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Research Note

VIABILITY OF SERICULTURE PROGRAMME OF BRAC: RESULTS OF A COST-BENEFIT ANALYSIS

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ABSTRACT

Sericulture is a part of BRAC's Employment and Income Generation (EIG) programme started in 1978. Major components of the programme are: a) nursery; b) mulberry plantation; c) rearing of the silkworms; d) reeling and e) weaving. The study aimed to measure the efficiency of the programme from the participants' as well as the organizer's point of view. Results showed that the programme involved a significant proportion of full-time housewives and created employment opportunity for them. All the participants earned accounting profit from the activities they were involved in. The net economic gain was also found positive for most of them although the amount was negligible. For BRAC the cost of services provided to the programme participants was higher than the amount it received as service charge which has even increased over time.

I. INTRODUCTION

Silk is a high value, low volume commodity that is in high demand around the world. While it is a luxury product consumed mainly by affluent people, silk is perhaps unusual in that mainly poor people derive direct income from its production and distribution - sericulturists, reelers, twisters, weavers and traders. The soil, rainfall, temperature and humidity of Bangladesh being well suited to mulberry cultivation and silk worm rearing (Jagannathan, 1995; Islam, 1994; Bakht, 1988).

Bangladesh has a long history of sericulture. In 1857, production of silk in Rajshahi district alone was 186 tons. In subsequent decades the industry declined due to frequent epidemic of diseases, competition for land generated by an increased price of foodgrains, and a failure to introduce new technology. On the eve of the partition of India in 1947, Bangladesh's silk industry - was on the verge of extinction, producing only 50 kg of silk from in a few villages in Rajshahi district (Morton and Sinha, 1995). After independence the government of Bangladesh together with a number of local and foreign non-government voluntary organizations tried to rehabilitate the silk industry which helped increase production up to 32 tons in 1994. But domestic demand for raw silk is estimated at around 200 tons which is mainly supplemented by imports of Chinese silk (*ibid*, p.1).

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Sericulture is a part of BRAC's Employment and Income Generation (EIG) programme started in 1978 to i) generate income and employment for landless poor women who represent a large proportion of BRAC's target group, ii) increase silk production of the country, iii) promote roadside afforestation through mulberry plantation, and iv) to use fallow land unsuitable for traditional crops for productive purposes. Major components of the programme are a) nursery; b) mulberry plantation; c) grainage; d) rearing of the silkworms; e) reeling; and f) weaving. The sericulture programme of BRAC starts with mulberry plantations. Mulberry is propagated through cuttings planted in sapling nurseries. BRAC supplies mulberry cuttings to group members for sapling raising. The group members selected for sapling raising undergo three days of training on nursery preparation, plantation, and care of saplings. They are also provided with credit. After one year of intensive nursing group members sell their saplings to BRAC, which are then replanted along roadside and homesteads of group members. BRAC leases the roads from the local government for a period of 20 years to use unused land and plant the sampling along roadside. To look after trees during the first three years after plantation the most vulnerable women among BRAC group members are employed as caretakers and are paid 3 kg of wheat per day. After third year of plantation, when trees become productive, the trees are distributed among the prospective silk worm rearers who themselves are responsible to look after these trees. By the end of 1995, a total of 24.3 million mulberry trees were planted on BRAC initiative.

Rearing is the next component of the programme. There are two types of rearers: *chawki* and late age rearers. *Chawki* rearing is relatively difficult and more capital-intensive activity. *Chawki* rearers are drawn from more experienced rearers. They are provided with credit to build a *chawki* rearing house. The *chawki* rearers receive disease-free larvaes (DFL)[1] from BRAC, which they hatch and rear for 10 days. Late age rearers buy second stage worms from the *chawki* rearers and rear them until cocoon formation. BRAC is the main buyer of cocoon produced by rearers although rearers have rights to sell it in the open market.

At the reeling centre cocoons are reeled by women reelers. BRAC has four reeling centres of its own. In these reeling centres cocoons of good quality are reeled. Rejected cocoons are reeled by the individual reelers by pedal reeling equipment traditionally known as *charka*.

