The Economic Feasibility Analysis of Crop Cultivation Practice Project in Pirganj and Kurigram Districts, Bangladesh

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작물재배기술의 경제적 타당성 분석 : 방글라데시 피르간즈군과 쿠리그람군 사례

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ABSTRACT

미국 농무성은 방글라데시의 Pirganj군과 Kurigram군에 작물재배기술을 보급하여 농민들의 소득을 향상시키고 작물의 수량을 제고하여 농민들의 식량을 자급 할 수 있도록 하기 위하여 2008년부터 2012년까지 4개년간 기술지원기금US $ 571,270을 제공할 계획이다. 이 사업의 주목적은 948ha, 임야개간 52ha 및 유휴지 345ha를 개발하고 농업생산기술을 지도·보급함으로써 농산물의 생산성을 제고시키고 가난한 1,059농가와 5,305명의 농촌농민들의 사회 경제적 생활조건을 개선시키는 것이다. 이 사업을 위하여 방글라데시의 미작연구소, 방글라데시 농업연구위원회, Rangpur Dinajpur 농촌 서비스 센터 및 농민단체들이 참여 하고 있다.

본 연구의 목적은 (1) 미곡, 밀, 옥수수, 엽연초 및 사탕수수의 생산성을 구명하고, (2) 작물 별 생산비와 소득을 추정하며, (3) 투입 산출물간의 상호관계를 구명하여 (3) 본 사업의 총 수익과 총 사업비를 비교함으로써 본 사업의 재무적 타당성 지표인 FIRR,NPV,B/C Ratio를 구명해 보고자 한다.

본 사업의 연간 순기대총편익은 US $ 33,028이다. 농산물 생산액의 총 증가액은 US $ 219,959이

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며 총 생산비증가액은 US$186,931로 추정되었다. 본 사업의 재무수익률은 경제분석기간을 15년으로 가정했을 경우 재무수익률(FIRR)이 26.15%로 추정되었으며, 이는 방글라데시의 할인율 10%보다 2.6배가 높게 나타났다. 방글라데시의 할인율을 10%로 볼 경우 B/C Ratio는 1.077이며 NPV는 US$ 101,663로 추정되었다. 따라서 본 사업은 방글라데시의 농촌경제를 활성화 시키고 가난한 농민들의 복지를 증대시키는데 있어 매우 중요한 농업정책으로써, 방글라데시의 타 지역에도 확대 보급함은 물론 재정적 지원을 지속해 나가야 할 것으로 판단된다.

핵심어: 경제적 타당성, 생산성, B/C ratio, 방글라데시

Ⅰ. Introduction

Situated in the north-eastern part of the South Asian subcontinent, between $20^025'$ and $26^038'$ north latitude and $88^001'$ and $92^040'$ east longitude, Bangladesh occupies a unique geographic location(http://en.wikipedia.org/wiki/Geography_of_Bangladesh). With an area of 14.4 million hectares, it is one of the most fertile regions of the world and spans a relatively short stretch of land between the Himalayan mountain chain and the Bay of Bengal. Despite the sustained domestic and international efforts to improve economic and demographic prospects, Bangladesh remains a developing nation, in part due to its large population. The agricultural land of Bangladesh is being reduced by about 1% per annum (Husain et al., 2006) while the population is increasing at an alarming rate of 1.43% (Economic Review, 2006). Bangladesh is one of the overpopulated countries in the world compared to the land size. Recent (2005-2007) estimates of Bangladesh's population range from 142 to 159 million, making it the 7th most populous nation in the world.

With a land area of 144,000 square kilometers, the population density is remarkable. The population growth rate is 2.1% increasing quite rapidly and total fertility rate is now 3.1 children per woman (http://en.wikipedia.org/wiki/Economy_of_Bangladesh).

