Farm and Non-farm Income Diversification in Selected Areas of Sunamganj District of Bangladesh

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Authors' contributions

The work has been carried out from author MSUA master's thesis in collaboration with supervisor author JUA, co-supervisor author MM and other authors. Author MSUA designed the study, performed the statistical analysis and wrote the protocol and the first draft of the manuscript. Authors MSUA, KF and MNM managed the analyses of the study. Author KF has contribution to edit, read and approve the final manuscript.

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ABSTRACT

Rural income diversification by increasing income and reducing risk of vulnerability help the poor farmers to improve their standard of living. The study assesses the occupational patterns, sources of income diversification and factors that affect farmer's decision towards income diversification. The findings will be extended to the rural farmers to identify their potential socioeconomic indicators that affect their livelihood diversification decision. Two villages of Sunamganj district of Bangladesh was purposively selected for this study. The results of the analyses showed that the maximum farmers (25) were following the crop cultivation + fish catching + non-farm occupational pattern. The Simpson index of diversification (SID) showed that the low, medium and high levels of diversified farmers were about 23 percent, 43 percent, and 13 percent, respectively. The result of the Logit model shows that age negatively and farm size positively influence income diversification decision of the farmer while sex, education level, marital status, family size, membership status of the sampled

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farmers, access to credit and market distance does not. The FGD revealed some coping strategies during the lean period. It could be suggested to the poor farmers to improve their farm activities and to diversify their income sources to non-farm income activities to reduce income vulnerability.

1. INTRODUCTION

Agriculture is the single largest producing sector of Bangladesh economy and contributes about 17 percent to the total GDP of the country. This sector also accommodates around 46 percent of labor force. GDP growth rate of Bangladesh mainly depends on the performance of the agriculture sector [1]. In Bangladesh, agricultural development is related with the food security of the vast population, directly link to poverty alleviation, improved standard of living and employment generation which has been given the highest priority to be self-sufficient in food [2]. There is now total 15183183 farm and 13512580 nonfarm holdings in Bangladesh [1].

In small farming in Bangladesh, there are four main components of farm sector such as crops, livestock, fisheries and poultry [3]. Non-farm activities in Bangladesh is comprised of a diversified activities like mechanics, rural business enterprises, transport operations, construction labor, various types of personal services (barbers, laundry services, midwives etc.), medium and large scale trading, etc. This diversification is driven by different incentives and capacity to undertake non-farm activities among rural household [4]. The diversification is important for a country like Bangladesh which mostly depends on agriculture because it associates with various types of risks and uncertainties by several natural calamities which hamper the production and income of the farmer result them into vulnerable conditions. Diversification to nonfarm income sector will help the farmers to cope up with these hazardous situations.

Sunamganj district was one of the sub-divisions of former Sylhet district. The district is full of *Haor*s [5]. *Haor,* back marsh or bowl shaped depression may consists of large number of beels locates between the natural levees of rivers [6]. The district has 95 *Haor*s, which is 268531 ha out of total 367000 ha area [7]. The total households in Sunamganj district is about 4 million and the total population is about 25 million. These households are doing farm activities like the produce of crops, namely, local and HYV rice, wheat, vegetables, jute, spices, pulses, oil seeds, etc and also engaged in different types of non-farm activities [5]. *Dekhar Haor* is a prominent *Haor* area in Sunamganj district. Because of having low income, the people of this area cannot meet their basic needs of life properly. Sanitation, safe drinking water, hospital facilities, communication problems, lack of government support are the common problems of them. In rabi season (November to March), the people can cultivate rice, mustard, sweet potato etc. Some households also have homestead vegetables. The production of vegetables is also very low. They mainly cultivate for their own consumption. Many families have small livestock rearing opportunities. Sheep, goat, cattle, and hen are the common livestock.

During the rainy season most of the area goes under the water by 12-15m. As a result, the farmers mostly depend on earning through fishing opportunities. They catch fishes and sell them to the local market with low price. The income earned from it is not sufficient to meet their daily requirement. Some of the farmers also engaged in non-farm activities in the period. The main working activities are artisans, day labor, rickshaw pulling, etc. So, during lean period of time, if they do some non-farm activities along with farming, the income level will rise up. The minimum standard of living will improve. This process of diversification will make them self-sufficient and help them to cope with risk.

