversification Strategies for Household Food Security in Southern Ethiopia: Empirical Evidence from Kecha Bira District of Kembata Tembaro Zone." *Journal of Finance and Economics*, vol. 8, no. 3 (2020): 142-151. doi: 10.12691/10.12691/jfe-8-3-7.

1. Introduction

Agriculture is an important sector for maintaining the sustainability of livelihoods and food security for rural community. It has been the predominant activity for most rural households in sub-Saharan Africa (SSA) which offers a strong option for stimulating growth, overcoming poverty and improving food security [1]. However; farming as a primary source of income has become failed to guarantee a sufficient livelihood for most farming households in sub-Sahara African countries [2]. This is because the agricultural sector in these countries is highly characterized by drought, erratic rainfall, decreasing farm sizes, low levels of output per farm, and a high degree of subsistence farming [3]. This leads to decline in agricultural productivity and in turn food security.

Developing countries suffer the most from the problem of food insecurity that is usually associated in the minds with the African continent, especially the Horn of Africa. In Africa the rates of food insecurity reach the maximum while the rates of improvement are the least and the slowest. For example, 28.6 percent of the population of the Sub Saharan African region suffers undernourished compared to 14.9 percent of the population of the developing countries as a whole [4].

Ethiopia is one of the most famine prone countries in

Sub-Saharan Africa (SSA), has a long history of famine and food shortages. The food insecurity situation of the country has been increasing and the estimated number of food insecure people increased from 5.6 million in 2016 to 8.5 million in 2017 [5]. The majority of the population being engaged in agricultural based economic activities and agriculture accounts for 41% of the GDP [6]. However; the sector has been continually blamed for its failure to meet the growing food need of the rural population, let alone to generate surplus for national economic growth. A significant number of people suffer from food shortage and poverty [7].

As stated in [8], the causes of food insecurity in Ethiopia are both short and long term structural factors. The long term factors include population growth, environmental degradation, diminishing of land holdings, lack of on-farm technological innovations and lack of non-farm/off-farm income generating sources; these all have led to decline in productivity per household. Also these factors combined with the effect of frequently occurring poverty, drought continuously grind down or erode the productive assets of households and communities.

To solve the problem of food insecurity and poverty, Ethiopian government has formulated Food Security Program(FSP) under the umbrella of Plan for Accelerated Sustainable Development to End Poverty (PASDEP) and embarked on the preparation of long term (2015/16 to 2029/30) national development Growth and transformation plan(GTP) that would integrate the SDGs into the plan. The SDG-integrated GTP is showing encouraging results. However; Severe drought occurred over broad regions of Ethiopia near the launch of the implantation of the GTP in 2016 caused severe food insecurity. Thus, implementations of the policies are envisaged to ensure food security in the whole country and at every household level to eradicate poverty in all its forms. Efforts have been made to improve the production and productivity of agriculture through research, technology adaptation and generation, extension services and input supply but there are no large-scale improvements in the living conditions of rural populations [9].

The southern Ethiopia region encounters irregular rainfall patterns, lacks adequate infrastructure and is affected by crop disease and pests. Together, these factors result in SNNPR experiencing high levels of food insecurity and the number of people who do not ensure food security is significant. More than half (55 percent) of the districts are reliant upon the Productive Safety Net Program for their basic needs to be met as indicated in [10]. Kembata Tembaro Zone is found in southern Ethiopia where large number of peoples affected by food insecurity problem. The study area, Kechabira district is known by prevailing food crises and one of the areas repeatedly affected by food insecurity problem and peoples in the study experiences sever food insecurity situations. The district is in food deficit every year where the food gap is covered by food aid [11].

Therefore, the objective of the study is to investigate the role of rural livelihood diversification strategies for household food security in southern Ethiopia with empirical evidence from Kecha Bira district of Kembata Tembaro Zone.

2. Statement of the Problem

Ethiopia is one of the developing countries in the sub-Saharan Africa. Numerous rural households practiced subsistence farming and depend on natural rainfall for their farming activities and they are affected by changes in weather patterns like recurrent drought, erratic rain fall and others. In this case most rural peoples are food insecure and; due to this a large portion of the country's population has been affected by chronic and transitory food insecurity [12].

Ethiopia has formulated development policies such as a five-year growth and transformation plans for sustainably improving rural livelihoods and national food security. In line with this, , government has exerted to improve the production and productivity of agricultural sector through research, technology adaptation and innovation, efficient extension services provision and timely input supply. Despite, there are no large-scale improvements in the welfare and living standards of rural populations in the country [8].

In Ethiopia large numbers of peoples are affected by food insecurity problem, the trend has been increasing and estimated 8.5 million Ethiopian people were affected by food insecurity problem in 2017 with prolonged drought, conflict, and crop disease among the main drivers [4]. Underlying vulnerability is also high with some four million people continuously dependent on the government's productive safety net program [9]. Among this in the south region of the country(SNNPR), 1.396 million people facing food gap which are being supported by regional food security program particularly through productive safety net program. Of these, 103,453 are found in KembataTembaro Zone including Kecha Bira district which are included in the program to come out the problem of food insecurity that they have been facing. In the study district, 18,498 peoples are supported by PSNP. In other way, PSNP is a necessary but not a sufficient condition to reverse food insecurity in the one hand and the farm sector is not adequate to support the over dense population in the study sites on the other hand. Smallholder rural households whose source of livelihood is dependent on rain fed agriculture face enormous risks on income as a result of weather variability. So, the rural households in the study area are keeping on to struggle with food insecurity primarily caused by erratic rainfall, drought, and other socio economic problems [6].