Bangladesh is primarily an agrarian economy. Agricultural activities dominate the national economy and account for 38% of gross domestic product (GDP) and employing around 60% of the total labor force. The performance of this sector has an overwhelming impact on major macroeconomic objectives like employment generation, poverty alleviation, human resources development and food security. The scarce land resource is subjected to continuously increasing pressure by a growing population. Considering the size of the agricultural population, the availability of arable land per capita is less than 0.1 hectares. This level of population pressure has made it difficult to make land-use allocations based on land capability. Meeting the nation's food requirements remains the key-objective of

the government and in recent years there has been substantial increase in grain production. However, due to the calamities like flood, loss of food and cash crops is a recurring phenomenon which disrupts the continuing progress of the entire economy.

Agricultural holdings in Bangladesh are generally small. Through Cooperatives the use of modern machinery is gradually gaining popularity. Rice, jute, sugarcane, potato, pulses, wheat, tea and tobacco are the principal crops. The crop sub-sector dominates the agriculture sector contributing about 72% of total production. Fisheries, livestock and forestry sub-sectors are 10.33%, 10.11% and 7.33%, respectively. Rice is the staple food, and its production is of major importance. If Bangladesh can't produce more food for increasing population, food shortage will become a serious problem in the future. To achieve the self sufficiency in food production, the Ministry of Agriculture has the agricultural policy for sustainable food by improvement the national strategies of agriculture. Crop diversification program, credit, extension and research, and input distribution policies pursued by the government are yielding positive results. The country is now on the threshold of attaining self-sufficiency in food grain production.

This crop cultivation practice project funded by United States Department of Agriculture (USDA) will be implemented in 6 villages in 2 districts of Pirganj and Kurigram covered 1,059 farm households effectively. BARI consultants have carried out consulting work for crop

cultivation practice project and BARC provide the technical assistance to train the farmer in target areas.

1. Necessity of feasibility study

Bangladesh is not self sufficient in major food crops like rice, wheat, maize, etc. Many economic and socio-economic factors are responsible for this low productivity including shortages of land, lack of capital of farmers, low investment in agricultural sector, low subsidies in crop production, poor knowledge of farm production technologies in land preparation, planted technique, water management at the farm level, poor storage facilities, grain quality reduction during processing, etc.

In Bangladesh, agriculture is dependent on the vagaries of nature and is risky. Availability of crop land is also decreasing. Widespread poverty among the population engaged in agriculture. Per capita income in 2006 was US $ 2,300 (on purchasing power parity basis) compared to the world average of $10,200. Bangladesh entered the first decade of the new millennium with poverty level at 49.8% of the population. In the project area more than 55% people live under the poverty level. Many limitations and constraints are identified in the target areas, such as lack of required capital for agricultural activities, inadequacy of appropriate technology considering farmers socio-economic conditions, uncertainty of fair price of agricultural commodities due to underdeveloped marketing system, rapid perishable and high post harvest losses of Agricultural

commodities and limited knowledge of common people about the nutritional value of agricultural commodities including vegetables and fruits etc. To overcome these situations, this Crop Cultivation Practice Project will be implemented by improving farm technology and production management. In spite of the above facts, feasibility study of the project has not been made. Therefore this study will cover estimating financial indices such as FIRR, B/C Ratio and NPV.

2. Objectives of the study

The economic development of the project area, which is one of the most depressed areas with many smallholder's farm households in the country. The main objective of this study is to identify financial feasibility indices of the project based on the following project design. This study is therefore designed to (1) estimate the productivity of paddy, wheat, maize, tobacco and sugarcane; (2) determine the cost of production and returns to the above mentioned crops; (3) study the interrelationship between inputs and output of the above mentioned crops and (4) examine the resource utilization patterns at farm level.

3. Methodology

The analysis methodology is based on a cost-benefit analysis; it means the project requires the economic analysis with appropriate decision criterion in mind including Internal Rate of Return, Net Present Value and Benefit-Cost

ratio method.

4. Limitation of study

This study is confined to the following specific study based on the project which will be implemented in 6 villages within 2 districts. In economic analysis all the inputs and outputs should be valued by shadow prices. But in this report, all inputs and outputs valuation are based on domestic market prices on account of difficulties to estimate shadow price.

1) Different crop production in target areas
2) Cost Benefit analysis of the project and
3) Socio economic Assessment of the project.
4) Decision making criteria will be based on financial benefits and costs.

