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Socioeconomic impact of Jamuna bridge on farming community in some selected areas of Sirajganj district of Bangladesh

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Abstract

The 'Jamuna Bridge' is a success in terms of implementation of a dream. It portends an era of socioeconomic transformation, linking the more marginalized North with the rest portion of the country. It was opened to traffic on 23 June 1998. The present study was mainly designed to assess the socioeconomic impact of Jamuna Bridge on farming community. The study was conducted in three villages of Saidabad Union under Sadar Upazila in Sirajganj district of Bangladesh. Farm survey method was followed in the study.

Most of the members (58.61 per cent) of the selected households were found in age group between 16.01 and 45 years. Average family size of the study area was 5.93 and it was the highest in the case of small farms. The area had a very impressive literacy profile; about 71 per cent of the family members were literate. Agriculture was found to be the main occupation of the majority (79.50 per cent) of the people in the study area, followed by business (6.32 per cent) and service (4.89 per cent).

Household income was remarkably changed after the construction of Jamuna Bridge. It was found that the highest increase in income accrued in the case of medium farms. Although income from both farm and off-farm sources was found to have increased, the share of farm income to the total income decreased by 2.20 per cent and share of off-farm income increased by 6.28 per cent. Findings of the Cobb-Douglas production function suggested that all the selected variables, viz., farm size, family size, average age of the members, average years of schooling, and income from off-farm activities except proportion of female members in the household had positive and significant impact on household income of the selected farmers.

Construction of Jamuna Multipurpose Bridge has created numerous employment opportunities, especially in the off-farm sector and thus found to have contributed to alleviate poverty in the Northern region of Bangladesh as well as in the study area.

Cropping patterns of the study area has changed to a considerable extent due to implementation of JMBP. It was observed that the farmers preferred crops with lesser risk higher economic returns. There was a notable positive change in vegetables production in the study area.

Finally, based on the findings of the study, some policy recommendations such as establishment of agro-processing industries, partial mechanization for farm operations, price stabilization for agricultural product, provision of credit to the farmers with soft conditions and providing self employment training to the young people, etc., were made for the sound economic development of the study area and the country.

Keywords: Jamuna bridge, Farming community, Income and Employment

Introduction

Bangladesh is a developing country, where hunger, poverty, malnutrition and unemployment prevail widely. The country possesses a dualistic economy with a large predominant agricultural sector and a very small rudimentary industrial sector. Agriculture sector contributes about 25 per cent to the GDP (BBS, 2000).

National development depends to a substantial extent on the development of agriculture and of farmers. It should put equal emphasis on all regions of the country for the balanced development. But the country is crisscrossed by innumerable rivers. The mighty river Jamuna, which is the fifth longest river in the World flows from the North towards South, has virtually divided the country into East and West zones and again West into Northern and Southern parts. This has not only created a serious physical barrier for uninterrupted road and rail communications but also to uneven development between the two zones of the country.

'Jamuna Bridge' the longest in South Asia, eleventh longest in the World is not only a bridge over a river but a bridge to bridge over the socioeconomic disparity between the two major parts of the country. We had been dreaming of a prosperous Bangladesh since our inception as an independent state but with a part remaining almost disassociated from the whole. Now the country is likely to move ahead towards more integration. Construction of this bridge has brought about a revolutionary change in our communication system as well as economic development. It is expected that the development of communication with the rest of the country will lead to higher investment in the Northern Bangladesh and stimulate the macro economic scenario of the country.

The overall objective of the study is to assess the socioeconomic impact of Jamuna Bridge on farming community in some selected areas of Sirajganj district. The specific objectives were as follows:

i. to investigate the socioeconomic characteristics of the farming community of the study area;
ii. to analyse the change in income after construction of the Jamuna Bridge;
iii. to investigate the employment opportunities created due to implementation of JMBP;
iv. to assess the impact of Jamuna Bridge on cropping pattern and profitability of major crops;
v. to suggest some policy guidelines/recommendations.