Thus, the hope that achieving poverty reduction and alleviating food insecurity at any level(at national, household and individual levels) only through improving agricultural productivity and access to key agricultural resources could not be successful in the developing countries without rural development policies due attention given to non-farm and/or off-farm livelihood diversification activities [13].

Diversification into non-farm and off farm has huge contribution to household income and serves as household's livelihood diversification strategies [14]. Moreover; livelihood diversification is believed to be a solution, and an effective strategy for the reduction of poverty and food insecurity in rural Ethiopia [15]. The risk due to shocks and stresses can be overcome and withstood

if people have better flexibility and choice in their livelihood diversification strategies in [16]. Besides, it has been indicated that livelihood diversification is recognized to be one source of income and means of survival for rural households [17].

The empirical literature shows that the role of livelihood diversification strategies in Ethiopia in general and study area in particular were less researched. But some of the studies so far conducted in the country addressed the determinants and challenges of livelihood diversification and food security. A study was conducted by [18] employing the multinomial logit for investigating rural household livelihood diversification strategies in South Gondar zone using cross sectional survey design. This study found that participation and the contribution of livelihood diversification strategies were affected positively by factors such as gender, education, dependency ratio, credit access, having saving account, proximity to town and market, agro-ecological zone, and access to electricity where as those that negatively affecting variables are age, cultivated land size, and extension agent training and frequency of contact.

As investigated by [19], livelihood diversification status, challenges and factors influencing pastoral household's engagement in livelihood diversification activities in Bale zone pastoral livelihoods by using multinomial logistic model. The result indicated that factors such as age and education level of household head, size of livestock holding, distance to market and access to rural credit service were the major determinants of livelihood diversification. Moreover, study by [20] examined the level and determinants of food security in North Wollo Zone of Amhara Region, Ethiopia. They found out the age of household head, dependency ratio, average monthly expenditure, non-farm income, family size, distance from the market, farmland size, the number of oxen and livestock ownership were found determinant factors of food security. The above studies emphasized on the determinants of livelihood diversification but missed the role of livelihood diversification strategies for rural food security and thus, calls for further research. In particular the study aims to answer the following research questions.

- What are the livelihood diversification activities practiced by rural households in Kecha Bira district of southern Ethiopia?
- What is the food security status of the rural households in the study area?
- Do livelihood diversification strategies contribute to rural household food security?

3. Methodology of the Study

3.1. Description of the Study Area

This study had been conducted in Kecha Bira district, Kembata Tembaro Zone, which is found in Southern Ethiopia. Kembata Tembaro zone is one of the fourteen zones and four special districts in Southern region (SNNPR) and its capital is Durame. The zone is divided into eight distrcits. The zone has a total population of 1,080,837 people of which 536,676 males and 544,161 are females; rural inhabitants comprise 85.6% and the urban inhabitant's number is 14.4% of the population. An estimated density of 585 peoples resides in one square kilometer [21]. It is located approximately at 7°10'N to 7°50'N latitude and from 37°34'E to 38°08'E longitude. The woreda is stratified into three agro-ecological zones based on altitude and weather condition. That is, those between 1700-2000 masl, are considered as dry Woina Dega, and between 2000-2300 masl, wet WoinaDega; while above 2300 masl, are considered as Dega.

3.2. Research Design

Research design is a base or logical structure for conducting a particular investigation [22]. Thus selection of research design rests primarily on the specific question a researcher seeks to investigate and the applicability of such a design [23]. To this end, this study employed cross-sectional survey research design because cross sectional survey has greater degree of accuracy and precision in social science studies than other designs [24]. Cross sectional survey design was referred in this study with the rationale that it is more flexible and simple in collecting many types of information while employing mix of various data collection methods. The design is also economical in terms of costs and time due to its ability to draw generalization about large population on the basis of representative sample [25]. In this study, both qualitative and quantitative data were collected from rural households and key informants.

3.3. Data Type and Source

The study used quantitative data collected from both primary and secondary sources. The primary data was collected through cross-sectional survey from representative respondents among target population found in the study area by using questionnaire and interview of key informants. The secondary data were collected from review of different document such as research works, books, office reports and documents, journal articles written by different scholars on related issues

3.4. Sampling Techniques and Sample Size Determination

The study used multi-stage sampling technique which is a combination of purposive, stratification, simple random and systematic sampling methods so as to select district, sample kebeles and households. In the first stage from the total eight districts in Kembata Tembaro Zone, Kecha Bira district was selected by the purposive sampling technique. The district was chosen considering sever food insecurity situation of the district. The district is in food deficit every year where the food gap is covered by food aid and peoples in the study area highly affected by food insecurity problem [11], and also the researchers are familiar with the district with respect to the problem. In the second stage the total of 21 rural kebeles in the study area were classified in to three strata based on their agro ecological zones (namely: Dega, wet Woyina Dega and Dry Woina Dega). Accordingly, 6 Kebeles (28.6%) belong to Dega climatic weather category, whereas 7 Kebeles (33.3%) are wet WoinaDega and the rest 8