Some relevant literature on these modalities can be pictured as: Ahmed *et al.* conducted a study on patterns and extent of rural areas livelihood diversification of Bangladesh and they found that the livelihood diversification of rural Bangladeshi households is at a medium level [8]. Sultana *et al.* have used the Simpson Index of Diversity (SID) to calculate the annual average expenditure of households by the level of income diversification in the rural areas of Rajshahi district of Bangladesh and found that in the study area the income level diversification is very low and it is significantly and positively related to households' well-being [9]. Abimbola and Olaniyi

conducted a research on diversification of rural livelihood and inequality of income in Nigeria and revealed that the age, education level, and household size has a negative and positive relationship to adopt farming and non-farming activities, respectively [10]. Lama studied on livelihood diversification and determinants in West Bengal based on primary survey and the results of Binary Logit Model identified that to adopt non-farm activities, education plays a very significant role [11]. Adebayo *et al.* carried out a study on income diversification determinants among farm households in Kaduna State and suggested the importance of basic infrastructure in the farming communities to increase their non-farm activities [12].

Moreover, most of the studies were done either on the extent of diversification or on the determinants of diversification. Although there is several works on income diversification, very limited study was done on diversification of livelihood in *Haor* areas of Bangladesh. In this context, the study was undertaken.

i. To identify the occupational pattern and sources of income diversification of the *Haor* households,
ii. To examine the factors that influence farmers' decision towards income diversification; and
iii. To recommend enhanced coping strategies for the poor households during the lean period.

2. MATERIALS AND METHODS

2.1 Selection of the Study Area

To analyze the sources of income diversification and the factors that affect the farmer's decision towards income diversification the researcher selected *Noagaon* and *Bahadurpur* village of *Dakshin Sunamganj* Upazila of Sunamganj district purposively. The two villages were selected after a pre-–visit by the researcher. The villages are near the *Haor* and the people of those villages have a wide range of occupational pattern.

2.2 Sampling Technique

By using convenient sampling technique a total 120 sampled farmers were selected where 60 sampled farmers were selected from each village. To identify the coping strategies during lean period, two Focused Group Discussion

(FGD) were done with the sampled farmers where one was done in *Noagaon and another in Bahadurpur* village. Each of the FGD consist of 25 sampled farmer comprised of young members, older man, male and female household head, married and unmarried women and persons engaged in farm and non-farm activities. The FGDs were done after the face to face interview. The researcher collected the data during period Nov/15 to March/16. During interview the interviewer has to face lots of difficulties. The farmers did not kept information about their farming. So, the data were collected based on their memory. Most of the farmers had no idea about the research system. So before collecting the data a brief description was delivered to them which was time consuming for the researcher.

2.3 Analytical Technique

The tabular analysis was used to measure the occupational pattern of the sampled farmers. The sources of income diversification were analyzed by using Simpson Index of Diversification (SID) [13,14,15]. The formula for Simpson Index of Diversification [8] 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 portion of i-th income source. The value of SID ranges between 0 and 1. Farmer's having one income source represent zero index's value where index value 1 means highly diversified income sources of the sampled farmers. The number of income sources and its distribution among different sources affect the Simpson index of diversity. Based on the SID values, the level of livelihood diversification was classified as [8]:

i. No diversification (SDI <= 0.01);
ii. Low level of diversification (SDI = 0.01-0.25);
iii. Medium level of diversification (SDI = 0.26-0.50);
iv. High level of diversification (SDI = 0.51-0.75) and
v. Very high level of diversification (SDI =>0.75).

In order to identify the factors that influence farmer's decision towards income diversification Logit model was used [16]. The Logit model for the study is specified as [17]-

$$\frac{P_i}{1 - P_i} = \frac{1 + \exp(Z_i)}{1 + \exp(-Z_i)}$$

Because the equation is nonlinear, one can linearize the model by taking the natural log. This gives the following linear Logit model:

$$L_i = \ln\left[\frac{P_i}{1 - P_i}\right] = \beta_0 + \beta_1 X_1 + \cdots + \beta_9 X_9 + e$$

Where $P_i / (1-P_i)$ is the ratio of the probability of the farmer to diversify the income sources apart from the probability to not involved in another type of work. The dependent variable is binary and its value is 1 for a farmer who diversified their income sources and 0 for a farmer who did not. Here