For having a guideline in designing the research problem, 6 past researches in Bangladesh and 13 studies conducted abroad in relation to bridge as well as impact studies have been carefully reviewed.

Methodology

Keeping the objectives in mind, the present study was conducted purposively at 3 villages namely Saidabad, Dhukiabari and Porabari of Saidabad Union under Sadar Upazila of Sirajganj district. In total, 90 farmers were randomly selected of which, 50 small, 28 medium and 12 large farmers. Farmers holding land less than 1.0 hectare were considered as small, holding land between 1.0 to 3.03 hectares were considered as medium farms and those holding land above 3.03 hectares were considered as large farms. Random sampling technique was followed for collecting data. Primary data were collected by using structured questionnaire through direct interview technique during October 2001 to September 2002 by the first author himself. Secondary data were also collected from Jamuna Multipurpose Bridge Authority (JMBA), World Bank Bangladesh Field office, Department of Agricultural Extension (DAE) of Bangladesh, Bangladesh Bureau of Statistics (BBS), seminar papers, journals, daily news papers and web sites, especially www.jmba.org and www.worldbank.org. Both tabular and statistical techniques were used to analyse the collected data. Profitability of Modern Variety (MV) Boro and T (Transplanted) Aman rice was examined in terms of gross margin, net return and benefit cost ratio (undiscounted).

Functional Approach

To determine the effect of the most important variables on household income, the Cobb-Douglas production function was used. The following log linear model was used in the study.

$$Y = a X_1^{b1} X_2^{b2} X_3^{b3} X_4^{b4} X_5^{b5} X_6^{b6} e^u$$

Which was linearised in the logarithmic form and included a dummy variable as under:

$$\ln Y = \ln a + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + b_5 \ln X_5 + b_6 \ln X_6 + b_7 D + U$$

Where,

Y = Total annual income per household;
a = Constant or intercept value of the function;
X_1 = Farm size (hectare);
X_2 = Family size of the household (number of member per household);
X_3 = Average age of members of the household (years);
X_4 = Proportion of female members in the household;
X_5 = Average years of schooling of members of the household (years);
X_6 = Income from off-farm activities (Tk);
D = Dummy variable;
$D = 1$, after the construction of the Jamuna Bridge (i.e., in 2002)
$D = 0$ otherwise
u = error terms;
$b_1, b_2, \ldots\ldots b_7$ = Parameters to be estimated.

Result and Discussion

Regarding the first objective of the study, an attempt was made to identify the socioeconomic characteristics of the selected respondent households with respect to family composition, age distribution, literacy level, farm size, demographic and economic dependency ratio and housing status. It was evident from the study that socioeconomic settings of the selected farmers were not far different from that of the farmers of other parts of country.

It was observed that the average family sizes of small, medium, and large farm households were 5.98, 6.12 and 5.33, respectively and overall average family size was 5.93. It appeared that most of the members of the households were found in the age group between 16.01 and 45 years (58.61 per cent) followed by age group up to 16 years (33.52 per cent) and between 45.01 and 60 years (5.81 per cent). The old age group (above 60 years) was only 2.06 per cent.

The selected farmers had a very impressive literacy profile; about 71 per cent of the family members were literate. Agriculture was found to be the main occupation of majority of the respondents. It was found from the study that 85.34 and 79.50 per cent of the respondents were engaged in agriculture as their main occupation in the case of before and after situations respectively. After the implementation of JMBP, about 72.98, 86.45 and 80.01 per cent farmers were engaged in agriculture for small, medium and large farms, respectively. The average Demographic Dependency Ratio (DDR) and Economic Dependency Ratio (EDR) were 2.06 and 2.35, respectively (Table 1).

Table 1. Average DDR and EDR of different farm households

Dependency ratio	Small farm	Medium farm	Large farm	All farms
DDR	1.18	2.75	1.36	2.06
EDR	2.25	2.65	2.25	2.35

Source: Field survey (2002).

