

Women in Sericulture: A Case of BRAC¹

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ABSTRACT

BRAC is a Bangladeshi non-government development organization working with mainly the rural poor women. Its twin objectives are alleviation of poverty and empowerment of women. The sericulture programme of BRAC as part of BRAC's Employment and Income Generation (EIG) programme started in 1978 to i) generate income and employment for the landless poor women; ii) increase silk production of the country; iii) promote afforestation through mulberry plantation; and iv) to utilize fallow land unsuitable for traditional crops for productive purposes. Major components of the programme are: a) Nursery; b) Mulberry plantation; c) Rearing of the silkworms; d) Reeling and e) Weaving. Currently 21,445 BRAC Village Organization (VO) members are involved in different components of the programme.

This paper presents the findings of a study carried out by the Research and Evaluation Division of BRAC on 492 programme participants involved in its sericulture programme. The main objective of the study was to measure the efficiency of the programme from the participants' as well as the organizer's point of view. Results show that the programme involved a significant proportion of full time housewives and created for them an employment opportunity. Cost-benefit analysis of different components of the programme shows that all of its participants earned accounting profit from the activities they were involved in. The net economic gain was also found positive although the amount was negligible. For BRAC the cost of the business development services provided to the programme participants was higher than the amount it received as service charge although there is a declining trend in its service delivery cost per participant. Considering the study findings some suggestions are made for sustainable development of the programme and for generating more income for its programme participants and to reduce the service delivery cost of BRAC.

Sericulture in Bangladesh

Sericulture is a very prospective sector for Bangladesh economy. The soil, rainfall, temperature and humidity of Bangladesh are highly suitable for mulberry cultivation and silk worm rearing. In Bangladesh 80% of the population live in the rural areas, of which a great majority are agricultural labourers. This huge labour force remains unemployed or underemployed most of the time except for cultivation and cropping seasons. The choice of sericulture as a potential source of employment generation, especially for the rural women, comes from the fact that it is a highly labour intensive sector, employs a large number of labourers at various stages of its operation, does not require high-tech scientific skill and expertise, can be set up with small funds, and does not require full-time involvement (Jagannathan N, 1995, Islam, 1994, Bakht, 1988). Women with other household work can carry out this activity. Silk is a high value low volume commodity that is in demand both at home and abroad. It transfers wealth from richer to poorer section of the society since silk is consumed by the affluent people and the money so spent on purchase of silk is distributed among the sericulturists, reelers, twistors, weavers and traders.

Bangladesh has a long history of sericulture. In 1857 the production of silk only in Rajshahi district was 186 tons. Subsequently the industry declined due to frequent epidemic of diseases, competition for land generated by increased price of foodgrains and failure to introduce new technology. On the eve of the partition of India in 1947 Bangladesh silk industry was on the verge of extinction, producing just 50 kg of silk from a few villages in Rajshahi District (Morton & 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).

The sericulture programme of BRAC: an overview

BRAC is a Bangladeshi non-governmental development organization working with the rural poor, mainly women. Its twin objectives are alleviation of poverty and empowerment of women. The sericulture programme of BRAC as part of BRAC's Employment and Income Generation (EIG) programme started in 1978 to i) generate income and employment for the landless poor women who represent a large percentage 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 the establishment of mulberry plantations. Mulberry is propagated through cuttings planted in sapling nurseries. BRAC supplies mulberry cuttings to group members for sapling raising. The group members who are selected to become sapling cultivators undergo three days of training in nursery preparation, plantation and care of saplings. They are provided with Tk. 10,000 as credit per acre of land for sapling raising. After one year of intensive nursing group members sell their saplings to BRAC, which are replanted along roadsides and homesteads of group members. BRAC leases the roads from the local government for a period of 20 years to use unused land and provide group members with sapling to plant. To look after trees during the first three years after plantation the most vulnerable women among BRAC group members are employed as caretakers. They are paid 3 kg of wheat per day. After third year of plantation, when trees become productive, the trees are distributed among the prospective rearers who themselves would have to use leaves for rearing of silk worms. Thus, it is their responsibility to look after these trees. By the end of 1996 a total of 25 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 the 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 eggs 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 they have rights to sell it in the open market.

At the reeling centre cocoons are reeled by the 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*.

