SAARC J. Agri., 16(1): 7-21 (2018) *DOI: http://dx.doi.org/10.3329/sja.v16i1.37419*

FACTORS AFFECTING EXTENT OF RURAL LIVELIHOOD DIVERSIFICATION IN SELECTED AREAS OF BANGLADESH

M.T. Ahmed[1*], H. Bhandari[2], P.U. Gordoncillo[3], C.B. Quicoy[4] and G.P. Carnaje[5]

[1]Bangladesh Academy for Rural Development (BARD), Kotbari, Comilla, Bangladesh
[2]International Rice Research Institute, Bangladesh
[3,4]Department of Agricultural and Applied Economics, College of Economics and Management, University of the Philippines Los Baños, Laguna, College 4031, Philippines
[5]Department of Economics, University of the Philippines Los Banos, Laguna, College 4031, Philippines

ABSTRACT

The study was carried out to investigate the patterns and extent of livelihood diversification in rural Bangladesh. It also identified the major factors affecting extent of livelihood diversification. The study drew a random sample of 500 rural farm households in Bangladesh through a multi-stage sampling technique. The primary data were collected using semi-structured questionnaires, and analyzed using descriptive statistics and statistical techniques. The results showed that remittance contributed the highest to the household income followed by petty business and rice farming. The estimated values of Simpson Index of Diversification (SID) showed that majority of the rural households had "medium" and "high" level diversified livelihood activities. Tobit regression analysis found that gender of the household head, household size and amount of credit had positive and significant effects; and number of migrant household member, dependency ratio, household assets, education of the household head and amount of savings had negative but significant effects on the extent of livelihood diversification. The small and medium landholding households were more likely to diversify their livelihoods compared to the functionally landless and large landholding households. The study recommended that non-farm employment opportunities should be expanded to combat poor households' vulnerability to shocks and income fluctuations. Functionally landless households should be given more attention to increase and diversify their incomes.

Keywords: Livelihood diversification, simpson index, Tobit regression, rural Bangladesh.

[*] Corresponding author email: tanvir4344@yahoo.com

Received: 22.04.2018 *Accepted: 25.05.2018*

INTRODUCTION

The economy of Bangladesh is typically agriculture driven. More than 45% of the country's population live in rural areas (World Bank, 2016). Agriculture has remained the main source of livelihoods of rural people since many years. But, in recent years rural livelihoods are rapidly transforming. The importance of agriculture in rural livelihoods is declining, while the importance of the non-agricultural sources, such as business, services, remittance and non-farm labourer is increasing (Hossain and Bayes, 2010). The contribution of agriculture to rural household income dropped from 60% in 1988 to 45% in 2013. Land owned per household has declined from 0.60 ha in 1988 to only 0.30 ha in 2013 (Hossain and Bayes, 2014). On the other hand, agriculture is a risky investment due to the volatility in price and weather. The impact of "Risk" and "Seasonality" in agriculture triggered the diversification process in rural occupations and income. On the other hand, non-farm occupations reduce the risk by combining activities that have different risk profiles, while they can also ameliorate labor and consumption smoothing problems associated with seasonality (Ellis, 2005).

Rural livelihood diversification can be defined as the process by which rural households construct an increasingly diverse portfolio of activities and assets in order to survive and to improve their standard of living (Ellis, 2000). It also refers to a continuous adaptive process whereby households add new activities, maintain existing ones or drop others, thereby maintaining diverse and changing livelihood portfolios. People diversify their livelihoods by adopting a range of activities and income sources. Thus, income sources may include 'farm income', 'non-farm income' (non-agricultural income sources, such as non-farm wages and business income), and 'off-farm income' (wages of exchange labor on other farms, i.e. within agriculture, including payment in kind) (Ellis, 2000).