The sample farmers had on an average 1.12 hectares and 1.02 hectares of farm size in before and after of JMBP, respectively (Table 2). It was found from the study that both household and cultivable land of the selected farmers has decreased due to land acquisition by JMBP. It was also observed from the present study that most of the farmers (44.44 per cent) had tin-shed house. Farmers upgraded their houses after the construction of bridge as their income level had remarkably increased.

Table 2 Average Farm Size of the Sample Households

Categories of farms	Before (ha)	After (ha)	Change (%)
Small Farm	0.28	0.26	-7.35
Medium Farm	1.28	1.19	-6.67
Large Farm	3.83	3.45	-10.14
All Farms	1.12	1.02	-9.39

Source: Field survey (2002).

Note: (i) "Before" and "After" indicate the data of the year 1997 and 2002, respectively.

(ii) Negative sign (-) indicates the decrease of land area.

Household income has increased for all categories of farms due to implementation of JMBP. Average household nominal incomes of small, medium, large and all farms were estimated at Tk 27,715, Tk 97,573, Tk 1,69,418 and Tk 68,345 per annum after the construction of Jamuna Bridge; while before construction of the bridge the corresponding figures were Tk 19,992, Tk 69,408 Tk 1,23,213 and Tk 49,129, respectively in the study area (Table 3). It was observed from the analysis that change in household real income was the highest (17.36 per cent) in the case of medium farms as they were notably engaged in business and other off-farm activities along with agriculture.

Table 3. Household Annual Income of Different Farm Categories

Farm categories	Real Income (Tk)		Change (%)
	Before	After	
Small farm	9,579 (19,992)	11,086 (27,715)	15.74
Medium farm	33,256 (69,408)	39,029 (97,573)	17.36
Large farm	59,036 (1,23,213)	67,767 (1,69,418)	14.79
All farms	23,539 (49,129)	27,338 (68,345)	16.14

Source: Field survey (2002)

Note: Figures in the parentheses indicate the nominal income.

Although total household income has increased, relative share of farm income to the total income has decreased by 2.20 per cent and share of off-farm income sources to the total income has substantially increased (by 6.28 per cent) for all farms after the implementation of JMBP (Table 4).

Table 4. Share of Farm and Off-farm Income to the Total Household Income of Different Farm Categories (In percentage)

Farm categories	Period	Farm sources	Off-farm sources	Total
1	2	3	4	5 = (3+4)
Small	Before	40.76	59.24	100
	After	38.33	61.67	100
	% Change	- 5.97	4.11	-
Medium	Before	78.63	21.37	100
	After	76.56	23.44	100
	% Change	- 2.63	9.66	-
Large	Before	83.32	16.68	100
	After	82.66	17.34	100
	% Change	- 0.78	3.93	-
All	Before	74.01	25.99	100
	After	72.38	27.62	100
	% Change	- 2.20	6.28	-

Source: Field survey (2002).
Note: Negative (-) sign indicates the decrease of relative share to total income.

After the construction of Jamuna Bridge, the highest increase of income from farm sources was obtained by medium farms (14.28 per cent) followed by large (13.89 per cent) and small (8.84 per cent) farms (Appendix Table 1). Among the farm sources, change in income from the production of vegetables and fruits was the highest (41.78 per cent) for all farms after construction of the bridge. Medium farms were in the top most position (65.18 per cent) in this regard (Appendix Table 1). Prices of agricultural products especially perishable products increased after the construction of Jamuna Bridge all over the Northern region of Bangladesh as well as in the study area. It was found that farmers were more interested in producing vegetables such as cabbage, cauliflower, radish, tomato, sweet gourd, bottle gourd, *lal shak*, onion, garlic, chilli, etc. Income from crop production had increased by 5.26, 9.68, 7.96 and 8.60 per cent for small, medium, large and all farms, respectively after the construction of Jamuna Bridge (Appendix Table 1).