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 weaved depending on the quality of production. Some basic information on BRAC's Sericulture Programme is provided in Table 1.

Table 1. BRAC's sericulture programme at a glance

Items	Years						
	'90	'92	'94	'95	'96	'97	'98
Sapling nurserers (No.)	137	225	1613	129	128	62	-
Cumulative planted trees (Million)	1	6.1	17.9	24.3	24.4	24.5	25.0
DFL reared (million)	0.08	0.19	2.06	4.04	2.85	3.8	2.02
No of rearers ('000)	1.67	2.36	11.99	14.92	20.71	21.41	11.01
Cocoon (mt)	22	32	419	414	455	582	225
Raw silk produced in BRAC reeling centres (MT)	-	-	-	2.5	2.2	2.8	2.9
Production of spun silk (MT)	-	-	-	5.9	11.8	9.5	11.5
No of reeling centres	7	13	6	4	4	4	4
No of reeling basins	54	62	220	284	260	260	260
No of weaving centres	-	-	3	3	3	3	3

Source: RDP Sericulture Programme Report 1998

Objectives of the study

The major objective of the study was to measure the efficiency of BRAC's sericulture programme by doing a cost-benefit analysis from the participants' as well as the organizers' point of view. To achieve this objective the study attempted to:

- 1) determine employment created by BRAC to measure the opportunity cost of time and BRAC's achievements in this area;
- 2) determine the programme costs and returns for calculating the profitability of different components of the programme;
- 3) calculate accounting and economic profit to determine the viability of programme participants; and
- 4) identify the socioeconomic constraints on programme sustainability.

Methodology

Ten areas of BRAC's Rural Credit Programme (RCP) operation were selected from different regions. The selection criteria were: 1) the areas should be located in different geographical regions; 2) should be at least eight years old where BRAC's maximum investment matured; and 3) each component of sericulture programme, mainly plantation, had reached at least two years of maturity in December 1994.

The study has considered four different stages of measuring programme viability. In the first stage the employment generation in each sector programme was determined to calculate the minimum opportunity cost of time and to determine BRAC's achievements. There are two types of employment such as a) paid employment; and b) self employment. Paid employees get salaries either in cash or kind from BRAC. Self-employees are the beneficiaries of BRAC programmes who do not get direct wages. Eight working hours in a day were considered as one full-time person day of employment.

In the second stage two programme records were used. These were (1) cost or input records; and (2) revenue or output records. There are two kinds of costs - fixed and variable. Fixed

costs are those that do not change within a certain period of time such as land, housing, interest on loan and depreciation on fixed assets. Variable costs are those varying with the level of output, programme strategy, geo-political and socioeconomic situation of area such as labour, operation and maintenance costs. Major components of fixed and variable costs may differ in different programme activities which are also considered in this study.

Output records 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.

Profitability (benefit-cost) of the programme was calculated by using the above mentioned records. There are two types of benefits; primary and secondary. Primary benefit can be measured by economic and financial viability. In case of financial viability only the accounting profit was measured to check profitability in lump-sum account. In case of economic viability the economic profit was calculated 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 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 taken similar to BRAC's rate of interest.

In the third stage participants' viability was investigated. Indicators used to measure participant viability were:

Profit per unit of input;

Average rate of return on investment = profit/total investment on fixed assets;

Average rate of return on operating cost = profit/operating cost;

Yield or value of output per unit of major input;

Amount of input per unit of output or cost of input per unit of output.

For the analysis of participants' viability the rate of return on investment was compared with the market rate of interest. The programme is treated as an economically viable activity when the actual rate of return exceeds the market rate of interest.

The fourth stage describes programme viability. Monthly receipts and expenditure statements of each sector programme were used to evaluate the programme viability. If the expenditure of a programme exceeds receipts, then it needs subsidy for survival. BRAC's target is to minimize the subsidy. The study tried to focus on how to increase the physical output to its maximum level and to reduce costs to its minimum.

Sources of data and sampling method

Secondary data were collected from BRAC annual reports and the receipts and expenditure statements of RDP. Field survey was carried out by using special checklists and questionnaires. Primary data were collected from a random sample of 492 programme participants. Twenty-six sapling growers and 300 rearers from 10 AOs were randomly selected. Since reeling, pedal spinning and weaving were not done in every selected AOs, 57 workers from three reeling centres and 45 weavers from three BRAC weaving programme areas were also selected and 64 pedal spinners from 5 sampled AOs were finally surveyed. Data were collected in April-May 1996.