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[1] BRAC buys majority of its DFLs from Bangladesh Silk Foundation. Part of it also produced in BRAC owned grainages.

The silk yarn is used for weaving fabric by both BRAC member and non-member weavers. BRAC has taken steps to create employment opportunities for unemployed weavers in traditionally cotton-weaving areas. BRAC supplies them silk yarn and receives silk fabrics after weaving. A weaver is paid Tk. 20-25 per metre of fabric produced depending on the quality of production. Silk clothes produced by the contract growers are being marketed through *Aarong*. Figure 1 shows all the backward and forward linkages, which have been developed over years to run the programme smoothly.

The objective of the study was to measure the efficiency of BRAC's sericulture programme through cost-benefit analysis from the participants' as well as the organizers' point of view. The study also focuses on the impact of programme's on generation of self-employment.

II. METHODOLOGY

Programme efficiency from the participants point of view was calculated by using costs and returns data collected directly from the programme beneficiaries. Programme efficiency of BRAC was calculated by using its cost or input and revenue or output records. Output record include the total output with its input prices calculated through cash and credit sales of the products, and imputed values of the quantities consumed on the farm, i.e. given away and in-kind payment. Imputed value is estimated by using the current market price of the products.

In measuring economic viability of the given activity the economic profit was calculated by deducting all opportunity costs from the financial profit. The imputed value of household labour was calculated based on the average wage of the similar kind of activities, which were carried out under each of the individual project. For *chawki* and late age rearing and pedal spinning cost of household labour was taken Tk. 30 per person day employment as taken by Rural Development Programme (RDP) in measuring profitability of the similar activities (RDP Working Manual, 1995). To measure the opportunity cost of additional capital used in the activity other than BRAC loan 15% interest rate was considered similar to BRAC's rate of interest. The programme can be treated as economically viable if the actual rate of return exceeds the market rate of interest.

Indicators used to measure participant viability were: profit per unit of input; average rate of return on investment; average rate of return on operating cost; yield or value of output per unit of major input and amount of input per unit of output or cost of input per unit of output.

Primary data used for measuring programme viability at the participants' level were collected from 10 randomly selected sericulture programme areas of BRAC in different regions where the plantation was at least two years old. The survey covered 492 programme participants including 26 sapling growers and 300 rearers. Since reeling, pedal spinning and weaving were not done in every selected Area Offices (AOs), 57 workers from three reeling centres, 45 weavers from three BRAC weaving programme areas, and 64 pedal spinners from 5 sampled AOs were finally surveyed. Data from the beneficiary households were collected in December 1995. The supply side data were collected from BRAC annual reports and the receipts and expenditure statements of RDP.

III. HOUSEHOLD CHARACTERISTICS OF DIFFERENT SERICULTURE PARTICIPANTS

Socioeconomic condition of members involved in different sericulture activities varied. Average household size of the participant households ranged from 4.5 to 6.2 members. It was highest for weavers and lowest for reelers. Percentage of income earners to household size was highest for reelers and lowest for sapling growers and weavers. Higher percentage indicates the lower number of dependence per income earner and vise versa. The total landlholding status of the households and percentage of households without any cultivable land indicate that all the programme participants except sapling growers and *chawki* rearers belong to the poorer section of the population. Average household education level[2] was highest for weavers and lowest for late age rearers. By combining results on dependency, landholding and education we found that late age rearers were the poorest and the sapling growers, *chawki* rearers and weavers were relatively better endowed households.

Regarding BRAC membership it was found that except those engaged in reeling and weaving at least one member from each household had participated in RDP. For reeler and weaver households the rates of participation in RDP were 50% and 38% respectively. It implies that RDP also employed non-members in reeling centres. It also works with non member weavers. Membership in other NGOs indicates that a certain proportion of households of all groups participated in other NGOs.

The per capita annual income was highest for weavers and lowest for reelers. It implies that the reelers were the poorest and the weavers were relatively better-off households among programme participants (Table 1).