There was a remarkable change in income from off-farm sources in all categories of farms after the construction of Jamuna Bridge. The highest increase was found in the case of medium farms (28.70 per cent) followed by small (20.49 per cent) and large farms (19.30 per cent) (Appendix Table 2). In the small farm households, income from van/rickshaw pulling has sharply increased (76.57 per cent) after the construction of the bridge (Appendix Table 2).

A Cobb-Douglas model was specified and estimated to determine the effect of socioeconomic attributes of household income. The included variables were farm size, family size of the household, average age of the members of the household, proportion of female members in the household, average years of schooling of members of the household, income from off-farm activities. A dummy variable was included to see the effect on household income level before and after the construction of Jamuna Bridge. It was observed that except proportion of female members in the household, the rest five explanatory variables were positively related with household income and were significant at 1 or 5 per cent level (Table 5).

Table 5. Estimated Values of the Co-efficient and Related Statistics of Household Income Function for All Farms (N=90)

Variables/Parameters	All farms	
	Coefficient	T- value
Intercept	2.80	
Farm size (X_1)	0.256 **	4.3402
Family size of the household (X_2)	0.097 **	2.7115
Average age of members of the household (X_3)	0.301 *	2.0260
Proportion of female members in the household (X_4)	0.093	1.3125
Average years of schooling of the household members (X_5)	0.286 **	2.9598
Income from off-farm activities (X_6)	0.127 **	3.4066
Dummy (D)	0.17 *	2.53
R^2	0.8615	-
Adjusted R^2	0.8307	-
F – value	32.31 **	-

Note: ** Significant at 1% level
* Significant at 5% level

It was found from the present study that there was a considerable change in employment generation in the study area due to implementation of the JMBP. Dependency on farm activities was reduced by 2.54 per cent; while dependency on off-farm activities increased by 1.47 per cent and dependency on both farm and off-farm activities also increased by 2.13 per cent for all farms after the construction of Jamuna Bridge (Table 6). Considering the post construction period, increase of dependency on off-arm activities was the highest (6.16 per cent) in the case of small households (Table 6).

Table 6. Dependency on Farm and Off-Farm Activities of Different Farm Categories (in percentage)

Farm categories	Household dependency								
	Fully on farm			Fully on off-farm			On both farm and off-farm		
	Before	After	% Change	Before	After	% Change	Before	After	% Change
Small	20.58	15.36	- 25.36	57.33	60.86	6.16	22.09	23.78	7.65
Medium	50.71	47.83	- 5.68	27.26	28.32	3.89	22.03	23.85	8.26
Large	48.25	47.37	- 1.82	9.28	9.45	1.83	42.47	43.41	2.21
All	42.16	41.09	- 2.54	24.57	24.93	1.47	33.27	33.98	2.13

Source: Field survey (2002)

Labour force employed in farm activities has increased in all categories of farms except small farm. Overall man-days involvement in the farm activities has increased by 1.37 per cent in the study area after construction of Jamuna Bridge (Table 7). Engagement of labour force in farming was found the highest in the case of medium farms (Table 7).

Table 7. Household Employment in Farm Activities per Annum

Farm Categories	Before (Man-days/year)	After (Man-days/year)	Change (%)
Small	243	237	- 2.47
Medium	338	356	5.33
Large	397	412	3.78
All	293	297	1.37

Source: Field survey (2002).

The study reveals that after the construction of Jamuna Bridge, increase of employment in off-farm activities was the highest in the case of small farms (22.60 per cent) and the lowest in large farms (11.16 per cent) (Appendix Table 3). Labour absorption in off-farm activities in the study area was found to increase by 16.81 per cent. Medium and small farms were found to substantially diversify their activities to business and van/rickshaw pulling respectively after construction of the bridge (Appendix Table 3).

It was also found from the present study that due to implementation of JMBP the highest increase of employment occurred in small farms (11.21 per cent) followed by medium (10.58 per cent) and large (6.51 per cent) farms (Table 8). Overall labour absorption has increased by 8.19 per cent after construction of the bridge (Table 8).