II. Description of the Project & Benefits and Costs Analysis

1. Present situation of project areas

The project has proposed to be implemented in joint collaboration by Bangladesh Agricultural Research Council (BARC) and Bangladesh Agricultural Research Institute (BARI). This project will be funded by the USDA for a total amount of **571,270** US$. The implementation period of the project will be 4 years from 1st February 2008 to 31th January 2012. The project will be implemented in 6 villages; which has 1,097 hectares areas, covered 1,059 households equal to 5,305 persons in Pirganj and Kurigram districts (Table 1).

Table 1. Present situation of project areas

District	Village	Agriculture area(ha)	Forest land(ha)	Other (ha)	No. of family (households)	Population (persons)	Average No. of family members (persons)
Pirgonj	Uttar Shibpur	132	10	40	211	910	4.31
	Shibpur	150	12	31	162	850	5.24
	Dohora	141	8	63	150	800	5.33
Kurigram	Prashad Kalea.	210	14	90	225	1150	5.11
	Shibram	152	5	50	170	750	4.41
	Jothgobardhan	163	3	71	141	845	5.99
Total	6 villages	948	52	345	1,059	5,305	5.065

Source: Bangladesh Bureau of Statistics, 2006.

1) Location

The project targets 6 villages within two districts, Pirganj and Kurigram. This block is located in northern part of Banglaadesh.

2) Socio-economic status

The target area is mainly characterized by agriculture. About 85 percent of the total people in this area who have been living with agriculture. And some people engage in other professions like, shop-keeper, van driver, small holder business etc. Due to small facilities of irrigation system and short knowledge in new machineries technologies, the agricultural productivity is low. So the economic condition of the farmers is not satisfactory. The average per capita income of the people of this area is less than 1US$ per day. Health problems abound, ranging from surface water contamination, to arsenic in the groundwater, and diseases including malaria, leptospirosis and dengue in the target areas. The literacy rate in Bangladesh is approximately 31%, according to a 2004 UNICEF estimate.

The farmer families in defined area will be enhanced directly through providing the training course, practice of demonstrative paddy fields and providing some input materials as such seed, fertilizer, etc. The trained farmers will extend their knowledge around the hold area. It means agriculture technology will be extended throughout area. The farmer's livelihood in defined area becomes stable and safety.

3) Development constraints

In the target area, the productivity of different agricultural crops like paddy, wheat, maize, tobacco, sugarcane etc is very low. This low productivity is raised from many factors such as, the lack of credit facilities of farmers, insufficient supply of agricultural inputs, shortage of the application of new technologies, lower knowledge of the farmers about new techniques and crop cultivation process, lack of irrigation

facilities, etc. So the crop yield also becomes low. As a result, farmer's income of this area comes down and sometimes negative. Their standard of living is in below of the poverty level. For the above reasons, the credit support and the extension of agricultural knowledge are necessary to the farmers of this area. So the increasing of population and food shortage in this area from year to year stimulated different partner's NGO considering developing this area to reduce poverty and increase income of household by Crop Cultivation Practice Project. It's necessary to improve their living standard by extend the knowledge; provide some agricultural inputs such as seed, fertilizer, pesticides, technique, and also support their initial idea for developing their family.

2. Land use and target yield with and without project

After the implement of project, all the villages in project areas have increased from 948 ha to 1,097 ha of the agricultural land (Table 2 and 3). Furthermore, the forest land also increased from 52 ha to 81 ha and other land has decreased from 345 ha to 334 ha (Table 2).

3. Project cost for crop cultivation practice project

Farmers usually plant several kinds of crops such as 690 ha of the paddy, 210 ha of the wheat, 10 ha of maize, 32 ha of tobacco and 6 ha of sugarcane. All of that crops, their yields were very average and low because of the

farmer have poor knowledge about agriculture technology, lack of irrigation system, lack of capital to invest to their farm. Due to the lack of transportation and difficult road, they sell their harvested crops in nearly markets at low prices.

