



GOVERNMENT OF BANGLADESH
MINISTRY OF ENVIRONMENT AND FORESTS

WOOD HARVESTING

FORESTRY MASTER PLAN

ASIAN DEVELOPMENT BANK (TA NO. 1355-BAN)

UNDP/FAO BGD 88/025

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WOOD HARVESTING

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WOOD HARVESTING

SUMMARY

The Asian Development Bank, United Nations Development Program and the Government of Bangladesh are financing the technical assistance services to prepare a twenty year Forestry Master Plan. The plan aims to assist Bangladesh to decide its priorities for developing and protecting its forest resources. This report results from a four month assignment of the Wood Harvesting Specialist from November 1991 to February 1992.

Issues

1. Lack of security in the Chittagong Hill Tracts is a major problem hampering Government harvesting operations. Bangladesh Forest Industries Development Corporations's timber and Karnafuli Paper Mill's bamboo extraction are seriously affected. Until the political unrest is resolved new development cannot begin nor normal extraction operations resume.
2. The Sundarban's allowable annual cut is now substantially reduced from former levels. As a result, Khulna Newsprint Mill's wood supply is less than capacity. Although this is not the major problem with this mill, unless the Mill's supply is raised to capacity levels, operating costs will render operations financially uneconomic, beyond Mill management control.
3. The high forest felling moratorium is not serving the intended goal of reducing deforestation. Resultant higher log prices make it even more profitable for illicit felling. Private mills still receive adequate log supplies of forest species despite the ban.
4. At present, the policy limiting sundri felling to trees at least 50 percent dead results in major economic loss. Losses affect Departmental revenues and hardboard quality while significantly increasing manufacturing costs. Harvesting trees as soon as top dying begins, avoids waste since infected trees never recover their health. Much earlier felling ensures full use economic value, use and benefit from sundri.
5. The gamar pulpwood plantations near Kaptai are now over mature. Expected volume yield is low, a result of poor plantation practices in the past and severe Loranthus parasite infestation. The plantations require proper development including felling and replacement.
6. Raw material shortages reduces the productivity of the Karnafuli Pulp Mill at Chandragona. The Mill has difficulty harvesting enough bamboo to meet its annual requirements of 40,000 air-dry tonnes. Disturbed conditions in the Chittagong Hill Tracts precluded normal operations since 1986. As a partial solution, the Department allocated Karnafuli a temporary harvesting area in Gangaram, Kassalong West region. It now proposes to withdraw this permit.
7. The Forest Department proposes to create a security force equipped with automatic weapons. This does not make good sense given the new direction of public involvement in forest protection and management opening up for the Department.
8. Insect caused defoliation in teak plantations is a major concern. The teak skeletonizer seriously affects most teak areas. In some cases, early mortality occurs. Most of the damage

so far comes from slowed growth rather than outright mortality. However, if allowed to continue, mortality occurs.

9. Sylhet Pulp and Paper Mill faces a continuing shortage of raw materials. This year the situation was even more severe than last year. The Mill experienced a long delay getting approval for 1991/92 cutting areas. At least one half of the harvesting season was lost this year, a direct result of delayed cutting approvals. In this case, no approved management plan existed. The prior one expired and is yet to be replaced by a new one. Reportedly, the problem requires a minor technical decision. As a result, cutting authority rests with the Secretariat.
10. Present bamboo auctioning procedures prevent efficient use and complete utilization of forest bamboo. The system discourages contractors from investing in improving the transportation infrastructure. Consequently, while accessible areas are overcut, stocks in accessible areas deteriorate from overcutting. Meanwhile, the inaccessible stock remains unused. Currently, an estimated 20-50 percent of Sylhet bamboo remains unharvested.
11. Recent forest products royalty rates increases appear excessive. Too high rates prove counterproductive. Industry is only able to pay royalties set at realistic rates since their product prices are market determined and not set by Government. Normally, companies tend to react to rapidly increased log prices by reducing their utilization standards. They concentrate only on the most valuable species and log materials, leaving behind the less valuable and smaller or low quality material. The royalty rates for gewa pulpwood at Khulna and bamboo at Sylhet were recently hiked severely, compared to past rates.
12. The Sylhet Pulp and Paper Mill's raw material supply continues to be erratic and unstable. This results in inefficient, unprofitable mill operations and in major financial losses to Government. The Company has not in the past, and definitely not control encroachment on the assigned 10,000 ha reedland. The lack of raw material availability makes it mandatory that the reedlands be retained as a potential supply source for the Mill until such time as a stable supply becomes available. Population increase in the future will increase demand for agriculture land in the area, compounding the difficulties.

Recommendations

1. Khulna Newsprint needs a supply of 133,100 m³ and preferably 141,000 m³ for at least ten years. The latter volume is the volume needed at the lately improved operating level. This period provides the Company and the Forest Department ample time to investigate and finance alternative raw material supplies. Although harvesting is very extensive, the level of disturbance is minimal owing to selective felling, the uneven-aged conditions and good natural regeneration. Wildlife is hardly affected by normal harvesting operations. Planned operations during this 10-year period can avoid the existing or newly proposed game sanctuaries, if found necessary.

Some possible avenues of increasing supply needing investigation are:

- a. Clearcut trials on some areas to see if this increases the very slow growth rates of gewa, the pulpwood species.
- b. Silvicultural trials of alternative treatments to promote stand growth and vigour.
- c. Trial plantations of other pulpable species.

2. Allowing selected and controlled felling in the high forest is a more positive approach compared to the cutting moratorium. Authorized felling allows the Department to exercise legal control, monitor operations, collect revenues and control felling to known locations. At present, only isolated individuals benefit. Moreover, felling is sporadic and at widespread isolated locations. In effect, there is no control or management, nor is revenue collected.
3. Sundri top dying felling practices need changing. Any tree showing early signs of top dying needs felling for commercial removal. This practice makes the most sense, both from a sanitary and economic viewpoint. Earlier cutting ensures maximum tree utilization before damage by insect and fungus attack.
4. The Department lacks the necessary funds to properly replace, maintain and manage the Kaptai gama plantations. Development financing is possible to arrange by leasing them to the Forest Development Corporation and making the Corporation responsible for management and development funding. The Corporation can manage the financing without involving government. Lease conditions would govern the level of control, lease term and set Departmental planning, supervision and development standards. Properly used, the funds would finance a proper level of plantation management. Improved management practices, likely on a silage basis, would create sufficient pulpwood for the Karnafuli Mill from thinnings and the small material at harvest time.
5. The Karnafuli Mill requires the right to continue bamboo extraction from their temporary Kassalong area until such time as they can return to their normal operating area. Otherwise, Mill production will be seriously reduced, affecting Company profits and Government losses.
6. The creation of a Departmental security force would conflict seriously with the Department's newly developing role promoting public participation in forest protection and management. This conflict would be counter productive and undermines this intended new role and supporting programs
7. The Department needs an active program to control and reduce the effects of the teak skeletonizer attacks to reduce value losses and to prevent early teak mortality.
8. Decisions on technical forestry matters are best made as close to the field location of the problem. Technical decision making powers should reside in the Chief Conservator's office. Ministry decisions are better left to matters of policy and principals, not day to day operations. In this particular case, it means the Divisional or Circle Office should have the authority to approve minor revisions to annual cutting plans. .
9. The chief cause of poor bamboo utilization in Sylhet is poor contractor supervision by the Department. Poor access aggravates the situation. Because of the long distance and travel time involved, proper supervision lags. An auction method encouraging successful bidders to build or improve access in extraction areas would yield better results. Better results include a vastly improved bamboo supply and improved utilization. A chief feature required by the new procedure is longer tenure over lease areas rather than the annual conditions, at present.
10. The Khulna Newsprint Mill and Sylhet Pulp and Paper Mill already operate at substantial losses. In Khulna's case, this is not caused by inefficiencies. The Sylhet Mill's harvesting standards far exceed most contractors. Additionally, the Mill salvages dead and undersized culms not used locally.

The report therefore, recommends resetting the royalty rates for gewa wood and Sylhet bamboo to reflect realistic economic values. The former bamboo rate is more reasonable.

At present the Khulna gewa rate is Tk 530/m³, a 250 percent increase. Meanwhile the rate for Sylhet bamboo is Tk 3,900/1000 culms, approximately 75 percent of the finished paper price, a level not based on economic reality.

11. The Sylhet Pulp and Paper Mill requires a more stable raw material supply if it is to have any chance to become profitable. One possible source is the short term importation of bamboo from Assam in Sylhet Division. Another is a leased or partnership arrangements to plant spare tea garden lands. Both need investigation. These are all short term options pending a long term solution, which is to provide the Mill with substitute lands for captive pulpwood plantations. The exchange basis are the assigned reed lands. Even so, much of the Mill's future supply must continue to come from surrounding villages.
12. The present system of auctioning standing bamboo and timber prevents contractors from building a permanent transportation infrastructure. Good permanent roads extend harvesting throughout the year, thereby reducing overall wood costs. A short harvesting season renders uneconomic the creation of a permanent skilled labour force. Trained workers are the base for improved harvesting efficiencies and better utilization.
13. The Department needs to introduce a wood allocation system which encourages or even requires contractors to construct permanent transportation infrastructure in the forest. Similarly, management responsibilities could also be incorporated. Both could be achieved by listing required infrastructure and management conditions, defining acceptable standards and time tables in recognizable working areas.

These types of responsibilities would be gradually added to normal contract harvesting or cultural operations. This system, of course, only works if the cost of performing the responsibilities is a legitimate charge against wood values. Contractors also have to have a long term interest in stable wood supplies. These conditions imply stable contractors engaged in legitimate business practices. The contractor's reward is long term tenure, while Government's ensures controlled annual harvest volumes and responsible, improved forest management.

WOOD HARVESTING

INTRODUCTION

General

The Asian Development Bank, United Nations Development Program (UNDP), and the Government of Bangladesh (GOB) are financing the technical assistance services to prepare a twenty year Forestry Master Plan. The plan aims to assist the GOB decide the priorities for developing and protecting the country's forest resources. This report presents the results of a four month study by the Harvesting Specialist, part of the planning process.

Forest harvesting operations provide secondary industrial raw materials, give direct employment, and offer indirect benefits to supporting industries in the major transportation and energy sectors. As well, they provide the Government with revenues and possibly foreign exchange.

A good harvesting operation is one clearing the natural forest at predetermined intervals with minimal soil disturbance. Harvesting leaves the remaining forest in a healthy condition by removing the mature trees susceptible to disease and rot. In the case of plantations the harvesting of the mature crop is a natural cycle similar to agricultural cropping with the major exception that it occurs over a much greater time period.

For consistency sake, this report adopts metric units of measurement. Appendix 1 lists equivalent Bangladesh local units. Volumes quoted are true roundwood volume in cubic metres (m³). Appendix 2 includes the Terms of References for the report.

Major Issues

1. The security of extraction operations in the Chittagong Hill Tracts is a major problem hampering harvestin operations. Bangladesh Forest Industries Development Corporation's (BFIDC) timber and the Karnaphuli Paper Mill's (KPM) bamboo extraction operations are badly affected. This situation requires resolution before normal extraction operation can resume.
2. In the Sundarbans BCIC's (Bangladesh Chemcial Industries Corpotion) Khulna Newsprint Mill's (KNM) allowable annual cut is reduced below mill design levels. The mill needs an annual supply of 133,140 m³, preferably 141,600 m³ for at least ten years to give the Company and the Forest Department time to investigate and finance alternatives supply. (This latter volume is needed to continue operations at the present mill capacity.) Briefly some possibilities are:
 - a. Initiate trials to clearcut some areas to see if this will increase the very slow growth rates of gewa (*Excoecaria agallocha*) (White, 1979).
 - b. Silviculture trials of alternative treatments to promote stand growth and vigor.
 - c. Trial plantations of other pulpable species.

* For this and other abbreviations, terms and conversion factors see Appendix 1

d. Limit further game sanctuaries creation until KNP establishes a sustainable annual wood supply.