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[2] *Average household education level is calculated by aggregating the individual level of schooling giving individual scores and dividing it by the number of members in a household with six and above years of age and then multiplying by hundred*

Table 1. Household Status of Different Sericulture Entrepreneurs

Indicators	Sapling	*Chawki* Rearing	Late age Rearing	Reeling	Pedal Spinning	Weaving
Average hh education	175	145	110	111	194	215
No. of BRAC members per household	1.31	1.15	1.21	0.49	1.03	0.38
No. of other NGO members per household	0.12	0.31	0.16	0.19	0.09	0.27
No. of income earners	2.46	2.9	2.5	2.7	2.92	2.58
Household size	5.88	5.1	5.1	4.5	5.03	6.16
Economic dependency ratio	208	102	147	79	1	172
Homestead land (decimals)	18.5	8	11	13	5.6	12.3
Cultivable land (decimals)	66.5	55	15	14	16.1	21.6
Per capita annual income (Tk.)	7,236	5,487	4,680	4,430	5,030	8,289
% of absolute landless	3.8	4.4	7.1	3.5	1.6	-
% of households without cultivable land	38.5	31.1	71.4	73.7	64.1	80.0

IV. PARTICIPATION OF WOMEN AND GENERATION OF EMPLOYMENT

The participation of women in different sericulture activities differs due to the nature of job and its duration. Sapling is a yearlong activity. It does not require full-time involvement of a person during the production cycle that allows growers to involve in other works. Results show that a total of 121 person days were required for sapling raising in one acre of land. Women did half of the sapling work including sampling raising, planting of cuttings, and weeding. Men did the rest of the work including land preparation, irrigation, and marketing of saplings. All work related to roadside plantation including planting, caretaking and weeding of trees except prunning were also done by women. Men did pruning of trees four times a year.

Rearing is a home-based part-time activity. During the year a maximum of 6 rearing cycles (crops) can be completed. A rearing cycle continues up to 25 days. Nearly 60% of the rearers did not possess any rearing houses and carried out rearing in their living houses. Only 40% of the rearer had separate rearing houses. On average, a rearer spent 7.4 hours daily during the production cycle for rearing of 100 DFLs to collect leaves from the roadsides, feed preparation, feeding, cleaning of beds and for other activities. A chawki-cum late age rearer reared 4.22 crops, while a late age rearer whose involvement in one production cycle is considered to be maximum 15 days reared 2.56 crops a year. It means that the involvement of a member in a

chawki rearing unit generates maximum 97.6 person days employment and 35.5 person days of employment for a late age rearer. Although all household members including children shared the total workload, major activities were done by the member-women. In maximum cases male household members helped collect mulberry leaves from the roadsides. Since rearers did rearing with other household work which did not hamper other job responsibilities and, therefore, the opportunity cost of their labour is virtually zero.

Reeling is a full-time paid employment. Nearly 40% of the workers in BRAC owned reeling centres were the unmarried female BRAC school graduates. In reeling centres 50% of the workers came from non-BRAC households. None of the workers had any previous experience on the activities they were carrying out in the centre. They received training in respective field of their work in the centre. There are five different types of workers namely boilers, reelers, re-reelers, fuel suppliers and helpers. The first three were paid on production basis and the last two were paid on daily basis.

Spinning of unreelable or waste cocoon by pedal *charka* is done by full-time housewives. They do spinning throughout the year in addition to their household work. On an average, a spinner reeled 8.9 kg of cocoon in a month and spent more than six hours per day. It is estimated that a total of 27.13 person days are required for reeling of one kg of yarn by pedal *charka.*

Table 2. Employment Generation by BRAC Through Sericulture Programme

Indicators	Sapling raising/bush plantation in one acre of land	Rearing of 100 DFLs	Reeling of 1 kg yarn in the centre	Reeling of 1 kg yarn in Charka	Weaving of 1 metre of silk cloth
Labour requirement (person days)	121	23 person days	.42	27.13	.64

Source: Halder Shantana R.,'Cost-Benefit Analysis of BRAC's Sericulture Programme', 1998, BRAC

