Financial viability of small farm forestry based on no-cost sharing arrangement in Sal (Shorea robusta) forest of Bangladesh

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FINANCIAL VIABILITY OF SMALL FARM FORESTRY BASED ON A NO-COST SHARING ARRANGEMENT IN SAL (*SHOREA ROBUSTA*) FOREST OF BANGLADESH

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ABSTRACT

The Sal (*Shorea robusta*) forests provide a substantial part of the forest cover of the country and contribute to the economy by providing timber, firewood, fodder, non wood forest products and by protecting the environment. Due to over exploitation the forest is being degraded. The Forest Department of Bangladesh had initiated a program through the participation of the present encroachers to stop this overexploitation. The centerpiece of this attempt was a no-cost sharing arrangement. A number of 63 settlers who were landless and encroachers before joining the program were settled in the forest. The settlers were provided 1.21 ha/299.51 acres degraded forestland with full input support. The current study examined the financial viability of the farms, including homesteads, based on this arrangement. The BCA approach was employed to determine the net incremental benefit. It was found that a no-cost sharing arrangement option was financially feasible. Sensitivity analysis showed that the NPV is sensitive to the cost items of the program. The NPV, IRR and BCR, BIR and AI of the program showed the feasibility of the program. The discount rate used in the analysis was the real discount rate (5.67%). The sensitivity of NPV to the discount rate was also examined and found the program was more feasible at a 10% nominal discount rate. The sensitivity analysis also showed that a decrease or an increase in cost and benefit respectively could substantially change feasibility indicators. The no-cost sharing arrangement could be replicated to manage forest resources at the initial level to create a multiplier effect for sustainable use of resources. Integration of technologies such as bee keeping or Seri-culture to the program could increase the scope of labor utilization and output of the degraded land.

INTRODUCTION

Resource degradation is a severe problem in Bangladesh. In particular, forest resources are experiencing a chronic depletion in their resource base. There are several reasons for this scenario. Some of those are: high man-land ratio, land hungry agriculture, grass-root level poverty and so forth. The consequences of these phenomena affect directly the natural resources of the country. As a result of this, a recent estimate shows that there is only 13.36% forest cover remaining out of 144,000 sq km land of the country. The Sal (Shorea robusta) is one of the major forest types of Bangladesh. It is vital to the economy. The Sal forests comprise an area of 120,255 ha (29,715,611.775 acres) of notified forests under the control of the Forest Department out of which 104,616 ha (25,851,136.68 acres) (87%) are located in the central region and 15,639 ha (3,864,476.00 acres) (13%) in the northern region. The concentration of the forests in central region is higher than the northern region.

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The capital city, Dhaka, is situated near the forest. Scarcity of dwelling places of the migrated poor people from flood affected areas and unplanned urbanization are identified as other strong phenomena that caused notable denudation, poor stock, and degradation. Also, the increasing demands of forest products cause free riders to encroach and over exploit the resources. The depletion of Sal forest has a significant impact on the environment. Loss of cover causes the rivers that flow across the forest to change direction, leading to unwanted water erosion. As a result, river erosion is increasing along with the increasing, substantial number of landless people. Recent studies showed that river erosion has resulted in the displacement of over 728,000 people during 1981-1993. In addition, over 60,000 people become landless annually due to river bank erosion (UNESCAP, 2003). Microclimate has also changed in the area. There have been strong thunder storms and tornados in the surrounding area of the Sal forest for the last few decades. This disastrous depletion slowed down the developmental growth of Bangladesh.

The Sal forest is under centralized management. The Forest Department of Bangladesh government is responsible for its maintenance, protection, and development. But due to bureaucratic discrepancy and lack of success in managing forest resources, the centralized management is less effective in achieving its goal. As a result, the sustainability of the resources deteriorates and tends towards extinction. A shortage of funds for rehabilitating the forest and continued maintenance demands that the Forest Department change the centralized management option to participatory management. There has been no participation of the local people in management before that caused an overall depletion in forest resource base.

However, the Forest Department has now adopted a new approach in managing Sal forest through the participation of local people. The objective of the new approach is sustainability of resources. A survey report on Thana (sub-district) Afforestation and Development Project that adopted the participatory approach shows that the net annual income (from all sources) of the participants increased from Tk. 14,187 ($248.89) to 21,834 ($383.05) per male participant and from Tk. 11,555 ($202.71) to 16,766 ($294.14) per female participant (Anon, 1995). Another study conducted in Sal (Shorea robusta) forest shows that the net annual on-farm income of the farm household increased from $348.48 to $1,194.59 by 766.4% per year (Safa, 1998). The results of these studies showed that the participatory forestry management is sufficient to increase farm income. The new management option included agroforestry as a social forestry program with the dimension of a no-cost sharing arrangement. Participants will be provided all sorts of input support from the Forest Department. Thus, the impact of the program needs to be evaluated from the economic perspective, whether there was any efficacy in the participatory no-cost sharing management.

