DETERMINANTS OF INCOME DIVERSIFICATION AMONG MAIZE FARM HOUSEHOLDS IN THE GARU-TEMPANE DISTRICT, GHANA

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ABSTRACT

This study explores the determinants of income diversification using a sample of 200 farm-level data collected from households in the Garu-Tampane district, Ghana. The Simpson Index of Diversification was used to determine the extent of income diversification while Fractional Response Model, particularly Generalized Linear Model (GLM) was employed to identify the determinants of income diversification. Results from the Simpson Index of Diversification showed that the average income diversification index was 0.65 with the minimum and maximum of 0.13 and 0.83, respectively. No farm household was found to depend solely on a single source of income for its survival. The results from the Generalized Linear Model revealed that extension services, attendance to demonstration fields, membership of Farmer-based Organizations (FBOs), farmer accessibility to credit, the number of days spent on on-farm activities per month and the number of years in maize farming significantly influence income diversification. The study, therefore, concludes that farm-level policies geared towards alternative sources of income for the rural farm household should focus on improving extension services, the formation of farmer-based organizations, use of demonstration fields as well as ensuring farmers' accessibility to credit.

Keywords: Income Diversification, Generalized Linear Model, Simpson Index of Diversification, Ghana
JEL: Q00, Q01, Q12

INTRODUCTION

Agriculture is the primary activity for the majority of rural households in Sub-Saharan Africa (SSA). It significantly contributes to economic growth, helps in overcoming poverty, and enhances food security**.** This sector in the Sub-Saharan Africa is mainly based on smallholder farms and contributes about 29% to GDP and employs more than half of the labour force **(World Development Report, 2008).** Ghana's agricultural sector contributes about 19% to GDP, **(GSS, 2015).** It is an indisputable fact that most farming households in the Sub-Saharan Africa derive a significant amount of income from agriculture. The Ghanaian agricultural sector is dominated by about 90% smallholder farmers with farm holdings of 0.8 to 2 hectares (GSS, 2014). The industry consists of five main sub-sectors which include, the crop subsector, livestock, fishery, forestry, and cash crops such as cocoa, shea, etc. Most of the cereals like maize, millet, rice, and sorghum in the crop sub-sector are grown in the northern part of the country. Maize is the predominant crop in the Garu-Tempane District according to the 2010 District Assembly composite budget report **(GSS, 2014).**

However, agriculture is associated with several risks and uncertainties (e.g., pests and diseases, marketing, policy, etc.), coupled with climate change being a global threat to farming and its related activities. For instance, farmers are faced with challenges of drought, flood, and crop failure among others. In an attempt to mitigate some of these risks and address the problems of food poverty and food insecurity, they tend to diversify their sources of income; both on-farm and off-farm **(Korir *et al.,* 2013).** Recent studies in SSA indicate that rural households are increasingly diversifying their income sources by combining farm and non-farm activities to sustain their livelihoods **(Winters *et al.,* 2010; Ellis 2005; De Janvry *et al.,* 2002 and Barett *et al.,* 2001). Ellis (2000)** indicated that income diversification has a positive impact on the livelihood of households. **Lay and Schuler (2007)**, noted that diversification supports the accumulation of farm household income for engagement in other non-farm economic activities, and to overcome immediate households needs such as food, shelter, expenditure on healthcare and education, among others. With diversification, households can earn more income for their livelihoods as well as be able to cope in case of crop failure. Income diversification encourages innovation among farm households in developing strategic means of generating multiple streams of income from both on-farm and off-farm. In fact, most rural farmers would be at the "mercy" of governments and food aid in the absence of income diversification when there is crop failure or outbreak of endemic livestock disease as they wouldn't be able to buy food for their consumption. Despite the

enormous importance of income diversification to the rural farm household, there are little empirical studies on the extent and the determinants of income diversification among rural farm households, especially in the study area. The economic activities undertaken by the farming households in the Garu-Tampane district is being driven by some push and pull factors as well as the general motive of raising the standard of living through diversification. Moreover, there is heterogeneity in the kind of income diversification strategies households engage in due to differences in incentives and constraints they face (**Barret, 2005**). This study, therefore, seeks to contribute to the empirical literature on the extent and the determinants of income diversification in Ghana in particular, and Africa in general. Understanding the degree of income diversification will provide the empirical platform for rural economic development programs to appropriately respond to the needs of the rural farm households.