Findings

Household characteristics of different sericulture participants

The 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 earner 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 vice versa. The total landholding 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 level² was highest for the weavers and lowest for late age rearers. By combining results on dependency, landholding and education we found that the 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 of the household was highest for weavers and lowest for reelers. It implies that the reelers were the poorest and the weavers were the relatively better-off households among programme participants (Table 2).

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 year-long activity. It does not require full-time involvement of a person during the production cycle which allows growers to involve in other activities. It was found that for sapling raising in one acre of land 121 person days were employed. Sapling raising, cuttings plantation and weeding were done by women that constituted 52.7% of total person days employed. All other works were done by men. All the plantation works are done by women including care taking of trees. The pruning of trees which is done four times a year is basically done by men.

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 2. Household status of different sericulture entrepreneurs

Indicators	Sapling	<i>Chawki</i> 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 hh	0.12	0.31	0.16	0.19	0.09	0.27
No. of income earner	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 (dec.)	18.5	8	11	13	5.6	12.3
Cultivable land (dec.)	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 hhs	3.8	4.4	7.1	3.5	1.6	-
% of hhs without cultivable land	38.5	31.1	71.4	73.7	64.1	80.0

Rearing is a home-based part-time activity. During a year a maximum of 6 rearing cycles (crops) can be completed. A rearing cycle continues up to 25 days. Nearly 60% of the rearing takes place in the homes of the rearer women. Only 40% of the rearing were done in separate rearing houses. For rearing 100 disease free larvae (DFLs) during one production cycle, on an average, 7.4 hours per day are spent to collect leaves from the roadsides, feed preparation, feeding, cleaning of beds and for other activities. A *chawki* rearer who is also doing late age rearing completed 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, the major activities were done by the member-women. In maximum cases male household members helped collect leaves from the roadsides. Since rearers did rearing with other household work which did not hamper other job responsibilities the opportunity cost of their labour is virtually zero.

Reeling is a full-time paid employment. Nearly 40% of workers in the reeling centres are unmarried women who are recent 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 the 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 by the volume of their output multiplied by normative rate per unit of output and the last two were paid on daily basis.

Spinning of unreelable or waste cocoon by pedal *charka* is done by the females who are full-time housewives. These females do spinning throughout the year after doing all household work. On an average a spinner reeled 8.9 kg of cocoon in a month and spent more than six hours per day.

Weaving is a home-based labour intensive full-time activity. BRAC has only three small weaving centres where only a small part of silk cloth is produced. Maximum silk weaving is done on a contract basis by the individual weavers who are doing weaving in the handlooms set-up in their house. They received silk yarn from BRAC, weave it and sell it 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 female BRAC members without any previous skill. 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 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%.

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 involving with BRAC. For

them sericulture is a new activity. By launching sericulture programme, BRAC created an additional employment opportunity for these women who were basically full-time housewives. All the 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 (AOs) and other places also increased their mobility. For all the participants except contract weaving households 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 who weaved cotton previously their involvement in silk weaving also increased their total household income, otherwise they might not have continued silk weaving. The 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.

Table 3 presents annual income from sericulture earned by the participant households and its share to total household income. The amount differs due to differences in the total number of days involved in the given activity, nature of job, volume of investment, skill and experiences of different workers.

Table 3. Annual sericulture income and its share to household total income

Indicators	Sapling	<i>Chawki</i> rearing	Late age rearing	Pedal spinning	Reeling	Weaving
Annual income through sericulture (Tk.)	2,740	5,231	1,544	2,899	3,168	29,652
Share of sericulture to total hhs 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

Use of sericulture income

The use of income earned through sericulture varied widely among groups (Table 4). Ninety-five percent of the income earned through silk weaving was spent to meet household expenses while less than one percent 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 earned through sericulture activities indicates relative dependence of the household on the activities.

Viability of the programme from the participants point of view: a comparative analysis

Analysis of annual income of the programme, its share to household income and its use for different purposes revealed that the project has made significant contribution in maintaining the household expenses and changing the well-being status of the household. Table 5 presents the comparative features on the rate of return from different components. Before going into the details it may be kept in mind that although unit of analysis was the same for all the components, volume of investment, investment pattern, period of involvement and skill of the worker were different for different activities.

