IUBAT Review
A Multidisciplinary Academic Journal

Abdul Jabber, Selina Nargis and Muhammad Shahjahan. 2017. "Improvement of Livelihood through Diversified Income Generation." *IUBAT Review* 1 (2): 37-48. iubat.edu/journal

Improvement of Livelihood through Diversified Income Generation

Abdul Jabber,
Department of Economics
IUBAT – International University of Business Agriculture and Technology
Uttara, 1230

Selina Nargis
Department of Psychology,
IUBAT – International University of Business Agriculture and Technology
Uttara, 1230

Muhammad Shahjahan
Economics Department
IUBAT – International University Of Business Agriculture and Technology
Uttara, 1230

ABSTRACT: *This paper evaluates existing modern rice technology adoption and the possibility of increasing household income of resource-poor farms under three diversified production environments in Bangladesh. The potential expansion of modern rice technology has nearly been exhausted in areas displaying favorable production environments. In these areas, there remains scope for enhancing household income through non-rice crop production. On the other hand, the prospect for increased productivity seems elusive in the tidal wetland areas unless flood-resistant rice varieties can be developed and adopted. The output in flood-prone areas devoted to Modern Variety (MV) rice cultivation in the Transplanted Aman (T. Aman) season is 35%, against the national average of 60%. To cultivate a larger area under a flood-prone environment, alternative crops such as vegetables may be cultivated immediately after the recession of flood water. About 38% of the cropped land in drought-prone areas is devoted to MV T. Aman season rice cultivation. Low diffusion of modern technology, caused by infrastructural backwardness, is a prominent barrier to higher agricultural income generation for farms in drought-prone areas of Bangladesh.*

KEYWORDS: *Economics, rice technology, agriculture, income , productivity, livelihood, crop cultivation, development, environment, floods, drought*

Introduction

The importance of rice as source of income of farming households in Bangladesh can hardly be overestimated (Elias, 2000). Agriculture diversification and rice-based income are always important to all the marginal and small farm households of the country (Brahmmer, 1977). It is agreed among agricultural experts that the principal constraints to increasing rice-based income is inadequate knowledge in relation to two questions; (i) for which sub-groups of households is income from rice-related activities especially important; and (ii) how best to assist and enhance the income from such activities among poor households. The context to this analysis is the rapid diversification of agricultural activities (Orr and Magor, 1992).

In order to understand the assets and livelihood strategies of target groups, their coping strategies and cultivation practices should be analyzed. This article analyzes the livelihood strategies of resource-poor households within and beyond rice-based activities in three different production environments: flood-prone, drought-prone, and environments with favorable rice production conditions (Hussain et al., 1999). It attempts to provide policy guidelines to enhance productivity and income generation among resource-poor households. The specific objective of the study is to (i) examine the pattern of income earnings against source; (ii) examine the influence of different asset-based factors on income generation of these farming households; and (iii) evaluate the related factors for enhancing output to reduce poverty of the resource-poor farmers.

Methodology

Data for this study were collected from three environments favorable, flood- and drought-prone). Bogra district was taken as a favorable production environment, while Kurigram and Rajshahi districts have been treated as flood and drought-prone environments respectively. One upazila from each district was selected, and from each selected upazila one union was selected. Two villages from each union were randomly selected. As first step, a list of farmer from each village was prepared. Sample farms from each village were selected following the wealth ranking procedure. From each village 50 farms were selected, in total100 farms from each of the three environments. Farm households in a village were divided into four categories: large, medium, small and vulnerable groups (marginal farmers).

Analytical Tool

Tabular analysis is followed by analyzing the data related to sources of income and rice production technology. The asset base factors have been divided into five categories: (i) Natural capital (natural resource stocks able to generate resource flows); (ii) Social capital (social networks, memberships, access to wider institutions upon which people draw); (iii) Human capital (skills, knowledge, and ability plus good health); (iv) Physical capital (basic infrastructure and production equipment); and (v) Financial capital (total income received as saving and remittance) (Reordan, 1997).

In order to estimate the relationship between net income and asset-based factors the

Corresponding Author: Md Abdul Jabber, dr.jabber@iubat.edu

following multiple linear regression model has been used.