Livelihood Diversification versus Income Diversification
The concept of livelihood diversification connotes, ex-ante, the existence of multiple sources of livelihood per households (**Dzanku, 2015**). Much empirical evidence from SSA (e.g., **Wouterse and Taylor, 2008; Lay et al., 2009 and Stifel, 2010**) in general and Ghana (**Anrqueze and Diadone, 2010**) have all documented that households in developing economies engage in pluriactivity. **Davis et al., (2010)** argues that diversification and not specialization has become a norm for families in developing countries. According to **Readon et al., (1998)** and **Haggblade et al., (2002)**; household diversification behavior emanated from either distress (push) or proactive factors. The *push factors* may result from a search for family survival due to perilous economic situations. Due to original conditions such as low private endowment, diversification resulting from push motives may occur in low-income generating activities with little or no barrier to entry (**Dzanku, 2015**). However, the diversification resulting from the *pull factors* are usually associated with lucrative opportunities for the accumulation of wealth (**Barret et al., 2001b**).

Nevertheless, the drivers of both *push* and *pull* diversification are associated with factors such as risk aversion behaviour, coping strategies, seasonality, market imperfection, constraints to credit, and accumulation of assets (Ellis 2000b). **Bryceson (1996)** also noted that household diversification behaviour could be attributed to the political economy and neo-classical notion of surplus labour. Other evidence of household diversification behaviour documented by previous studies by **Ellis (2000b)** and **Barret et al., (2001b)** include market failure, diminishing return to labour, ex-ante risk management, ex-post coping with adverse shocks, availability of social insurance, among others. **Havnevilk et al., (2007)** and **Ellis (2010)** posited that these factors are influenced by agro-ecology, political systems, macroeconomic policies and institutional arrangements. From the concept of diversification explained above, Ellis 2001 summarized it into a single definition as "*the process by which rural households construct a diverse portfolio of economic activities to accumulate wealth and enhance their*

standard of living." Thus, analysis of livelihood diversification concept emanated from the viewpoint of economic or income generating activities. Hence, livelihood diversification and income diversification are mostly used interchangeably.

Income diversification is defined as the process by which multiple income sources are created by a rural household (**Minot et al., 2006**). **Ijaiya et al., (2009)** defines it as the process of increasing the sources of income or the balance among the different sources of income. However, **Agyeman et al., (2014)** defines income diversification as a situation where farm households rely on multiple sources of revenue both on-farm and off-farm. Thus, though, income diversification is sometimes considered same as livelihood diversification, **Ellis (1997, p5)** pointed out that livelihood diversification is not necessarily the same as income diversification. **Ellis (1997)** defines livelihood diversification as "the process by which rural families construct a diverse portfolio of activities and social support capabilities in their struggle for survival and to improve their standards of living". Though the two concepts are similar regarding the multiple revenue streams, we could conclude that an improvement in income is very likely to result in advancing one's livelihood. Thus, an individual livelihood is a function of many variables including income.

Regarding the empirical front on the determinants of rural income diversification in Sub-Saharan Africa, a study by **Block and Webb (2000)** in Ethiopia and **Abdulai and CroleRess (2000)** in Mali and **Barret et al., (2001)** have concluded that wealth creation is a significant driver of diversification. These studies also indicated that poor households have limited opportunities to engage in multiple sources of income and hence have less diversified income. Similarly, **Canagarajah et al., (2001)** in using the first, and third round of the Ghana Living Standards Survey (GLSS) concluded that rural dwellers were less diversified than the urban dwellers. In recent studies, **Dimova and Sen (2010)** using panel data from Tanzania provided similar conclusions regarding urban and rural dwellers. **Agyemang et al., (2014)** in using household-level data from the Western region of Ghana to analyse the determinants of income diversification reported that factors such as extension contact, the age of the household, gender and ownership of productive assets are significant drivers of income diversification. **Sallawu et al., (2016)** conducted a similar study on the drivers of income diversification among rural households in the Niger State of Nigeria. Using Tobit regression model, the study indicated that household size, poverty status, and educational attainment were the essential determinants of rural income diversification status.