3. The cutting moratorium on high forest felling does not appear to be working. The resultant high prices of wood have made it more profitable for illicit felling. Allowing selected and controlled felling in some areas of high forest is a more positive approach. This method also gives better legal control by Government.
4. The policy of not felling sundri (*Herithera minor*) until the tree is 50 percent dead needs changing. Allowing these trees to be harvested sooner avoids wasting a large part of their economic value. The Khulna Hardboard Mill requires sound wood for a profitable manufacturing process. Sundri showing early signs of top dying needs felling. This is both a sanitary and economic measure which ensures maximum utilization before the trees are destroyed by insects and rot.
5. Kaptai pulpwood plantations need harvesting. The report favours a long term lease basis to BFIDC. The Bangladesh Forest Department (BFD) cannot get the funds to adequately maintain them. *Loranthus* has attacked 20-30 percent of the gamar (*Gmelina arborea*). The plantations need a sanitary felling as soon as possible. Thinning has not been done and yields are much less than expected. BFIDC has the financial resources to improve the plantations yields so that they will produce the maximum economic benefit to the country. Plantations management indicates a sawlog rotation of 18-20 years with thinning and tops used as pulpwood.
6. KPM has difficulty harvesting enough bamboo to meet their annual requirements (48,000 ADT). They have not operated in the Kassalong Reserved Forest (RF) due to security problems since 1986. The Forest Department allocated them a temporary extraction area in Gangaram, Kassalong West region but is now threatening to withdraw this temporary permit. KPM requires the right to extract bamboo in this area until Kassalong security improves.
7. The Forest Department proposes to create a security force equipped with automatic weapons. If allowed to happen it will be impossible for the Department to project a joint custodian image with the local people.
8. Defoliation in teak plantations is a major concern. The teak skeltonizer insect is seriously affecting the growth rates. Persistent attacks will cause mortality, therefore, the BFD needs an active program to find out control methods for this outbreak.
9. *Molucanna* (*Paraserianthes falcateria*) harvesting in the Sylhet Forest Division is seriously delayed. Sylhet Pulp and Paper Mill (SPPM) faces a shortage of raw material during this monsoon period. Already one half of the harvesting period is lost this year. The problem require Secretariat approval or reference. Technical decisions are best made at the lowest level possible.

In this case there is no approved management plan. The Chief Conservator of Forest (CCF) needs the power to make the final decision on revisions to annual cutting plans. Where an approved management plan exists, the Divisional Forest Officer is the officer best equipped to make any minor revisions in the annual cutting plan. Headquarters needs informing so that the Resource Information Management System (RIMS) data is kept up to date.

10. Annual bamboo mahal auctioning is not the most efficient way to ensure maximum bamboo supply. This system discourages contractors from investing in infrastructure, eg. roads, cable ways and stream improvement. A good infrastructure network permits full harvesting of the

mahal total area. Drigo Et Al (1988) in the Sylhet Forest Inventory estimated that from 20-50 percent of harvestable culms remain behind in the forest. The chief cause is poor contractor supervision by the Forest Department. This is mainly due to poor access. Department Officers may have to walk for one or two days to make their inspections, hence, supervision is infrequent and/or cursory.

11. Royalty rates for forest products need reviewing. Industries are only able to pay royalty rates set at realistic rates. This means:

a. Lowering the royalty rate of gewa wood from Tk 530/ m³. KNM is already operating at a loss. This is not due to any major inefficiency on their part. In any case paying this rate for branch wood is excessive.

b. The proposal to charge SPPM the average market rate for bamboo (Tk 3,790/ 1,000 culms) seems counter productive. SPPM harvesting standards exceed most contractors. Their operations salvage dead and undersized culms which are not saleable in the local markets. The current rate Tk 1,071/1,000 culms, is more realistic.

12. The lack of fibre availability in Sylhet Division makes it mandatory that the reed lands remain a potential source of raw material for SPPM. SPPM cannot control encroachment on their assigned reed lands. Increases in population projected over the next twenty years will compound protection difficulties. Multi bamboo flowering within the next five to ten years is very likely. Material supplies to SPPM then becomes even more critical. The availability and security of the long term importation of bamboo from Assam, India needs investigation as a potential raw material supply.

13. The present system of auctioning bamboo mahals and standing timber strongly discourages contractors from improving or building permanent infrastructure. Infrastructural improvements extend the harvesting period. Short harvesting seasons undermine the creation of a permanent skilled labour force. Demand forces permit companies or contractors to improve harvesting efficiency.

PRODUCTION FOREST

Bangladesh needs to introduce the concept of a production forest. This is a permanent forest area with main function to produce forest products on a sustainable yield basis. This includes sawlogs, pulpwood, poles, fuelwood and all minor forest products. This primary function does not preclude the use of this forest from one or more of the following uses.

- a. Protection of flora and fauna
- b. Watershed protection
- c. Fisheries enhancement
- d. Recreation
- e. Grazing
- f. Soil stabilization

Production forest management concentrates on increasing the economic benefit to the country. This includes providing for protecting and enhancing the environment in addition to providing industrial raw materials.

FOREST DEPARTMENT EXTRACTION

The Forest Department operates many extraction operations throughout the forest areas. However, BFD relinquished control of harvesting operations in three areas to BFIDC, KPM and KNM. These are as follows:

- a. Bangladesh Forest Industries Development Corporation (BFIDC) operates a 30-year concession agreement in the Chittagong Hill Tracts. This ended on October 1990.
- b. Karnaphuli Paper Mill, a subsidiary of Bangladesh Chemical Industries Corporation (BCIC) harvests bamboo in the Chittagong Hill Tracts. Its lease agreement is 99 years.
- c. Khulna Newsprint Mill, also a BCIC subsidiary, harvests gewa in the Sundarbans on a long term lease.

Each of the above needed large capital investment in machinery and infrastructure. This made it attractive for GOB to create corporations to operate the areas rather than making the Department responsible for the extraction. The same philosophy should apply to all extraction operations excepting two situations. Plantation thinning and small scale harvesting operations in some Division are better left with the Department.

The Department's appropriate role is as the guardian or custodian of the nation forests. Another major responsibility is to ensure the nation receives adequate payment for forest resource use. It is better it remain outside any commercial activity other than collecting royalties. The long term care and management of the forests is a difficult and challenging job requiring full time Departmental attention.

The Forest Department has many alternative ways to dispose of the mature timber or other products scheduled for harvesting. Each of these alternatives requires good supervision by the Forest Department. Supervision ensures the contractor's operations cover only the area specified and that volumes harvested are correct. The following list shows some of the viable alternatives:

- a. Sell the standing trees on a unit basis to a contractor by public auction or tender.
- b. Engage one contractor at fixed unit price to deliver the timber to a log depot where it can be sold in an auction.
- c. Have separate contractors for road construction, timber extraction to roadside, and transport to a log depot. Sell by auction.
- d. Establish a set royalty fee per unit of volume for each species produced for contractors.
- e. Sell standing trees by public auction on a lump sum basis.

Alternative (a) is the Forest Department present system. The main weakness in this method is that the contractor rarely invests in building good roads. Contractors usually confine themselves operations in the dry season. This provides very little full time employment to labour. However, nothing prevents the Department from including sales contract clauses prescribing the type of road and other structures to be built by the contractor. This allows building the infrastructure necessary for long term production efficiency, forest management and protection. Alternative (e) requires a very good inventory of the area. This is difficult to achieve in Bangladesh. The main advantage of (e) is that the volume recovered is maximized as the contractor has the incentive to harvest all

the merchantable volume possible. In Bangladesh it proves difficult to confine the contractor to the area specified.

Alternative method (c) favours the lowest costs and the best return to the Forest Department. In this alternative, each separate specialized contractor should be more efficient than one main contractor. Off-setting the obvious attraction, this method requires good supervision and control. Moreover, when the Department does its own extraction and actions the timber it is gambling on getting a higher price today compared to selling standing trees, possibly 6-12 months earlier.

Some DFOs favour setting up a divisional utilization section. This applies especially in teak plantation harvesting using alternative (b) to deliver the logs to a log depot for auction. DFOs claim this gives them better control and maximizes the volume recovered. However, this puts the Department in the position of gambling. Gambling is risky, log prices do not always go up.

At this stage of Bangladesh's development alternative (a) is the most viable alternative. Sales contracts need to incorporate clauses to ensure that road construction is adequate and that the contractor is penalized for leaving any merchantable volume in the forest. This alternative provides little incentive for the contractor to trespass from his cutting area. It provides maximum protection and requires the least supervision. Also the Forest Department avoids gambling on future prices of timber. Additionally, this business area is more suitable to timber traders.

BANGLADESH FOREST DEVELOPMENT CORPORATION

Background

Prior to 1960 the mechanical extraction was by the Forest Directorate, but the Government decided that it could be more efficiently accomplished by a state corporation.

East Pakistan Forest Industries Development Corporation preceded BFIDC. The original corporation, formed in February 1960, extracted timber using mechanical equipment from the natural forests in the Chittagong Hill Tracts (CHT). The Corporation had an exclusive 30-year concession on the Chittagong Hill Tracts forest reserves. This lease expired in October 1991. In 1971 the partition of Bangladesh created Bangladesh Forest Industries Development Corporation. Since that time, BFIDC developed into a large corporation with many subsidiary divisions.

Report comments apply to BFIDC's two extraction division. The first is the Timber Extraction Unit (TEX) located at Kaptai. This unit uses wood from the Kassalong and Rankhiang Reserved Forests. The second is the Chittagong-based Sungoo-Matamuhuri Extraction Unit. This Division depends on wood from the Reserved Forests of the same names.

Appendix 3 contains historical operating details of the Corporations operations.

Timber Extraction Unit, (TEX)

In 1972 a sawmill was commissioned at Kaptai. The sawmill has not operated up to expectations as there were problems in obtaining spare parts from Poland and due to a lack of trained saw doctors. In 1977 the Swedish International Development Agency (SIDA) financed a project to provide equipment, spare parts and technical assistance for the extraction division and the sawmill. The extraction unit did not meet the forecasted production targets as the road development could not be completed due to a lack of local funds and security problems.

Table 1 - BFIDC Divisions and Manpower Summary

Division	Location	Officer/ Staff	Work ers	Total
Timber Extraction (TEX)	Kaptai	176	379	555
Procurement and Sale	Kaptai	19	39	58
Lumber Processing Complex	Kaptai	33	120	153
Sangu-Matamuhri Project	Chittagong	24	30	54
Cabinet Manufacturing Project	Chittagong	21	97	108
Furniture Industries(FIDCO)	Chittagong	32	130	162
Board Mill (LBM)	Chittagong	13	29	42
Particle Board & Veneer Plant	Chittagong	37	142	179
Wood Treatment Plant	Chittagong	34	166	200
Sangu Valley Timber Ind.	Chittagong	46	153	199
Eastern Wood Works	Dhaka	37	102	139
Cabinet Manufacturing	Dhaka	33	109	142
Wood Treatment Plant	Khulna	53	53	106
Cabinet Making Plant	Khulna	7	62	69
Total		565	1611	2176
Rubber Division		406	1719	2125
Total Employees		971	3330	4301

Recently BFIDC has been extracting timber without any foreign financial aid; however the level of production has been severely curtailed due to a lack of foreign exchange for spare parts and to a shortage of local funds. Kassalong extraction has also been severely restricted by the lack of security for the past four years. Harvesting operations are at a virtual standstill. This is an abnormal situation beyond BFIDC management control. Table 2 indicates the level of normal production for five years by sales groups before the security in the Chittagong Hill Tracts deteriorated. Data reflects a July to June financial years.

GOB completely stopped cutting when it imposed a moratorium on falling trees in the natural forests in 1989. While this report was being prepared, GOB initiated BFIDC permission to harvest 243 ha per year in the Kassalong RF and 40 ha annually in the Matamuhuri RF. A recent meeting with the army on security for BFIDC workers in the Kassalong determined that BFIDC needs 350 security guards to ensure employees safety. This is in addition to the logistic support they have to provide the army.

Table 2 - Normal Production by Sales Groups, m³/A

Timber Category	1982-83	1983-84	1984-85	1985-86	1986-87
Teak	-	-	56	125	66
Padauk	-	-	-	-	-
Class	-	-	-	-	-
I	3,698	1,880	3,295	694	869
II	787	675	1,318	1,137	1,601
III	196	229	272	469	482
IV	27,615	21,369	20,415	16,716	26,933
V	1,770	1,528	1,480	831	1,358
VI	367	174	325	190	155
VII	1,328	1,189	1,427	804	1,095
IX	1,698	1,746	1,987	1,041	1,254
X	890	2,910	2,355	3,679	3,439
Total	46,758	36,596	36,935	27,104	38,831

Table 3 indicates the levels of productions attained and the large losses suffered as a consequence of security problems and the subsequent moratorium on high forest felling.

Table 3 - Recent Production and Financial Results

Fiscal Year	Volume M ³		Percent Change	Operational Profit (Loss) Million Tk
	Target	Production		
1987-88	39,710	20,108	51%	(13.7)
1988-89	41,520	14,651	35%	(1.9)
1989-90	39,710	18,195	46%	(18.9)
1990-91	36,820	5,812	16%	(28.3)

The smaller loss (1989-90) was due to a large increase in the average sale price of logs (Tk 900 m³). The average sales price of logs has increased in ten years from Tk 1,540 m³ to Tk 4,290/m³. TEX financial statements for the years from 1981-82 to 1990-91 are in Appendix 3.

In normal working conditions and with adequate provision of foreign exchange to buy spare parts the presently constituted extraction unit can produce 43,300 m³/A. This level generates a profit of about Tk 30 to 60 million annually, depending on the average sale prices of logs. A moderate investment in new equipment will replace worn out old equipment. Some of the present tractors and loading cranes are 13-17 years old and are virtually beyond repair. TEX has enough manpower to produce 65,000 m³/A.

A production of 65,000 m³/A allows harvesting in the natural forest for more than 40 years without considering the volumes harvested from plantations. By the end of the Master Plan period existing plantation areas, properly managed, will produce significant teak volume. This volume of teak timber being made available to the railway and other markets should lower sales prices. This plantation wood promises to relieve pressure on cutting the natural forest in other areas and

reduce the incentive for illicit felling throughout the country. The net economic benefits to the country appear significant.