Table 8. Change of Overall Employment

Farm Categories	Before (Man-days/year)	After (Man-days/year)	Change (%)
Small	535	595	11.21
Medium	605	669	10.58
Large	630	671	6.51
All	525	568	8.19

Source: Field survey (2002).

Cropping patterns in the study area changed to a considerable extent after the construction of the bridge. Before the bridge was constructed, the study area was mainly rice based and farmers were not interested in producing vegetables as the marketing facilities were not well enough and prices of such perishable agricultural products were very low. Construction of the Jamuna Bridge minimized the price differentials of two zones of the country. As a result, trend of agricultural practices was quite changed. It was found that after construction of the bridge, Boro – fallow – T Aman was still the major cropping pattern in the study area.

Costs and returns of MV Boro and T Aman were calculated separately to find out the relative profitability of different categories of farms. Per hectare total costs for producing MV Boro were Tk 19,703 and Tk 26,130 in the case of before and after the situation respectively in all farms (Appendix Table 4). Per hectare gross margin and net return for producing MV Boro rice were found to increase for all categories of farms. Per hectare net return for producing MV Boro rice was the highest in the case of medium farms (Tk 9,269) followed by small (Tk 7,892) and large farms (Tk 7,491) (Appendix Table 4).

On the other hand, per hectare total costs of producing T Aman rice were Tk 10,290 and Tk 14,290 in the case of before and after the construction of Jamuna Bridge. These rises in cost were not just because of the construction of the Jamuna Bridge, it was because the cost of the items such as variable and fixed cost had increased by 32% and 37 %. Per hectare gross margin was found to increase by 6.15, 12.05 and 4.23 per cent for small, medium and large farms, respectively (Appendix Table 5). It increased because of rise in price of boro paddy and by-product were increased by 26% and 17% respectively after the construction of the bridge. Subsequently, after the construction of the bridge, increase of per hectare net return was the highest in medium farms (10.88 per cent) followed by small (4.47 per cent) and large (1.89 per cent) farms (Appendix Table 5). Medium farms enjoyed the highest return over per Tk invested for producing T Aman rice on the basis of variable and total cost both in before and after situation (Appendix Table 5).

Conclusions and Policy Recommendations

The present study reveals that the Jamuna Bridge portends an era of socioeconomic transformation, linking the more marginalized North with the rest of the country. It has brought a massive change in income level of the farmers and created a great opportunity for employment generation, especially in off-farm sector. The bridge also changed the cropping patterns of the study area and the profitability of crop production has increased to a considerable extent in the study area as well as Northern region of Bangladesh.

The government should facilitate necessary conditions for improving private sector to set up agro-processing industries at Sirajganj district and around so that farmers could enjoy the benefits of value addition for perishable agricultural products. Establishment of agro-processing industries may create a greater opportunity for employment as well as income generation in the study area.

After the construction of Jamuna Bridge, as off-farm activities was found to have been more attractive than farming, labour shortage for farm activities as expected, may occur. Therefore, labour saving technology such as partial mechanization will be necessary, research institutions and manufacturing farms should be geared up appropriately. It may be mentioned here that the BAU Farm Power Machinery Department has already captured this scenario and invested items and prototypes. This Department has already established a network with some of the manufacturing workshops of Bangladesh who have already been producing some of these items.

Farmers had to sell their products to local market where they experienced low prices. If they could establish linkage with big city markets, they could possibly get higher prices. NGOs may help in building up linkage between the local level producers and the urban business places. Department of Agricultural Marketing (DAM) of Bangladesh should also help the farmers in this regard. Price stabilization and/or floor price schemes should be introduced by the government to ensure stable income of the farmers.

Farmers reported the problem of access to credit. They should be given credit facilities at the time of their need to meet the cost of relevant inputs of the concerned crops. Agricultural credit facilities should be geared up to solve these problems. The policy makers should pay an immediate attention to this matter.