Bangladesh is one of the densely populated countries in the world, with 1252 people living per square kilometre (World Bank, 2016). The average arable land per capita declined from 0.13 ha in 1971 to 0.05 ha in 2013 (FAO, 2015). Due to limited land per capita and scarcity of resources, people are now shifting their livelihoods from agriculture to non-agricultural sectors. Large numbers of people are migrating from rural areas to urban areas and also to abroad as overseas foreign workers (OFW). Moreover, climate change has made agriculture more vulnerable and risky. The youth are more interested to non-agricultural jobs as it give higher income compare to the job in agricultural sector. It has been seen that there are significant changes happening in terms of earning income from different sources as well as livelihood patterns of the people living in rural areas of Bangladesh (Hossain and Bayes, 2010). But the process and extent of rural livelihood diversification is not same through all the regions of Bangladesh.

The ramifications of livelihood diversification on rural development are colossal. But, the literatures on rural livelihood diversification in Bangladesh are fragmented

and scanty. Some studies deal with the income variation and determinants of non-farm and off-farm income diversification in Bangladesh (Malek and Usami, 2009; Rahman, 2013). However, no literature is available on the level of livelihood diversification and its determinants. Therefore, it is very essential and useful to measure the extent of livelihood diversification in rural areas of Bangladesh and determine the factors affecting the extent of livelihood diversification.

The specific objectives of this study are to (a) find out the extent of livelihood diversification; and (b) determine the factors affecting extent of livelihood diversification. Based on the primary data, it will provide empirical evidences regarding the factors contributing to the transformation of rural livelihoods in Bangladesh. This study will assist the policy makers and donor agencies who frame policies and finance to different projects for the development of rural economy of Bangladesh.

METHODOLOGY

Data source and sampling design

This study was conducted in 12 villages representing major agro-ecologies and diverse livelihoods of Bangladesh. Eleven districts were selected purposively to represent large geographical area and diverse livelihoods of the country. Those districts are Narsingdi, Madaripur, Mymensingh, Bogra, Comilla, Chandpur, Chuadanga, Jhenaidah, Patuakhali, Kurigram and Thakurgaon. Multi-stage random sampling technique was followed to select sample villages. In 10 districts, one sub-district from each district, one union from each sub-district and one village from each union were selected randomly. In Mymensingh district, which is the 5^{th} largest district in the country (Wikipedia, 2018), two sub-districts, one union from each sub-district, and one village from each union were selected randomly. Thus, 12 villages were randomly selected from 11 districts and four geographical regions (e.g. northern region, middle region, south-eastern region and south-western region) of the country. Finally, 45 rural households were randomly chosen from each selected village making a total sample of 540 households. Only 500 households were included in the analysis as some households' data were incomplete.

The study used primary data collected through face to face interview using pre-tested semi-structured questionnaires during 2012–2013. The collected information included demography , land ownership, primary and secondary occupations of household members, migrations and remittances, assets ownership, labor force, on-farm activities, off-farm activities, non-farm activities, credit and savings, agricultural prices, income from different sources and living conditions to name major ones.

The most important determinant of livelihood for any society is income (Gebreyesus, 2016). In this study, household income refers to net income generated by deducting total cost from total return. The share of income from different sources was the basis

to assess their livelihood diversification. Extra attention was paid during data collection and analysis to estimate household's income accurately because farmers do not keep record about their crop production related data and often they tend to under-report their income. Sometimes they do not consider their own production and the in-kind received as income.

Household income was grouped into nine sources.

1) Rice crop (net income from all rice crops in a year);
2) Non-rice crops (net income from all non-rice crops in a year);
3) Non-crop agriculture (income from livestock, fishery and forestry);
4) Agricultural labourer (labour employed in agricultural sectors);
5) Non-agricultural labourer (included both formal and informal types of employment);
6) Petty business;
7) Salaried job and services;
8) Remittance income (received from family members presently living outside the family: both domestic and abroad); and
9) Transfer payment

For analysing purpose sampled households were also classified in four groups based on their landholding.

(1) Functionally landless (>= 0.2 ha),

(2) Small (0.21-0.80 ha),

(3) Medium (0.81-1.50 ha) and

(4) Large (>1.50 ha).