DATA AND METHODS

Conceptual Framework and Estimation techniques
This section presents the conceptual framework and estimation techniques used to achieve the objectives of the study. The study employed three analytical methods to attain its objectives. First, the *Mean of Income Share* procedure used by **Davis et al., (2007)** and **Agyemang et al., (2014)** was employed to estimates the income shares

obtained by the individual households by finding the proportion of each income source in the total household income for each household. The mean share of income can be expressed by Eq. 1.

$$MSI = \left| \frac{\sum IM/THI}{N} + \frac{\sum IOC/THI}{N} + \frac{\sum ILS/THI}{N} + \frac{\sum INFB/THI}{N} + \frac{\sum IWS/THI}{N} + \frac{\sum IR/THI}{N} \right| \quad (1)$$

Where:
IM, IOC, ILS, INFB, IWS and *IR* denotes share of income from maize, share of income from other crops, share of income from livestock, share of income from non-farm business, share of income from wages and salaries, and income from remittances, respectively.

Second, the study employed economic diversity index to measure the degree of income diversification among farm households in the study area. Previous studies (**Oluwadare *et al.*, 2009; Babatude and Qaim 2009, Rhaman 2009, Ogundari 2013**) on diversification (e.g., income, crop, etc.) have used several economic indexes in literature to measure the extent of diversification. These indexes include; Simpson, Herfindahl, Shanon Weaver, Ogive, Entropy, Modified Entropy indexes, among others. This study, however, employs the *Simpson Index of Diversification (SID)* because the index takes into account the number of sources of income as well as the evenness of distribution (**Minot *et al.*, 2006**). Thus, SID takes into account the uniformity of the distribution of the revenues generated from the various activities undertaken by the farm households (**Minot *et al.*, 2006**). Recent application of the Simpson index includes; **Babatude and Qaim (2009)**, **Agyemang *et al.*, (2014)**, **Sultana *et al.*, (2015)**, among others. The Simpson diversification index is given by Eq. 2.

$$SID = 1 - \sum_{I=1}^{N} V_i^2 \quad (2)$$

Where:
SID = Simpsons Index of Diversification, N = Number of income sources and V_i is the proportion of income from the ith source. The value of SID ranges from zero (0) to one (1). It is low when households have few different income sources and becomes 0 when the household depends on only one income source (**Minot et al., 2006**).

To calculate the index, we took into account six income sources: income from maize, income from other crops, livestock rearing, wages, non-farm business, and remittances. Hence, the SID model is expressed in this study as Eq. 3.

$$SID = 1 - \sum_{i=1}^{6} \left[\left(\frac{IFM}{THI} \right)^2 + \left(\frac{IFC}{THI} \right)^2 + \left(\frac{IFL}{THI} \right)^2 + \left(\frac{IFW}{THI} \right)^2 + \left(\frac{INF}{THI} \right)^2 + \left(\frac{IFR}{THI} \right)^2 \right] \quad (3)$$

Where:
IFM = Income from maize, *IFC* = income from other crops, *IFL* = Income from livestock, *INF* = income from non-farm businesses, *IFR* = Income from Remittances and *THI* = Total household income. Simpson index of diversification (SID) lies between 0 and 1 where zero denotes no diversification while one denotes perfect diversification. Hence, the closer the index is to 1, the greater the degree of diversification.

Finally, the *Fractional Response Model (FRM)* was used to assess the factors influencing the extent of income diversification. The model was employed because the dependent variable, *SID* is fractional or proportional in nature. *SID* is a function of several variables (*X*), which may include farmer and farm-specific characteristics, location and other socioeconomic characteristics (Eq. 4).

$$E(SID/X = Xb + e \quad (4)$$

Where:
SID is the dependent variable as defined above, *X* is a matrix of independent variables, *b* is a vector of parameters to be estimated, and *e* is the error term. We used FRM to estimate the *b* vector of the model because the dependent variable is a fraction which is confined to zero and one. In the *FRM* model, a functional form of the dependent variable is selected to impose a constraint on the response variable to ensure that predicted values would always lie within the closed interval (0, 1). The bounded nature of the dependent variable (*SID*) does not permit the use of Ordinary Least Square (OLS) estimator to generate consistent and unbiased coefficients of the explanatory variables (**Bius, 2006**; **Ferrari and Cribari-Neto, 2004**). Some other authors have used censored regression procedure such as Tobit regression to model fractional dependent variable. However, **Maddala (1991)** and **Buam (2008)** opined that such method is inappropriate because such observed data is not censored. Hence, values outside the range (0, 1) is not possible in fractional data. In cross-sectional settings, the FRM accounts for the proportional nature of the dependent variable. The model has been applied in many pieces of economic and finance literature where specific error due to fractional response, defined by the close range of zero (0) and one (1) is addressed (**Choi, 2013**). The FRM is considered as an econometric technique alternative to models such as binary logit, OLS and beta regression which might fail to produce plausible and efficient estimates with fractional values including 0 and 1 (**Ferrari and Cribari-Neto, 2004**). In FRM, the functional form imposes a constraint on the dependent variable such that the predicted values would always lie within the closed interval (0, 1) (Eq.5).