$y_i = \alpha + \Sigma ß_i x_i + u_i$

Where,

y_i = Net income in Taka per household i = 1 … 300

x_1= Human capital. It is measured by scoring the education level and technical knowledge). For no education scoring is zero. Otherwise scoring is measured on the basis of years of schooling. Technical knowledge is considered as dummy variable = 1, if farmer has technical knowledge, otherwise it is zero.

x_2 = Natural capital. A farmer having all these resources, namely owned land, domestic animals, and irrigation facilities, scores 100. In the case of two or one resource, the score is 66 or 33 respectively.

x_3= Physical capital. Agricultural tools and availability of electricity are measured by dummy variables. If available value is 1; otherwise it is zero.

x_4= Financial capital. It is measured by actual amount of money available from savings, gift and remittance.

x_5= Social capital. It is measured by scoring the number of memberships in any social institution including service as village leader.

α = intercept

u_i= disturbance term

Results and Discussion

Annual income distribution pattern of the resource-poor households

The annual income distribution of resource-poor farm households in three different environments of Bangladesh is presented in Table 1. It is evident

Table 1: Average annual income (Taka) of farm households in three environments of Bangladesh, by income source 2015

Sources of income	Environment		
	Favourable	Flood-prone	Drought-prone
On-farm income	32670 (30.53)	12027 (27.51)	19383 (19.72)
Off- farm income	18350 (17.15)	13941 (31.88)	73830 (75.16)
Non-farm income	56000 (52.32)	17754 (40.61)	5030 (5.12)
Grand total	107020 (100)	43,722 (100)	98244 (100)

Note: Figure in the parentheses indicate percentage of total

On-farm income = Cereals crops, vegetables, spices and others

Off- farm income = Fisheries, livestock, day labor and daily workers in different operations

Non- farm income = Business, service (public, non-Government, remittance, and services at different transport sector)

Source: Survey Data, 2015

that annual income per farm household was the highest (Tk. 107,020) in favorable production environment followed by drought-prone environment (Tk. 98,244) and flood-prone environment (Tk. 43,702). The average income of the farm households at flood-prone environment was extremely low and it was only two-fifth of favorable production environment. The probable reason for low income in flood-prone environment was low productivity of crops due to hazards in cultivating crop in water logging and poor crop management practices. This can be improved through adaption of flood resistant variety or cultivation of high yielding alternative crop variety.

In the flood-prone environment, the non-farm income source was the most important (41%). Among the on-farm income sources, rice was the main source of income, almost 60 percent of the total on-farm income. A different picture appeared in the drought-prone environment: off-farm sources of income contributed by far the highest share (75%). Among the off-farm income sources, livestock production was the highest (81 percent). The high income from this source was due to low cost of production in livestock. Raising livestock is an established agricultural sector. Small investments can generate robust income. Income from rice and vegetables was very low in this area because farmers fear drought. In the favorable environment (Bogra), non-farm income was the main source of income generation (52%), followed by on-farm income source (31%). The high share of income from non-farm sources is due to foreign remittance. Among the on-farm sources, vegetable production was the main source (59%). The share of rice to total on-farm revenue was 35 percent. Though the rice share of on-farm income was low, the income from rice was still higher (Tk.12,000) compared to the other two environments. The main causes were higher rate of MV adoption in the favorable environment compared to the two other environments.

Determinants of net income

The influence of different asset-based factors on farmers' net earnings was evaluated using regression analysis and the corresponding result are given in Table 2. The asset-based factors are financial, natural, social, physical and human capital at different environments. The independent variables were taken considering the weighted average value of each factor. The co-efficient of natural capital were positive and significant (at 10% level) for all the locations. This indicated that net income of the sample farm households increased through natural capital.

In the favorable production environment, the co-efficient of financial capital was 8655 (significant at 5% level) implying that the income would increase by Tk. 8655 due to increase of 1 weight of financial capital. This shows that financial capital has a very important impact on net income generation in this environment, because most of the households received foreign remittances on a regular basis and actual amount of saving from agricultural sector. The impact of financial is so high in favorable production environment it influenced other two environments too. That is why financial capital projected significant result in all regions. As a result $R^2 = 0.70$ due to high impact of financial capital.

Table 2: Association of Average annual income (Taka) of farm households with Asset-based Factors under different environment environments, 2015

Variables	Coefficients			
	Favourable production	Flood-prone	Drought-prone	All regions
Financial capital	8655**	1807	8998	16778**
	(4018)	(2030)	(6200)	(2818)
Natural capital	3396*	822*	3537*	2522*
	(1843)	(530)	(1743)	(1208)
Social capital	3356	300	686	90
	(4885)	(261)	(975)	(683)
Physical capital	15620	3861	6420*	3689
	(9860)	(2121)	(3607)	(2285)
Human capital	7393*	161	388	6778
	(4124)	(889)	(3056)	(3780)
Number of observations	100	100	100	300
R^2	0.77	0.49	0.68	0.70
Adjusted R^2	0.76	0.48	0.66	0.69

Figures in the parentheses indicate standard error.