Analytical tools

Simple descriptive analysis (average, mean, median, percentage, etc.) was carried out to determine the household income from different sources. Tabular analysis was done to find the share of various income sources and the extent of livelihood diversification. Tobit multiplicative heteroscedasticity regression was employed to determine the factors affecting the extent of livelihood diversification. The Microsoft Excel and STATA-12 was used to analysis the data.

Part I: Extent of livelihood diversification

The most common measure of livelihood diversification is the vector of income share associated with different income sources (Khatun et al., 2012; Datta et al., 2011). Livelihood diversification can be measured using different indicators and indices, such as Simpson index, Herfindahl index, Ogive index, Entropy index, Modified Entropy index and Composite Entropy index (Khatun et al., 2012; Datta et al., 2011;

Shaha et al., 2011; Shiyani and Pandya, 1998). Several studies have used the Simpson index to measure livelihood diversification (Shaha et al., 2010; Babatunde et al., 2009; Joshi et al., 2003 and Hill, 1973). This study followed the suite because of its computational simplicity, robustness and wider applicability. The formula for Simpson index (SID) is:

$$SID = 1 - \sum_{i=1}^{n} P_i^2$$

Where, n is the total number of income sources and P_i is the income proportion of i-th income source. The value of SID falls between 0 and 1. The index's value is zero if there is just one source of income. As the number of sources increase, the shares (P_i) decline, as does the sum of the squared shares, so that SID approaches to 1. Households with most diversified income sources have the largest SID value, and the least diversified income sources have the smallest SID value. The higher the number of income sources as well as more evenly distributed the income shares, the higher the value of SID. The Simpson index of diversity is affected both by the number of income sources as well as by the distribution of income among different sources. Based on the SID values, the level of livelihood diversification was defined as:

1. No diversification (SID < = 0.01)
2. Low level of diversification (SID = 0.01 - 0.25)
3. Medium level of diversification (SID = 0.26 - 0.50)
4. High level of diversification (SID = 0.51 - 0.75)
5. Very high level of diversification (SID > 0.75)

Part II: Determinants of livelihood diversification

The value of livelihood diversification index ranges between zero and 1. An Ordinary Least Square (OLS) estimate is not appropriate to find the parameters because OLS cannot censor the variables. Tobit model is more suitable to find the parameter estimates if latent or censored sample presents in the dependent variable (Gujarati, 2003). A sample in which information of the dependent variable is not available for some observation is known as censored or latent sample (Gujarati, 2003).

The following Tobit model was employed;

$$SID^* = \beta_0 + \beta_1 Gender + \beta_2 Household\ size + \beta_3 Farm\ size + \beta_4 Member\_org + \beta_5 Migrants + \beta_6 Dev\_prog\_part + \beta_7 HH\_assets + \beta_8 Primary\_Occupation + \beta_9 Dependency\_ratio + \beta_{10} Age\_HH\_Head + \beta_{11} Edu\text{-}HH\_Head + \beta_{12} Amount\_credit + \beta_{13} Amount\_savings + \beta_{14} Distance\_district\_town + \beta_{15} Distance\_market + \beta_{16} Region\_D1 + \beta_{17} Region\_D2 + \beta_{18} Region\_D3 + \beta_{19} Land\_D1 + \beta_{20} Land\_D2 + \beta_{21} Land\_D3 + \mu_i$$

$$SID = \begin{cases} SID^* & \text{if } SID^* > 0 \\ = 0 & \text{Otherwise} \end{cases}$$

Where,

SID* = Livelihood diversification index

β_0 = Intercept

Gender = Gender of Household Head (1= Man, 0 = Women)

Household size = Household size (Number)

Farm size = Total amount farm size (ha)

Member org = Member of any organization (1 = yes, 0 = No)

Migrants = Number of household members staying outside of house (considering both domestic and international migration) (1 = yes, 0 = No)

Dev_prog_part = Households' participation in any govt. development program (1 = yes, 0 = No)