1. Raw Material Supply

a. Natural Forest

The remaining natural forest in the Kassalong and Rankhiang Reserved Forests were evaluated by De Milde Et Al (FAO, 1985). However, due to lack of security in these areas no field work was possible. The report, therefore, was based on interpretation of 1984 aerial photographs. Table 4 summarizes FAO's report forest classification areas. Non forest areas include brush and reeds, jhum, clearings, logged areas, agriculture and settlements. Also included are the natural forest areas or protection strips between plantation blocks.

Table 4 - Kassalong and Rankhiang Forest Areas, ha

Timber Type	46.395	7.116
Mixed Timber	14.878	3.228
Bamboo	23.525	6.194
Mixed Bamboo	12.653	13.606
Timber	14.330	8.873
Bamboo*	46.960	36.624
Plantations	300	486
Non Forested	5.377	977
Non Productive		
Water and Swamps		
Total	164.448	77.104

* Mostly muli Bamboo

BFIDC withdrew from the Rankhiang RF in 1977. At that time their operations were not profitable. Thereafter, they concentrated activities in the Kassalong RF which has more favourable terrain for harvesting than the Rankhiang.

BFIDC could return to the Ranghiang when the plantations reach maturity. At which time an assessment should be made for harvesting the remaining unjhummed natural forest. The natural forests left now are reported to be on very steep ground; therefore, the decision may be to leave them as a natural gene source for posterity.

Since the FAO inventory, the Corporation reportedly has cleared 3,700 ha of natural forests in the Kassalong RF. This leaves about 57,600 ha to sustain their operations. Under normal conditions BFIDC harvests 810 ha/A which means there is enough natural forests left for 64 years.

Management, reportedly, is obtaining GOB permission to resume contract operations on 800 ha/A beginning in December 1993.

a. Plantations

The large scale plantations of mostly teak and jarul, in the RFs are approaching maturity. FAO reports the areas under plantations to be 26,886 ha (1981). Since that time an additional 30,304 ha are reportedly planted in these RFs, making a total of 57,190 ha.

Table 5 shows plantation areas established in the Hill Tract RF areas, by five year intervals.

Table 5 - Chittagong Hill Tract Plantation Areas, ha

Year	Kassalong	Rankhiang	Sitapahar
1919 - 39	3	350	959
1940 - 49	146	195	738
1950 - 54	736	175	352
1955 - 59	827	337	350
1960 - 64	1,126	954	321
1965 - 69	4,195	2,624	500
1970 - 74	1,678	733	283
1975 - 79	3,572	1,885	45
1980 - 84	12,749	11,944	49
1985 - 90	1,700	8,029	11
Total	26,285	27,222	3,683

Large areas of plantation establishment occurred in the 1980-84 period. However, the FAO survey found about 20 percent less in the Kassalong and about 39 percent less in the Rankhiang than the BFDs total reported. There are presently 2,345 ha of mature plantations that should be harvested and regenerated during the next three years. BFIDC should be given the sanction to proceed with the harvesting of these plantations.

The accurate prediction of yields from these plantations is not possible. The annual increments are low because these plantations have not been maintained and protected. Reliable area and species composition data are simply unavailable. Therefore an inventory should be made to establish the actual areas and levels of stocking.

A conservative approximation of harvestable volumes over the next forty years uses an annual increment of 2.5 m³ ib/ha/A for all species at a rotation age of 45 years (Figure 1 illustrates the volumes expected over the next forty five years), the rotation age recommended by the Management Specialist. Figure 1 indicates that plantation harvesting and extraction in the natural forests needs rationalizing to give a sustainable yearly industrial output.

A sawmill improvement program should be an integral part of any proposed project for this area. Once GOB resolves the security situation in the CHT a feasibility study is needed to determine the amount of financial assistance to rehabilitate BFIDC's TEX operations. The study should also include the Rankhiang RF and Sitapahar RF as there are about 9,053 ha of plantations there approaching maturity in the next 20 years. BFIDC is the logical agency to harvest salutation areas as they have the experience, manpower, water transport, and infrastructure in place.

Sangu-Matamuhuri Extraction Unit

The headquarters of this division is located at BFIDC's Kalurghat Depot on the eastern outskirts of Chittagong. This Division does no mechanical extraction in the Matamuhuri Reserve Forest as they found it too difficult for tractor or skidding logging due to the steep terrain. Presently, all extraction ceased due to GOBs felling moratorium in the natural forest. The annual production target is 2,830 m³ radda (squares) and 1,080 m³ of roundwood. As there are no roads in this reserve this volume will be carried to the charas and then floated down the Matamuhuri River to Chiringa where it gets loaded onto trucks for transport to Kalurghat (103 km).

1. Raw Materials Supply

FAO did a aerial photo interpretation classification exercise of these two reserves based on 1983 photos in 1984 (Choudhury 1991). No ground truthing was possible due to travel restrictions in this region caused by lack of security.

Shifting cultivation has occurred since the last inventory in 1961. The natural forests have been encroached upon by illicit shifting cultivation by the resident tribal population. Both reserves exhibit broken and rough topography. Deep gorges and steep slopes are characteristic in both drainages. The forest areas are bounded on all sides by ridges with crests up to 840 m. Table 6 shows the combined area classification of the two reserves. Individual RF details are not available.

Table 6 - Sangu - Matamuhuri Forest Reserves Area Summary, ha

Item	Area	Percent
High Forest		
Medium-Good Density	8,700	11.7
Poor Density	47,840	64.2
Low Forest/Bamboo		
Medium-Good Density	17,100	23.0
Shifting Cultivation	380	0.5
Grass, Agriculture, Settlement		
Water	480	0.5
Total	74,500	100.0

The overall average timber volumes in the forested areas is only 42.6 m³/ha (East Pakistan Forest Dept. 1961 inventory). Garjan makes up about 12 percent and civit 50 percent of the volume.

2. Matamuhuri Reserve

The draft five-year working scheme for the period 1990-95 indicates 25,186 ha in the Matamuhuri timber working circle. Plantations area in 1990 was 5,037 ha. Therefore, the remaining forest area estimate is 20,149 ha. Workable area is therefore 17,952 ha.

The total volume in this reserve is estimated to be about 765,000 m³, based on an average of 42.6 m³/ha and workable area of 17,192 ha. However all of this volume may not be economical to extract or all of the species merchantable. All plantation areas are required to have a 100 metre wide strip of natural regeneration strips (NRS) between blocks of 50 ha. This further reduces the exploitable volume to be removed in the natural forest as mother trees have to be left as a seed source in the NRS.

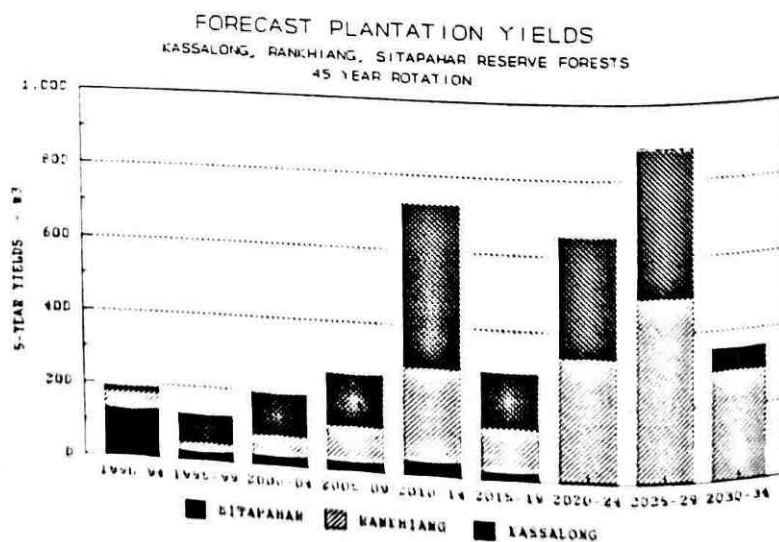


Figure 1 - Forecast Chittagong Hill Tract plantation 5-year yields.

The working plan proposes to convert the natural forest into plantations over a period of 60 years. Calculated annual area harvested is then calculated 383 ha including the existing plantations. No volume yield was estimated from this annual area. The volume produced annually varies over 50 percent. This makes it very difficult for production planning in the extraction and manufacturing units.

The bamboo working circle has a total area of 25,186 ha. Cutting is on a four year cycle. The working schedule proposes to dispose of bamboo mahals annually by open auction to maximize revenue. No estimate of anticipated yields is given. It is unlikely that the total area can be harvested economically (Choudhury, 1983).

3. Sangu Forest Reserve

The proposed working schedule for 1990-95 is not complete at this time. Table 7 presents an approximate summary of the forest area after deducting the Matamuhuri areas as reported by the FAO inventory. Assuming the same proportions of area as in the Matamuhuri RF the workable area estimate is 13,625 ha. Similarly, the proportionate yield totals 580,00 m³ and the annual cutting area is 500 ha for the Reserve.

Table 7 - Sangu Reserve Forest Areas, ha

Item	Area
Natural Forest	15,310
Bamboo	14,791
Jhum	3,420
Water	400
Total	33,921

4. Production Costs

Access to both the Matamuhuri RF and the Sangu is limited to small river craft except in the dry months. A paved road to Ali Kadam is within six km of the eastern boundary of the Matamuhuri RF. There are many side drainages flowing into the rivers with deep gorges. Road construction in the RF reportedly is very difficult and costly. During the dry season access to this is very difficult by boat. Walking is the only sure alternative at present.

The Matamuhuri contractor will be paid Tk 3,324/m³ for radda delivered to Kalurghat. Royalty is fixed at Tk 1,247/m³ for logs. Conversion to squares is estimated to be 70 percent therefore royalty on square basis is Tk 1,781/m³. Administration and overhead costs for BFIDC are estimated at Tk 1,0149/m³. At the full production target, total costs of radda delivered to Kalurghat is estimated to be Tk 6,119/m³.

The working area for 1991-92 requires manual carrying for six to eight kms to stream beds. Logs are then floated a further eight kms to the Matamuhuri river where they are made into rafts. The rafts are then floated down stream to Chiringa. From Chiringa they are trucked to Kalurghat.

Proper development of the Matamuhuri and the Sangu requires reliable road access. Engineering studies are needed in both Reserves once security is assured. The feasibility of constructing an access road into the area, improving the river transport by construction of weirs or deepening the channel needs careful evaluation. Road access would give the local people year round access to the outside markets for their produce. Access also provides an economic way to transport timber, bamboo and minor forest products.

The volume of merchantable timber remaining in each reserve is likely insufficient to amortize the access costs of the proposed structures. Some form of initial subsidy is therefore necessary to support these permanent improvements. Both rivers have hydroelectric potential, which if developed, would create access for possible commercial timber purposes.

BANGLADESH CHEMICAL INDUSTRIES CORPORATION

General

Bangladesh Chemical Industries Corporation has four subsidiary companies using wood or bamboo as their main source of raw materials. Operating history details for these operations are in Appendix 3. The operations are:

- a. Khulna Newsprint Mill, using gewa logs harvested from the Sundarbans RF.
- b. Khulna Hardboard Mill, utilizing waste wood from the cutting of sundri in the Sundarbans RF.
- c. Sylhet Pulp and Paper Mill using bamboo, reeds and molucanna logs from the Sylhet Forest Division.
- d. Karnaphuli Pulp and Paper Mill, utilizing 60 percent bamboo from the Chittagong Hill Tracts and 40 percent logs presently coming from clearing of the Unclassified State Forest land areas in the Chittagong Forest Division.

In addition, BCIC's North Bengal Pulp Mill, located at Paksey, uses bagasse for making pulp. This report excludes this mill since bagasse is not a forest product. The Wood Processing Specialist's report covers the Paksey mill.

Khulna Newsprint Mill

1. Raw Material Supply

The Khulna Newsprint Mill's installed capacity is 40,000 ADMT per annum. However, the mill can produce 50,000 ADMT/A if enough raw material can be supplied.

KNM had an original leased area of forest in the Sundarbans of 273,300 ha. The Sundarbans is one of the largest remaining mangrove areas in the world. It is of major importance as a source of timber, pulpwood, fuelwood, and fish as well as minor forest products.

In 1969, the matchwood felling Block I of 59,729 ha was added to Mill's lease to ensure better utilization of gewa. In 1977 the BFD created a game sanctuary and deleted 23,700 ha from the lease leaving a total of 309,320 ha. The harvesting plan for gewa is a 20-year cutting cycle with four five-year felling plans prepared for detailed operations.

Since the 1959 commissioning of the newsprint mill, the extraction operations have completed one cycle of the cutting area. The first full cycle was due to finish in 1980. Due to lower production in the mill and the 1971 civil war the first cycle did not end until 1987.