After the construction of Jamuna Bridge, social crimes by the young people increased to some extent in the study area. These youths should be motivated and converted to human resources through giving some self-employment training.

References

Afzal, A. M. (1998), Bangabandhu Bridge: A Titanic Task, Dhaka, Bangladesh, pp. 9-20.

Bangladesh Observer (1998), Special Issue on the inaugural ceremony of the Bangabandhu Jamuna Multipurpose Bridge, June 23, 1998, Dhaka.

BBS (1991), Community Series, Zilla: Sirajganj, Bangladesh Bureau of Statistics, Statistics Division, Ministry of Planning, Government of the Peoples Republic of Bangladesh, Dhaka, Bangladesh.

BBS (1998), Yearbook of Agricultural Statistics, Bangladesh Bureau of Statistics, Statistics Division, Ministry of Planning, Government of the Peoples Republic of Bangladesh, Dhaka, Bangladesh.

BBS (2000), Statistical Yearbook of Bangladesh, Bangladesh Bureau of Statistics, Statistics Division, Ministry of Planning, Government of the Peoples Republic of Bangladesh, Dhaka, Bangladesh.

Bishop, C.E. and Toussaint, W.D. (1958), Introduction to Agricultural Economic Analysis, John Willey, New York.

Dick, A.C. and M. Dobias, (1987), Estimation of Cross-Channel Traffic Created by a New Fixed Link between England and France, Paper presented in a symposium organized by OECD at Yokohama, Japan, May 25-26, 1997.

Dillon, J.L. and Hardaker, J.B. (1980), "Farm management Research for Small Farmers Development", Agricultural Science Bulletin, 41, FAO, Rome, Italy.

Doran, H.E., J.W.B. Guise and Miah,M.T.H (1994), Single Equation Methods in Econometrics: Applied Regression Analysis, Teaching Series 3, University of New England, Armidale.

FAO (1994), FAO Production Year Book 1994, Vol. 48, FAO Statistics Series No. 136, Rome, Italy.

FFYP (1998), The Fifth Five Year Plan (1997-2002), Planning Commission, Government of the Peoples Republic of Bangladesh, Dhaka.

GOB (2001), Bangladesh Economic Review, Financial Advisory Subdivision, Finance Division, Government of the People's Republic of Bangladesh, Dhaka.

Gujarati, D.N. (1995), Basic Econometrics, Third Edition, McGrew Hill Inc, New York.

IRTA (1989), Impact of Road Infrastructure in the National Economy of India , Indian Road Transport Authority, New Delhi, India.

Jalal, K.F. et al., (1974), Evaluation of G-K Project, Kustia Unit, A Preliminary Report by G-K Project Evaluation Committee, May 1974, Dhaka, Bangladesh.

JHPC (Japan Highway Public Corporation) (1986), "Examples of Economic and Social Effects due to Expressway Construction in Japan", Year Book of JHPC, 1986, Yokohama, Japan.

JMBA (1995), News Letter, Jamuna Multipurpose Bridge Project, Jamuna Multipurpose Bridge Authority, October-December, 1995, Dhaka.

JMBA (1998), Making of the Bangabandhu Bridge, Jamuna Multipurpose Bridge Authority, Dhaka, Bangladesh.

Judge, E.L. (1977), Regional Issues and Transport Infrastructure: Some Reflections on the Effects of the Lancashire-Yorkshire Motorway, London, UK.

Khan, A.R. (1993), "Jamuna Multipurpose Bridge is Beneficial to the Whole Economy". The Daily Star, November 06, 1993, Dhaka.

Latif, S. (1998), "From Bridge to Barrage", The Daily Star, June 22, 1998, p.9, Dhaka.

Mellor, J.W. (1974), The Economics of Agricultural Development, Vora and Co., Bombay, India.