Table 4. Use of sericulture income by different participants

Use	Sapling	<i>Chawki</i> 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

Results show that net economic gain on one person day of employment was highest for *chawki* rearing and it was negative for pedal spinning. Gross revenue per taka economic cost was highest for *chawki* rearing followed by sapling growing, weaving and late age rearing. This rate was lowest for pedal spinning i.e. per taka spent in pedal spinning brought only Tk. 0.48 as gross return. It implies that except pedal spinning all other activities made profit and were viable. In pedal spinning the total cost of production considering the opportunity cost of labour was more than two times higher than its return. But in strict economic sense, an

enterprise can be treated as economically viable if net economic profit of the enterprise at least equalizes the market rate of interest i.e.(15%). If so, sapling growing was also found to be an economically non-viable activity.

Viability of the programme from the organizer's point of view

To determine programme viability from BRAC's point of view annual income and expenditure data of the sericulture programme of BRAC were used. Generally AOs 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.

Table 5. Return on investment of different components of sericulture programme of BRAC

Indicators	Sapling	<i>Chawki</i> Rearing	Late age Rearing	Reeling	Pedal Spinning	Weaving
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

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 plantation was not included since it was implemented with food for work programme of the World Food Programme (WFP). Overhead cost of the programme was also not included due to lack of necessary information. Table 6 presents income and expenditure for different years of the programme. Service charges paid by the rearers was the only source of income for BRAC. For maintenance and capacity development of its clients, in 1995 BRAC spent Tk. 1,588 per rearer and received Tk. 262 from each rearer which implied that the programme was subsidized. Over time expenditure per rearer reduced gradually (Table 6). At the same time programme's income has also reduced.

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 (Table 7). 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 products 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 Aarong⁴ 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

³Yearly 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 through training the latter being calculated by subtracting present age of the rearer from the upper limit of membership age. .

⁴Aarong is a handicraft marketing project of BRAC.

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.

Table 6. Income and expenditure statement of sericulture programme for different calendar years

Head's of accounts	1994	1995	1996	1997
Income (Tk.)	1,832,291	4,469,554	2,475,428	3,246,714
Expenditure (Tk.)	18,293,122	2,706,352	17,361,112	15,520,386
Number of rearers	11,856	17040	20,709	21,445
Service charge paid to BRAC by each rearer (Tk.)	154.55	62.30	119.53	151.40
Expenditure of BRAC per rearer (Tk.)	543	1,588	838	724

Table 7. Profitability of reeling in three reeling centres in 1995 (in Taka)

Items	Manikganj	Jamalpur	Atghoria	Total
Salaries and benefits	47,177	116,678	139,962	303,817
Variable cost	297,651	1,236,830	812,145	2,346,626
Total cost (fixed + variable)	344,828	1,353,508	952,107	2,650,443
Total Output	236,407	973,958	973,408	2,183,773
Profit/loss (+/-)	-10,8421	-379,550	+ 21,301	-466,670

Source: Income and expenditure data sheet of reeling centres

Key issues in sericulture programme of BRAC

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

1) Eighty percent of the mulberry trees are planted along roadsides. Study found that 47% of the trees planted along roadsides were damaged due to several factors. In addition to that, floods 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 reared by silk worm rearers are supplied by Bangladesh Sericulture Board (BSB). In many cases the quality of DFLs is not up to the standard. Majority of rearers, rearing in their living houses, can not maintain proper hygiene. Most of the rearers are also illiterate. The low quality of DFLs and leaf, unhygienic 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.
- 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. The 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. In 1997 the programme recovered only 21% of its expenses. Floods in 1998 deteriorated the present situation.

The programme perspective

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 requires a significant amount of land (Esim, 1998). 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 roadsides 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 BSB 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 BSB 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 BSB 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 a more positive impact on poverty alleviation. At the

same time, it could make sericulture relatively a more cost-effective 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 hand-operated 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 labour-intensive 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 utilization 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 has been decided to reel only high quality cocoons in the reeling centres. To produce large quantity of high quality cocoons it has been decided to use the cool season suitable for high quality cocoon production.

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