HHassets = Household Assets (Estimated value of all physical assets owned by a household, except the value of cultivable land in BDT)

Primary_Occupation = Primary occupation of the household head (1 = farming, 0 = otherwise) *Dependency_ratio* = Dependency ratio of the household (ratio of economically inactive persons (younger than 18 and older than 59) over the active persons (ages 18-59 years) expressed in percentage

Age_HH_Head = Age of household head (years)

Edu-HH_Head = Education of household head (Year of schooling)

Amount_credit = Amount of credit (Received credit from any sources in a year expressed in BDT)

Amount_savings = Amount of savings (Money saved in any account in a year expressed in BDT)

Distance_district_town = Distance of district town (Distance of household from the district town in Kilometer)

Distance_market = Distance of market place (Distance of household from the nearest market place in Kilometer)

Region_D1 = Regional Dummy1 (1= Northern region, 0 = otherwise)

Region_D2 = Regional Dummy2 (1= Middle region, 0 = otherwise)

Region_D3 = Regional Dummy3 (1= South-Eastern region, 0 = otherwise)

Land_D1= Land class dummy1 (1= Landless, 0 = otherwise)

Land_D2 = Land class dummy2 (1= Small land class, 0 = otherwise)

Land_D3 = Land class dummy3 (1= Medium land less, 0 = otherwise)

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

The method of Maximum Likelihood Estimates (MLE) is employed to Tobit model as it gives consistence parameter estimates and makes error term asymptotically normal.

Test of multicollinearity

A test for multicollinearity was done to establish and examine the cross-correlations among explanatory variables. The result of correlation analysis showed that the correlation coefficient between farm size and land-man ratio was 0.84 which suggests the present of serious multicollinearity problem. The most practical remedial measure of multicollinearity is to drop one of the correlated variables from the regression model (Gujarati, 2003). Here, land-man ratio was dropped from the model. Another diagnostic test of multicollinearity, variance inflation factor (VIF), was also conducted and found no serious multicollinearity problem anymore.

Test of heteroscedasticity

One of the assumptions of linear regression model is that the disturbance terms (μ_i) are homoscedastic, which means that they have same variance. If the variance of U_i is not same (Var $\mu_i \neq \sigma^2$), then the heteroscedasticity problem can be raised. To test for heteroscedasticity, this study applied the Cook-Wiesberg test (1983) and the "hettest" test in STATA and both the tests confirmed the presence of heteroscedasticity problem in the model. This study used Tobit multiplicative heteroscedasticity regression by executing *"tobithetm"* command in STATA-12 to find the estimates by omitting the effects of heteroscedasticity problem. It deals with multiplicative heteroscedasticity and produces coefficients that can be used to test a formal hypothesis.

RESULT AND DISCUSSION

Sources of household income

Income share from different sources indicates the level of livelihood diversification. The statistically significant F-value of ANOVA indicates that income share differ significantly across various sources in rural Bangladesh. The average annual total income of the sample household was found to be about USD 2,400 (Table 1). According to the Household Income and Expenditure Survey (HIES) of 2010, Average yearly household income of Bangladesh is USD 1722 (BBS, 2015). The result also shows that remittance contributed highest share (29%) to the household's total income, followed by Petty business (20%) and rice crop (16%). The other sources also had considerable contribution to the household income.

Table 1. Distribution of household yearly income by sources

Source of income	Amount of income (USD/year)	Share of income (%)
Rice crop	380	16
Non-rice crops	202	8
Non-crop agriculture	221	9
Agricultural laborer	61	3
Non-agricultural laborer	171	7
Petty business	487	20
Salaried job and services	155	6
Remittances	699	29
Transfer payment	16	1
Total	2,393	100
F-value of ANOVA	14.27 (P = 0.000)	

Source: Survey result, 2012-13, Note: 1 USD = 80 BDT

Household livelihood diversification

Majority of the rural households diversified their livelihoods into several activities and earned significant amount of income from multiple sources. As depict in the Table 2, 94% of the total sampled households pursued some extent of diversification in their livelihoods. Only 6% of households had zero Simpson index, meaning they earned income from just one source for their livelihoods. Of the sampled households, 20% had low, 32% had medium, 38% had high and 4% had very high level of livelihood diversification. The result implies that majority of the households are diversifying their livelihoods at medium and high level.