OECD (1987), The Development of the Studies on the Economic and Social Effects of Highway Investments, Paper presented in a symposium organized by OECD at Yokohama, Japan, May 25-26, 1997.

Perrels, A. and P. Nijkamp (1987), "Infrastructure Improvement, Technology change and Regional Development: A Case Study on National Road Infrastructure", Department of Economics, Free University, Netherlands.

Task Force Report (1991), Report of Task Forces of Bangladesh Development Strategies for the 1990's Environment Policy, Environment and Development, Vol. 4, University Press, Dhaka.

World Bank (1986), Feasibility Study Report, Jamuna Multipurpose Bridge Project, Dhaka.

World Bank (2002), Yearly Report on Employment in the Developing Countries, Washington, USA.

Yang, W.Y. (1962), Methods of Farm Management Investigation for Improving Farm Productivity, FAO, Rome, Italy.

Appendix

Appendix Table 1. Average Annual Income from Farm Sources

Enterprises	Small			Medium			Large			All		
	Before (Tk)	After (Tk)	% Change	Before (Tk)	After (Tk)	% Change	Before (Tk)	After (Tk)	% Change	Before (Tk)	After (Tk)	% Change
Crops	2,100 (4,383)	2,210 (5,526)	5.26	21,202 (44,250)	23,254 (58,135)	9.68	40,056 (83,600)	43,243 (1,08,108)	7.96	13,104 (27,350)	14,231 (35,578)	8.60
Vegetables & fruits	599 (1,250)	807 (2,018)	34.80	1,803 (3,762)	2,978 (7,445)	65.18	3,825 (7,983)	6,304 (15,760)	64.81	1,403 (2,929)	2,215 (5,538)	57.86
Livestock	730 (1,523)	836 (2,090)	14.51	2,127 (4,439)	2,507 (6,268)	17.88	3,253 (6,789)	4,020 (10,050)	23.58	1,500 (3,132)	1,780 (4,450)	18.65
Fishery	473 (987)	393 (983)	-16.92	1,017 (2,123)	1,144 (2,860)	12.44	2,052 (4,283)	2,447 (6,118)	19.24	853 (1,780)	900 (2,250)	5.56
Total	3,902 (8,149)	4,246 (10,617)	8.84	26,148 (54,574)	29,883 (74,708)	14.28	49,185 (1,02,655)	56,014 (1,40,036)	13.89	16,861 (35,191)	19,126 (47,816)	13.43

Source: Field survey (2002).
Note: Negative (-) sign indicate decrease of income from respective farm source; Figures in the parentheses indicate the nominal income.

Appendix Table 2. Average Annual Income from Off-Farm Sources

Activities	Small			Medium			Large			All		
	Before (Tk)	After (Tk)	% Change	Before (Tk)	After (Tk)	% Change	Before (Tk)	After (Tk)	% Change	Before (Tk)	After (Tk)	% Change
Business	841 (1,756)	1,163 (2,908)	38.27	4,179 (8,723)	5,903 (14,758)	41.25	5,815 (12,135)	7,032 (17,580)	20.93	2,543 (5,307)	3,724 (9,310)	34.52
Services	661 (1,380)	768 (1,920)	16.16	2,276 (4,751)	2,531 (6,328)	11.20	3,152 (6,578)	3,760 (9,400)	19.28	1,496 (3,122)	1,721 (4,303)	15.05
Day labour	2,511 (5,241)	2,317 (5,793)	- 7.73	-	-	-	-	-	-	2,511 (5,241)	2,317 (5,793)	- 7.73
Van/rickshaw pulling	1,158 (2,416)	2,045 (5,113)	76.57	-	-	-	-	-	-	1,158 (2,416)	2,045 (5,112)	76.57
Others	503 (1,050)	545 (1,363)	8.29	652 (1,360)	695 (1,738)	6.62	884 (1,845)	961 (2,403)	8.67	600 (1,252)	647 (1,618)	7.83
Total	5,674 (11,843)	6,838 (17,097)	20.49	7,107 (14,834)	9,129 (22,824)	28.70	9,850 (20,558)	11,753 (29,383)	19.30	8,307 (17,388)	10,454 (26,136)	22.17