After implementation of the project, the farmer has increasing their knowledge, improve their production through changing cropping pattern in their own farm. Almost of the farmer in the project areas have increased the productivity of their crops. The project was determined 4 years for operating in the target areas (6 villages in Pirganj and Kurigram districts). The project cost was estimated at **571,270** US$ that have divided many category such as the labor cost, survey and design, operating cost, subsidies for production cost, monitoring and evaluation and miscellaneous, as was summarized in table 4. The project would give subsidies to the farmers of targeted areas to buy production inputs like seed, fertilizer, pesticides, etc. in the proper time. By supplying all material inputs in the proper time, the farmers can increase their yields and production of their crops.

4. Present and proposed amount of inputs, prices and costs per hectare

The estimated incremental and decremental amount of different applied material inputs like seed, fertilizer and pesticides is summarized in table 5. After the project implementation, the land size of all crops would be increased. In the project period, the planted area increased by 90

Table 2. Land use with and without project   Unit: ha

Land Use	Before Project	After Project	Fluctuation
Agricultural Field (1)	948	1,097	149
Forest land (4)	52	81	29
Other (5)	345	334	-11
Total agriculture land	948	1,097	149

Source: Socio Economic Survey in Bangladesh, 2006.

Table 3. Cultivation area by districts   Unit: ha

District	Village	Before Project	After Project	Increment
Pirgonj	Uttar Shibpur	132	152	20
	Shibpur	150	174	24
	Dohora	141	190	49
Kurigram	Prashad Kalea	210	222	12
	Shibram	152	170	18
	Jothgobardhan	163	189	26
Total	6 villages	948	1,097	149

Source: Socio Economic Survey in Bangladesh, 2006.

Table 4. Annual project costs (Financial value)   Unit: US$

Items	Total	Year 1	Year 2	Year 3	Year 4
Labor Costs	196,270	98,105	54,225	32,475	11,465
Survey and Design	5,000	2,000	1,000	1,000	1,000
Operating Cost	112,000	50,000	30,000	20,000	20,000
Vehicle	10,000	10,000	0	0	0
Fuel and Maintenance	22,000	7,000	7,000	4,000	4,000
Material for teaching	26,000	8,000	8,000	5,000	5,000
Transportation cost	14,000	5,000	5,000	2,000	2,000
Administration	36,000	15,000	7,000	7,000	7,000
Security	6,000	2,500	1,500	1,000	1,000
Insurance	6,000	2,500	1,500	1,000	1,000
Subsidies for production cost	235,000	70,000	55,000	55,000	55,000
Monitoring and Evaluation	11,000	2,000	2,000	2,000	5,000
Project final evaluation	2,000	0	0	0	2,000
Internal impact assessment	2,000	0	0	0	2,000
Technical support missions	7,000	2,000	2,000	2,000	1,000
Miscellaneous	4,000	1,000	1,000	1,000	1,000
Total Net Costs	571,270	223,105	143,225	111,475	93,465

Source: Socio Economic Survey in Bangladesh, 2006.

Table 5. Present and proposed material costs per hectare

Crop	Planted Area (ha)	Seed Quantity (Kg/ha)	Seed Price Rate (Tk/kg)	Seed Cost (Tk/ha)	Fertilizer Urea Quantity (Kg/ha)	Urea Price Rate (Tk/kg)	Urea Cost (Tk/ha)	TSP Quantity (Kg/ha)	TSP Price Rate (Tk/kg)	TSP Cost (Tk/ha)	MP Quantity (Kg/ha)	MP Price Rate (Tk/kg)	MP Cost (Tk/ha)	Pesticide Tk/ha	Irrigation Tk/ha	Misce Tk/ha	Total Tk/ha
With Project																	
Paddy	780	20	15	300	280	14	3,920	100	14	1,400	70	10	700	2,500	15,000	2,000	25,820
Wheat	235	120	25	3,000	210	12	2,520	200	14	2,800	100	10	1,000	2,300	13,000	1,800	26,420
Maize	20	120	16	1,920	215	12	2,580	180	14	2,520	90	10	900	2,500	12,000	2,000	24,420
Tobacco	50	110	800	880	120	12	1,440	115	14	1,610	70	10	700	2,300	14,000	2,500	23,430
Sugarcane	12	5,100	1.25	6,375	270	12	3,240	150	14	2,100	90	10	900	2,500	14,000	3,500	32,615
Total				12,475			13,680			10,630			4,200	12,100	68,000	11,800	132,705
Without Project																	
Paddy	690	25	15	375	300	14	4,200	80	14	1,120	60	10	600	2,500	12,000	2,000	22,795
Wheat	210	140	25	3,500	240	12	2,880	190	14	2,660	75	10	750	2,300	9,000	1,300	20,390
Maize	10	100	16	1,600	200	12	2,400	150	14	2,100	75	10	750	2,500	9,000	1,500	19,850
Tobacco	32	0.95	800	760	100	12	1,200	111	14	1,554	10	10	100	2,250	10,000	2,000	15,864
Sugarcane	6	5,000	1.25	6,250	250	12	3,000	140	14	1,960	70	10	700	2,500	8,000	4,000	24,410
Total				12,485			13,680			9,394			2,900	12,050	48,000	10,800	103,309