Weaving is a home-based labour intensive full-time activity. BRAC has only three small weaving centres where a small amount of silk fabric is produced. Maximum silk weaving is done on a contract basis by individual weavers who are weaving in the handlooms set-up in their houses. They get silk yam from BRAC, weave it, and sell fabric back to BRAC. A weaving household produced 171 meters of silk on handlooms and received Tk. 25 per metre of fabric produced. In BRAC

weaving centres all work are done by unskilled female BRAC members. They received training in the centres. The contract weaving is done by professional weavers, mostly men. Degumming, washing of silk yarn, dyeing, rolling and other support work are done by female household members. It is estimated that from washing to marketing a total of 5.1 hours (0.64 person days) are spent for one metre of fabric production. Weaving took 42% of the time spent. The rest was spent for other activities. The contribution of female to total time spent was almost 50%. Employment generation in different sericulture activities is shown in Table 2.

V. THE ROLE OF BRAC

Except contract weavers who weaved cotton previously most of the other programme participants did not have any attachment with sericulture before BRAC. For them sericulture is a new activity. By launching sericulture programme BRAC created an additional employment opportunity for these women who were basically the full-time housewives. All participants gained skill by receiving several days of formal training in their respective field in sericulture. The direct interaction with BRAC staff, frequent visit to BRAC Area Offices and other places also increased their mobility. For all participants except contract weavers the income earned through their involvement in sericulture might be considered as an addition to their total household income. It is likely that for contract weavers involvement in silk weaving also increased their total household income, otherwise they might not have continued silk weaving. Net economic gain due to their involvement in silk weaving could not be calculated due to lack of data on their previous income from cotton weaving.

VI. TRENDS IN ACHIEVEMENTS DURING 1995-2000

Table 3 describes BRAC's year-wise achievements in sericulture activities during 1995 to 2000. Although by 1995 BRAC planted around 25 millions of mulberry trees along government roadsides and in the homestead of beneficiaries, since 1996 it shifted its focus on bush plantation for several reasons. Firstly, of all the survivality rate of trees planted along roadsides is very low, less than 50% (Halder, 1998). Secondly, roadside plantation could not produce high quality leaves necessary for better quality cocoon production. Thirdly, BRAC realized that there would be little scope for extension of roadside plantation over time. Finally, beneficiaries of BRAC sericulture programme are the poorest section of rural population majority of whom do not have excess space for mulberry plantation at their homestead. Basically

sapling trees grown in nurseries are used for roadside and homestead plantation. Since the programme focus has been shifted towards bush plantation, demand for sapling raising reduced drastically over time. On the other hand, the increasing rate of bush cultivation is the outcome of BRAC effort. Farmers who were involved in bush cultivation received, on average, Tk. 3,500 as subsidy from BRAC for the first year, the period when no income can be generated, that also played a vital role.

Table 3. Yearwise Achievements of BRAC Sericulture Activities

Years	Sapling Nurseries (acres)	Bush plantation (acres)	No of DFLs rearerd (million)	Yarn reeled in the reeling centres (MT)	Yarn reeled by charka spinners (MT)	Silk cloth weaved (000 metres)
1995	129	-	2.28	2.5	10.5	216.7
1996	116	20.46	2.8	2.2	11.7	231.7
1997	56	19.47	3.8	2.7	9.6	205.0
1998	55	18.81	2.0	2.8	11.4	236.7
1999	82	360.36	1.68	2.2	8.2	173.3
2000	81	419.10	1.69	3.0	6.2	153.3

Reduction in DFLs rearing, especially after 1998 was due to huge loss of trees caused by the devastating flood of 1998 that ultimately affects on yarn production. At the same time, increase in yarn production in the reeling centre and the reduction of yarn produced by *charka* spinners for the last several years indicate an overall improvement of the programme output. It is likely that the quality of cocoon produced by the programme beneficiaries has improved which is mainly used in the reeling centre.