$$E(SID/X = h(Xb) \quad (5)$$

Where:
h is a nonlinear Bernoulli distribution function which transforms the predicted value of the dependent variable to lie between 0 and 1 (**Papke and Wooldridge, 2008**). This Bernoulli distribution and the parameters in the model are estimated using quasi-likelihood estimators such as Generalized Linear Models (GLM). The study adopted the technique introduced by **Baum (2008)** that demonstrate the implementation of FRM using GLM. This procedure requires that both the link function and the distribution function are specified.

The parameters in the model are obtained by

maximizing the Bernoulli quasi log-likelihood function for the FRM that takes the form of Eq. 6.

$$InL(b) = \sum_{j=1}^{N} w_j SID_j In\{h(X_j'b)\} + W_j(1 - SID_j)In\{1 - h(X_j'b)\} \quad (6)$$

Where:

SID_j is the dependent variable, N denotes sample size (spanning from 1 to 200), X_j are the independent variables for farmer j, and w_j is an optional weight. We assume that the link function $h(.)$ follows a logit distribution with the function shown in the model (Eq. 7).

$$h(X_j'b) = \frac{e^{X_j b}}{1 + e^{X_j b}} \quad (7)$$

This leads us to the empirical specification of the FRM as presented in the Eq. 8.

$$E(SID/X) = E(Y) = \beta_0 + \sum_{i=1}^{8} \beta_i X_i + \varepsilon_i \quad (8)$$

Where:

X_i are the explanatory variables estimated to influence the extent of income diversification, ß are parameters to be estimated and e is the error term.

The Study Area and Sampling Procedure

The study was carried out in Garu-Tempane District in the Upper East Region of Ghana. The District lies in the south-eastern part of the Upper East Region of Ghana. It covers an area of 1060.91 square km. The district shares boundaries with Bawku Municipal to the north; Bunkpurugu-Yunyoo District to the south; Bawku West District to the west; and the Republic of Togo to the east. The population of Garu-Tempane District, according to the 2010 Population and Housing Census, is 130,003 representing 1.2 percent of the region's total population. Unskilled agriculture, forestry and fishery workers are the dominant occupation in the District recording 85.2%, followed by small scale industrialization, fishing, and trading. About 95.4% of households in the District engage in agriculture. In the rural localities, nine out of ten households (97.2%) are agricultural households while in the urban localities; approximately 70% of households are into agriculture. Agriculture is the mainstay of the district's economy with vast potentials in maize, millet, sorghum, onion, water melon, Soya bean, mango, groundnuts etc. Animal rearing is equally dominant in the district with high potentials in guinea fowl rearing and cattle rearing. Communal Ownership accounts for over 98% of land acquisition in the District for farming and other agro business. Women do not own land but get access to farm lands through their relatives, husbands and landowners.

In this study, we followed a multi-stage random sampling technique. The Garu-Tempane district was randomly selected from the list of 13 administrative districts in the Upper East region of Ghana. Ten farming communities in the District were randomly selected where 20 maize farm households were selected from each community through a simple random sampling, making a total sample size of 200 households. A cross-sectional data was collected through the use of structured questionnaire. The data collected consists of; demographic factors, socio-economic factors, engagement in farm and non-farm activities, gross income generated from the economic activities (both cash and kind) for 12 months preceding the time of data collection. The analysis was done using STATA version 14 Software. The variables used in the models are presented in Table 1.