Table 6. Present and proposed benefit estimation

By Crops	Planted area (ha)	Main product				By product				Project Benefit Per Ha (Tk/ha)	Total Project Benefit (Tk)
		Yield (kg/ha)	Production (ton)	Unit price (Tk/kg)	Production value (Tk/ha)	Yield (kg/ha)	Production (ton)	Unit price (Tk/kg)	Production value (Tk/ha)		
With project											
Paddy	780	5,500	4,290	10	55,000	5,500	4,290	0.50	2,750	57,750	45,045,000
Wheat	235	4,000	940	10	40,000	4,000	940	0.50	2,000	42,000	9,870,000
Maize	20	4,000	80	10	40,000	7,500	150	0.30	2,250	42,250	845,000
Tobacco	50	1,800	90	40	72,000	1,500	75	2.30	3,450	75,450	3,772,500
Sugarcane	12	95,000	1140	1	95,000	45,000	540	0.25	11,250	1,06,250	1,275,000
Total (Tk)	1,097		6,540		3,02,000		5,955		21,700	323,700	60,807,500
Total (US$)					4,315				310	4,624	868,679
Without project											
Paddy	690	5,000	3,450	10	50,000	5,000	3,450	0.50	2,500	42,000	36,225,000
Wheat	210	3,000	630	10	30,000	3,000	630	0.50	1,500	31,500	6,615,000
Maize	10	3,000	30	10	30,000	5,100	51	0.30	1,530	31,530	315,300
Tobacco	32	1,300	41.6	40	52,000	1,000	32	2.30	2,300	42,925	1,737,600
Sugarcane	6	80,000	480	1	80,000	25,000	150	0.25	6,250	62,500	517,500
Total (Tk)	948		4,632		242,000		3,543		14,080	210,455	45,410,400
Total (US$)					3457.4				201	3,007	648,720
Incremental											
Paddy	90	500	840	0	5,000	500	840	0	250	15,750	8,820,000
Wheat	25	1,000	310	0	10,000	1,000	310	0	500	10,500	3,255,000
Maize	10	1,000	50	0	10,000	1,100	99	0	720	10,720	529,700
Tobacco	18	500	48.4	0	20,000	200	43	0	1,150	32,525	2,034,900
Sugarcane	6	15,000	660	0	15,000	5,000	390	0	5,000	43,750	757,500
Total (Tk)	149		1,908.4		60,000		1,682		7,620	113,245	15,397,100
Total (US$)					857				109	1,618	219,959

Source: Socio Economic Survey in Bangladesh, 2006.

hectares, 25 hectares, 10 hectares, 18 hectares and 6 hectares for paddy, wheat, maize, tobacco and sugarcane, respectively. For the improved knowledge and technology, the average yield of crops would be increased. Crop production and yields have increased 500kg/ha, 1,000kg/ha, 1,000kg/ha, 500kg/ha and 15,000kg/ha for paddy, wheat, maize, tobacco and sugarcane, respectively (Table 6). So the estimated increased production of 840 tons paddy, 310 tons wheat, 50 tons maize, 48.4 tons tobacco and 660 tons of sugarcane (Table 6) would be a good sign

for the implementation and further extension of this project.