Kebeles (38.1%) are Dry Woina Dega. In the third stage, simple random sampling technique was used to select kebeles from each agro ecological zone taking consideration the number of kebeles in each agro-ecological zone. In this regard, four kebeles considered and selected for the study purpose were Wererama, Awaye, Ashera, and Eta. In the fourth stage, the sample size was determined and this is enables us to make inferences about a population from a sample. The data for this research was obtained mainly from the four selected kebeles of rural households of the district. The sample size was determined using [26] statistical formula as follows:

$$n = \frac{N}{1 + N(e)2}$$

Where, N is the total population, *e* (margin of error) is 0.05(5%) while the confidence level is 95%. Using the total population of selected kebeles 4046 and error margin of 0.05, the sample size was calculated as follows.

$$n = \frac{4046}{1 + 4046(0.05)2} = 364.$$

Hence, out of the total population of 4046 a sample size of 364 was taken.

Then, the respondent households from each sample kebele was calculated by using the probability proportional to sample size methods to determine the number of sample size to be taken from each kebele.

$$nk = \frac{NkS}{\sum N}$$

Where nk is the sample size to be estimated from sample kebele, Nk is the number of households of the sample kebele, S is the total sample size determined and $\sum N$ is the summation of all sample kebele population. Finally, the individual households were selected by using systematic sampling method. In order to know the interval level, this study used K=N/n formula [27]. Where K is the interval level, N is the sample population and n is the sample size of the study kebele. After the interval is determined the study used lottery method to know from which number the interval will start. Accordingly, the total size of sample households for the study was 364. This sample had been distributed to each selected kebele by using simple random sampling method based on agro-ecology and probability proportional to sample size as listed in Table 1 below.

Table 1. Sample size determination for respondent households

S/N	Selected kebele	Location	Number of Households (HHs)	Proportion of sampled HHs $n_k = NkS/\sum N$
1	Wererama	Dry woina Dega	996	89
2	Awaye	Dry woina Dega	942	85
3	Ashira	Wetwoina Dega	1067	96
4	Eta	Dega	1041	94
Total			4046	364

Source: Own computation, (2018).

3.5. Methods of Data Collection

Data collection for the study was carried out through questionnaires and interviews with key informants. For data collection, first questionnaires were translated to local language (kembatigna) and five enumerators had been given both theoretical and practical training to avoid risks of misinterpretation of the questions to respondents during interview period without influencing the respondents' answers. To maintain consistency, questionnaires were pre-tested before data collection. And finally data on livelihood diversification and food security were collected using a semi-structured questionnaire for households and an unstructured open ended checklists interview for key informants.

3.6. Methods of Data Analysis

For the proper investigation of the research objectives, the study used both descriptive and econometric methods of analysis.

Descriptive Statistics

In order to identify and examine livelihood activities that are pursued by rural households in the study area descriptive statistics like frequency, percentages, cumulative percentages were used. In addition, the household food insecurity access scale (HFIAS) was employed to identify the food secure and food insecure households in the study area.

The Econometric model specification and Estimation procedure

The core aim of this investigation was to assess the relationship between livelihood diversification strategies and household food security. Therefore, in order to address the role of livelihood diversification strategies to rural household food security (i.e. assessing the relationship between livelihood diversification strategies and household food security) logistic regression model was used. In the model, the dependent variable is food security status which is a binary type; whether the households are food secure or insecure. Such models approximate the mathematical relationships between explanatory variable and the dependent variables that are always assigned by qualitative responses. The most commonly used approaches to estimate dummy dependent variable regression models are (1) the linear probability model (LPM), (2) the logit, and (3) the probit model [28].

Linear Probability Model (LPM), with proportion of success as the outcome variable, could be used to fit qualitative response regression model. But, the limitation of this model is that the predicted probability values can lie outside the admissible range 0 to 1 and prediction errors can be very large. Besides, although the linear probability model is often used because of its computational ease, outcomes are sometimes predicted with certainty when it is quite possible that they may not occur. Of course, it is possible to overcome difficulty of linear probability model by replacing proportions with odds ratio for easy for interpretation too. The problems of linear probability can be solved by logit and probit models [28].

The logit and probit models are comparable, the main difference being that the logistic function has slightly flatter tails i.e.; the normal and probit curve approaches that axes more quickly than logistic curve. The close similarity between the logit and probit model is confined to dichotomous dependent variables. Ignoring this minor difference, the most widely used estimation techniques for a binary analysis are logit and probit, one can easily estimate a logit as well as a probit and we likely get similar estimates of probabilities. The logistic regression model is advantages over other in the analysis of dichotomous outcomes variable in that it is an extremely flexible and easily usable model from mathematical point of view and results in a meaningful interpretation [29].

Therefore, the binary logit model was employed in order to address the of role of livelihood diversification strategies to rural household food security (i.e. assessing the relationship between livelihood diversification strategies and household food security). The analysis of the logistic regression model shows that changing an independent variable alters the probability that a given individual become food secure, and it help to predict the probability of achieving food security.