VII. ACHIVEMENTS IN EMPLOYMENT GENERATION THROUGH SERICULTURE

An attempt was made to measure how much of employment BRAC generated through sericulture. Calculations were done by using data presented in Tables 2 and 3. Results of such calculations were presented in Table 4. According to table annual creation of employment flactuates from 2,432 person years to 4,253 person years over the last six years since 1995. Highest number of employment was created in 1997, after which a declining trend was observed. The future output may potentially

increase because during the last two years vast areas were under bush cultivation which will be used for rearing.

Table 4. Component Wise total Employment Generated by Brac's Sericulture Programme in Different Years (Person Years*)

Years	Sapling	Bush	DFLs rearing	Reeling at reeling centres	Charka spinning	Weaving	Total
1995	52.03	-	1,748	3.5	950	464.4	3,217.93
1996	46.79	8.25	1,247	3.1	1,058	494.3	2,857.44
1997	22.59	7.85	2,913	3.8	868	437.3	4,252.54
1998	22.18	7.59	1,533	3.9	1,031	505.0	3,102.67
1999	33.07	145.35	1,288	3.1	742	369.7	2,581.22
2000	32.67	169.04	1,296	4.2	561	327.0	2,389.81

1 person years = 300 person days, 1 person day employment =8 working hours

VIII. SERICULTURE INCOME AND ITS CONTRIBUTION TO TOTAL HOUSEHOLD INCOME

Activity-wise cost-benefit analysis show that, on an average, a sapling farmer earned Tk. 1,249 economic profit by sapling raising in one acre of land, a silk worm rearer by rearing 100 DFLs received Tk. 108 and a weaver by weaving of one metre of silk fabrics earned Tk. 1.39 as economic profit (Table 5). On the other hand, although reeling of yarn by pedal *charka* bring some extra income for the *charka* spinner, net economic return is negative if considered opportunity cost of labour used for its production. Similarly, cost of reeling in the reeling centre is higher than the price of yarn produced in the centre even without considering the depreciation value. Table 6 presents annual average income from sericulture earned by the participant households and its share to total household income. The weavers received the highest amount and the late age rearer got the lowest. The amount differs due to differences in total number of days involved in the given activity, nature of job, volume of investment, skill and experiences of different workers. Share of sericulture to total household income indicates the actual contribution of sericulture activities to total household earning. As mentioned earlier since majority of the participants, except weavers, were full-time housewives before involvement in sericulture and carried out all the sericulture activities with other household work, the amount they received was an incremental benefit for their household. For weavers who weaved cotton previously, share of silk weaving to total income (58%) did not show the real

contribution of silk weaving unless we could find out their previous income from cotton weaving. Since we did not have enough data on these it is difficult to find out the actual economic gain of silk weaving.

Table 5. Costs and Returns from Sericulture

Indicators	Sapling raising in 1 acre of land	Rearing of 100 DFLs	Reeling of 1 kg yarn in reling centre	Reeling of 1 kg yarn by pedal charka	Weaving of 1 metre silk fabric
Depreciation on fixed cost	-	221.5	-	2.12	1.06
Total recurrent cost	11306.2	159.5	1505.1	174.8	10.04
Total accounting cost	11306.2	295	1505.1	176.8	11.10
Imputed cost of household labour	484.8	360	-	512.82	12.00
Total economic cost	11791	655	-		23.10
Total revenue	13040.5	763	1240.0	333.3	24.49
Net accounting profit	1734.2	468	-265	156.52	13.39
Net economic profit	1249.4	108		-356.4	1.39

Table 6. Annual Sericulture Income per Household and its Share to Total Household Income

Indicators	Sapling	*Chawki* rearing	Late age rearing	Pedal spinning	Reeling	Weaving
Annual household income through sericulture (Tk.)	2,740	5,231	1,544	2,899	3,168	29,652
Share of sericulture to total household income (%)	6.4	18.7	6.5	11.6	15.9	58.1

Note: Income earned through sericulture are equal to annual accounting profit after deducting only variable costs

IX. USE OF SERICULTURE INCOME

The use of income from sericulture varied widely among groups (Table 7). Ninety-five percent of the income from silk weaving was spent to meet household expenses while <1% of *chawki* rearing income was spent for this purpose. Percentage spent for debt servicing was highest for pedal spinners (52%) and lowest for weavers (0.6%). Eighty percent of income from *chawki* rearing were saved. Percentage of income saved was lowest for late age rearers (1.2%). Percentage used for asset purchase was highest for sapling growers (40%) and lowest for pedal spinners (0.3%).