** Significant at 5% level. * Significant at 10* level.

Source: Survey Data, 2015

In the drought-prone environment, the co-efficient of physical capital was 6420 (significant at 10% level), which implies that the contribution of physical capital has substantive impact on net income generation.

The adjusted coefficients of determination for favorable, flood-prone and drought-prone environments are 0.76, 0.48 and 0.66 respectively, overall 0.69.

Area devoted to rice production and its impact on income generation

Over the period 1971/72 to 2015/16, the Aus rice area declined at an annual rate of 4.12 percent. The growth rate was positive (but not substantial) during the 1970s. Beginning in the 1980s, the total Aus rice area declined (see Table 3). The possible reason could be the shifting of Aus rice areas into Boro rice. Moreover, the expansion of irrigation facilitated the remarkable growth of the Boro area. In the Boro season (winter), irrigation constitutes a major cost, which the resource-poor farmers cannot afford.

The cost analysis showed that the benefit cost ratio in T. Aman season is higher compared to other two seasons (Boro and Aus) in all environments (Table 4). Therefore, the only option remains for the resource-poor farmers is to increase rice production through increasing production per unit area and expanding of the MV T. Aman area.

Table 3: Estimates of annual growth rates of area under rice in Bangladesh, 1971-2015				
Growth	Aus (summer harvest)	Aman (autumn harvest)	Boro (spring harvest)	Total rice
1971-72 to 2015-16	-4.12	-0.02	6.12	0.25
1971-72 to 1980-81	0.45	0.90	2.00	0.96
1981-82 to 1990-91	-4.58	-0.96	9.10	-0.12
1991-92 to 1999-00	-3.98	-0.35	6.12	0.48
2000-2001 to 2008-2009	-3.99	-0.40	2.16	-0.38
2009-2010 to 2015-2016	-3.75	-0.48	8.01	1.68

Source: Handbook of Agriculture Statistics (2015), Ministry of Planning.

Table 4: Cost-benefit analysis of modern rice cultivation (Takas/hectare), 2015									
Items	Favourable production			Flood-prone			Drought-prone		
	Boro	Aus	T. Aman	Boro	Aus	T. Aman	Boro	Aus	T. Aman
Variable cost	71000	55200	60070	60000	49020	51000	55000	50100	50000
Fixed cost	180	110	160	150	118	148	160	130	135
Total cost of production	71180	55310	60230	60150	49138	51148	55160	50230	50135
Grain yield	5520	3580	4500	4800	3000	3900	4000	2900	3500
Gross return	99360	64440	85500	81600	54000	70200	70000	52200	65000
Net returns	28180	9136	25270	21450	4862	19052	14840	1970	14865
Benefit-cost ratio	1.40	1.12	1.42	1.36	1.10	1.37	1.27	1.04	1.30

*Land cost not included, ** Includes straw cost.

Source: Survey Data, 2015

Enhancement in MV adoption to national level

The present share of cultivable land devoted to MV T. Aman in the drought-prone environment is only 38 percent. It is 60 percent at the national level. If farmers in the drought-prone environment could realize the national share of land devoted to MV T. Aman rice, then on average each farm would be able to obtain an additional 20.65 kg of rice. By a similar calculation, the farmers in the flood-prone environment could get an additional production of 115.02 kg per household (Table 5).

Table 5: Projected increase in production of T. Aman through enhancing areas under MV cultivation, 2015

Average area under T. Aman (per household) (Decimal)	MV area c. (Decimal)	Reduction in LV area d. (Decimal)	Reduction in LV production (Kilogram)	MV production (Kilogram)	Increase in MV production (Kilogram)	Net increase in rice production (Kilogram)
1.	2.	3	4.	5.	6.	7. (= 6.–4.)
	Flood-prone					
0.81 (x 0.35) a.	0.283	-	-	446.66	-	-
0.81 (x 0.60) b.	0.486	0.203	205.38	767.06	320.40	115.02
	Drought-prone					
0.84 (x 0.38) a.	0.319	-	-	387.29	-	-
0.84 (x 0.60) b.	0.504	0.252	203.96	611.90	224.61	20.65
	Favourable					
0.75 (x 0.89) a.	0.667	-	-	966.35	-	-

Notes:

environment-specific level of MV adoption,

National level of MV adoption

MV: modern variety of rice

LV: local variety of rice

In drought-prone environment MV and LV rice are 3000 kg/ha and 2000 kg/ha respectively.