The approach involved substantial cost for its transfer from centralized management to participatory management that was born jointly by the Forest Department and other foreign funding agencies. Different types of tangible and intangible costs influenced the effectiveness of the new participatory management option, which sheds light on the different costs/benefits resulting

from centralized and participatory management. Besides, there are different benefits accrued against the costs of the new management. The interaction of these substantial costs and benefits generated a net benefit to the society. A study conducted on different income groups who were living in the degraded Sal forest showed that the timber production of reforested species increased significantly through a participatory management between the Forest Department and the participants (Alam, 1998). The previous studies did not focus much on the viability of the new management option taking into account the marketed forest, non-forest and homestead products. Hence, the current study has attempted to examine the financial viability of the no-cost sharing arrangement under participatory management option.

THE STUDY AREA

Dhaka Forest Division was selected as the study area purposively because the program was matured and the plantation was the oldest among the patches. Also, the technical aspects and other criteria regarding no-cost sharing arrangement were well implemented according to the design of the program. Geographically, the area was located at 24^0 1′ north latitude and 90^0 14′ east longitudes, about 50 km north of the capital city Dhaka.

The settlers were provided a total 1.21 ha (299.51 acres) out of which 1 ha (247.105 acres) was to be used for tree plantation and the rest for their homestead. They were settled adjacent to the garden they planted for protection and maintenance in a cluster of 7-9 households so that the social necessity could be met jointly and interaction could increase the degree of participation in managing the plantation. These settlers had been chosen for joining the program based on the criterion of owning land less than 0.05 ha (the level of being identified as landless by the country statistics and the Forest Department). Agroforestry technology was followed by the settlers.

METHODS

In the process of sampling, the list of the participants was considered as the sampling frame. Based on the sampling frame the settlers were selected for the interview by using a simple random sampling method. Under the Mouchak mouza (smaller administrative segment of a district), 63 participants were resettled by the Forest Department. Out of them 45 settlers were randomly selected for the interview to fulfill the objective of the study. The sampling intensity was 66%. Survey schedule was used to collect the desired information for the study. The necessary data were collected by visiting the households in the months of January and February, 2000. For assessing the financial viability the 'with' and 'without' approaches had been used for calculating the net incremental benefit of the farm investment. The 'without' category included the dwellers who were not enlisted by the Forest Department.

The BCA was carried out using the value in constant 2002 prices. The real discount rate used in the analysis was 5.7 %. Two discount rates, 10% and 5%, also were used in the sensitivity analysis to examine the sensitivity of NPV to the different discount rates. For converting nominal price to constant price the CPI was used as a deflator. In order to examine the change in NPV due to an increase or decrease in cost and sharing arrangement another sensitivity analysis was carried out using 5.7% real discount rate which is 12% at nominal discount rate. The indicators used in the cash-flow analysis are discussed below:

Benefit-Cost Ratio (BCR)

Benefit-cost ratio is the ratio of incremental discounted cost divided by incremental discounted benefit. It implies the benefit derived from one unit of cost. All sorts of cost, namely labor cost (either in cash form or non-cash form), input cost, establishment cost and so forth, and the benefits accrued from marketed products were included to calculate BCR using the following formula.

$$BCR = \frac{\sum_{t=1}^{n} \frac{B_t}{(1+i)^t}}{\sum_{t=1}^{n} C_t}$$

Where,

BCR= Benefit-cost ratio, B_t = Benefit in t year, C_t = Cost in t year, T=Number of years (1,2,3 ...n), i = Interest rate.

Net Present Value (NPV)

Using the following formula the net present value NPV of the cash flow stream was calculated. It was computed by subtracting the total present value of cost from the total present value of benefit.

$$NPV = \sum_{t=1}^{n} \frac{B_t - C_t}{(1+i)^t}$$

Where, NPV = Net present value, B = Benefit, C = Cost, i = Interest rate

Internal Rate of Return (IRR)

It is that discount rate which makes the net present value (NPV) of cash flow equal to zero. It represents the highest possible rate of return from an investment over the lifespan of the program. The operating formulae of calculating IRR is,

$$IRR = LDR + DTDR \times \frac{NPV_L}{ADPV}$$

Where, LDR = Lower discount rate, DTDR = Difference between the two discount rate, NPV_L =Present value of cash flow at the lower discount rate, and ADPV = Absolute difference between the present value of cash flow at the two discount rates.