The use of income from sericulture indicates relative dependence of the household on the activities.

Table 7. Use of Sericulture Income by Different Participants

Use	Sapling	*Chawki* rearing	Late age rearing	Pedal spinning	Reeling	Weaving
Debt servicing	6.5	6.0	6.2	51.6	4.8	0.6
Hh expenditure	24.8	0.6	85.6	46.5	79.6	94.7
Savings	28.4	80.1	1.2	1.6	9.2	2.6
Asset accumulation	40.4	19.3	5.8	0.3	6.4	2.2
Total	100	100	100	100	100	100

X. ANALYSIS OF PROGRAMME VIABILITY FROM THE PARTICIPANTS' POINT OF VIEW

Analysis of annual sericulture income, its share to total household income and the use revealed that the project has made significant contribution in maintaining the household expenses and changing their well-being status. Table 8 presents the comparative features on the rate of return from different components. Before going into details it may be kept in mind that although the unit of analysis was the same for all components, volume of investment, investment pattern, period of involvement and skill of the worker were different for different activities.

Table 8. Return on Investment of Different Components of Sericulture Programme of BRAC

Indicators	Sapling	*Chawki* Rearing	Late age Rearing	Reeling	Pedal Spinning	Weavin g
Return on one person day employment						
Net accounting profit per person day employment	14.33	55.2	39	12.35	9.2	21.1
Net economic profit per person day employment	10.32	25.2	9	-	-20.9	2.2
Return on per taka investment						
Revenue per taka accounting cost	1.11	4.74	2.59	-	0.48	1.06
Net economic profit per taka expenses	0.11	0.56	0.16	-	-0.52	0.06

Results show that net economic gain from one person day employment was highest for *chawki* rearing and negative for pedal spinning. Gross revenue per taka

economic cost was also highest for *chawki* rearing followed by sapling growing, weaving and late age rearing. This rate was also lowest for pedal spinning. Per taka spent in pedal spinning brought only Tk. 0.48 as gross return which means that except pedal spinning all other activities made profit and were financially viable. In pedal spinning the total cost of production including the opportunity cost was more than double than its return. But in strict economic sense, an enterprise can be treated as economically viable if its net economic profit at least equalizes the market rate of interest i.e.(15%). If so, pedal spinning, sapling growing, and weaving were also found to be economically non-viable activities.

XI. VIABILITY OF THE PROGRAMME FROM THE ORGANIZER'S POINT OF VIEW

To determine the programme viability from BRAC's point of view the annual income and expenditure data of the sericulture programme were used. Generally Area Offices provided services to only silk worm rearers since pedal spinning, reeling, and weaving were not carried out in all areas. Reeling was done in BRAC owned reeling centres for which accounts on reeling were maintained separately. For pedal spinning and weaving BRAC supplied only raw materials to the participants for which no separate account was maintained.

Types of services provided to the rearers included supplying adequate number of DFLs for rearing, providing technical support for rearing, monitoring and supervision of the rearing process, and training of the rearer. Cost of services provided to the rearer included salary and benefits of programme staff, traveling and transportation, staff training, and training of the rearers.[3] The establishment cost of roadside plantation was not included because this initial investment cost paid once tagged with the food for work programme financed by the World Food Programme (WFP). Overhead cost of the programme was also not included due to lack of necessary information. Table 9 presents programme's income and expenditure for different years. Service charges paid by the rearers are the only source of income for BRAC. As shown in the table for programme management and capacity development of its clients, in 1995 BRAC spent Tk. 2,258 per rearer and received Tk. 372.9 from each rearer. Expenditure per rearer had reduced significantly compared to 1995, but it

[3] Yearly cost of training of the rearer is calculated by summing up the total cost of training of the rearer divided by probable life time of using knowledge gained throw training the latter being calculated by subtracting present age of the rearer from the upper limit of membership age. .

started rising since 1998, when the programme was severely affected by the devastating flood that submerged nearly two-thirds of Bangladesh. Income received from each rearer was highest in 1995 and lowest in the year 2000. The recovery rate defining by the ratio of income and expenditure expressed in percentage terms was also lowest for 2000, only 7.7% indicate that last year BRAC has to bear 92.3% of the total expenses to run the programme.