Table 2. Distribution of sampled household as per the level of livelihood diversification

Sid range	Percentage	Level of diversification
<=0.01	6.0	No
0.01 – 0.250	19.6	Low
0.260– 0.500	31.8	Medium
0.510– 0.750	38.4	High
>= 0.760	4.2	Very high

Source: Survey result and author's computation, 2012-13

Factors affecting livelihood diversification

From the value of Simpson index of diversification (SID), it is clear that most of the households in rural areas of Bangladesh participated at different 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 extent of livelihood diversification among the rural households of Bangladesh. The limited chi-squared distribution was found insignificant at 5% level of significance and thus the null hypothesis of homoscedasticity ($\alpha = 0$) was accepted. This confirms no more heteroscedasticity problem in the model. The estimated results of the Tobit regression and the marginal effects are presented in table 3 and table 4, respectively.

The Tobit regression results (Table 3) indicated that gender of household head, household size, number of migrants, household's participation in development program, household assets, dependency ratio, education of household head, amount of credit, amount of savings, regional dummy and land classification dummy were the factors which had significant contribution in determining livelihood diversification in rural areas of Bangladesh. The results showed that man headed household had a positive and significant effect on the extent of livelihood diversification among the rural households (at 1% level of significance). This is probably because in the rural areas of Bangladesh a man has more access and social acceptance to have more employment opportunities both inside and outside of the house than a woman. On the other hand, women have less access to work outside of the home and thus less scope to diversify their sources of income. This results are consistent with some other studies on income diversification in Nigeria (Alaba and Kayode; Babatunde and M. Qaium, 2009). The marginal effect of gender explains that if the household is headed by a man then the extent of livelihood diversification is likely to increase by 13.7%.

Household size was also found important and significant in determining the livelihood diversification. It had positive contribution to the extent of livelihood diversification and found highly significant at 1% level of significance. The positive contribution of household size is as expected because having more members in a household means more scope to access different income sources and earn higher amount of income. The result is consistence with the work of Oluwatayo (2009). The marginal effect of household size revealed that the extent of livelihood diversification is likely to be increased by 2% for an additional member in the household (Table 3).

The results also showed that number of migrants and household assets had negative and significant contribution to the level of livelihood diversification. Both the number of migrants and household assets are significant at 1% level of significance. The households which have more number of migrant members both in-country and abroad, are receiving regular and higher amount of income as remittance. Thus, these households do not seek for alternative sources of income which result low level of

livelihoods diversification. The same type of result was found by Malek and K. Usami (2009) in their study on non-farm income diversification in Bangladesh. They found negatively significant coefficient of out-country migration capital on non-farm income diversification.

In rural farm areas of Bangladesh, household assets constituted by mostly farm and agricultural assets which are an investment for increasing farm production. Having higher amount of household assets influence the household to act that they are more secured in context of vulnerability and thus, they hardly go for non-farm income. Therefore, those households that had more assets are less diversified in their income sources and probably more involved in farm activities. The marginal effect of number of migrants explains that for an additional out-migrant member from the household the level of diversification is likely to goes down by 2.7%.

The dummy variable of participating in some development program was found significant at 1% level of significance and had positive impact on the level of livelihood diversification. This implies that, if the households are members or beneficiaries of some developmental programs or projects then they are more likely to be diversified in their livelihoods. Because, being a member or beneficiary of some developmental projects or programs they can have more access to information and scope to intensify their income sources. Moreover these types of developmental programs itself provide some amount of income to its participants. The marginal effect showed that, if a household is a member of any developmental program then the likelihood of livelihood diversification increases by 10.5% compared to the household that is not involve in some development programs.