Based on [28] and [29] the functional form of logistic model is specified as follows:

$$Pi = E\left(Y = 1/Xi\right) = \frac{1}{1 + e^{-(\beta_0 + \beta iXi)}}. \qquad (1)$$

For ease of exposition, we write (5) as

$$Pi = \frac{1}{1 + e^{-Zi}}. \qquad (2)$$

The probability that a given household is food secured is expressed by (6) while, the probability not food insecure is:-

$$1 - Pi = \frac{1}{1 + e^{Zi}}. \qquad (3)$$

Therefore we can write:

$$\frac{Pi}{1 - Pi} = \frac{1 + e^{Zi}}{1 + e^{-Zi}}. \qquad (4)$$

Now, (Pi/1-Pi) is simply the odds ratio in favor of food security. The ratio of the probability that a household will be food secured to the probability of that it will be food insecure.

Finally, taking the natural log of equation (8) we obtain:-

$$Li = \ln\left[\frac{Pi}{1 - Pi}\right] = \beta o + \beta 1X1 + \beta 2X2 + \ldots + \beta nXn + Ui \quad (5)$$

Where Pi = is a probability of being food secured ranges from 0 to 1

Zi = is a function of n explanatory variables (X) which is also expressed as:-

$$Zi = \beta o + \beta 1X1 + \beta 2X2 + \ldots + \beta nXn + Ui \qquad (6)$$

βo is an intercept
β1, β2……βn are slopes of the equation in the model
Li = is log of the odds ratio, which is linear in Xi
Xi = is vector of household characteristics
Ui = is the disturbance term of the logit model

The logit model cannot be estimated by the usual ordinary least square method because to apply OLS we must know the value of the dependent variable in which obviously not known and more over the methods of OLS does not make any assumptions about the probabilistic nature of the disturbance term. If there is a data on individual observations the method of maximum likelihood would be used to estimate the coefficients of the equation [28].

4. Results and Discussion

The results of descriptive statistics and logistic regression model results for investigating the role of livelihood diversification strategies to rural household food security in the study area have been presented in this section. The response rate in a cross sectional survey design is crucial and should be sufficient for survey quality. But it is quite natural in some cases that a person agrees to participate; however, may refuse to answer some questions which results in non-response for some variables [30]. Recent studies have shown that survey result of higher response rate is preferable because the missing data is not random. A high response rate >80% from a small, random sample is preferable to a low response rate from a large sample [31]. In this regard, the sample size calculated for this study was 364 though data was collected from 355 households only due to unwillingness of some selected units to cooperate and provide some information requested. The response rate in this study was 97%. Therefore, this study was analyzed by 355 sampled households in the study area.

Table 2. Summary of definitions, measurements of variables and its expected sign

Variable code	Definition	Variable Type	Measurement	Expected sign
Dependent variable				
FSS	Food security status	Dummy(HFIAS)	1 food secured; 0 food insecure	+
Independent variables				
LHD	Livelihood diversification	Categorical	0 on farm ; 1 on farm + non-farm ; 2 on farm + off farm ; 3 on farm + off farm +non-farm	+
INC	The share of income	Continuous	(Birr)	+
SHHH	Sex of the HH	Dummy	1 for male; 0 for female	+
HHFS	Household Family size	Continuous	number	+
ESHHHE	Education status of a HH	Continuous	years of schooling	+
TFLSOHH	Total farm land size of the HH	Continuous	hectare	+
TLUOWNED	Total livestock owned	Continuous	TLU	+
TAEXS	Training and extension service	Dummy	1 yes ; 0 no	+
ACR	Access to credit	Dummy	1 yes ; 0 no	

Source: Own definition and literature review, 2018.

4.1. Descriptive Analysis Results

The descriptive results of the types of livelihood diversification strategies pursued by poor rural household in the study area in terms of demographic, socio economic, institutional factors and land characteristics have been explained. Inline with this, rural households in the study area engaged into different combination of livelihood diversification activities. Even though, agricultural land is declining from time to time, a significant part of the sampled respondents still engaged into on farm activities. As it can be seen from the survey results on Table 3,in the study area out of 355 sampled respondents, 41.69% participated into on-farm activity and 22.54% respondents participated in both on-farm + off-farm, 21.41% respondents participated into on-farm + non-farm diversification strategy and the rest 14.37% respondents engaged into on farm + off farm + non-farm diversification strategies.

The key informants also explained that households in the study area engaged in different livelihood activities like on farm (crop production and animal husbandry activities), off-farm activities (local daily wage labor at village level, the agricultural work at another person's farm in return for part of the harvest in kind and firewood and charcoal selling), and non-farm activities (handicraft activities like carpentry and house mudding), petty trade (grain trade, fruits and vegetables trade), selling of local drinks, trading of small ruminants and cattle, wheelbarrow, Cart and remittance transfers within and across nations). Thus, rural farm households in the study area have followed different combination of these livelihood activities to pursue their livelihood strategies. However, the earnings from these livelihood activities were low. These was constrained by poor socio-economic infrastructures (educational facilities, health institutions, and veterinary facilities) and poor market and market information, availability of road and transport service, lack of skill training, poor access to sufficient credit. This influenced the food security situation of the study district.