A serious technical controversy exists over the sustained yield capacity of the Sundarbans. A recent inventory completed by Overseas Development Assistance (ODA) (Chaffey Et Al, 1985) measured a serious reduction in growing stock volumes and a major change in species composition. ODA's inventory says that the standing volume of gewa is 45 percent lower than the projected volume estimates by Forestal in the 1959 original inventory (Forestal, 1959). KNM

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disagrees with ODA's assessment. The mill's pre-logging inventories agree with the yield forecast by Forestal.

In an effort to resolve this controversy two joint check sampling exercises have been carried out. In the period of November 1985 to January 1986 the joint sampling by BFD and KNM was measured in Blocks 2 and 3. This sampling shows that ODA's inventory volume in Block 2 was 78 percent low and in Block 3 was 27 percent low. The Department did not accept the check. Therefore, a further joint sample check took place in November - December 1989. Appendix 4 has a summary showing a comparison of standing volume estimates between this latest check and the ODA's inventory.

Both jointly conducted check samples show substantially higher volume than ODA results. Analysis is based on regression computation of tree volumes to a top diameter of 10 cm dib. This is a lower volume standard than ODA's volume table. This comparison is on the weighted results for Block 4 through 8 only as Block 1 to 3 extraction operations occurred after the ODA inventory. The results show volumes over twice that recorded by ODA, summarized below.

<u>Diameter Class</u>	<u>Compared to ODA</u>
10 cm diameter class and above	+ 204%
12 cm diameter class and above	+ 201%

Based on the check sampling volumes the calculated annual allowable cut for gewa (10cm dib) using the Modified Hanzlik's Formula is 133,800 m³/A. Excluding mother trees left as a seed source, the net volume available is 120,400 m³/A. Since KNM utilizes gewa to 7.5 cm, this raises the available volume by 28 percent (Chaffey 1985, Appendix 10). At this lower diameter standard the annual harvestable volume becomes 154,100 m³/A.

An interministerial meeting in April 1990 permitted KNM to extract 133,140 m³/A until there was a noticeable decrease in the growing stock. At this reduced level of harvesting there is no gewa available to the match factories in Khulna. Accordingly, one match factory shut down and the other, Dhaka Match Industries Co Ltd, began using wood supplied by the local villagers. This latter mill also stopped operating at a later date.

Gewa has a low annual growth rate, currently estimated at 0.32 m³/ha/A. This indicates the great need to find sound methods to increase the growth rate. White (1979) suggested the following:

- a. Trials to clearcut some areas to see if this will increase the growth rate.
- b. Silviculture trials of alternative treatments to promote stand vigour and growth.
- c. Trial plantations of other pulpable species.

The proposed Forestry III World Bank Project supports a forest management improvement program in the Sundarbans comprising the following main components:

- a. Forest management and research team.
- b. Forest inventory and assessment.
- c. Experimental management and plantations.

A post-felling inventory assessing the condition of residual stands and natural regeneration for five years is a part of Forestry III. Once completed, this inventory project should resolve most of the outstanding issues of the long term Sundarbans harvesting. To accurately monitor the gewa wood supply and to assess the stocking changes for such a critical resource, requires a complete inventory every 10 years. The next is due 1997. If followed regularly, this inventory cycle would determine precisely exact levels of sustainable harvest.

2. Royalty Rate

During the period of the lease up to 23 May 1989, the gewa royalty was Tk 2.21/m³ below a cutting level of 84,950 m³. Above this volume, the rate was Tk 3.53/m³. On expiry of the lease, the Department raised royalty to Tk 529.72/m³. The original royalty rate was kept too low. There should have been provision for royalty escalation in the lease agreement to keep up with inflation. However, it is difficult to see any economic justification to jump the rate to Tk 530/m³. The Company presently loses about Tk 5,000/T of newsprint. Most of the loss is due to GOB furnace oilcosts, not raw material charges. However, this increase in royalty adds to this loss by Tk 1,350 per tonne of newsprint.

KNM's operations are quite efficient. The extraction operations costs cannot be decreased very much. At the most Tk 71/m³ from a total cost of Tk360/m³ is possible. This means that the Company has to absorb most of this cost increase in raw materials.

It is beyond the terms of reference of this report to recommend an appropriate economic solution to this situation. However in addition to financial loss, the KNM faces staff morale problems due to the large operating losses sustained. Other reports will present an assessment on current royalty rates.

3. Extraction Operations

The annual harvest area is divided into cutting blocks. A pre-operational inventory determines the volume in each cutting block. Based in this inventory, extraction contracts are made up and placed for tender.

A contractor is responsible for felling, carrying to the khal, piling and bundling. Company tugboats tow the bundles to a central rafting ground where the bundles make up into rafts of 225 bundles. Four rafts linked together make one tow for the long journey (approximately 100 km) up river to Khulna. The tow is made by either a 525 or 600 hp tugboat on the floodtide. When the tide is ebbing the tow is tied to the bank. During the monsoon the strong current requires three tug boats to make the tow.

Felling operations are manual with axes used for felling the trees and cutting them into multiple lengths of 2.5, 3.8 or 5m. The stumps are cut at ground level and the top cut is made at 7.5 cm or less depending on the length. Two men can average about 40-50 trees per 10 hr day. This rate includes carrying to the nearest khal where the logs are piled ready for bundling. The wood is left in piles for about 21 days to let it dry so that the bundles will float. Every tenth bundle is scaled by a company scaler. Bundles are then towed by a small tug to the rafting area. The felling operations appear quite efficient.

The use of axes create waste. Cross cut saws were tried but rejected. Saws are too difficult to use and maintain. The small gewa diameters means that the waste is negligible. Therefore axes appear to be the appropriate tool.

Each of the three different length bundles consist of 80-90 pieces of wood. They are made into sections with two wires to hold them together. These wires are recyclable. Bundling rafting and towing requires a lot of wire rope. Most of this rope is recovered but invariably there are losses, with the result that wire rope is a major expenditure each year. These operations are the major expense in the delivered wood cost. Raw material costs in 1990-91 were 60 percent of the total the mill is more efficient. This type of system eliminates a dumb barge system transporting logs to rope and would result in logs being cleaner and fresher. Furthermore, during the monsoon season it should be easier and faster to tow barges against the current.

Debarking at the mill site is not working well. Therefore, a system of debarking in the forest resulting in more volume being transported by barge should result in a more economic operation. The bark which is presently used by the local people for fuel could be transported to Khulna by country boats.

Appendix 3 includes a five-year summary of KNM's wood costs.

Khulna Hardboard Mill

The sundri-based Khulna Hardboard Mill (KHM) has an annual production capacity of 297 million m² of 1.25m x 2.5m x 3mm hardboard. Mill production is presently running at 60 percent of capacity (1.78 million m² due to the shortage of sundri wood. The BFD only supplies 19,820 m³. Cutting is restricted to trees which are at least 50 percent dead. This restriction was effective with the high forest cutting moratorium.

This policy of limiting sundri to 50 percent dead results in KHM receiving mostly rotten wood. This in turn severely affects the board quality and the mill yield. Analysis of the wood supply shows a net yield of 44 percent of gross volume with an unusually high (10 percent) loss in chipping. This level is commercially unacceptable.

The Department manages extraction operations with no quality control allowed by KHM personnel. The Mill apparently cannot reject any pieces that have too much rot. Consequently, the contractors take full advantage by including anything that will hold together.

The delivered wood cost to the mill is presently Tk 353/m³ which includes a royalty payment of Tk 106/m³. Royalty payments and contractors payments are based on a gross end area measurement of stacked wood with no allowances made for voids or rot. In this type of wood KHM pays about 40-50 percent too much. When the mill did its own harvesting contractors delivered wood for Tk 106/m³.

The Department needs to review their policy on sundri utilization. Cutting the trees when they first show evidence of dying is a better solution all round. The economic benefits of this change in policy are substantial. The present policy of only salvaging 50 percent dead sundri results in very high costs to KHM. BFIDC's treatment plant is also affected.

Unless the Department exercise quality control over the contractors, they should withdraw from the harvesting operation. Quality control is better exercised by the company utilizing the materials.

Sylhet Pulp and Paper Mills

Sylhet Pulp and Paper Mill Ltd's original design concept utilized reeds from nearby land near Chattak. The present annual capacity of the pulpmill is reportedly 22,000 ADT of pulp excluding reed. This is slightly below the design capacity of 24,000 ADT. However due to severe encroachment the reed was never adequate to provide a fibre supply. Final raw material supply shifted to bamboo and wood. Jute cuttings were tried but abandoned. There is no pulpmill on the site yet.

Table 8 shows the projected raw material supply program for 1991 - 92.

Table 8 - SPPM's 1991-92 Raw Material Supply

Fibre Type/ Source	Airdry Tonnes
Bamboo	
Reserve Forest	10,000
Tea Estate/ Auction	10,000
Village	7,000
Station Purchases	<u>7,000</u> 34,000
Plantation Roundwood	
Reserve Forest	6,000
Private	<u>5,000</u> 11,000
Reeds	1,000
Total	46,000

Table 9 details the total bamboo supplied to SPPM from the forest reserves for the last seven years, based on 1,000 culm = 1.66 ADT. Table 9 shows that BFD's supply of bamboo fluctuates widely from year to year. This makes the task of procuring the raw material supplies for the pulpmill very difficult to plan on any long term basis.

Table 9 - Bamboo Supplied by Forest Department

Year	Culms (millions)	Weight (ADT)
1985	3.4	5,640
1986	5.9	9,800
1987	1.5	2,540
1988	6.1	10,170
1989	3.0	5,030
1990	6.1	10,130
1991	4.0	6,640

600 Culms / t

Two ranges totalling 12,000 ha, account for 86 percent of the pure bamboo areas in Sylhet Forest Division. According to the latest inventory (Drigo Et Al, 1988), the total exploitable bamboo resource in the two ranges is:

<u>Range</u>	<u>Reserved Forest</u>	<u>ADT</u>
Juri Range	Pathariaga	178,780
Rajkandi	Rajkandi	<u>48,490</u>
Total		227,270

Bamboo is harvested every four years. Theoretically, the annual harvest is 56,820 ADT/A (about 35.2 million culms). According to the proposed management plan, the annual yield of accessible bamboo is about 19.0 million culms or 30,400 ADT/A.

For the ten year period, 1978/79 to 1987/88, Sylhet Forest Division bamboo production averaged 14.6 million culms/A. The highest was 17.9 million and the low 11.3 million culms/A. This indicates that the annual actual recorded yield is only 41 percent of the total sustainable yield.

This analysis ignores whether the bamboo can be harvested profitably. An economic analysis requires extensive fieldwork beyond the scope of this report. However, there is an apparent large potential resource not currently utilized. The Minister's 1988 decision to allocate 15,000 ADT to SPPM appears very conservative, based on the previous data.

To make the full amount of Sylhet bamboo economically accessible requires investment in extraction infrastructure. Since GOB does not make any development funds available the pragmatic solution is to assign a bamboo area to SPPM on a long term allocation, subject to agreed management and development conditions and standards.

The costs of infrastructure should be shared by the BFD and SPPM. The Department should reduce the royalty on bamboo to allow SPPM to make the investments required profitably. An economic appraisal of the bamboo areas could determine an equitable royalty to produce maximum revenue for the Department and provide an acceptable SPPM raw material cost. The present royalty rate is Tk 1,071/1000 culms. If the volume exploitable could be doubled by reducing the royalty rate by 50 percent the Forest Department would not lose any revenue. SPPM's unit costs per ADT might remain the same due to increased harvesting costs. Overall, the nation benefits by supplying additional bamboo to the market.

1. Bamboo Supply

a. Reserve Forests

SPPM procurement of adequate supplies of bamboo is a problem. BFD's commitment of 15,000 ADT/A as per the Minister's 1988 decision, has not been met. Tea estates clearing land for tea garden expansion meets some of the gap. However, this source has an indeterminate life span and certainly cannot be counted for the long term.

Most bamboo mahals are purchased by contractors at BFD's annual auctions. Contractors only harvest the most accessible culms near the streams. According to FAO, approximately 20-50 percent of the available culms get left unharvested (Drigo Et Al, 1988). Under this short term system of allocation, contractor's have no incentive to invest in infrastructural development or on any long term solutions to lower costs and increase yields.

A case in point is the two mahals in the Indian watershed, Madabchara and Kuramachara with a total area of 1,237 ha. FAO recommended that ropeways be constructed to harvest these areas. No contractor is likely to do this unless they can write off the relatively large capital expenditure required. SPPM has the resources and the trained personnel available from a sister company. KPM already uses this type of equipment in the Chittagong Hill Tracts. Under the present auction system, however, the Company gambles on acquiring these mahals at an auction sale every fourth year. This places them in an exposed position over which they would have almost no control against other bidders. There is less financial risk by not installing the indicated ropeways.

Another factor which SPPM and BFD must keep in mind and plan for is the expected flowering of muli around 1995. This does not leave much time to line up alternative supplies for the mill. All the more reason to investigate the bamboo resources in Assam, and especially the species of bamboo available.

b. Village/Station Source

Village bamboo supply fluctuate with agricultural crop yields. In good years the villagers have very little incentive to sell bamboo. This means that SPPM cannot predict with any certainty the volume available each year. Most of this bamboo arrives during the wet season and is an important source of raw material. SPPM should encourage villagers to plant more bamboo on their vacant land. Villagers literally need some type of incentive to manage their holdings on a more scientific basis. The Company needs to place more effort in developing a stable and consistent supply from villages in the surrounding area.