Source: Field survey (2002).
Note: Negative (-) sign indicate the decrease of income from respective off-farm source;
Figures in the parentheses indicate the nominal income

Appendix Table 3. Household Employment in Off-Farm Activities per Annum (in man-days)

Activities	Small			Medium			Large			All		
	Before	After	Change (%)	Before	After	Change (%)	Before	After	Change (%)	Before	After	Change (%)
Business	83	103	24.10	129	163	26.36	98	113	15.31	99	123	24.24
Service	69	82	18.84	117	128	9.40	135	146	8.15	93	105	12.90
Van/Rickshaw Pulling	91	121	32.97	-	-	-	-	-	-	1.82	2.42	32.97
Others	49	52	6.12	21	22	4.76	-	-	-	39	41	5.13
Total	292	358	22.60	267	313	17.23	233	259	11.16	232	271	16.81

Source: Field survey (2002).
Note: "Others" includes carpentry, blacksmith, fishing, cycle making, hair cutting, bamboo work, etc

Appendix Table 4. Per Hectare Gross Margin, Net return and BCR (undiscounted) for Producing MV Boro Rice by Farm Categories

Particulars	Unit	Small			Medium			Large			All		
		Before	After	Change (%)	Before	After	Change (%)	Before	After	Change (%)	Before	After	Change (%)
Gross return	Tk	25,499	31,509	23.60	30,155	37,693	24.99	29,264	37,562	28.36	27,768	34,479	24.17
Total variable cost	Tk	17,581	22,994	30.79	20,480	27,675	35.13	21,447	29,278	36.52	19,410	25,654	32.17
Total cost	Tk	18,057	23,617	30.79	21,034	28,424	35.13	22,027	30,071	36.52	19,703	26,130	32.62
Gross margin	Tk	7,918	8,515	7.54	9,675	10,018	3.54	7,817	8,284	5.97	8,361	8,835	5.67
Net return	Tk	7,442	7,892	6.05	9,121	9,269	1.62	7,237	7,491	3.52	8,065	8,349	3.52
Return per Tk invested (Variable cost basis)	Tk	1.45	1.37	-	1.47	1.36	-	1.36	1.28	-	1.43	1.34	-
Return per Tk invested (Total cost basis)	Tk	1.41	1.33	-	1.43	1.33	-	1.33	1.25	-	1.40	1.31	-

Source: Field survey (2002)

Appendix Table 5. Per Hectare Gross Margin, Net Return and BCR (undiscounted) for Producing T Aman Rice by farm Categories

Particulars	Unit	Small			Medium			Large			All		
		Before	After	Change (%)	Before	After	Change (%)	Before	After	Change (%)	Before	After	Change (%)
Gross return	Tk	14,645	18,726	27.86	17,315	22,098	27.63	16,881	22,015	30.42	15,140	19,318	27.60
Total variable cost	Tk	9,266	13,016	40.47	10,781	14,777	37.07	11,449	16,354	42.84	10,019	13,913	38.87
Total cost	Tk	9,517	13,369	40.47	11,073	15,177	37.07	11,759	16,797	42.84	10,290	14,290	38.87
Gross margin	Tk	5,379	5,710	6.15	6,534	7,321	12.05	5,432	5,661	4.23	5,121	5,405	5.56
Net return	Tk	5,128	5,357	4.47	6,242	6,921	10.88	5,122	5,218	1.89	4,849	5,028	3.70
Return per Tk invested (Variable cost basis)	Tk	1.58	1.44	-	1.61	1.50	-	1.47	1.35	-	1.51	1.39	-
Return per Tk invested (Total cost basis)	Tk	1.54	1.40	-	1.56	1.46	-	1.44	1.31	-	1.47	1.35	-

Source: Field survey (2002)