β_0 = Constant
$\beta_1 - \beta_8$ = Logistic regression co-efficient.
$X_1 - X_8$ = Independent variables

Where,

X_1 = Age of the sampled farmers (year)
X_2 = Sex of the sampled farmers (if male = 1 otherwise if female = 0)
X_3 = Educational level of the sampled farmers (0 for illiterate, 1 for literate, 2 for primary, 3 for high school, 4 for S. S. C (Secondary School Certificate), 5 for H. S. C (Higher Secondary School Certificate), 6 for graduation)
X_4 = Marital status of the sampled farmers head (1 for married and 0 for unmarried)
X_5 = Family size (No. of people living or eating together)
X_6 = Farm size (area of land cultivated in acre)
X_7 = Credit (1 for having credit access and 0 for otherwise)
X_8 = Market distance (distance from house to nearest market in km)
X_9 = Membership status of the sampled farmers (1 for membership of farmer group and 0 for otherwise)
e = error term

3. RESULTS AND DISCUSSION

3.1 Occupational Pattern

The study examined the occupational pattern of the farmer between farm and non-farm activities. The sampled farmers were engaged in farm activities as crop production, livestock rearing and fish catching along with different non-farm activities such as nonagricultural wage labor, contract job, service holder, small business, transportation labor etc. There were some farmers who have only one source of income and some others have more than one that means they are diversified.

Table 1 shows the occupational patterns of the sampled farmers. It can be seen from the Table that 25 percent of sampled farmers had crop cultivation + fish catching + non-farm occupational pattern. They cultivated crop by leasing land. Livestock rearing opportunity is very limited in the study area. Households with large family size also catch fish and doing some non-farm activities for more income. Among all the sampled farmers, only 0.83 percent had crop production+ livestock rearing + non-farm and crop production+ fish catching + livestock rearing + non-farm occupation pattern.

3.2 Sources of Income Diversification

Different researchers have used the number of income sources as a measurement of diversification [12]. The person having more sources of income is more diversified. Diversification of the selected sampled farmers was analyzed by using Simpson Index of Diversification (SID).

The Table 2 depicts that the average Simpson index was 0.27. The Table also shows that majority of the sampled farmers (42.50 percent) belongs to medium level of the diversified group. Only 22 percent had zero SDI 23 percent had low, and 13 percent had a high level of livelihood diversification. That implies that majority of the sampled farmers were diversifying their earning sources through various activities.

3.3 Factors Affecting Farmer's Decision towards Income Diversification

To determine the effect of different independent variables on the decision of farmers towards income diversification in *Dekhar Haor* a Logit model was used. The estimated coefficient of the Logit model, standard errors, level of significance and odds ratio are presented in Table 3. The table shows that the Cox and Snell R^2 were 0.26 and Nagelkerke's R^2 was 0.40. This implies that the model explains about 40 percent of the variation in the data. The results show that the age of the sampled farmers had a negative value of coefficient and it was significant at 10 percent level. This indicates that the older the sampled farmers, the lower the probability of farmer's decision towards income diversification.

Table 1. Occupation status of sampled farmers in the study area

Occupational status	Frequency	Percentage of the occupational status
Crop cultivation	3.00	2.50
Fish catching	3.00	2.50
Non-farm	17.00	14.17
Crop cultivation + non-farm	28.00	23.33
Crop cultivation + fish catching	17.00	14.17
Crop cultivation + livestock rearing	6.00	5.00
Crop cultivation + fish catching + livestock rearing	2.00	1.67
Crop cultivation + fish catching + non-farm	30.00	25.00
Fish catching + non-farm	12.00	10.00
Crop cultivation + livestock rearing + non-farm	1.00	0.83
Crop cultivation + fish catching + livestock rearing + non-farm	1.00	0.83
Total	120.00	100.00

Source: Field survey, 2016.

Table 2. Percentage distribution of the sampled farmers by sources of income diversification

Items	No. of sampled farmers	Percentages of sampled farmers
<0.01 (no diversification)	26.00	21.67
0.01-0.25 (low level)	27.00	22.50
0.26-0.50 (medium level)	51.00	42.50
0.51-0.75 (high level)	16.00	13.33
>0.75 (very high level)	-	-
Total	120.00	100.00
Average	0.27	

Source: Field survey, 2016.