Dependency ratio is also found significant at 1% level of significance and it had negative sign over the level of livelihood diversification. Which means if dependency ratio increases then the level of livelihood diversification will decreases and vice versa. The marginal effect of dependency ratio explains that for one percent increase in dependency ratio the level of livelihood diversification will goes down by 0.06% and vice versa.

Higher level of education among the household heads had a negative and significant (1% level of significance) effect on livelihood diversification in the study areas of rural Bangladesh. This is probably because school education increases the human capital level and provides necessary skills to an individual to get a decent and more permanent type work which leads him or her to get income from a single source. Moreover, educated persons also hardly look for farm and non-farm employment types of job. Marginal effect of education of household head implies that the level of livelihood diversification is likely to be decreased by 0.7% for every additional year of schooling of household head. This result contradicts with the findings of Asmah (2011), Shaha (2010) and Babatunde (2009).

The results found that amount of credit had positive impact on the level of livelihood diversification. It was significant at 1% level of significance. This implies that

households having more amount of credit are likely to be more diversified in their livelihood activates. The probable reason of this is the credit money helps the household to invest for both farm and non-farm types of activities and boast up their income. This result is supported by some other similar types of study e.g. Asmah (2011), Saha et al. (2010), Oluwatayo (2009) and Babatunde (2009).

On the other hand, amount of savings had a negative and highly significant (at 1% level of significance) effects on livelihood diversification. This implies that households having some saving money are likely to be less diversified in their livelihood activities. It is because; more savings means less investment which eventually results less income as well as less number of income source.

The dummy variable for South-Eastern region was found positive and significant at 5% level of significance which means that households in South-Eastern region had significantly higher level of livelihood diversification compared to Western region. The marginal effect of this dummy variable can be explained as if the households are in the South-Eastern region then the likelihood of livelihood diversification increases by 7.1% compared to the households from Western region. While the dummy variable for Northern and Middle region was insignificant.

Similarly, all three land classification dummy variables were found significant at 5% level of significance. The functionally landless households had negative coefficient while the small and medium land holding households had positive coefficient compared to the large land holding households. This means that the functionally landless households are likely to be less diversified in their livelihoods compared to large land holding households. On the other hand, small and medium land holding households are likely to be more diversified in their livelihoods compared to the large land holding households.

Table 3. Tobit regression results to determine factors affecting the livelihood diversification in rice-based areas of Bangladesh

Variables	Coefficients	Std. Err.	Z-value	P-value
Intercept	0.1441	0.0687	2.10	0.036
Gender of household head	0.1366***	0.0349	3.91	0.000
Household size	0.0209***	0.0038	5.53	0.000
Farm size	0.0140	0.0114	1.23	0.219
Member of any organization	0.0148	0.0189	0.78	0.433
Migrants	-0.0270***	0.0061	-4.43	0.000
Development program participation	0.1054***	0.0247	4.27	0.000
Household assets	-8.73e-08***	1.97e-08	-4.42	0.000
Primary occupation	-0.0128	0.0199	-0.65	0.518

Variables	Coefficients	Std. Err.	Z-value	P-value
Dependency ratio	-0.0007***	0.0002	-3.83	0.000
Age of household head	0.00002	0.0008	0.02	0.981
Education of household head	-0.0077***	0.0019	-4.08	0.000
Amount of credit	1.12e-07***	2.66e-08	4.21	0.000
Amount of savings	-3.05e-07***	9.89e-08	-3.08	0.002
Distant to nearer district town	0.0019	0.0013	1.48	0.138
Distance to nearer market	0.0106	0.0078	1.36	0.173
Region_dummy1	0.0142	0.0316	0.45	0.653
Region_dummy2	-0.0651*	0.0386	-1.69	0.092
Region _dummy3	0.0719**	0.0348	2.06	0.039
Land class _dummy1	-0.0732**	0.0370	-1.98	0.048
Land class_dummy2	0.0694**	0.0287	2.42	0.015
Land class_dummy3	0.0692**	0.0289	2.40	0.017
Sigma	0.1821			
LR chi2(21)	-40.47			
Prob> chi2	1.00			
Log likelihood	86.03			