Table 1: Definition of Variables

Variables	Description	Apriori Expectation
Marital Status	Married =1, otherwise 0	+/-
Experience	Number of years in crop farming	+
Educational attainment	Years spent in formal education	+
Demonstration farms	Visit to DEMOS =1, Otherwise 0	+
Membership of Farmer-based-Organization	FBO membership = 1, Otherwise 0	+
Access to credit	Access to credit = 1, otherwise 0	+
Number of days in Non-farm activities	Number of days (count)	+

RESULTS AND DISCUSSION

Demographic Characteristics

The demographic characteristics of the respondents (Table 2) showed that most of the respondents interviewed during the survey were males. Thus, about 67% of the respondents were males and 33% females. 83% of the respondents interviewed were married and 17% not married (either single or divorced). The majority (33.5%) of the maize farmers in the Garu-Tempane District had just a primary education and as high as 32% had no formal education. A few (6%) of the farmers interviewed had a tertiary education either in Training college, polytechnic or a University. Fifty-two percent (52%) and sixty and a half percent (60.5%) 52% and 60.5% belong to farmer-based organizations and have access to extension services, respectively. Moreover, 43.5% of the sampled farm households had access to agricultural credit while 56.5% had no access to financial credit.

The average age of a maize farmer in the study area is approximately 44 years, and the average household size is about ten (Table 3). The minimum and maximum farm sizes are 2.5 and 29.5 acres, respectively with an average of 6.75 acres. Thus, most of the maize farmers in the study area are smallholder farmers. On the average, maize farmers in the study area have been in maize production for about 17 years.

Table 2 Demographic characteristics of respondents

Variable	Frequency	Percentage
Sex		
Female	66	33
Male	134	67
Total	200	100
Marital status		
Single/Divorced	33	16.5
Married	167	83.5
Total	200	100
Level of education		
None	64	32
Primary	67	33.5
JHS	30	15
SHS	23	11.5
Technical/vocational Institute	4	2
Training/Poly/University	12	6
Total	200	100
Membership of FBOs		
Yes	104	52
No	96	48
Total	200	100
Access to Extension Service		
Yes	121	60.5
No	79	39.5
Total	200	100
Access to credit		
Yes	87	43.5
No	113	56.5

Source: Field survey, 2017

Table 3 Summary statistics of socioeconomic characteristics

Variable	Minimum	Maximum	Mean
Age	18	80	43.83
Household size	3	31	9.88
Experience	2	37	16.82
Total farm size	2.5	29.5	6.75
Farm size for maize	1	10	3.09
Farm size for others	0	27	3.7

Source: Field Survey, 2017

Mean Share and the Extent of Income Diversification
The mean share of income and the degree of income diversification among farmers in the Garu-Tampane district are reported in Table 4. The study revealed that maize crop income recorded the highest mean percentage of about 31.36% while other crops had approximately 23.19% of the total household income.

Income from livestock rearing recorded about 29.67% of the total household income. Thus, the overall share of revenue from agricultural activities is approximately 84.22% of the total household income. These results indicate the importance of agriculture to the local economy. Moreover, the mean share of non-farm business (self-employment such as petty trading, engagement in other informal employment such as carpentry, etc.) had approximately 11.16% of the total household income while wages and salaries from formal employment recorded about 3%. Only about 1.78% of the total

household income came from internal and external remittances. The results of the mean shares of income are line with recent studies of **Agyemang *et al.,*** (2014) who reported the mean percentage of the farm and non-farm income to be 70.95% and 29.05%, respectively. However, the result is contrary to the study of **Idowu *et al.,*** (2011) who reported 32.92% and 67.08% share of the farm and non-farm income in the total household income amongst rural farm households in the Southern Nigeria.

The study further revealed that the minimum diversification index of farmers in the Garu-Tempane district is 0.128 while the maximum is 0.827. The result suggests that no maize farm household depends on only maize as his/her sole source of income since there is no zero index of diversification (**Minot *et al.,* 2006).** The average index of diversification is 0.65 which implies that, on the average, farmers in the Garu-Tempane district diversify about 65% of additional income sources. However, given an average diversification of 65%, each farmer's diversification differs about 10%. The study showed that 50% of the sampled population diversifies higher than 66.8%. Hence, the extent of income diversification among maize farm households is relatively great.

Determinants of Income Diversification
The estimates of the Generalized Linear Model (GLM) on the determinants of income diversification are presented in Table 5. The variables included in the model are; marital status, experience in crop farming, education, extension service, farmer-field school, farmer-based organization, credit access and the number of days spent on on-farm activities with Simpson index of diversification (SID) being the dependent variable. The results show the Akaike information criterion (AIC) which measures the goodness of fit of the model. Smaller values of AIC indicate a better fit of a model and can also be used to compare models. The AIC is 1.93876 (Table 5) which shows an excellent fit of the data. Out of the eight (8) explanatory variables, extension service, attendance to demonstration fields, membership of farmer-based organizations, credit accessibility and the number of days spent on on-farm activities per month were found to influence income diversification significantly.