A unit increase in the age of the sampled farmers will reduce the probability of household income diversification decision by on an average 0.97 holding other factors remaining constant. The reason of such negative sign was that the older sampled farmers do not want to take the risk to change their profession. The results reveal that the farm size had positive effect on income diversification decision and it was highly significant. Which implies that the larger the farm size greater the probability towards income diversification decision. Holding other factors fixed, one unit increase in farm size would lead to increase the probability of income diversification decision by 13.76. That represents having large farm size had more scope of diversification than small farm sized sampled farmers. This finding is similar with Msoo and Aye conducted a research on farm household diversification and welfare in Makurdi, Benue State [17]. From the result, it can be seen that the credit access has a negative relationship with sampled farmer's income diversification decision which is insignificant. In the study area, the formal sector credit facility is very limited. Most of the sampled farmers take credit from the informal sector like money lenders with limited amount and high interest rate.

Because of this constraint in accessing credit, they cannot get proper amount of money for initial investment in both farm and non-farm sector. The membership status is also negatively affecting the income diversification decision which is also insignificant. The sampled farmers in the study area have very little opportunity to become member in any organization. Because of this, the membership status affects negatively to take decision about income diversification.

3.4 Coping Strategies

The livelihood of the sampled farmers was intermingled with different problems such as low productivity of crops, poor transportation system, improper health facilities, inadequate farm inputs, non getting proper price of agricultural output, etc. Those problems made their life more uncertain and affected their farming system as well as the engagement of non-farm activities resulting in gradual reduction in their standard of living. The researcher had done two FGDs with the sampled farmers to identify some coping strategies during the lean period. Sampled farmers pointed out some issues and strategies to overcome the crisis period, and they found

Table 3. Estimated values of coefficient and related statistics for measuring the effect on decisions towards income diversification

Selected variables	Coefficients	Standard errors	Level of significance	Exponential of coefficient or odds ratio
Constant	-13.99	2.20	1.00	0.00
Age (X_1)	-0.03*	0.01	0.07	0.97
Sex of the sampled farmers (X_2)	0.41	1.50	0.77	1.50
Education level(X_3)	0.20	0.28	0.48	1.22
Marital status(X_4)	19.09	2.20	1.00	1.94
Family size(X_5)	-0.06	0.14	0.68	0.94
Farm size(X_6)	2.62***	0.83	0.00	13.76
Credit access(X_7)	-0.79	0.57	0.17	0.45
Market distance(X_8)	0.06	0.14	0.65	1.06
Membership status(X_9)	-1.65	1.13	0.14	0.19
-2 Log likelihood	87.36			
Cox & Snell R^2	0.26			
Nagelkerke R^2	0.40			

Source: Author's estimation, 2016
*** = 1% level of significance, ** = 5% level of significance and * = 10% level of significance

these might be helpful for them to overcome crises during the lean period. Those strategies are described below-

3.4.1 Adopting modern farming system

Most of the sampled farmers argued that the farming systems they use are traditional which give them less amount of yield. They said that improving farming system will be able them to get production and will make them self-sufficient and secured in food all year round.

3.4.2 Improving physical structure of farm area

The physical structure of the farming area was not so good and well-constructed. The drainage and irrigation system was also not well developed. For this reason, during the period of flood, the water cannot pass from the field properly. Because of this, they got less amount of production which made them suffer in a lean period. So it is one of their other strategies that they will improve their physical structure of the farming system.

3.4.3 Homestead gardening

Many sampled farmers had argued that making a homestead vegetable garden will help them to meet the demand for vegetable. The fellow land around their homestead area can be used for it. Besides, cultivation of small amount of different vegetables in their small pieces of land is not so

costly. But the output from it will be immense. The vegetable can be used for their home consumption. This will be a good source of nutrition for making them food secured. The surplus amount can be sold in the market which will give them some cash also.