Source: Authors' computation, 2013

*** Significant at 1% level; ** Significant at 5% level; *Significant at 10% level

Table 4. Marginal effect of the variables on livelihood diversification after running the Tobit regression

Variables	dy/dx	Std. err.	z- value	p-value
Gender of household head	0.1366	0.0350	3.91	0.000
Household size	0.0209***	0.0038	5.53	0.000
Farm size	0.0140	0.0114	1.23	0.219
Member of any organization	0.0148	0.0189	0.78	0.433
Migrants	-0.0270***	0.0061	-4.43	0.000
Development program participation	0.1054***	0.0247	4.27	0.000
Household assets	-8.73e-08***	0.0000	-4.42	0.000
Primary occupation	-0.0128	0.0199	-0.65	0.518
Dependency ratio	-0.0007***	0.0002	-3.83	0.000

Variables	dy/dx	Std. err.	z- value	p-value
Age of household head	0.00002	0.0008	0.02	0.981
Education of household head	-0.0077***	0.0019	-4.08	0.000
Amount of credit	1.12e-07***	0.0000	4.21	0.000
Amount of savings	-3.05e-07***	0.0000	-3.08	0.002
Distant to nearer district town	0.0019	0.0013	1.48	0.138
Distance to nearer market	0.0106	0.0078	1.36	0.173
Region_dummy1	0.0142	0.0316	0.45	0.653
Region_dummy2	-0.0651*	0.0386	-1.69	0.092
Region _dummy3	0.0719**	0.0348	2.06	0.039
Land class _dummy1	-0.0732**	0.037	-1.98	0.048
Land class_dummy2	0.0694**	0.0287	2.42	0.015
Land class_dummy3	0.0692**	0.0289	2.4	0.017

Source: Authors' computation, 2013

*** Significant at 1% level; ** Significant at 5% level; *Significant at 10% level

CONCLUSION

Majority of the rural households in Bangladesh have diversified their livelihoods from agriculture to different activities. Most of them have diversified their livelihoods at medium and high level. Several factors either positively or negatively impacted extent of livelihood diversification. Gender of the household head, household size, households' participation in development program and amount of credit have positive and significant effect on the extent of livelihood diversification. On the other hand, number of migrants, household assets, education of household head, dependency ratio and amount of savings have significant but negative effects on livelihood diversification. It was also found that south-eastern region was significantly more diversified in their livelihood activities as compared to western region. The significant and negative coefficient of dummy variable for functionally landless households indicated that they pursued lower level of livelihood diversification compared to the large households. While, the significant and positive coefficient of dummy variable for small and medium land holding households indicated that they pursued higher level of livelihood diversification compared to large land holding households. The declining farm size limits the household ability to earn adequate livelihoods from agriculture. The diversification of agriculture-based rural livelihoods is necessary to improve rural livelihoods. The government should craft and implement policies and programs to promote diversification of

livelihoods through increasing and creating the opportunities of more income generating activities especially for the poor households to combat the risk of income fluctuation. The policies and programs should focus on factors that have large impact on livelihood diversification.

REFERENCE

Awoniyi, O.A., and Salman, K.K. (2011). Non-farm Income Diversification and Welfare Status of Rural Households in South West Zone of Nigeria. In *a conference organized by IFPRI in conjunction with the AV, UNECA and FARA in* 1st–3rd Nov in Addis Ababa, Ethopia.

Asmah, E.E. (2011). Rural livelihood diversification and agricultural household welfare in Ghana. *Journal of Development and Agricultural Economics*, *3*(7), 325-334.

Babatunde, R.O., and Qaim, M. (2009). Patterns of income diversification in rural Nigeria: determinants and impacts. *Quarterly Journal of International Agriculture*, 48(4), 305-320.