Table 3. Distribution of sampled household by livelihood diversification strategies

Livelihood Diversification Strategies			
	Frequency	Percent	Cumulative Percent
On- farm	148	41.69	41.69
On farm + off farm	80	22.54	64.23
Off-farm + Non-farm	76	21.41	85.63
On-farm + Off-farm +Non- farm	51	14.37	100.0
Total	355	100.0	

Source: own survey computation, (2018).

Moreover, the descriptive result indicated the food security status of households in the study area. In this regard, the study used household food insecurity access scale (HFIAS) to identify the food secure and food insecure households. The HFIAS score is a continuous measure of the degree of food insecurity (access) of the household in the past four weeks (30 days). First, a HFIAS score variable is calculated for each household by summing the codes for each frequency-of-occurrence

question. Before summing the frequency-of-occurrence codes, the data was coded based on frequency-of-occurrence as 0 for all cases where the answer to the corresponding occurrence question was "no" (i.e., if Q1=0 then Q1a=0, if Q2=0 then Q2a =0, etc.). The maximum score for a household is 27 (the household response to all nine frequency-of-occurrence questions was "often", coded with response code of 3); the minimum score is 0 (the household responded "no" to all occurrence questions, frequency-of-occurrence questions were skipped by the interviewer, and subsequently coded as 0 while data was analyzed. In the analysis result, the higher the score implies more food insecurity that the rural household have experienced but the lower the score shows the less food insecurity status of a households

In order to distinguish the food secure from the food insecure households, households were classified into two groups based on overall distribution of the HFIAS in the sample. Consequently, a score of < 17 was classified as food secure and a score of ≥ 17 classified as food insecure [34]. Based on this score of household food insecurity access scale (HFIAS),the food security status of the sampled households in the study area were identified (see Table 4).

Table 4. Food security status of the sample respondents by HFIAS

Food security status	Frequency	Percent
Food insecure	182	51.27
Food secured	173	48.73
Total	355	100

Source: Own survey computation (2018)

As it can be seen in the Table 4, out of 355 sampled respondents, 182 households were food insecure and the rest 173 were food secured. The 51.27% of the respondents were food insecure which means the household who are food insecure and need interventions that focus on livelihood diversification strategies that should improve the livelihoods of the communities. And 48.73% of the respondents were food secure due to diversifying their source of income in to different livelihood strategies of off farm/non-farm activities.

4.2. Logistic Econometric Model Results

In order to examine the role of livelihood diversification strategies for rural household food security in the study area, this study used two different variables; these are livelihood diversification strategies and share of income. Also the study used household food insecurity access scale (HFIAS) to identify the food security status of the sampled households.

The logistic regression model was employed to assess the role of livelihood diversification strategies to rural household food security. The hypothesized explanatory variables were tested for the existence of multicollinearity and hetroscedasticity problems.

Before conducting econometric analysis it is vital to look into the problem of multicollinearity among the continuous explanatory variables and verify the degree of associations among dummy explanatory variables which otherwise, the parameter estimate would seriously be affected by the existence of multicollinearity among

variables. To this end, the variance inflation factor (VIF) was used to test the degree of multicollinearity among the continuous variables and contingency coefficients were also used to check for the degree of association among the discrete variables. The values of VIF for continuous variables were found to be small (i.e. VIF values less than 10). As a rule of thumb, if the VIF of a variable exceeds 10, that variable is said to be highly collinear [28]. Based on the VIF result, in this study none of the variables has VIF value of 10 and above which is an indication that there is no problem of multicollinearity among the variables in the model.

In order to check the degree of association among dummy/discrete variables contingency coefficient were computed. A contingency coefficient is a chi-square based measure of association where a value 0.75 or above indicates a stronger relationship between explanatory variables [28]. Accordingly, the results of the computation reveal that there was no serious problem of association among discrete explanatory variables in the model.

Besides, the study conducted the hetroscedasticity test in the model. It employed Breusch-Pagan test following [32]. The Breusch-Pagan test for this study was significant with Prob> chi^2 = 0.0000. This indicates that there is hetroscedasticity problem in the model. Thus, robust standard error was used to solve this problem.

The goodness-of-fit determines the accuracy of the model prediction approximates to the observed data. Wald Chi- square test shows the overall goodness of fit of the model at 1% probability level. Wald Chi-square test shows that at least one of the predictors' regression coefficients is not equal to zero. From the results in the Table 5, a Wald chi^2 statistic of 84.69 with a Chi-square distribution of (Prob> chi2) = 0.0000 is significant at less than 1% probability level shows at least one of the explanatory variables in the model has significant effect on household's livelihood diversification strategies and that the explanatory variables jointly influence household's livelihood diversification strategies.

After calculating and identifying household food security status in the study area by using household food insecurity access scale (HFIAS) following [34], the dependent variable food security status was stated "1" indicating for food secured household and "0" otherwise. Then the binary logistic regression model was used to assess the role of livelihood diversification strategies for rural household food security. That means the model was used for assessing the relationship the between livelihood diversification strategies and food security status of the households in the study area.

The goodness-of-fit determines the accuracy of the model prediction approximates to the observed data. Likelihood ratio (LR) Chi-square test shows the overall goodness of fit of the model at 1% probability level. Likelihood ratio (LR) Chi-square test shows that at least one the predictors' regression coefficient is not equal to zero. From the results, a likelihood ratio (LR) statistic of 84.69 with a Chi-square distribution at 12 degree of freedom is significant at less than 1% probability level. This indicates that at least one of the explanatory variables in the model has significant effect on household's food security and that the explanatory variables jointly influence household's food security status(see Table 5).