3.4.4 Homestead livestock rearing

Most of them suggested that livestock can be reared in their house which is not so much cost for them. The hay from the rice production can be used for their feed. The livestock may be cattle, hen, duck, sheep or goat, etc. Cattle can be reared for meat, drought and also for dairy purpose. Dairy purpose cattle can give milk daily in their lactation period. This will provide nutrition to the small children and also will earn some revenue by selling it. They can also rear duck or hen. Duck can be easily reared by them cause of wide available water body. This will provide them meat and adequate amount of eggs resulting make them food secured and self-sufficient.

3.4.5 Acquiring knowledge of farming through training

To cultivate properly, they need proper knowledge about it. They can acquire it from training. They found that the application of the knowledge from training will improve their productivity. So they assured that they will participate actively in all training program organized by the government and different non-government organizations.

3.4.6 Adoption of proper education

Education will change their lifestyle and make their thinking broad. Proper education will improve their decision-making capacity, adoption of modern technology and will also help them to improve their farming system. So they also came in a single decision that they will manage proper education for their child rather than involving different earning sources.

3.4.7 Adoption of improved variety of seed and modern technology

Use of HYV quality seeds and modern technologies will increase their production. They had strategized that they will adopt modern technologies for their production and will use good quality seeds in the right amount.

3.4.8 Proper application of fertilizer in right amount

Most of the sampled farmers did not know the right amount of fertilizer to be used in their field which hampers the crop production and hence amount of crop yield. But the proper amount of fertilizer application in right time might increase their yield. So they made the strategy to use the right amount of fertilizer in right time.

3.4.9 Co-operative farming system

At present, there is a cooperative fishing organization in the *Bahadurpur* village which had made their fishing profitable with low cost. So, they suggested that they can also apply the cooperative system at the time of seed sowing, intercultural operation, harvesting and post-harvesting operations of crop production. This decision will be effective when there are so many crises in labor with high wage rate.

3.4.10 Catching of fish in right time

Many sampled farmers did not know the proper time of fishing. Those who knew did not obey the rules. Some of them caught fish during banning times which is breeding period. This will hamper proper fish growth in size and in quantity results the lack amount of fish at the time of harvesting. To they mentioned out that catching of fish in right time will make them more profitable in fishing.

3.4.11 Proper use of their financial and other assets

The major problem of the sampled farmers was having low amount of financial and other assets. But they commented that the assets will be productive through the use of them in a proper way. They should use the capital in productive purpose instead of unproductive one. This decision will help them to cope in the time of no working period and also invest in farm production as well small business.

3.4.12 Increasing sources of income means diversification

Some of the FGD participation who had only a single source of income which is not sufficient for all year round. Sometimes it may be sufficient but in some month they face difficulty. Those farmers who had only farm activity can diversify their income in non-farm ones like rickshaw pulling, transportation labor, small business, etc. If they adopt their activities with more than one income sources, this would make them self-sufficient throughout the year.

4. CONCLUSION

The livelihood condition of *Haor* area is different from the other parts of a country. They are subjected to different types of risk and natural calamities. Fishing activities and crop cultivation are their main earning sources. Besides in the study area, many people also diversified with some non-farm activities along with farm activities. This diversification process will increase their standard of living. The people of the area should increase different kinds of non-farm activities. If the farmers adopt modern and newly introduced methods of crops cultivation process and fish catching, it is expected that their farming systems will be improved which will increase their standard of living. But it constraints by various factors such as environmental issues, credit facilities, adoption perception towards new technology, etc. Further research is needed regarding these issues.

In order to increase their livelihood process, the provision of credit facilities, improving the transportation system, providing proper information about their product prices is essential. It is necessary to encourage the small entrepreneur and small scale business. The government, non-government, cooperatives and other autonomous institutions should take initial

steps in order to expand credit market, infrastructure development, providing proper information and training, proper medical facilities. The Proper amount of agricultural inputs with appropriate prices is needed for them. The transportation systems, electrification, and their marketing process should be developed. The proper prices of their product should be ensured. Present study focuses two adjacent villages; therefore, the findings of this study should be interpreted with considerable caution to generalize for the country as a whole.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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APPENDIXES

Questionnaire for FGD:

1. What are the problems in your area for agriculture and nonfarm activities?
2. Do you know about the diversification of income?
3. Do you think diversification of income will improve your standard of living?
4. What difficulties did you face during lean period of time?
5. What are the possible solutions do you think to overcome those difficulties?
6. What is the logic behind the strategy?
7. Are you all willing to follow those strategies?