Table 9. Income and Expenditure Statement of Sericulture Programme for Different Calendar Years

Head's of accounts	1995	1996	1997	1998	1999	2000
Total income (Tk.)	4469554	2475428	3246714	2468638	1951288	1793060
Total expenditure (Tk.)	27059520	17361112	15520386	18843047	17685264	23233944
Number of active rearers	11985	15244	16364	11924	11557	11697
Income of BRAC from each rearer (Tk.)	372.9	162.4	198.4	207.0	168.8	153.3
Expenditure of BRAC per rearer (Tk.)	2258	1139	948	1580	1530	1986
Expenditure of BRAC for creation of one person year employment	8409	6076	763	6073	6852	9722
Recovery rate (%)	16.5	14.3	20.9	13.1	11.0	7.7

Profitability analysis of reeling also shows that cost of production, consisting of only operating costs, exceeds the value of silk yarn produced in the centre. The actual cost of production might be higher if depreciation on building and equipment were included. Silk yarn produced in the centre, in many cases, were of low quality. The low quality of product was due to lower quality of cocoons reeled and lower skill of the worker. Workers in the reeling centres came from poorer households. They did not have any previous experience on the activities they were involved in. They received in-service training on reeling in the centre. Average working length of the worker in the centre was less than two years. One of the recruitment policy of the centre was to choose females, aged 15-25 years. As a result a large number of trained workers dropped out after their marriage. Cost of training of new workers and inadequate supply of cocoons for maximum use of centre's capacity were also responsible for higher cost. Marketing of the final products of the centre was another important issue. The centre was opened and worked to meet the demand of Ayesha

Abed Foundation. But the Foundation, the main supplier of *Aarong*[4] products, purchased only a part of the total product of the centre due to its low quality and higher price compared to the market. Our observation and discussions with field staff revealed that a significant proportion of yarn produced in the centre could not be sold. There was an uncertainty as to whether all yarn stored in the centres would be sold which could at least recover total cost since storing of yarn will increase cost. At the same time reducing price in the international market may also create further problems.

Since production of spun silk was done on a contract basis, as of silk fabrics weaving, it was found to be the most financially viable activity for BRAC.

XII. PROBLEMS OF IMPLEMENTING SERICULTURE PROGRAMME UNDER BRAC

In the process of implementation the programme faced different problems. Some of the major problems were:

1) Eighty percent of the mulberry trees are planted along roadside. Study found that 47% of the trees planted along roadside were damaged due to several factors. In addition to that, flood of in 1998 destroyed another seven million trees. As a result more than ten thousand rearers switched over to other activities due to shortage of leaves.

2) BRAC's mulberry plantation is fully rain-fed. Lack of irrigation and fertilization facilities negatively affected the quality and quantity of leaf production;

3) Most of the DFLs are supplied by Bangladesh Sericulture Foundation (BSF). In many cases the quality of DFLs is not up to the standard. Majority of rearers, rearing in their living houses, cannot maintain proper hygiene. Most of the rearers are also illiterate. The low quality of DFLs and leaf, unhygenic rearing houses, limited resources of the rearers, and spread of pebrine diseases adversely influenced the quantity and quality of cocoon production. The decreasing price of silk in the market due to import of cheaper and better quality silk from China reduced the profit margin of the rearer.

4) Lack of appropriate technology suitable for country's environment is the reason for low productivity in all sectors of the sericulture industry.

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[4] Aarong is a handicraft marketing project of BRAC.