SPPM purchases bamboo at different stations along the railroad. This supply is very uncertain and highly dependent on purchase price. The supply originates from villages, unrecorded felling or comes from India.

2. Wood Supply

a. Forest Department Plantations

BFD established 2,310 ha of moluccana plantations in the Sylhet Division by 1991. Plans are to plant a further 2,970 ha for a total of 5,280 ha. If these plantations are properly maintained the annual yield should average at least 72,000 m³ in approximately ten years time. Existing plantations have not been thinned. Some infection by mistletoe (*Loranthus* spp) exists. This results in a reduced yield for the infested plantations.

Harvesting operations are confined to the five month dry season. All weather roads constructed with permanent culverts and bridges are lacking. This means only temporary employment for all wood harvesting crews. Contractors have no incentive to develop a skilled efficient workforce.

GOB does not provide funds for road improvement programs and plantation maintenance. Providing acceptable management and control is possible. These plantations should be assigned to SPPM to manage under strict BFD supervision. This would leave Department personnel more free time for their other duties. As well, better access to the plantations should result in more efficient use of their manpower.

SPPM wood requirements need an additional 3,000 ha of land available for moluccana plantations. The increase in yields and the lowering of extraction costs should result in more revenue for BFD. SPPM's ultimate objective would be to have year round access to the plantations. This would permit harvesting operations for at least 10-11 months a year. Contractors could then develop a skilled efficient, safety conscious workforce and a more efficient transport system.

SPPM prefers freshly cut trees in their pulping and chipping process. BFD should make an economic analysis of the rotation age of moluccana. From the harvesting viewpoint, with manual operations continuing to be the norm, a 10-year rotation appears suitable. On a ten-year rotation trees do not become too large and difficult to carry to the roadside.

Moluccana scaling practices need investigation by BFD. At present, an 80 percent solidwood factor applies for one meter of stacked debarked wood. This appears to be 5-7 percent high on recovery and results in over payment of royalty. Periodic checks should be made to ensure the solidwood factor is accurate to within ± 3 percent of actual volume.

Mechanization of harvesting operations does not appear to be a viable option in the foreseeable future in view of the current surplus of labour and projected population growth.

b. Private Wood

This is a last resort type of supply for the mill as there are so many different species which complicates the pulping process. SPPM avoids purchasing this wood except in a crisis situation when nothing else is available.

3. Reed Supply

Reed lands in Sylhet Division were once extensive, more than 27,560 ha in size. Proposed management plans report reed lands are over exploited and depleted. In 1978, 10,120 ha reed area was leased to SPPM. The Company could not control encroachment or illicit cutting so that almost no reeds were harvested.

In 1985 BFD declared the area a reserve forest to allow them to enforce their jurisdiction over the area and to provide some protection against encroachment. The Company then proceeded to demarcate their area and establish boundary markers. A reed plantation program began only in 1989-90. To date 1,500 ha of established plantations exist. A recent inspection of some plantations indicated approximately a 40-50 percent survival rate.

In view of the reported difficulties in establishing reed plantations, the lack of protection and security of SPPM's work force and the inability to stop encroachment on their leased area, SPPM should probably relinquish their lease when it expires in 1995. However, before that date, the Company should investigate the possibility of large scale importing of bamboo from Assam, India, on a long term basis. They also need to negotiate the procurement of an assured annual supply from BFD. It will probably take up to ten years before the supply of wood is stabilized at 72,000 m³/A level planned.

Until the reed lands revert, SPPM should continue a small scale reed plantation program as a contingency for any deficiency in future supplies.

4. Other Supplies

FAO reported 10,100 ha of forest land in tea estates (Choudhury M R, 1984). Some tea companies may be interested in growing bamboo or moluccana with a market assured by SPPM provided it does not affect their GOB leased land. This type of arrangement has the potential as a favourable scheme for the tea estates. The planted areas could serve as a future land bank for the expansion of the tea gardens, in the meantime yielding a good income.

Karnaphuli Paper Mill

The Karnaphuli Pulp and Paper Mill complex lies at Chandragona on the Karnaphuli river, just below the Kaptai Dam. The mill began operation in 1953. KPM has projected annual production capacity of 30,000 ADT of paper and 25,000 ADT of pulp.

The ideal mix of raw material for making pulp is reported to be 60 percent bamboo and 40 percent pulpwood. Actual raw material percentage varies with the availability of bamboo. Annual raw material requirements are:

<u>Material</u>	<u>ADT</u>
Bamboo	41,715
Pulpwood	<u>27,810</u>
Total	69,525

KPM holds a 99-year lease of 95,870 ha of bamboo areas in the Chittagong Hill Tracts. However, due to illicit encroachment, their effective area is about 50,700 ha.

1. Wood Supply

The problems of CHT security and the possible flowering of muli bamboo about 1995 prompted BFD to develop pulpwood plantations in the Kaptai and Bandarban Divisions starting in 1974. The Kaptai Pulpwood Division has 18,100 ha of plantations and Bandarban has 4,900 ha for a total of 23,000 ha in 1991. Report species composition of the plantations are:

<u>Local Name</u>	<u>Botanical Name</u>	<u>Percent</u>
Gamar	Gmelina arborea	78
Kadam	Anthrocephalus cadamba	15
Others	Eucalyptus, Albizzia etc.	7
Total		100

Extraction operations were supposed to start in 1990-91 as these plantations were based on a managed 11-year rotation. Harvesting is delayed as BFD and KPM failed to reach a mutually satisfactory agreement on the royalty rates. Due to lack of funds the Department has been unable to properly maintain these plantations. Consequently, the yield is low. Reportedly, about 20 percent of the plantations are mistletoe infested and need sanitary cutting.

Annual pulpwood requirement is 23,000 ADT. With an air-dry density of 475 kg/m³ the annual mill requirement is 48,300 m³. This requirement could be met with about 5,250 ha of productive area even at the present low yields. If the yield can be raised to 15 m³/ha/A, the productive area required reduces to 3,200 ha. Bangladesh Forest Research Institute (BFRI) forecast plantation yields of 101.2 m³/ha at a rotation age of 11 years. This equals a mean annual increase (MAI) of 9.2 m³/ha/A. If the yield could be increased by 60 percent, a reasonable expectation, the unit/m³ road costs reduces by about 40 percent. KPM plans a revised pulpwood total production of 127,350 m³/A. This reduces their bamboo intake to 2,800 ADT in contrast to their stated objective of using 60 percent bamboo. Their present planned supply is 52,000 ADT/A of bamboo.

The total present area of plantations is some 23,000 ha. At full potential, the indicated yield is 345,800 m³/A. With present low levels, they yield 212,000 m³ annually, a pulp equivalent of just over 100,000 ADT. Thus the plantation area is more than KPM requires, even if the muli bamboo flowers in the next 5-10 year. These plantations therefore, need managing on a sawlog rotation with KPM getting the thinning and tops for pulpwood.

KPM can not use all the area of plantations at their existing capacity. If an MAI of 12 m³/ha/A is achievable in this location, the Mill's annual pulpwood volume 127,350 m³ need only a productive area of 10,600 ha. This leaves a existing surplus plantation area of 12,453 ha. This area should be converted to sawlog production. However, a more desirable option is to manage the whole plantation area for sawlogs with pulpwood as a by-product. This give BFD the flexibility to lower the royalty rates on pulpwood to a more realistic amount to about Tk 177/m³. A much higher royalty rate would apply to the sawlog volumes.

The gamar plantations are badly in need of maintenance and some sanitary cutting. It would appear the best way to ensure these plantations are managed to get the highest economic return is to allocate them to KPM or to BFIDC on a long term basis. The pulpmill would utilize the pulpwood component. BFIDC needs to modernize its mill at Kaptai to convert the sawlogs. At the present low yields the plantation would support a sawmill of 20,000-25,000 m³/A.

2. Bamboo Supply

KPM bamboo requirements are 41,715 ADT/A. The Mill has a 99-year lease (50,700 ha) to harvest bamboo in the Rankhiang (33,350 ha) and Kassalong (17,350 ha) reserves.

KPM has a network of 966 kms of temporary roads throughout the economically accessible areas (about 24,000 ha in each RF). In the Kassalong no extraction has occurred since 1986-87 due to security problems.

Bamboo cutting is manual as is transportation to the khals. Ropeways and farm tractor trailer units are also used. In the water, the bamboo gets bundled and made into rafts for towing to Kaptai where it is processed into chips. Chips from Kaptai are then transported by truck to the Chandragona mill site. The losses in storage, theft and in transit average about nine percent of the total annual culm production. Reported average yield is 2,700-3,000 culm/ha about 4.9 ADT/ha/A. The current yearly supply situation for raw materials is as follows:

Table 10 - KPM Raw Material Sources

Source	ADT/A
Leased Reserved Forest	
Rankhiang	10,000
Kassalaong	5,000
Private	
Above Kaptai Dam	15,000
Below Kaptai Dam	12,000
Kowkhali	5,000
Firewood	
USF Area	28,000
Total	75,000

The average cost of raw material delivered to the mill is Tk 2,880/ADT. If no security problems exists KPM harvests 30,000 ADT/A from their leases, the estimated costs reduces by Tk 308 million annually or by Tk 2,428/ADT. The royalty rates for muli bamboo in the CHT is Tk 400/1000 culms. Appendix 3 includes KPM's costs statements for the past five years.

3. Extraction Operations

The deteriorating CHT security situation poses severe restrictions on employee safety and the Company's harvesting operations. However, KPM has an infrastructure development plan for harvesting these pulpwood plantations. They propose to build 242 km of road at a total cost Tk 6.4 million (Tk 24,900/km). This gives a road density of 13 m/ha which is low for manual extraction.

KPM also proposes to install ropeways in some areas and to extract other areas directly to khals for transport by barge. This should help mitigate the long distances between roads. The Consultant was unable to visit the area so further comment are not possible. However, KPM should evaluate the option of constructing some all weather roads in the area to keep storage costs down and to ensure a more even flow of fresh wood to the pulpmill. This would have the added

advantage of stabilizing the work force by offering year round employment and consequent improved efficiency and productivity.

Road costs estimates for pulpwood from the Kaptai and Bandarban pulpwood plantations are shown below. The first year, 1990-91, employees manual road construction cost at Tk 93,000/km.

Year	Road construction, km		Total Cost Tk. Million
	Kaptai	Bandarban	
1990-91	16.1	-	1.5
1991-92	32.2	-	0.7
1992-93	32.2	-	1.2
1993-94	32.2	48.4	1.2
1994-95	48.4	32.2	1.8
Total	161.1	80.6	6.4

Table 11 presents the extraction costs estimates. The Consultant has not verified KPM estimates but they are the best available at this time. These operating costs include an assumed royalty payment of Tk 88/m³. This has not been agreed by the KPM and BFD. Operating costs for the second rotation stabilize at Tk 442/m³. By then all interest charges on the capital are over and depreciation paid.

Table 11 - Plantation Production Cost Estimates

Year	Annual Production (m ³)	Capital Cost (Tk million)	Total Costs (Tk million)	Unit Cost Plantation (Tk/m ³)
1990-91	21,225	26.2	14.1	669
1991-92	21,225	7.6	19.7	930
1992-93	42,025	13.6	32.0	762
1993-94	64,780	9.7	49.7	768
1994-95	87,065	11.0	68.6	789
1995-96	84,900	-	68.2	803
1996-97	84,900	-	77.9	918
1997-98	127,350	-	81.6	640
1998-99	127,350	-	76.9	604
1999-00	127,350	-	62.9	494
Total			683.43	

It is unrealistic to expect capital expenditures to stop completely by 1995-56. To keep any harvesting operation running efficiently requires some annual capital expenditures. Certainly bulldozers, trucks and small equipment will operate, but not efficiently for ten years.

TIMBER TRADERS

Traditionally timber traders purchase standing trees from BFD by auction or directly from local villagers. Traders usually have their own log deport or are associated with a sawmill. The trader employs local labour to fell and cut the large trees in the natural forest into squares at the tree stump. The current rate in Cox's Bazar is Tk 880-1,060/m³. Branches and tops are collected together for fuelwood at rate of Tk 35/m³.

In most of Cox's Bazar, trucks drive right into the forest without any major road work during the dry season. This means that the squares do not need to be carried for long distances. In the areas visited, the trucks could drive within about 50 m of the cutting site.

Main roads which are manually constructed are reported to cost Tk 20,000-30,000/km depending on the terrain steepness. Roads are to a minimum standard, very narrow (2.5-3.0 m) and with makeshift culverts. Roads are only used in the dry season. No surfacing is applied.