Annualized Income (AI)

Annualized income indicates the annual return of the investment on the basis of the discounted value for the life span of the program. The current study used the following formula for calculating the annualized income of the program:

$$D = \frac{r(NPV)(1+r)^T}{(1+r)^T - 1}$$

Where, D=Annualized income, r=discount rate, t=Lifespan of the project

Net Benefit-Investment Ratio (BIR)

This is a very convenient criterion for choosing the feasibility of the program. BIR is simply the present worth of the net benefits divided by the present worth of the investment (Gittinger, 1982). It is a form of benefit investment ratio though it represents the efficacy of investment. The following formula was used in the analysis.

$$BIR\ (N/K)\ ratio = \frac{\sum_{t=1}^{t=n} \frac{N_t}{(1+i)^t}}{\sum_{t=1}^{t=n} \frac{k_t}{(1+i)^t}}$$

BIR = Net benefit-investment ratio, N_t = Incremental net benefit in each year after stream has turned positive, K_t = Incremental net benefit in initial years when stream is negative, t = Project life

Determination of Real Discount Rate

In the current study an inflation rate is considered in the market interest rate that has been subtracted to calculate the real discount rate as follows (Boardman, 1996):

$$r = (i - m)/(1 + m)$$

Where, r = real discount rate, i = inflation rate (estimated 5% on average through out the 7 year of program), m = nominal discount rate (12%, 10%, 5%)

Sensitivity Analysis

The identified variables and parameters do not always reflect the project's true present worth. Due to discount factors the project's worth varies. It is too difficult to fix exact discount ratse for discounting benefit-cost stream. Thus, Sensitivity analysis was used to examine the change in NPV due to change in discount factor. Besides, an attempt was made to find out the change in NPV, IRR and BCR due to changes in the sharing arrangement. As the no-cost sharing arrangement is a unique characteristic of the program, it is necessary to see the change in NPV, IRR and BCR due to different combination of cost and sharing arrangements. The sensitivity analysis for sharing arrangements was carried out at 12% nominal discount rate. On the basis of empirical studies and previous experience (from post-evaluation studies), three different discount rate were chosen. For sharing arrangements the probable cost combination, considering cash, non-cash criteria, were employed to conduct sensitivity analysis.

The Decision Criterion

The formal decision criterion used in the study for each indicator is Benefit-Cost Ratio (BCR) of greater than one, Net Present Value (NPV) greater than Zero or internal rate of return (IRR) greater than opportunity cost of capital and annualized income (AI) and Net Benefit-Investment Ratio (BIR) is positive. Based on these five indicators the study analyzed the financial viability of the no-cost sharing participatory program.

RESULT AND DISCUSSION

Costs and Benefits of the Program

The Costs incurred were in the form of transplantation cost, maintenance cost, guarding cost, human labor, animal labor, fertilizer, pesticide and seed/seedling cost etc. In the last year (7^{th} year) only guarding cost were borne and was Tk. 1,357.00 ($23.81).

The benefits due to the participatory program are many. Some of the benefits are the value of leaves, value of woods and products from home gardens. In the last year of the program (7^{th} year) the benefit Tk. 248,641.00 ($4362.12) accrued as the value of the timber. Leaves and homestead products were valued at a total of Tk. 1,811.11 ($31.77) and Tk. 2,419.00 ($42.44) respectively in the same year. The total costs and benefits of the program are shown in a Table 1.

Discounted Benefits and Costs of the Project

Table 2 shows the streams of discounted costs and benefits for a seven-year program. The sum of the present value of incremental benefits was found to exceed the sum of the present value of incremental costs. The benefit-cost stream of the program showed

Table 1: Total costs and benefits of the farm households

Year	Cost(Tk.)	Benefit(Tk.)	Net incremental benefit (Tk.)
1	14428.46	3769.01	-10659.5
2	4856.33	2047.91	-2808.42
3	4507.33	1329.92	-3177.41
4	2253.45	1079.48	-1173.97
5	2253.45	2007.77	-245.68
6	1126.31	2007.77	881.46
7	1126.31	209883.02	208756.7
Total	30551.64 ($535.99)	222124.92 ($3896.93)	191573.3 ($3360.94)

Table 2: Discounted benefits and costs

Year	Present value of cost (Tk.)	Present value of benefit (Tk.)	Real discount factor (5.60%)	Net incremental benefit (Tk.)
1	19546.92	5106.06	0.947	-14440.90
2	5790.47	2441.84	0.903	-3348.63
3	4511.61	1331.18	0.792	-3180.43
4	1982.80	949.83	0.715	-1032.97
5	2047.76	1824.50	0.763	-223.25
6	978.78	1744.77	0.795	766.00
7	715.60	133349.50	0.620	132633.90
Total	35573.94 ($624.10)	146747.7 ($2574.52)	-	111173.70 ($1950.42)

(Figure indicates the local currency and discount rate in parentheses)