5) The cost-benefit analysis of different components of the programme shows that all the participants earned accounting profit from the activities they were involved in. Net economic gain for all the participants except pedal *charka* spinners was found positive, although the amount was negligible. Key reasons for the limited returns are the supply driven nature of the programme. The quality and productivity of output produced by the programme participants are fully dependent on what is supplied by BRAC. BRAC is the only supplier of major inputs, equipment and training. It is also the main buyer of the produce, including cocoons, silk yarn and fabric although the participants have the right to sell their products in the open market.

6) The retention of reeling workers and cost recovery of reeling are the other -areas of concern. Overall programme cost of BRAC is much higher than it receives through service charge. In1997 the programme recovered only 21% of its expenses. Floods in 1998 deteriorated the present situation.

XIII. CONCLUSION AND RECOMMENDATION

To resolve problems faced by the programme and to make it more viable for the rural poor women several alternatives are being tested. This study suggested that BRAC should take alternative policy and reduce the existing dependence on roadside plantation for ensuring sufficient quality leaves. Based on this finding the programme is considering expansion of mulberry bush cultivation. However, financially viable bush cultivation require a significant amount of land (Esim, 1999). The programme participants, who are the poorest section of the population, do not own that much of land. If BRAC plans to go for bush cultivation with the same population it should go for long-term lease of land which will require subsidy. Another alternative would be to work with the moderate poor. The separation of leaf production from silk worm rearing would open up the leaf market. If so, rearers who do not pay for leaves collected from roadside have to do it in future which will increase the cost of cocoon production. On the other hand, it will also be difficult for BRAC to encourage the land owners for mulberry cultivation in the absence of leaf market.

To reduce dependence on BSF supplied DFLs and to improve the quality of the egg study suggested to go for seed production on a large scale by establishing more BRAC-owned seed production centres (grainages). Although the productivity of DFLs produced in BRAC's own seed production centre is higher, the cost of BRAC

supplied DFLs was relatively higher than the BSF ones due to the higher establishment cost of a grainage centre. Presently BRAC produces eggs which is a small part of the total demand of the programme. Recently BSF stopped supplying eggs to BRAC and as a stop gap arrangement BRAC resorted to using contract seed farmers for egg production.

The study found that the skilled rearers those who raised more cocoons earned relatively higher profit. So, number of rearers could be reduced by enlarging the scale of operation in rearing. In such a case, the income earned from cocoon rearing could form a more significant part of total income and this could have positive impact on poverty alleviation. At the same time, it could make sericulture relatively a more costeffective enterprise. But the scale of cocoon rearing mainly depends on the availability of sufficient quality mulberry leaves.

Since good quality of cocoon is the prime criteria for producing good quality silk the programme has taken a three-tiered strategy to divide all the rearers into three groups. The successful rearers will be given high quality eggs to rear in favorable seasons and these cocoons will be sold to reeling centres. Medium quality rearers will be given the same eggs but their products will be sold to the *charka*- the handoperated reeling machine. The low quality cocoons produced by others will be sold to the spinners to convert them into spun silk (Khan, 1999).

The lowest earning of *charka* spinning was due to the higher price of rejected cocoon which constituted 88% of their production cost. Since this is a labourintensive activity, there is a limited scope to increase income. The study suggested either to reduce price of waste or rejected cocoons or to increase price of the yarn they produced to retain the involvement of the participant households. The programme has already taken necessary steps based on it.

For retention of workers in reeling it is suggested to make some changes in the recruitment policy of the centre and not to involve adolescent girls or unmarried women. To reduce cost and increase income, the scale of operation of the reeling centres can be expanded. For maximum use of the capacity of reeling centres it will be not so realistic to depend only on the supply of cocoons from BRAC's own rearers. Recently the productivity (in terms of renditta) of the reeling centres has increased.

It was also found that a significant proportion of yarn produced in the reeling centres remained unsold due to its lower quality and higher production cost. To increase the realization rate it was decided to reel only high quality cocoons in the reeling centres. To produce large quantity of high quality cocoons it was decided to use the cool season suitable for high quality cocoon production.

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Figure 1: BRAC Sericulture Programme: forward and backward linkages