In flood-prone environment MV and LV are 3900 kg/ha and 2500 kg/ha respectively.

In favorable area production, is 4500 kg/ha.

Figures in the parentheses indicate % of MV adoption.

In the favorable production environment, the rate of MV T. Aman adoption is much higher than the national level, because of favorable production environment and intensive utilization of land. So, there is no scope of increasing area under MV T. Aman area in this environment.

Previously, in the three seasons (Boro – Aus – T. Aman) the crop pattern was MV-LV-LV. Now, the prevailing present pattern is MV-MV-MV (Table 6).

Table 6: Past & present cropping pattern in favorable production environment, 2015

Previous cropping pattern % area covered (percent share)		Present cropping pattern % area covered (percent share)	
Boro-Aus-Aman MV – LV – LV	55	Boro-T.Aus-T.Aman MV – MV - MV	45
Potato-Jute-Aman	25	Potato-Boro-Vegetable	38
Rabi crops-Jute-Aman	10	Potato-Boro-T. Aus-T.Aman	5
Vegetable-Sugracane	2	Potato-Boro-Veg.-Veg.	8
Fallow-Aus-Aman	8	Veg.-Boro-T. Aus-T.Aman	4

Source: Survey Data, 2015

Famers' opinion on MV rice adoption

The farmers' perceptions about the problems and constraints with respect to MV adoption, in both drought-prone and flood-prone environments, are shown in Table 7. Among all problems mentioned by the sampled farmers, the absence of a demonstration program ranked first in both the areas. The second most important problem was lack of extension contact. The other problems were lack of irrigation facilities, non-availability of fertilizer and insecticides. These problems could be minimized if Direction of Agriculture (DAE), Bangladesh Agriculture Development Corporation (BADC) and Non-government Organization (NGOs) could provide assistance. Farmers' opinion on their desired assistance are presented in Table 8. Supply of good quality seeds got the highest priority among the needed assistance as desired by majority of the sample farmers in both the areas.

Table 7: Problems and constraints with respect to expansion of MV rice varieties in flood and drought-prone environments, 2015

Problems/ Constraints	Drought-prone		Flood-prone	
	Percentage of farmers response	Rank	Percentage of farmers response	Rank
Absence of demonstration program	90	1st	88	1st
Lack of extension contact	86	2nd	76	2nd
Lack of quality modern seeds	82	3rd	68	3rd
High price of input	73	4th	61	4th
Lack of Irrigation facility	68	5th	59	5th
Insect and disease infestation	38	6th	35	7th
Lack of fertilizer and insecticides	32	7th	21	8th
Environmental degradation	28	8th	50	6th

Source: Survey Data, 2015

Table 8: Farmers views about desired assistance for increasing household income, 2015

Desired assistance (s)	Percent of farmers respondent	
	Flood-prone	Drought-prone
Supply good quality seeds	96	85
Supply credit	75	38
Preventive measure for resisting betel leaf diseases	42	40
Supply good quality fertilizer and insecticides	36	25
Provide training to farmer	26	48
Increase irrigation facilities	12	9
Make necessary arrangement for testing the soil	2	6

Source: Survey Data, 2015

Increase in production through increasing yield

A second option for increasing income is to increase yield (see Table 9). For example, the present average MV T. Aman yield in the drought-prone environment is 3.00 tonne/ha. With proper management farmers could achieve at least 4.00 t/ha in T. Aman season, equivalent to an additional 149.77 kg per household. Similarly, farmers in the flood-prone environment could get an additional production of 269.11 kg per household.

Table 9: Estimated incease in production of T. Aman through increasing the yield (4.00 ton/ha), 2015

Average area under T. Aman (per households) (Decimal)	MV area (Decimal)	Reduction in LV area (Decimal)	Reduction in LV production (Kilogram)	MV production (Kilogram)	Increase MV production (Kilogram)	Net increase in rice production (Kilogram)
1.	2.	3	4.	5.	6.	7. (= 6.–4.)
Flood-prone environment						
0.81 (x 0.35)	0.283	-	-	312.55	-	-
0.81 (x0.60)	0.486	0.203	205.38	787.00	474.49	269.11
Drought-prone environment						
0.84 (x 0.38)	0.319	-	-	516.39	-	-
0.84 (x0.60)	0.504	0.185	149.73	815.86	299.47	149.77
Favorable environment						
0.75 (x 0.89	0.667	-	-	1215.18	-	-

See notes to Table 5.