Loading costs are on average about Tk 350/m³ unless the squares have to be carried a long distance. The trucking rate is based on the truck making about Tk 2,000/day. This translates into Tk 350-530/m³ depending on the condition of the road and length of haul. Trucks average about 5.7 m³/load. Depot handling costs are reported to be Tk 35/m³ with overhead and administration costs estimated to be about 10 percent of total costs. The cost of squares at the depot is Tk 1,230-1,590/m³ excluding road costs and overheads. Smaller round logs cost average Tk 880-1,240/m³, excluding road costs and overheads.

BFD's main problem with the timber traders is confining their operations to the contract area specified.

TIMBER AND FUELWOOD OPERATIONS AND COSTS

The generalized cost estimates developed in the section do not relate to specific area, they are for a general comparative economic estimate throughout the country.

Road Construction

Road construction costs will vary from Tk 20,000-30,000/km Cox's Bazar manual construction to Tk 300,000-500,000 for mechanized construction in the Kassalong RF. The former standard is a temporary road of less than 3.0 m width. The Kassalong standard is a 4 m wide all-weather road. Spur roads in the Kassalong will vary from Tk 200,000 to 300,000/km. All-weather road in the Rankhiang RF will be higher than the Kassalong. Average road costs in the Sangu and Matamuhuri will be even higher still.

The estimated road density in the natural forested Kassalong RF is 20-25 m/ha because of the broken hilly terrain. In the other remaining RF areas, the road density will average about 12-15 m/ha as the terrain is more favourable and harvesting takes place in the dry season.

Plantations require all weather main access road construction within each major block. The road density within the plantations should average 25-30 m/ha as all the yarding to roadside will be manual. About 60 percent of the spur roads could be fair weather roads if year round operations are contemplated. The roads will probably be constructed manually. All weather roads need surfacing with a herring bone pattern of bricks if suitable surfacing material is unavailable. The road costs average about Tk 110,00-130,000/km excluding the cost of culverts and bridges. Appendix 3 contains estimates of current costs of brick surfacing and structures unit costs.

Table 12 summarises typical road cost estimates for the various types of forests. It illustrates the relationship between road costs and the unit costs and the unit costs of recoverable volume. Estimated road costs are the anticipated costs to ensure an adequate harvesting road system. Tabular road costs do not include access roads outside harvested forest areas. Each forested area must be individually assessed to determine the length and costs of the access road required.

Table 12 - Typical Road Cost Estimates

Item	Rotation Age (Year)	Road Density (m/ha)	Final Yield (m ³ /ha)	Road Costs (Tk/km)	Average Cost (Tk/m ³)
Natural Forests		22	54	350,000	143.90
Kassalong RF (1)		15	51	50,000	14.70
Sylhet					
Cox's Bazar/ Others		13	72	30,000	5.40
Plantations					
Moluccana (2)	12	30	100-18	50,000	10.70
Gamar <i>Guinea</i>	11-18	27	0	100,000	15.40
Teak	15	25	120-23	150,000	31.30
Poles/Piling	18	25	0	100,000	21.70
Fuelwood	6	25	80-160	30,000	10.00
			70-160		
			60-90		

Notes:

1. Refers to Kassalong Forest Reserve only. Other FR's forested areas are too variable for forecasting accurate road costs. Estimates for these areas can only be determined by a detailed ground reconnaissance.
2. Moluccana MAI could be 30-40 m³/ha/A on the best sites.

The final yields in the plantations strongly affect unit road cost. Yields are highly dependent on the amount of maintenance and thinning done. The low end of the range in Table 12 indicates yields with status quo cultural operations. The high end indicates yields expected from well maintained plantations. Table 12 does not include thinning volumes or fuelwood recovered from natural forests. Both are low value products. The usual practice is to charge all road costs to the major products.

Some working plans base their plantation road development program on a road density of 10 m/ha of plantations. Using a winding factor of 10 percent produces a road spacing of 1,100 m. This means the average carrying distance to the roads is 275 m. This spacing is too wide for manual operations, especially if they require carrying.

The lowest road costs are achieved when the cost of transporting wood to roadside (yarding) and the spur road costs are equal. This report estimates the manual yarding costs for gamar and moluccana plantations. The estimate indicates the most economical road density for various levels of road costs (see Appendix 4). This calculation shows that with road costs of Tk 20,000/km the lowest combined costs correspond to a road density of about 54 m/ha for gamar and over 60 m/ha for moluccana. The estimate also illustrates that higher yielding plantations should have a higher road density.

Timber contractors understand these two basic principle very well. They try to get their trucks as close to the stump as economically possible. In flat terrain this presents very few problems in the dry season but in rougher terrain or in wet conditions the trucks cannot leave the road.

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BFD needs a new engineering cell to design and supervise the proposed permanent roads and structures required for the efficient supervision and economical harvesting of the plantations and natural forest. This technical cell requires two experienced forest or civil engineers and supporting staff to plan, survey, and monitor the construction of a permanent forest road network throughout the country. Any such development program should be phased with the harvesting of the plantations and natural forest. The cell would set the specifications of required roads and structures. Each private contractor would be required to build the structures required in his operating area according to a long term construction plan.

High Forest Extraction

Presently, due to the natural forest cutting moratorium, no extraction occurs. BFIDC has obtained permission to start operations on a small scale in the Matamuhuri and Kassalong Reserve Forests. In the Kassalong, due to security problems, BFIDC has been instructed by the Army to supply 350 armed guards for their worker's protection.

Matamuhuri RF extraction is entirely by manual methods due to the rugged terrain and lack of road access. The present contract rate for felling, making into squares by axe or saw at the stump, transporting by shoulder load for 6 to 8 km to the nearest stream, floating the squares down the Matamuhuri river to Chiringa, and trucking them to Kalurghat is Tk 3,320/m³. Royalty costs are Tk 1,590/m³. BFIDC's administration and overhead costs are estimated at Tk 1,290/m³ on an annual target of 2,830 m³ in squares and 1,080 m³ of round wood. The total costs of production of squares delivered to Kalurghat is Tk 6,150/m³.

Kassalong RF extraction is fully mechanized involving caterpillar tractors and skidders. Forestal (1963) estimated an average recoverable volume of 110 m³/ha of which 56 percent was considered merchantable at that time. BFIDC currently recovers about 35-45 m³/ha. Their merchantable volume consists of the more durable species over 29 cm dbh. With improved access, better transportation and less felling and bucking wastage it should be possible to increase the recovery to about 54 m³/ha. If a manufacturing complex including a board mill is established near the Kassalong RF the recovery could approach 129 m³/ha by using branches, tops and the presently non-merchantable species.

BFIDC's production and cost experience is the best information to go on. Appendix 3 includes Timber Extraction Unit's (TEX) costs for the years 1981-82 to 1990-91. Results for the last four years are abnormal due to security problems. Extraction costs include felling and bucking, extraction to roadside, loading onto trucks, and transport to log depot. Also included are depot costs, rafting or barging costs to Kaptai, equipment maintenance, road construction and maintenance, extraction depot and administration overheads. Kaptai administration costs include, office expenses, vehicles, building maintenance, electricity, insurance, employer provident fund contributions, overtime pay, uniforms, compensation and depreciation.

Average unit sales price of logs increased significantly in the last four years. It now stands at Tk 4,290 m³. This high price is probably due to the scarcity of timber brought on by the moratorium and security problems. Appendix 3 includes a volume summary of the various timber classes produced from 1981-82 to 1986-87. This Appendix also includes current 1991-92 BFIDC sales prices.

The current extraction costs estimate are for three alternative cases:

- a. Case 1, normal operations, means a normal production rate of 43,000 m³/A. This is the normal situation if there is no cutting moratorium or security problem.

- b. Case 2 assumes the cutting moratorium and security problem continue. Case 2 assumes a production rate of 13,000 m³/A until the moratorium is lifted, possibly by the year 2000. Security problems will continue.
- c. Case 3 assumes the moratorium is lifted but the security continues. The annual production in Case 3 is 28,900 m³. This considers that security problems continue indefinitely, but the moratorium is lifted before 1993.

1. Normal Operation Costs

The costs estimates are based on an annual volume of 43,300 m³ being harvested from 810 ha of natural forest. Assuming 10 percent of the natural forest is left in NRS strips (NRS) the remaining forests of 57,600 ha, based on FAO's inventory, should last about 64 years.

The normal annual production rate of TEX is 43,300 m³ providing BFIDC gets enough foreign exchange for spare parts and replacement of wornout machinery. Appendix 6 details the minimum capital cost requirements. These annual capital expenditures are urgently required to keep BFIDC functioning in an efficient manner.

Teak plantation harvesting could start immediately if a 45-year rotation period is adopted. Timing of the extraction operation depends on the availability of suitable processing facilities to ensure the maximum recovery from this very valuable species. BFIDC is the logical organization to harvest these plantations since it has the experienced people and established facilities already in these areas.

An inspection of BFIDC's operations was not possible due to lack of security. Therefore, the cost estimates reflect their past performance. It is obvious from a review of the equipment list and the date of purchase that the production machinery is operating at a very low efficiency. No foreign exchange was reported available for buying spare parts. Eight D7F tractors are 18 years old and the other two are 13 years old. There are two D6D tractors which are 6 years old but in poor running condition due to lack of spares. The only reasonably operable equipment are the two 518 Caterpillar wheel skidders and two hydraulic loading cranes.

TEX's reported staffing level is 555, 176 officers and staff and 379 workers. There is a surplus of staff and workers (about 13 too many) for this type of mechanized operation. However, due to current GOB regulations it is not possible to downsize the work force.

Provided the minimum annual capital expenditures, detailed in Appendix 6, is forthcoming, BFIDC could meet their annual production target of 43,300 m³. The annual extraction costs estimate, Tk 3,620/m³, is based on the current costs incurred by BFIDC. In these estimate no allowances applies for increased efficiency. However, the new royalty rates of Tk 1,476/m³ gets included in the alternative estimated costs shown below. Appendix 3 presents the estimating details.

<u>Costs</u>	<u>Annual Costs</u>	
	<u>Tk million</u>	<u>Taka/m³</u>
Variable	108.73	2,511
Fixed	47.97	1,108
Total	156.70	3,619

Assuming the species distribution remains the same as for the five period shown in Appendix 3 and that sales prices will remain the same as in 1990-91 at Tk 4,290/m³ then the estimated gross profit is Tk 29 million/A.

2. Moratorium and Security Problem Continues

This alternative assumes the moratorium and security restriction continue and BFIDC will be restricted to harvesting 240 ha/ A. This size of operation reduces 13,000m³/ A.

This production rate requires lower capital expenditures (See Appendix 6). The overhead costs will be very much higher on a unit basis as all the staff must be retained. All logs would be trucked from Bagaihat to Chittagong or Kaptai. Expected unit production cost are Tk 7,370/m³, detailed below. Assuming log prices remain the same, annual losses are Tk 4.0 million.

<u>Costs</u>	<u>Annual Costs</u>	
	<u>Tk million</u>	<u>Taka/ m³</u>
Variable	41.62	3,201
Fixed	<u>54.27</u>	<u>4,175</u>
Total	95.89	7,376

3. Moratorium Lifted, Security Problem Continues

The annual production rate considering security remains a problem for the next 20 years is 28,900 m³. In addition to the normal production costs, the costs for 350 security guards must be included. Rafting and barging would be permissible to Kaptai. Average production costs total Tk 4,390/m³. At this low production level and added security cost, TEX loses about Tk 2.8 million annually, detailed below.

<u>Costs</u>	<u>Annual Costs</u>	
	<u>Tk million</u>	<u>Taka/ m³</u>
Variable	72.50	2,508
Fixed	<u>54.27</u>	<u>1,878</u>
Total	1,267.7	4,386

The net effect of the security problems is a loss in production of 14,400 m³ annually. This causes a difference in BFD revenue of about Tk 20 million annually.

Sundarban Extraction

The other major area of natural forest extraction is KNM's operation in the Sundarbans mangrove forest. Appendix 3 details these costs for the past five years. BFD limits gewa production to 134,600 m³/ A until June 1993. Assuming overhead costs remain the same as in the past, this results in an estimated total cost of Tk 910 m³, detailed below:

<u>Item</u>	<u>Tk/ m³</u>
Direct cost	380.00
Royalty Payments	<u>529.50</u>
Total Cost	909.50

Booming, rafting, towing and raft breakdown costs make up about 60 percent of total direct costs. Management should be investigating ways to improve efficiency in these operations.

Contractors extract sundri poles in the Sundarbans under Departmental supervision. Reported extraction costs are Tk 5,510 and 5,790 for less than 10 m and more than 10 m, respectively. Details are:

<u>Item</u>	<u>Tk/m³</u>
Felling and carrying to kal	1,589
Barging to BFIDC Plant	<u>600</u>
Average Cost	2,189
Royalty Charges	5,507
Up to 9.4 m length	5,789
Over 9.4 m	
Total cost per pole	
7.5 m length (6.0 cft)	2,111
9.1 m length (7.7 cft)	2,710
10.7 m length (10.0 cft)	3,315

Plantation Extraction

Plantation harvesting depends upon the type of product grown. There are four main types of plantation for consideration, as follows:

- Fuelwood plantations, usually eucalyptus species grown on 6-year rotation.
- Moluccana pulpwood plantations in Sylhet Forest Division grown on 10/12-year rotation.
- Sawlog plantations, mainly teak, grown on 40/45-year rotation.
- Proposed gamar sawlog plantations and poles plantations of other species grown on 18/20-year rotation.