5. Present and proposed project benefits

Gross benefit is the multiplication of total production and their price of main product and by product of each crop. Project benefit per hectare is estimated at Tk. 42,000, Tk. 31,500, Tk. 31,530, Tk. 42,925 and Tk. 62,500 at present time and Tk. 57,750, Tk. 42,000, Tk. 42,250, Tk. 75,450 and Tk. 1,06,250 in. the proposed project, respectively for paddy, wheat, maize, tobacco and sugarcane. So the incremental benefits of paddy, wheat, maize, tobacco and sugarcane per hectare are estimated at Tk. 15,750, Tk. 10,500, Tk. 10,720, Tk. 32,525 and Tk. 43,750 in the proposed project, respectively (Table 6). At present time, these crop production practices are not profitable and for this reason they need more facilities and subsidies for their production inputs. Total incremental value of crop production in the project area is estimated at US$ 219,959 at full development year.

6. Present and proposed production cost

The total production cost is estimated as the summation of total material input costs and labor costs. In material input costs seed, fertilizer, pesticides, irrigation and miscelenous costs are included. And in the item of labor costs animal labor and hired labor are included. So the total production cost of paddy, wheat, maize, tobacco and sugarcane per hectare are estimated at Tk. 61,605, Tk. 55,070, Tk. 45,230, Tk. 53,564 and Tk. 67,140 at present time and Tk. 64,630, Tk. 61,100, Tk. 49,800, Tk. 61,130 and Tk. 75,345 in the proposed project, respectively by summing total material input costs and labor costs (Table 7). The total incremental production cost in the project area is amount to US$186,931 at full development year.

III. Analysis of Cash flows & Financial Feasibility

It requires the total planted area before and after the project for the estimation of cash inflow and cash outflow. For this purpose, the incremental area 149 ha has to be divided into 4 years. The project life time is 4 years. In every year 37.25 ha planted areas will be added as newly developed area. By this process the total planted area after starting the project will be estimated at 274.25 ha, 548.50 ha, 812.75 ha, and 1,097 ha for the 1st year, 2nd year, 3rd year and 4th year, respectively. So it is assumed that from 5th to 15th year the proposed planted area of 1097 ha would be continued as shown in table 9. The economic life of the Agricultural Cultivation Practice Project is assumed for 15 years considering the effectiveness of the newly introduced farming technology by the project.

According to Table 8, the incremental benefit and cost are US$219,959 and US$186,931 respectively. it showed that, the whole benefit

and cost are US$ 868,678.57 and 996,093.43 at present and US$ 648,720.00 and 809,161.97 with project.

As showing in table 9, we get the incremental value of crop production and incremental production cost in each year by the multiplication of net incremental value of crop production and incremental production cost at full production period with the annual percentage of incremental benefits and costs.

1. Cash inflow and outflow

In the study area shows that, cash inflow depend on specific product that the farmer produce such as paddy, wheat, maize, etc. The most of cash inflow come from the main product. For by product, it's cost is very low, they use it for animal feed or to make the fertilizer only such as straw, rice hull, rice bran, etc. In this section subsidies for crop production are included. On the other hand cash outflow,

Table 7. Present and proposed production cost in project areas

By Crops	Planted areas (ha)	Material input cost(Tk/ha)	Animal and hired Labor cost (Tk/ha)	Production costs	
				Per Ha (Tk/ha)	Total (Tk)
With Project					
Paddy	780	25,820	38,810	64,630	50,411,400
Wheat	235	26,420	34,680	61,100	14,358,500
Maize	20	24,420	25,380	49,800	996,000
Tobacco	50	23,430	37,700	61,130	3,056,500
Sugarcane	12	32,615	42,730	75,345	904,140
Total (Tk)	1,097			312,005	69,726,540
Total (US$)(A)				4,457	996,093.43
Without Project					
Paddy	690	22,795	38,810	61,605	42,507,450
Wheat	210	20,390	34,680	55,070	11,564,700
Maize	10	19,850	25,380	45,230	452,300
Tobacco	32	15,864	37,700	53,564	1,714,048
Sugarcane	6	24,410	42,730	67,140	402,840
Total (Tk)	948			282,609	56,641,338
Total (US$)(B)				4,037	809,162
Incremental cost (US$) (A-B)	149			420	186,931

Note : In this report, production cost is the same as management cost(1 US$=70Tk).
Source: Bangladesh Agricultural Research Institute, 2006.