Table 5. The result of logistic regression model

Variables	coefficient	Odds ratio	Z	P>|z|
Livelihood diversification (LHD)				
On farm + non-farm	2.15	0.116	1.7	0.078*
On farm + off farm	2.16	0.115	2.28	0.023**
On farm + off farm+ non-farm	5.40	0.040	3.39	0.001***
Income	0.004	1.004	8.64	0.000***
Sex of HH head	0.362	1.43	0.54	0.589
Household family size	-0.252	1.28	-1.63	0.104
Education status of HH	1.344	0.259	4.79	0.000***
Total farm land size	1.28	0.27	62.70	0.007***
Total livestock owned	0.529	1.698	2.01	0.044**
Training and Extension service	1.96	7.13	3.14	0.002***
Access to credit	0.944	0 .388	1.41	0.159
Cons	-3.75	0.023	-9.26	0.000

Dependent variable Food security status
Number of obs = 355
LR chi2(12) = 84.69
Prob> chi2 = 0.0000
Pseudo R2 = 0.71
Log likelihood = -125.42547
Source: own survey computation, 2018.
The asterisks ***, **, and * indicate 1%, 5% and 10% significance level, respectively

As it can be seen in the Table 5, the rural livelihood diversification strategies is categorical variable in which on farm activity is a base category. The interpretation of hypothesized explanatory variables on food security status of the households in the study area from the results of logistic regression model has been provided.

As expected, livelihood diversification strategies positively related to rural household food security status in the study area. Consequently; On-farm + non-farm activity positively and significantly related to rural household food security status at 10% probability level. This shows that households who are engaged into on farm + non-farm activities are more food secure than households engaged into on farm activities only. And also on-farm + off farm activities positively and significantly related to rural household food security status at 5% probability level. This means households who are engaged in to on-farm + off-farm activities are more likely to be food secured than the contrary. On-farm + off-farm + non-farm livelihood strategies are positively and significantly related to rural food security status of households and it is significant at 1% probability level. That implies that households who engage into on-farm +off-farm+ non-farm livelihood strategies are more food secured than households who engage into farm activities. This shows households who participated in different combination livelihood activities were more food secure than households engaged into on farm activities alone in the study area. This confirmed that livelihood diversification and food security were positively related. It is in line with the study by [35] that stated that there is positive and significant association between household livelihood diversification and household food security.

Income has a positive relation with the rural household food security status and it is significant at 1% probability level. This indicates that the higher the households' income, the more food secured such households will be. The income from diversification activities was found to have a significant and positive relation with the food security status of the household indicating that farmers who engaged in other income generating activities other than farming have better chance to be food secure. The interpretation of the result indicates that, if all other things are held constant, the odds ratio of 1.004 for income implies that, the odds ratio in favor of being food secure increases by a factor of 1.004 as the income of the household's increases by one Ethiopian Birr. This is consistent with study by [36], farmers who engaged in different income generating activities other than farming have more chance to be food secure than otherwise.

Education status of the households (ESHHH) was the other variable and it was found positively and significantly associated with the probability of being food secure in the study area at 1%. This shows households with more level education are more likely to be food secure. The interpretation of the result indicates that, if all other things are held constant, the odds ratio of 0.259 for the education status implies that, the odds ratio in favor of being food secure increases by a factor of 0.259 as the year of education status increases by one.

Total farm land size of households (TFLSOHH) was significant variable at 1% probability level and has a positive influence on the probability of farm households' food security in the study area. It implies that the probability of food security increases with cultivated farm size witnessing the fact that farmers who have larger farm land holding would be less food insecure than those with smaller land size. This is may be due to the fact that, larger farm size are associated with higher possibility to produce more food. The interpretation of the result indicates that, if all other things are held constant, the odds ratio of 0.276 for the farm land holding size implies that, the odds ratio in favor of being food secure increases by a factor of 0.276 as the farm land holding size increases by one hectare.

Total livestock unit owned (TLUOWNED) positively and significantly associated with the probability of being food secure in the study area at 5% level of significance. This indicates that households with more livestock would likely produce more milk, milk products and meat for direct consumption so that they could be more food secured. Besides, this enables the farm households to have better chance to earn more income from livestock production. This enables them improve their purchasing power of food during food shortage and could invest in purchasing of farm inputs that increase food production as well, and this in turn can ensure household food security. The result indicates that, if all other things are held constant, the odds ratio in favor of being food secure increases by a factor of 1.698 as TLU increases by one TLU.

Training and extension service (TAEXS) has a positive and significant effect on the probability of being food secure at 1% significance level. This is because training and extension service helps rural households to engage into different livelihood diversification activities. This

in turn improves the food security of rural households. The of the result revealed that, if all other things are held constant, the odds ratio in favor of being food secure increases by a factor of 7.13 for the households who get training and extension service than their counterparts.

Therefore; livelihood diversification strategies, income obtained from diversification activities, education status of the households, total farm land size of households, total livestock unit owned and training and extension service were found positively related to rural household food security status and improved food security status of rural households in the study area. Therefore, rural household diversification strategies play a positive and significant role in improving food security in the study area. This implies that households those who diversified their livelihood activities could increase households' income and, concurrently, could improve food security status at household level. In order to be food secured the rural households should choose a diverse portfolio of activities including on-farm, off-farm and non-farm livelihood diversification strategies.