On the other hand, the average yield of MV T. Aman rice in the favorable production environment was 4.50 t/ha, higher than the national average yield (3.00 t/ha). Farmers in the favorable production environment get an additional yield of 1.50 t/ha relative to the national average. The explanation is the higher diffusion of modern technologies. So, in the favorable production environment, there is little scope for reducing poverty through increasing MV adoption unless high yield potential varieties are introduced. The area under vegetable production in the favorable production environment is much higher than the national average. Another option for reducing poverty may be to increase vegetable production by supplying quality seeds.

The relative price index of crops and agriculture inputs over the period (1972-73 as the base year) shows that the relative price index for vegetables rose sharply in real terms to 322, a much greater increase than for other crops (see Table 10). If this trend continues, vegetable production in Bangladesh may have enormous scope for raising farm household net income, and could help to reduce poverty in all environments.

Table 10: Relative price index of crops and agricultural inputs, 1972/73 to 2013/14

Inputs/Output	Growth rate* (% per annum)	Index (1972-73 = 100)	Current price index (2013-2014)	Real price index, adjusted for inflation (1972-73=100)
Diesel	38	100	2380	595
Agricultural wages	23	100	580	145
Fertilizer	20	100	510	132
Insecticides	11	100	533	128
Cereals	10	100	401	90
Rice	10	100	452	118
Pulses	9	100	455	98
Mustard & oil seed	16	100	330	68
Jute	8	100	601	115
Sugarcane	15	100	448	97
Tobacco	6	100	360	69
Potato	5	100	342	58
Spices	18	100	515	110
Vegetables	24	100	1500	322

*Estimated by semi-log function fitted to least square trend line.

Source: Price information collected from Bangladesh Bureau of Statistics (Dhaka various years)

Conclusion

Household incomes in the drought-prone and flood-prone environments are extremely low compared to incomes in the favorable production environment. In the drought-prone environment the lion's share of income is generated from livestock production; the contribution of rice to the total income is low. In the flood-prone environment, income from the non-farm sources is the most important, and rice contributed a considerable share. In the favorable production environment, the adoption of MV T. Aman rice was above the national

average and the area under vegetable production was also high. But in drought-prone and flood-prone environments, the adoption of MV in T. Aman season was low compared to the national average. Lack of extension contact and inadequate supply of good quality MV seeds were the main causes for low MV adoption and yield in this area.

In the drought-prone and flood-prone environments there is potential to increase production in T. Aman season by increasing the level of MV adoption, which would be ultimately helpful in reducing poverty. On the other hand, increased cultivation of vegetables would help reduce poverty in these environments.

Financial capital plays a vital role on net income generation in the favorable area. Foreign remittances are the major source of financial capital. In all the environments increases in natural capital cause a substantial increase in net income. A different picture appears in drought- prone areas where physical capital development enables the households to realize additional income.

Recommendations

There is scope for increasing the rate of MV adoption and yield in T. Aman season, both in the drought-prone and flood-prone environments. Necessary steps should be taken by DAE, BADC and NGOs in supplying quality seed and providing technical and financial support. In the favorable production environment, poverty could be reduced through supplying improved seeds for vegetable cultivation.

Research Institutes can play a role in the development of appropriate seeds in all the environments. This would obviously help households to increase their on-farm income.

Since the road infrastructure in the flood-prone environment is extremely poor, steps should be taken to improve the physical infrastructure. The improvement in communication system would obviously enable resource-poor farmers to generate additional income.

References

BBS (Bangladesh Bureau of Statistics), 2015, Statistical Pocket Book of Bangladesh, Statistics Division, Ministry of Planning, Government of the Peoples Republic of Bangladesh.

Brahmmer, H, 1997. Agricultural Development Possibilities in Bangladesh. University Press Limited, Bangladesh.

Ellias, F., 2000. Rural Livelihoods and Diversity in Developing Countries, Oxford, UK

Hussain, K., and J.Nelson, 1999. Sustainable livelihoods and livelihood Diversification. IDS Working Paper 69.

Orr, A. W. and N. Magor, 1992. Reducing small Farmers Vulnerability in Bangladesh. Proceedings of BRRI Workshop, Joydebpur, 30-31 May, BRRI.

Reordan, T., 1997. Using Evidence of Household Income Diversification to Inform Study of Rural Non-farm Labour Market in Africa. World development, Vol.25, No.5, PP.735-747.