Table 8. Present and proposed production cost and benefit

Items	Without Project	With Project	Incremental
Total Benefit (US$)	868,679	648,720	219,959
Total Cost (US$)	996,093	809,162	186,931

Source: Bangladesh Agricultural Research Institute, 2006

Table 9. Annual Development Area and Benefit Estimation

Item	Year 1	Year 2	Year 3	Year 4	Year 5--15
Present project area (ha)	237	474	711	948	948
Proposed project area (ha)	247.25 (25.0)	548.50 (50.0%)	812.75 (74.1%)	1097 (100%)	1097 (100%)
Incremental project area (ha)	37.25	74.50	101.75	149	149
Incremental value of crop production (US$)	27,459 (12.5%)	54,990 (25.0%)	109,980 (50.0%)	162,990 (74.1%)	219,959 (100.0%)
Incremental production cost (US$)	23,366 (12.5%)	46,733 (25.0%)	93,466 (50.0%)	138,515 (74.1%)	186,931 (100.0%)
Incremental net benefit (US$)	4,129	8,257	16,514	24,475	33,028

the farmer usually have to buy seed, fertilizer, pesticides, land preparation, transportation and rent of labor to produce their production. During 4 years the project costs except subsidies are included.

After 4 years, we expect that the net benefit will be continued as the farmers would practice new knowledge and technologies. If this process and technology will be continue, then in the 15th year the above crop production practice would be profitable. So they may invest more money in agricultural sector. But economic life of the project is assumed 15 years. So cash inflows and outflows in present and proposed condition for 15 years are summarized in the table 10.

2. Description of decision making criteria

1) Net present value

The net present value (NPV) method reduces a stream of costs and benefits to a single number in which costs or benefits which are projected to occur in the future are "discounted."

The formula is

$$NPV = \frac{B_0 - C_0}{(1+d)^0} + \frac{B_1 - C_1}{(1+d)^1} + \cdots + \frac{B_t - C_t}{(1+d)^t} + \frac{B_n - C_n}{(1+d)^n}$$

where, C_t: the dollar value of costs incurred at time t,

B_t: the dollar value of benefits incurred at time t,

d : the discount rate (Opportunity cost of capital), and

n : the life of the project, in years

2) Internal rate of return

The internal rate of return(IRR) is a measure popularized by John Maynard Keynes and has received a good deal of attention. Until recently, this criterion was considered by many to be as good as the NPV criterion. The IRR of a project is defined as the rate of discounting that the sum of the discounted costs is equal to the sum of the future discounted net benefits. That is, the IRR is some such that Alternatively, it is the rate d which would make the NPV of the project equal to zero. A project with an IRR exceeding some predetermined level(the social discount rate) is deemed acceptable.

3) Benefit – Cost Ratio

The benefit-cost ratio (B/C) is normally defined in terms of discounted values. The formula for computing the B/C ratio is

$$B/C = \sum_{t=0}^{n} \frac{B_t}{(1+d)^t} / \sum_{t=0}^{n} \frac{C_t}{(1+d)^t}$$

Table 10. Cash flow for the proposed project   Unit : US$

Items	Year 1	Year 2	Year 3	Year 4	Year 5−15
A. Cash Inflow (A) = (A1+A2)	97,495	109,990	164,980	217,990	219,959
Incremental value of crop production (A1)	27,495	54,990	109,980	162,990	219,959
Subsidies for production cost (A2)	70,000	55,000	55,000	55,000	0
B.Cash Outflow (B) =(C+D)	176,470	134,958	138,941	176,980	186,931
Incremental production cost (C)	23,366	46,733	93,466	138,515	186,931
Project cost (D)*	153,104	88,225	56,475	38,465	0
C. Net benefit (E)=(A-B)	-78,975	-24,968	26,039	41,010	33,028

Note: * Project cost excludes farmer's subsidies because it is included in cash inflow.