5. Conclusions and Recommendation

5.1. Conclusion

Even if the rural households relay into on-farm strategies, but they are not able to maintain sustainable livelihood and food security merely. Rather, it should be practiced and implemented allied with off-farm and non-farm strategies. Recently, Ethiopian government paid attention to the agriculture sector with less emphasis on different diversifications indeed. But there is evidence that livelihood diversification strategies are growing up and contribute to poverty reduction and achieving food security of the rural area implying that the rural economy is beyond just farming.

The results of the study indicated that rural households in the study area engaged into different combinations of livelihood diversification activities. Accordingly, four types of livelihood diversification activities were identified in the study. These are on-farm, on-farm + off-farm, on-farm + non-farm and on-farm + off-farm + non-farm activities. Thus, in the study area from 355 sampled respondent households, 41.69% participated into on farm activity, 22.54% respondent households participated into both on-farm + off-farm, and 21.41% respondents participated into on-farm + non-farm diversification activities and the rest 14.37% households combine agriculture with non-farm and off-farm livelihood strategies. From this it can be concluded that, rural households in KechaBira district engaged in diverse livelihood activities to ensure their food needs and secure their future livelihoods. But agriculture is still dominant livelihood activity in the study area.

The household food insecurity access scale (HFIAS) was used to measure food security status of the sampled households in the study area. The result demonstrated that, out of sampled households in the study area, 51.27% of households were food insecure. And 48.73% of the respondents were food secure.

Finally, logistic regression model was used to assess the role of livelihood diversification strategies to rural household food security in the study area. The result of the model revealed that livelihood diversification strategies, income obtained from diversification activities, education status of the households, total farm land size of households, total livestock unit owned and training and extension service were positively and significantly related to rural household food security status and improves food security status of rural households in the study area. Thus on-farm + non-farm activity positively and significantly related to rural household food security at 5% probability level. This shows livelihood diversification strategies play a positive role for food security in the study area. The households who participated or engaged in different combination of livelihood strategies earn more income and improve food security status.This shows livelihood diversification strategies have a very critical role in ensuring rural household food security.

As other factors taken into account in the study, livelihood diversification has a potential to contribute to rural household food security. Therefore, livelihood diversification strategies have a positive effect and the best solution to reduce poverty and food insecurity at household level in rural areas. Because it enables the rural households to increase their income levels as well as access to food and minimize households' exposure to the risk and vulnerability due to shocks.

5.2. Recommendation

Livelihood diversification strategies are highly diverse and needs much more attentions. If livelihood diversification strategies are acknowledged it can be contributing to food security of the rural communities. Based on the findings of the study, the following recommendations have been provided for possible interventions and helps to adopt better livelihood diversification strategies among alternatives in the study area in particular and the region in general.

- Building capacity and creating awareness for aged households can increase their capacity to take risk; and that will ultimately improve their choice to participate into non-farm/off farm activities in addition to the farm activity.
- Due attention should be given for promoting farmers' education through strengthening and establishing both formal and informal type of education, developing farmers' training centers, expanding technical and vocational schools.
- The local, regional governments and non-governmental organizations should focus on productivity of livestock sector through improving livestock breeds, veterinary services, forage development, marketing, and overall management of livestock production that aimed at improving rural household's welfare in general and food security status in particular.
- The government offices at all levels and non-governmental organizations should provide training and extension service to rural households and regular follow up of extension agent needed.

- Livelihood options in the study area should be broaden and the government and rural community should give emphasis and work hand in hand for promoting livelihood diversification strategies to improve food security status in the study area.
- The government should develop comprehensive rural development policy and strategies that could empower off-farm and non-farm rural livelihood diversification strategies besides farm activities.

Acknowledgements

References

[1] World Bank "Agriculture for Development Policy". Washington, D.C: World Bank. pp. 177-179.2008.

[2] Babatunde,R.O., "On-Farm and Off-farm Works: Complement orSubstitute? Evidence from Rural Nigeria". *Contributed paper for the 4th International Conference of the African Association of Agricultural Economists September 22-25, 2013. Hammamet, Tunisia. URL:Economists, Septehttp://ageconsearch.umn. June 10,* 2013.

[3] Jirstrom, M. Andersson A, Djurfeldt G., "Smallholders caught in poverty-flickering signs of agricultural dynamism". In AfricanSmallholders: food crops, markets and policy. London, 2011

[4] Samar; "The problem of food insecurity in Africa". Institute of African Research and Studies, 2015.

[5] Food and Agriculture Organisation (FAO).,"Severe food insecurity in Southren Somali Region due to prolonged drought", 2017).

[6] MOFED(Ministry Of Finance And Economic Developemnt)., "Food Security Programme 2010 - 2014", Federal Democratic Republic of Ethiopia Addis Ababa, Ethiopia, 2016.

[7] Tezera, M., "Determinants of Rural Households Livelihood Diversification: The case of LibokemkemWoreda, Amhara region" . Addis Ababa: AAU,Ethiopia, 2010.