BBS. (2015). Statistical Year Book of Bangladesh, Bangladesh bureau of statistics, statistics and informatics division (SID), ministry of planning, pp. 516.

Datta, S.K., and Singh, K. (2011). Livelihood diversification: A case study of some backward regions in India. *International Journal of Current Research*, *3*, 139-151.

Developing Country Studies, ISSN 2224-607X (Paper), ISSN 2225-0565 (Online), 6(4), 10-18.

Ellis, F. (2000).Rural livelihoods and diversity in developing countries. Oxford university press.

Ellis, F. (2005). Small farms, livelihood diversification, and rural-urban transitions: strategic issues in Sub-Saharan Africa. *The future of small farms*, 135.

FAO. (2015). FAOSTAT. http://www.fao.org/faostat/en/#country/16

Gebreyesus, B. (2016). The most important determinant of livelihood for any society is income.

Green, W.H. (2003). Econometric Analysis. Fifth edition, *Upper Saddle River, New Jersey 07458*

Green, W.H. (2012). Econometric Analysis. Seventh edition, *Pearson Education, publishing as Prentice Hall, Edinburgh Gate, Harlow, Essex CM20 2JE, England.*

Gujarati, D.N. (2003). Basic Econometric. Fourth Edition, Mac Grow Hill Company, New York, USA, pp. 616-619.

Hill, M.O. (1973). Diversity and evenness: a unifying notation and its consequences. *Ecology*, 54(2), 427-432.

Hossain, M., and Bayes., A. (2010). *Rural economy and livelihoods: Insights from Bangladesh*. AH Development Publishing House.

Hossain, M., and Bayes, A. (2014). Rural Transformation in Bangladesh, 1988-2013: Insights from Longitudinal Surveys. In seminar, BRAC Centre Inn, Dhaka, Bangladesh.

Joshi, P.K., Gulati, A., Birthal, P.S., and Tewari, L. (2004). Agriculture diversification in South Asia: patterns, determinants and policy implications. *Economic and Political Weekly*, 2457-2467.

Khatun, D., and Roy, B.C. (2012). Rural livelihood diversification in west Bengal: determinants and constraints. *Agricultural Economics Research Review*, *25*(1), 115-124.

Malek, M.A., and Usami, K. (2009). Determinants of non-farm income diversification in developed villages of Bangladesh. *American Journal of Economics and Business Administration*, *1*(2), 141.

Oluwatayo, I.B. (2009l). Poverty and income diversification among households in rural Nigeria: A gender analysis of livelihood patterns. In *Conference Paper*, 41.

Petersen, D., and Waldman, D. (1981). The treatment of heteroskedasticity in the limited dependent variable model. *Mimeograph. University of North Carolina, Chapel Hill*.

Rahman, M.S. (2013). Socio-economic determinants of off-farm activity participation in Bangladesh. Russian Journal of Agricultural and Socio-Economic Sciences, 13(1).

Saha, B., and Bahal, R. (2010). Livelihood Diversification Pursued by Farmers in West Bengal. *Indian Research Journal of Extension Education*, *10*(2), 1-9.

Shiyani, R.L., and Pandya, H.R. (1998).Diversification of agriculture in Gujarat: A spatio-temporal analysis. *Indian journal of agricultural economics*, *53*(4), 627.

Talukdar, D., and Chile, L. (2013). Determinants of Growth in Consumption of Rural Household in Bangladesh: A Regression Analysis. *International Journal of Applied Economics*, 10(1), 39-63.

Wald, J.K. (1999). How firm characteristics affect capital structure: an international comparison. *Journal of Financial research*, 22(2), 161-187.

Wikipedia. (2018). https://en.wikipedia.org/wiki/List_of_districts_of_Bangladesh

World Bank. (2016). https://data.worldbank.org/indicator/EN.POP.DNST

World Bank. (2016). https://data.worldbank.org/indicator/SP.RUR.TOTL.ZS