3. Calculation of NPV,B/C Ratio and FIRR

After the project implementation, the expected project benefits are assumed to be continued for 15 years. The benefit cost ratio (B/C) of the project is estimated at 1.077 (table 11) when using discount rate of 10% as an opportunity cost of capital in Bangladesh. FIRR of project is estimated at 26.15% which is bigger than the opportunity cost by more than double. So this project is financially feasible and acceptable. Therefore, this project should be extended to other areas to increase the farm income and economic growth of marginal poor farmers in Bangladesh.

IV. Conclusion and Policy Recommendation

The present situation of farmers of the target area is not satisfactory. Lower productivity of crops cause their lower income. They live in the below standard of poverty level. To improve their economic condition this Crop Cultivation Practice Project is very beneficiary. So it is expected that the beneficiary farmer who was included under the project selected from the poor farmer to improve their production, income and employment in their own farm. This may lead to reduction of inequalities within the project area. The incremental net benefit would be estimated at US $ **219,959** at full development year after the project being implemented. However, the financial benefit from this project will be differently derived from paddy, wheat, maize, tobacco and sugarcane production in the target area.

Considering the opportunity cost of capital of 10% in Bangladesh, the above mentioned B/C Ratio, NPV and FIRR is estimated at 1.077, US $ 101,663 and 26.15% respectively. The FIRR is higher than discount rate of 10% by 2.6 times. Therefore this Crop Cultivation Practice Project is considered very feasible from the view point of farmer's financial status in the project area. Accordingly, increasing farm household income through this project would be an important agricultural policy measure for the

Table 11. B/C ratio, NPV, FIRR(1) calculation for 15 years

Item	10%	12%	16%	20%	30%	35%
PWB	1,428,160	1,260,717	1,002,764	817,226	533,885	447,491
PWC	1,326,497	1,181,907	958,342	796,610	546,802	469,397
NPV	101,663	78,810	44,422	20,616	-12,917	-21,905
B/C Ratio	1.077	1.066	1.046	1.026	0.976	0.953

Note : FIRR=26.15%.

(1) FIRR: Financial Internal Rate of Return. FIRR calculates only from the financial point of view, whereas IRR usually calculates from the economic point of view.

growth of Bangladesh rural economy. So this project should be supported and extended to other areas by the Government continuously.

ABSTRACT

The United States Department of Agriculture (USDA) funded collaborative project on The Economic Feasibility Analysis of Crop Cultivation Practice Project in Pirganj and Kurigram Districts in Bangladesh will started during 2008-2012, for 4 years with total project cost of US$ 571,270. The project will be implemented in 6 villages; has 1,097 hectares areas which is divided into 948 hectares of agricultural land, 52 hectares of forest land and 345 hectares of other land, covered 1,059 households equal to 5,305 persons in Pirganj and Kurigram districts The project has proposed to be implemented in joint collaboration by Bangladesh Agricultural Research Council (BARC), Bangladesh Agricultural Research Institute (BARI) and Rangpur Dinajpur Rural Service (RDRS) Bangladesh with full participation of the farmers' groups of respective project site.

The specific objectives of the project are: (1) to estimate the productivity of paddy, wheat, maize, tobacco and sugarcane (2) to determine the cost of production and returns to the above mentioned crops (3) to study the interrelationship between inputs and output of the above mentioned crops and (4) to examine the resource utilization patterns at farm level.

In this project analysis, the net incremental profit is US$33,028. The expected incremental project benefit and incremented production cost are estimated as US$ 219,959 and US$ 186,931 respectively. The financial decision making criteria would be followed in this crop cultivation practice project. After the project implementation, the expected project benefits are assumed to be continued for 15 years. The benefit cost ratio (B/C) of the project is estimated at 1.077 (table 11) when using discount rate of 10% as an opportunity cost of capital in Bangladesh. FIRR of project is estimated at 26.15% which is bigger than the opportunity cost by more than double. So this project is financially feasible and acceptable. Therefore, this project should be extended to other areas to increase the farm income and economic growth of marginal poor farmers in Bangladesh.

Key words: Economic Feasibility, Productivity, Benefit-cost ratio, Bangladesh.

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