[8] Workneh,N., "Food Security Strategy and Productive Safety Net Program". Digest of Ethiopia's National Policies, Strategies and Programs, Pp 1-22. Forum for Social Science: Addis Ababa. Ethiopia,2008.

[9] NPC., "The 2017 Voluntary National Reviews on SDGs of Ethiopia: Government Commitments, National Ownership and PerformanceTrends" Addis Ababa,Ethiopia, 2017.

[10] FEWS NET., "Largescale food security emergency projected for Ethiopia". FEWS NET: Wshington, October 2016.

[11] WAO., "Kecha Bira woreda agricultural office report" ,*Kambata Tambaro Zone,Southern Ethioopia,* 2017.

[12] African Development Bank., "African food security brief: Special focus on Climate of Africa Food security change Impacts". Statistics Department, Issue No 5, April 2014.

[13] Emanuel,E., "Rural Livelihood Diversification and Agricultural household welfare in Ghana" .J.Develop.Agricultural. Economics., 3(7), 325-334, 2011.

[14] Yisehak, G.,Gezahegn, A., Tesfaye, L., Dawit, A., "Rural household livelihood strategies: Options and determinants in the case of Wolaita Zone, Southern Ethiopia". *Social Sciences Research*, 3. 92-104, (2014).

[15] Yenesew,S. Y., Eric N. O., and Fekadu B., "Determinants of livelihood diversification strategies: The caseof smallholder rural farm households in Debre Elias Woreda, East Gojjam Zone, Ethiopia". *Journal of Agricultural Research, 10, 1998-2013.* 9-10, 2015.

[16] Yalneh, B.,"Poverty profile and livelihood diversification in Rural Ethiopia: Implication to poverty reduction" , Konrad, Hagedorn, 2002

[17] Enat, S., "Challenges of Rural Livelihood Diversification: The case of SebetaAwas District in South West Shoa Zone, Oromiya Region, Ethiopia". Addis Ababa University, Unpublished MA Thesis. College of Developmental Studies. (2007).

[18] Abebaw, S., "Dimensions and Determinants of Food Security among Rural Household" . Dire Dawa, Eastern Ethiopia,2003.

[19] Birhanu, N. and Getachew, D., "Livelihood Diversification: Strategies, Determinants and Challenges for Pastoral and Agro-Pastoral Communities of Bale Zone, Ethiopia". *International Review of Social Sciences and Humanities*, pp. 48-49, 2017.

[20] Tibabu, A and Sisay, G., "Level and Determinants of Food Security in North Wollo Zone (Amhara Region - Ethiopia). *Journal of Food Security, Vol. 5, No. 6, 232-247*, 2017.

[21] Central Statistics Agency of Ethiopia (CSA)., "The population projection for July 2011Magazine (1)", CSA, Addis Ababa, 2017.

[22] De Vaus, D., " Research design in social research". London, California and NewDelhi: SAGE Publications Ltd.,2001.

[23] Berger, M.P. and Wong, W.K., "An Introduction to Optimal Designs for Social and BiomedicalResearch". Willey, Chichester. 2009.

[24] Casley, D. and Kumar, K., "The collection, Analysis and use of Monitoring and Evaluation of data" .The international Bank of reconstruction and development. Washington D.C., 1988.

[25] Krishna, W. and Ranga, N., "Creating and Harnessing social capital. In Dasgupta, P. and I.Seragldin, Social capital: a multifaceted persepective" . The World Bank, Washington, D.C. 2005.

[26] Yemane, T., Statistics: An Introductory Analysis, 2nd Ed. New York: Harper and Row, 1967.

[27] Ken, B., " Business Statistics for Contemporary Decision Making" Fourth (Wiley Student Edition for India) ed.). *Wiley-India. ISBN 978-81-265-0809-9,* (2004).

[28] Gujarati, Damodar N., "Basic Econometrics" (4th ed.). New York: The McGraw-Hill Campanies,2004.

[29] Hosmer, D. and Stanley Lemeshow., "Applied Logistic Regression" 2nd Ed.,AP Wiley Inter-science Publication, JOHN WILEY & SONS, INC. New York,2000.

[30] John C., "Good Practices in the Organisation and Management of Statistical Systems' for ASEAN countries" , Yangon Myanmar, Dec.11-13, 2002.

[31] Nigel L.," The average survey response rate" , 2018 benchmark, 2018.

[32] Williams., "Hetroscedasticity" . University of Notre Dame,2002.

[33] Jennifer, C. Anne, S. and Paula B., "Household Food Insecurity Access Scale (HFIAS) for Measurement of Food Access: Indicator Guide(V.3)".Washington, DC 20009-5721: Food and technical assisstant project , Academy for Educational Development, 2007.

[34] Mahama, S. and shaibu, M.O., "school of medicine and health science Report", University for development studies.Ghana,2013.

[35] Mensah, C., "The Impact of livelihood Diversification on Food Security Amongst Farm Households in Northern Ghana: A case study of Bole District, Ghana". University of the Western Cape, 2014.

[36] Daniel, C. N.,Raphael, N.E.,and Chigozirim N. O., "Effects of livelihood diversification on food security status of rural farm households in Abia State Nigeria". Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development*PRINT ISSN 2284-7995, E-ISSN 2285-3952.*Vol. 17, Issue 1, 201