Table 13 shows the derived extraction costs. Currently, harvesting in only the moluccana plantations occurs. These estimates use the road spacing shown in Table 12. Moluccana costs include debarking in the forest. The cost of tools and temporary housing of workers is included in the estimates. Extraction costs to the roadside are not affected significantly by volume per ha. The major factor is distance to the roadside. Sloping terrain on favourable grades of up to 30 percent will have a minor affect on manual yarding. Adverse grades over 10 percent will lower production considerably.

Table 13 - Plantation Roadside Extraction Costs

Item	Average Log Length (m)	Cost, Tk/ m ³		
		Felling and Bucking	Yarding to Roadside	Total
Fuelwood	1	30-40	30-40	60-80
Moluccana	1.2	100-110	30-40	130-150
Teak Sawlogs	2.0-4.8	70-80	175-240	245-320
Gamar Sawlogs	2.0-2.4	80-90	170-240	240-330

Teak is a dense wood, averaging over 1,080 kg/m³ green. In the teak and other hardwood plantations, the yarding costs estimates use a Caterpillar D4 tractor with winch skidding logs to roadside. BFIDC currently uses these small tractors for yarding poles in the natural forest. This method was selected as being appropriate as the majority of the teak plantations are in the CHT.

In the other divisions other mechanical means will have to be introduced for yarding the steeper uphill slopes. A small farm tractor equipped with a winch would be ideal in many cases.

Gamar sawlog plantations are not ready for harvesting. Generally, gamar has poor form. Logs are short, 2.0 to 2.4 m in length. On the downhill slopes there should be no problems in manual yarding. On steeper uphill slopes, some type of mechanical assistance is required. No recommendations for equipment can be made without a on-site inspection of the forest conditions. Gamar cost estimates have been based on manual yarding with a allowance made for the uphill carrying.

The hauling costs for plantations can be calculated using the trucking costs developed in the transport section. Loading and unloading costs of Tk 500 per load are in addition to the transport costs.

The total costs for the plantation can then be calculated by including the following costs:

- a. Road construction and maintenance.
- b. Felling and bucking.
- c. Yarding to roadside.
- d. Transport costs to mill site or log depot.
- e. Royalty rates.
- f. Overhead costs, assumed to be 10 percent of the above costs.

Village Wood

Reportedly, rural homesteads supply approximately 80 percent of the wood used in the country. The extraction process in delivering this wood to the local industry is very variable, depending on the inclination of the seller.

Some trees are sold standing and a contractor is engaged for extraction and transport. Farmers also do their own felling and carry logs to a motorable road from where the purchaser engages a contractor to haul the timber to the depot or sawmill. In other cases the seller delivers the logs to the purchaser's depot.

The village wood extraction process and its extensive nature complicates any organized effort for improvement. The main cost component in the log price is usually the cost of road transport. GOB has many ongoing road improvement projects throughout the country, such as the ADB road project. Continuing these projects will provide farmers with good road access for transporting all their produce, including wood to market at a reasonable cost.

Quality Control and Waste Reduction

Quality control and waste reduction measures are difficult to legislate. The best method of increasing the former and reducing the latter are increased profits. The impetus for quality control has to come from the end user. For example, if KHBM rejected all sundri with more than 50 percent rot, BFD contractors would not include these pieces in their piles. Sawmills should pay a lower price for logs which are not sawn properly or to the right lengths. In this way the contractors would soon realize that better quality control is worthwhile.

In the natural high forests and definitely in plantations the use of axes should be restricted. From 5-10 percent of the best quality volume of the tree is wasted due to high stumps, felling, and in cutting into logs. In manual operations, sawing or chopping large trees into squares results in about 30 percent waste. Some of this waste is recovered in the form of firewood but this is a much lower value product.

Training

Worker training in seasonal manual operations is almost entirely on the job training. Large areas of plantation will mature in the near future. There is a strong need for better trained workers to harvest these valuable trees to maximize recovered volumes. Otherwise, the Country receives reduced benefits from its extensive plantation program.

Once harvesting becomes a full time occupation companies or contractors have a built-in incentive to provide training to improve their worker skill so they can do their jobs more efficiently, productively and safely.

The present system of seasonal short term work means that workers suffer from poor working and living conditions. Improved safety and better living conditions are a necessary facet of better harvesting operations. Upgrading workers skills results in improved utilization of scarce forest resources. With the present policy of seasonal weather roads, contractors can work only in the dry period (five months/year). Consequently, there is little incentive to introduce better working methods or train workers. This policy needs reversing before improved quality, reduced waste and increased workers skills can provide a positive return to Bangladesh.

Environmental Effects

Clearing natural high forests and replanting with commercial species need have very little impact on the human environment. However, removing natural high forest species severely alters the habitat of many other plant and animal species using the multi storied canopy. Natural regeneration strips mitigate these changes somewhat. However, NRS give problems; they are not as good as leaving a large block of natural forest. BFD should review this NRS policy. Possibly a better solution is to leave the equivalent area in a larger compact block to preserve the natural habitat.

Transportation requirements are a major source of environmental disturbance. There could be a temporary increase in erosion due to road construction associated with the original development. This only lasts for 3-5 years until road embankments stabilize and revegetate. Much of the negative effects are controllable provided effective engineering standards exist and are enforced. Meanwhile, the practice of allowing trucks to go into the forest needs monitoring. The narrow tires of these vehicles cause soil compaction, hindering future growth rates of plantations.

Excluding vegetative changes and providing a permanent stable road network gets established initially in the plantations, the environmental effects of harvesting are minor. Most yarding operations will probably be manual for the foreseeable future. There will be a small effect of the loss of the tree cover for at the most one year in properly managed plantations. For plantations with a 12-year rotation this amount is eight percent of the area annually. For a 40-year rotation crop the area involved is less than three percent of the total. Providing roads are constructed to a sufficient standard with permanent bridges and culverts, the disturbance is minimum. The principal is to limit the effect to a brief initial development period. Unless properly controlled the effect becomes a regular annual occurrence and severe environmental damage occurs.

OTHER PRODUCTS, OPERATIONS AND COSTS

Bamboo

The two main bamboo industrial harvesting operations are for two BCIC pulpmills. These are Karnaphuli Pulp and Paper Mill at Chandragona and the Sylhet Pulp and Paper Mill at Chhatak.

KPM harvests bamboo from leased areas in the reserved forests of the Chittagong Hill Tracts. This is the only long term operation in Bangladesh. With the financial assistance of Sweden, KPM established a temporary road network of 966 km. Farm tractors with trailers transport the bamboo from roadside to the nearest khals for rafting.

Reportedly, these temporary roads, constructed by bulldozers, cost an average of Tk 25,000/km. The cost of maintaining these roads every three years is Tk 4,000/km. Total annual maintenance costs, if normal operations resume and the leased area harvesting is on a 3-year rotation, is Tk 1.29 million on average.

Faced with security problems in the Chittagong Hill Tracts from 1986-87, KPM's Kassalong operation received a temporary permit to harvest in another region. Due to public demand for bamboo, BFD may cancel this permit. However, with the existing security situation the Company cannot resume economical operations in the Kassalong. As a result, the Mill uses more pulpwood, resulting in a poorer quality product.

KPM's extraction operations are mostly manual. Some ropeways are used for carrying bamboo where distances to road are too long. In other bamboo extraction operations, SPPM or bamboo mahal contractors, all the extraction is manual. Table 14 shows the range of extraction costs of bamboo in 1992.

Table 14 - Bamboo Extraction Costs, Normal Operations, Tk/ADT

Item	KPM	SPPM	Contractors
Cutting, Carrying to khal	700	690	700
Other Costs, Roads, Vehicles	1,500-2,000	56	60
Towing in rafts	200-600	110	100-300
Trucking	140	610	200-450
Royalty (Muli)		594	140
Overheads		440	60
Total	2,540-3,440	2,500	1,260-1,710

KPM during normal operations produces about 20,000 ADT/A from the Kassalong and 10,000 ADT/A from the Rankhiang RF. In addition, bamboo from private sources totals 9,000 ADT/A from above and 6,000 ADT from below the Kaptai dam. Appendix 3 includes KPM's current extraction costs for reference.

The costs of BFD bamboo to the Sylhet Pulp Mill increased from Tk 1,827/ADT in 1986-87 to Tk 2,499/ADT in 1990-91. About 50 percent of this increase comes from increased royalty rates which BFD increased at 10 percent per year. During the same period, contract costs increased by about five percent annually. SPPM's bamboo cost from private suppliers, such as the mahal purchasers, tea garden owners and villagers, increased from Tk 1,913/ADT in 1986-87 to Tk 2,514/ADT in 1990-91, keeping pace with the bamboo from BFD.

Wastage and Environmental Effects

The average wastage reported by KPM in their bamboo harvesting operations is about nine percent of the total culms cut. This includes losses in storage, theft and intransit. Losses are high but KPM transports bamboo for up to 240 kms in the Kassalong RF to Kaptai.

The most obvious wastage is in not fully utilizing all mature bamboo available from the exploitable areas. In the Sylhet district, FAO reported that only the areas within easy carrying distance of streams are fully or over exploited. Lack of good management and effective felling control reportedly leaves over 30 percent of the mature culms in the forest. A further 20 percent is considered to be uneconomically exploitable. Although, these figures could not be verified during this report time, it is apparent a substantial volume remains utilized.

Since harvesting operations take place mainly in the dry season large volumes of bamboo get stored at the pulpmill yard. The consequence of this is high reduction in quality from the long storage period.

Harvesting bamboo has little environmental effects. The physical effect is minimal as the operations in the forest are virtually all manual. The only exception is KPM's operations in the Chittagong Hill Tracts. There will be some disturbances to wildlife as the work force is large. Usually no sanitary provisions exist for the workers. Environmentally, there is a slight problem in keeping the camp areas clean and sanitary. This is easily avoided by tidying up these areas before the crews leave.

KPM uses a bulldozer to maintain the temporary harvesting roads. They can prevent road related erosion by constructing water bars on the steeper sections (above 12 percent). The bars stop the water from running down the road and causing gullies. KPM can also construct culverts or temporary bridges over major water courses to avoid polluting streams due to vehicular traffic. At present operating levels, detrimental environmental effects are very slight, if any exist at all.

Minor Forest Products

1. Murta

Murta (*Schumannianthus dichotoma*) is a reed-like plant used for making fine baskets and sleeping mats. At Ratargul RF, Sylhet Forest Division, BFD created and maintains a 120 ha plantation of murta. The reported cost was Tk 300,000. There are four additional murta mahals in the Division. Murta mahals are sold in public auction every two years. Harvesting involves about 2,390 ha managed on a 3-year cycle. Projected yield is 2,470 pieces ha annually.

Harvesting operations start in November and continue until the start of the wet season in late May. The operation is totally manual. Workers receive a daily rate of Tk 25 plus food. Bundles of murta are sold throughout the area to local basket weavers. Reportedly, the major portion goes for distribution to Dhaka. Distribution costs were not available.

The murta is cut by hand with a dao and made into bundles of 500 to 1,000 stems. Reportedly, average production of 750 pieces/manday. The bundles are carried into the camp where the stems are split into thin strips and laid out for sun drying. The production cost to riverside is Tk 0.06/piece, reportedly.

Murta plantations provide seasonal employment for the and additional revenue to BFD. The last auction price at Ratargul RF was Tk 0.18 million, which is a good annual return for the initial investment.

2. Sungrass

Sungrass (*Imperata arundinacea*) is sold at public auction to local contractors. For local villages a general permit applies. Sungrass areas get harvested in January and February. Average yield reported is 125 bundles/ha. Each bundle averages about 20 kg. The production per manday, reported at four bundles, assumes an average carrying distance to the road of about 1.5 km. Based

an a daily wage rate of Tk 60, each bundle costs Tk 15 delivered to roadside. The average cost of a bundle of sungrass reportedly is Tk 40-50 in the Cox's Bazar Forest District depending on the distance of road transport.

After harvest the area is burnt to eliminate other plant competition. Fertilizer at the time, if applied, induces better growth.

TRANSPORT METHODS AND COSTS

Road Transport

Most forest produce travels to markets by trucks. In Sylhet Forest Division a small but significant volume goes by rail, trucks transport all timber and logs.

The typical truck used throughout Bangladesh is a single axle chassis with a general cargo box and a load capacity of six tonnes. These small trucks are not very efficient for hauling logs. The forest work is very seasonal and sporadic, thus owners have very little incentive to change and improve. This means investment opportunity is low.