Table 3: Financial analysis of the farm household

Indicators	Discount rate
	5.60 % (nominal 12%)
Net Present Value (NPV)	111173.8 ($1950.42)
Benefit-Cost Ratio (BCR)	4.13
Internal Rate of Return (IRR)	0.38
Investment-Benefit Ratio (BIR)	6.00
Annualized Income (AI)	-7018.199 ($-123.13)

Table 4: Sensitivity analysis at different real discount rate

Indicators	Real discount rate		
	5.60 (12%)[1]	3.70 (10%)	-1.00 (5%)
Net Present Value (NPV)	111173.8 ($1950.42)	128430.7 ($2253.17)	184789.1 ($3241.91)
Benefit-Cost Ratio	4.13	4.48	5.52
Internal Rate of Return (IRR)	38%	41%	48%
Investment-Benefit Ratio (BIR)	6.00	6.61	8.48
Annualized Income (AI)	7018.199 ($123.13)[2]	5669.416 ($99.46)	-613.00 ($-10.75)

[1] Nominal discount rate

[2] Converted value in USD currency

Table 5: Sensitivity analysis at different cases based on benefit-cost sharing

Item	BCR	NPV	IRR
	5.60% (nominal 12%)		
Full cost (FD[1]) + 50% benefit sharing (P[2])	2.30	45374.02	0.23
Non-cash (FD) +50% sharing (p)	2.91	52637.60	0.34
Initial cost reduction 10%	4.10	105776.78	0.36
Benefit increased 10%	4.38	117935.97	0.38

[1] Forest Department

[2] Participant

that the cash flows from 1 to 6 years were negative but in the last year it is positive. The result of financial analysis shows that the BCR is 4.13 at full cost basis. The NPV, IRR, BIR and AI are 111,173.8 ($1,950.42), 38%, 6.00 and 7,018.199 ($123.13) respectively, clearly indicating the viability of the program (Table 3).

Sensitivity Analysis

Sensitivity analysis was carried out for examining the sensitivity to the discount rate and also different benefit-cost sharing arrangement. Three nominal discount rates such as 12%, 10% and 5% were used to recalculate the NPV, BCR, IRR, BIR and AI. Table 4 shows the result of sensitivity analysis at different real discount rates. After converting the nominal 5% discount rate to a real discount rate, it turned out with a negative sign because of high inflation rate (referred to the conversion formula of discount rate in methods section). Thus, the study considered two discount rates, 12% and 10%. At 10% discount the NPV is higher than the other one whereas annualized income is lower than the one at 12%. It is seen that the 10% nominal discount rate gives higher feasibility to the program. The study also conducted another sensitivity analysis based on the change in cost, benefit and sharing arrangement of the total output of the program. The cases are described below.

Case-I

Sensitivity analysis was conducted based on the assumption that if all costs were borne by the Forest Department and 50% of the benefits of the program went to the participants then what would have happened to the feasibility of the program. The results are shown in Table 5. In this case the project seemed feasible with a lower BCR of 2.30, positive NPV and IRR 23%.

Case-II

Sensitivity analysis was conducted based on the assumption that if the non-cash costs were considered and 50% of the benefits of the program went to the participant then what would have happened to the feasibility. The result shows (Table 5) that the program is viable. In this case BCR, NPV and IRR are higher than that in case-I.

Case-III

It was also carried out based on the assumption that if all costs of the program remained the same, then what would have happened in the profitability as only initial costs decreases by 10%. In this case, it is evident from Table 5 that the BCR of the project was 4.10 which was greater than unity; NPV was Tk. 105,776.78 ($1,855.73), which was positive and greater than the opportunity cost of capital (i.e., 5.6% real discount rate). This implied that the project was profitable.

Case IV

It was also examined based on the assumption that if the benefits increased by 10% due to an increase in price of the output and costs remained same, what would have happened to profitability? Table 5 shows that the BCR of the program increased substantially and it was 4.38, which were greater than other cases. NPV was Tk. 117,935.97 ($2,069.05) which was positive and IRR was 38% that was higher than the assumed opportunity costs of capital. It indicated the high financial feasibility of the program.

CONCLUSION

The financial viability of the farm households based on a no-cost sharing arrangement was found highly successful. All the indicators have proven its viability. A low discount rate produced a high net present value that indicates that a low discount rate is appropriate for evaluating its feasibility. As this is a social forestry program with a nature of forest rehabilitation, the discount rare is supposed to be lower. Thus, the NPV is reasonably feasible within a 5.6% real (12% nominal) discount rate to a 3.70% real (10% nominal) discount rate. Considering the financial viability of the program, we recommend that the program is useful in managing forest resources in other parts of the country with a little integration of integrated technology like beekeeping or Seri-culture. Though the concept of a no-cost sharing arrangement could increase the dependency on external financial support, it has positive aspects at the beginning of a program to create momentum to move ahead and protect forest resource within its user's co-operation.

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