Extension service has a positive and significant influence on income diversification, which is in line with our *apriori* expectation. Farmers that have access to extension services are well equipped with modern production technologies and proper adaptive mechanisms to risks and uncertainties which aids them to intensify their degree of diversification. This could also be ascribed to the presence of extension agents in the farming communities advocating for the need of farm households to engage in various forms of income-generating activities as an adaptive measure to reducing the adverse effects of climate change. This confirms the findings of **Kidanemariam (2015)** that extension programs positively influence income diversification.

Table 4 Simpson index of diversification

Variable	Minimum	Maximum	Mean	% mean share of income
SID	0.1282	0.8265	0.6548	
Income from maize	120	7,000	1,661.182	31.36
Income from other crops	105	4,550	1,228.712	23.19
Income from livestock	0	9,000	1,572.03	29.67
Non-farm business	0	6,000	591.1675	11.16
Remittances	0	780	94.30769	1.78
Wages/salaries	0	2,500	150.4737	2.84

Table 5 Determinants of income diversification

Variable	Coefficient	Robust Standard Error	P-value
Marital status	0.0108	0.0212	0.611
Experience in maize farming	0.0013**	0.0006	0.042
Education	0.0008	0.0013	0.574
Extension service	0.0319**	0.0148	0.032
Attendance to demo fields	0.0089**	0.0040	0.025
Farmer based-organization	0.0527***	0.0188	0.005
Credit accessibility	0.0166**	0.0161	0.034
Number of days on on-farm activities/month	-0.0038***	0.0014	0.006
Constant	0.5434***	0.0378	0.000
Number of Observation =200	AIC = 1.9382	BIC = 1016.685	
Log Pseudo likelihood =203.78668			

Attendance to demonstration fields also had a positive and significant effect on the degree of diversification. Thus, encouraging farmers' engagement in demonstration fields increases the degree of diversification. Membership of farmer-based organizations (FBOs) was estimated to have a significant and positive influence on income diversification. When farmers group themselves into a team, it offers them to collectively analyse alternative means of supplementing their sources of income to improve their well-being through farmer-to-farmer teaching and learning. The study also revealed that farmers that have access to credit diversify income more than those that do not. When farmers have access to credit, they can invest in different activities that would generate multiple sources of revenue; both from on-farm and off-farm activities. Similarly, the number of days spent on on-farm activities per month showed a negative and statistically significant influence on income diversification. This makes a lot of sense because farmers who spend much time on their farms will have little time to diversify into other off-farm activities.

CONCLUSION AND POLICY RECOMMENDATION

The study had identified the sources of rural household income, estimated the extent of income diversification and identified factors influencing rural income diversification using data collected from 200 smallholder farmers in the Garu-Tempane District, Ghana. The study found the share of farm income to be 84% of the total household income. Thus, income generated from non-farm income was only 15.78%. This result calls for farm-level policies to ensure maximum farm productivity is attained since much of the rural income is obtained from production and marketing of agricultural products. The extent of income diversification was estimated to about 65% was is relatively high, suggesting that farm households in the study area generate their income from more livelihood activities. The study, therefore, recommends that stakeholders in the agricultural sector should support rural farm families to engage in various sources of revenue, through skill and management development programmes. This will aid to mitigate the effects of climate change, reduce hunger and enhance the standard of rural livelihoods.

Moreover, the study found the determinants of income diversification strategies pursued by farmers to be the number of years in maize farming, contacts with extension agents, attendance of demonstration plots, membership of a farmer-based organization, and access to the agricultural credit facility. Thus, strengthening of rural extension services through recruitment and provision of logistics will help in advocating for the need of farmers to engage in multiple sources of income generating activities in this era of climate change. Supporting the formation of social groups such as FBOs will also encourage farmer-to-farmer extension where farmers share knowledge and learn new business opportunities from each other. In sum, income diversification should be encouraged amongst farm households in the study area to enable them to mitigate the effects of risk and uncertainties in agricultural activities, address household demands and for the accumulation of wealth.

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