BFIDC owns the only specialized log hauling equipment in Bangladesh. The Corporation's mechanized Kassalong natural forest extraction operation uses a typical Northwestern American logging truck with pole trailer for transporting long logs. The average load capacity of trucks on a good road varies according to product, as listed below:

<u>Item</u>	<u>Units</u>	<u>Average Load</u>
Logs		
-Natural Forest	m ³	7.2
-Moluccana	m ³	15.8
-Gamar, Teak, etc	m ³	6
Sawn Timber	m ³	9
Bamboo	ADT	4
Sungrass	Bundles	250

Typical hauling costs estimates have been prepared for a typical truck. These are for use in the economic analysis when planning alternatives. Appendix 4 details these estimates. The cost estimate will not necessarily be accurate for a specific situation but apply for general forecasts.

At reporting time, there is a general transport strike. Truck owners have demanded lower diesel fuel prices adjustments and lower duties on tires and spare parts. The outcome of this strike will have some impact on the cost estimates but the final results cannot be forecast at this time.

Figure 2 illustrates the trucking costs for different forest products on paved roads and on temporary roads. Appendix 4 presents detailed estimates.

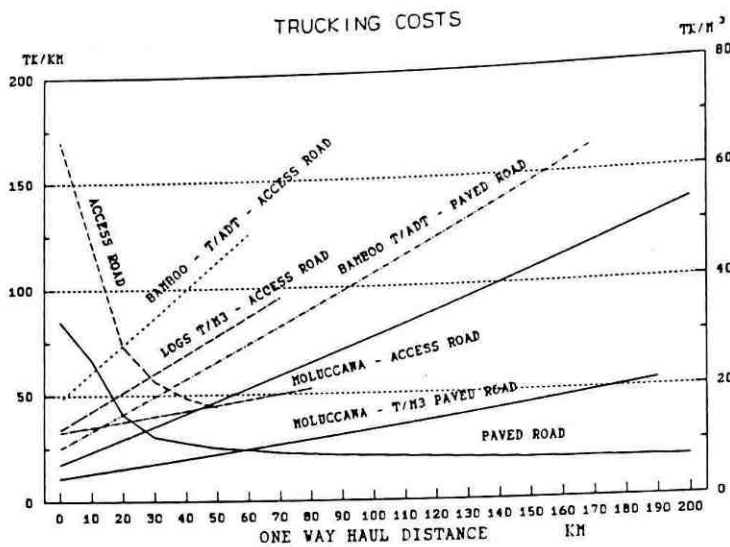


Figure 2 - Estimated trucking costs.

Water Transport

Water transport is the most economical and energy efficient method for moving forest produce. It is only limited by the navigability and access to a suitable waterways. The method is used extensively in certain region of the country for moving product to market.

In most areas of Bangladesh bamboo moves by water for a portion of its market journey. The usual practice is to carry the culms to the nearest bank. Depending on the steam size the culms are made into bundles and then rafts for towing to their destination. In the Chittagong Hill Tracts, KPM tows rafts of bamboo for distance up to 240 km from the Kassalong and for 75 from the Rankhiang RFs. KPM also receives bamboo rafts from areas south of their pulpmill. Matamuhuri RF bamboo travels about 150 km by water. The average cost of towing rafts by launch averages Tk 3/ADT/km. This includes the costs of making the bundles into rafts.

Log movement by water occurs on a large scale in BFIDC's Kassalong operations and in KNM's Sundarban operations. Before security problems curtailed operations. BFIDC transported logs by self-propelled barges and by rafts. Several natural forest species need buoying up by bamboo to enable them to float and for rafts. The costs of supplying bamboo for raft make up and towing the rafts to Kaptai are as follows:

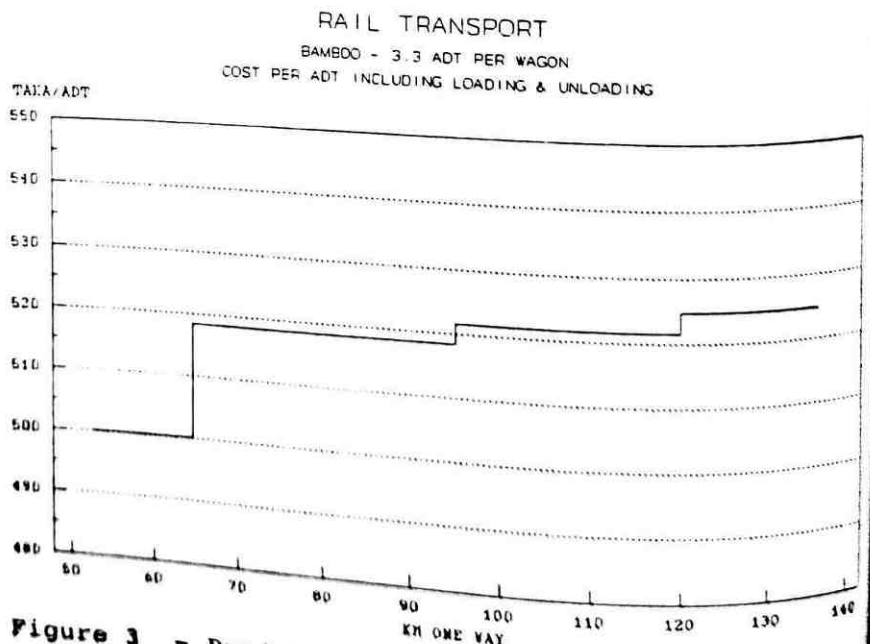


Figure 3 - Projected rail transport costs.

Probably the most difficult factors to estimate accurately for Bangladesh trucking costs is the delay encountered on the road and loading and unloading times. Traffic jams are common in most small towns as the roads are being taxed to their limit by rickshaws, baby taxi's and other vehicles. Presently, main roads go directly through the heart of most cities and towns. Furthermore, vehicle ferries are a common feature at most major river crossings.

The present estimate assumes that sufficient road improvements will, during the next twenty years, keep the traffic moving at the same rate as today. This is a conservative estimate since the country is now making major improvement in its highway network.

<u>From/To</u>	<u>Oneway Distance</u>	<u>Cost Tk/m³</u>
Bagiahat/ Kaptai	168 km	499
Shishak/ Kaptai	145 km	388

The average cost of transporting logs by self propelled barges was Tk 89/m³ from the two depots above to Kaptai. In some years the reservoir water level is only high enough to allow the barges to operate for two months. Normally, transporting logs by barge usually starts in August and ends in January or February, a period of six months. This means that logs extracted in February or March get stored for up to six to seven months before delivering by water to Kaptai.

There is a road link to Kaptai from Bagaihat but not from Shishak. The link allows some log trucking directly to Kaptai. However, the cost is very high, Tk 1,590/m³.

Sundarbans gewa for the Khulna pulpmill is made in large rafts for towing up stream to the mill. The cost of booming, rafting, towing, and raft break down totals Tk 207/m³ in 1990-91. This cost is mainly affected by the maintenance costs of the tugboats which was abnormally high in 1989-90. Appendix 3 summarizes KNM's wood costs.

Rail Transport

The only substantial volume of forest products being transported by rail is SPPM bamboo. This mill uses rail wagons to transport bamboo for distances of from 60 to 130 km. The transport costs reported by SPPM are the same for rail or by truck. Figure 3 graphs the total average costs for this operation. Costs are inclusive of loading, unloading and extra rail cost like demurrage.

The bamboo contractor is responsible for loading and unloading and the rail charges. Bamboo loading uses closed rail wagons and two metre bundle lengths, approximately. Each bundle weighs about 20 kg. The average green weight of bamboo per rail wagon is five raw tonnes. This is approximately equivalent to 3.3 ADT, 40 percent moisture content. Open gondola cars or flat cars are much easier and faster to load and unload. However, there could be problems in controlling the losses in transit.

AUCTIONING PROCESS

General

The Forest Department has a well-tested method of auctioning off timber, bamboo and minor forest products. This should ensure best GOB's return. However, a number of problems are evident which are not the fault of the current auctioning process. These are listed below, not necessarily in order of importance.

- a. Approving the accepted bid takes an inordinate amount of time, sometimes up to four months. This cause hardship to the contractors and opens the system to abuse; they may lose the best part of the harvesting season. In addition, BFD does not acknowledge any responsibility for the delay in approvals. This is unreasonable and should be changed. Either the contract date should start from the time of approval or the delays should be eliminated by giving the responsible Conservator of Forests the authority to make these decisions.
- b. Annual auction practice are not always suitable or appropriate for effective long term management of the forested areas. Some areas require permanent roads, or other infrastructure to develop the potential fully. Contractors are unwilling to invest their funds developing any permanent structures unless they have sufficient time to amortize the

associated costs. This is critically important to proper development of the maturing plantations. These valuable plantations need a permanent road system to provide easy access for harvesting, and regular maintenance work, thinning, protection and supervision operations. The GOB has two basic options:

1. Provide sufficient funds to develop infrastructure.
 2. Extend The contract term to allow contractor to recover infrastructure costs.
- c. Some existing contract clauses require major modification to make them equitable to both parties and to prevent abuse. Appendix 5 includes, for reference, a copy of the sale tender for a bamboo mahal. Unequitable tender clauses which are considered to require modification are listed below:
1. Clause 5. It is impossible to make an exact estimate of the amount timber or bamboo unless there is a 100 percent enumeration. Even that method is error prone. In India, contractors get a 20 percent margin around the estimated amount. This margin is a little on the high side. Probably 10 percent is adequate providing enough sampling is done. The objective is to harvest the entire area properly and generate maximum revenue.
 2. Clause 15. In case of delays in approval the contractor will not get any compensation or time extension. (Item a above).
 3. Clause 33. This clause requires change to allow the contractor a time extension. It is unreasonable to hold the contractor responsible for acts of God, prolonged internal disputes such as a hartals or border disturbances.
 4. Clause 40. The respective Conservator of Forest should have legal authority to accept any bid, subject to review by a higher authority in case of a formal protest by another bidder.

Small Lot Auctions

Selling minor forest products by public auction appears to be working satisfactory from BFD's perspective. There are some minor complaints but this is not a fault of the auctioning system.

In some cases involving the sale of natural forest timber lots, some villagers have not always been able to collect firewood. Contractors occasionally clear all debris, including the leaves. This is easily corrected by including a clause in the sales contract stipulating that a specific volume must be made available to legitimate local users. Assign the DFO the discretion to decide the amount.

Some discussion arises about restricting eligible bidders to local villagers. A policy of restricting bidders to some specific area defeats the benefits of the auction system, which is to maximize GOB revenue.

BFD needs to review its policy of rejecting a bid lower than a previous bid. This policy is anti-business and fails to reflect true market conditions. Also, such a policy ignores differences in quality and cost of extraction between areas. The effect of this policy may drive prices up/ or force poorer people out of the official market and into illicit activities.

HARVESTING OPERATIONS ENVIRONMENTAL GUIDELINES

This section presents suitable guidelines to limit the impact of harvesting operations on environment values. There are two existing and one future basic type of harvesting operations in Bangladesh outlined as follows.

- a. Manual operations in the Sundarbans and high forest areas outside the Chittagong Hill Tracts.
- c. Mechanized yarding in the high forest.
- b. Plantation harvesting.

1. Sundarbans

Environmentally, the physical impact of manual harvesting of gewa is minimal, excepting minor vegetation changes and short term disturbances. The only way to reduce it significantly is to decrease the cutting level. There is some disturbance of animals by the cutting crews but this is only for a short time in any one area. There is a 20-year cutting cycle and the crews only intrude for two-three months in each cycle. The chief area of concern is the temporary camp areas, where some debris accumulation may take place.

The towing of the rafts in the river could cause some water pollution and have a slight effect on the down stream fisheries. However, this is only conjecture and requires further study.

2. Mechanized Forest Extraction

The CHT contain most of the remaining natural high forests. Reportedly, the Kassalong R F has about 60,000 ha of high forest left. Terrain varies from gently rolling to steep slopes exceeding 100 percent. The following guidelines should apply to all harvesting operations.

- a. Provide accurate topographic maps to assist in planning the logging layout, especially locating the main road network.
- b. Confine all road construction to the dry season. Install permanent bridges and culverts in all main roads. All roads need adequate ditching to prevent erosion. Keep road construction equipment out of stream beds, especially those with fish. When roads are no longer required install water bars on all roads with grades over 10 percent.
- c. Have experienced surveyors locate skid trails. Keep the skid trails from traversing steep slopes over 30 percent. Locate skid trails at the bottom or the top of the slopes wherever possible. Use a longer winch line where the slopes are over 50 m in length.
- d. Keep the tractors and skidders on the skid trails to prevent soil compaction. This applies particularly in the wet season. Complete construction of all skid trails before the timber is felled.
- e. Burn or bury all refuse in the landings after completion of yarding. If a ripper is available, scarify the landings so that the soil is loose and ready for planting.
- f. Maintain cleanliness in the areas around the workers camps. This includes providing sanitary facilities for all permanent camps.
- g. Adopt natural cutting block boundaries rather than artificial compass boundaries.

In the other natural forest areas with manual extraction the environmental impact will be minor as the terrain is usually more gentle. Operations are confined to the dry season so the damage to the soils by the trucks entering the forest is slight.

3. Plantation Harvesting

Serious environmental problem and damage in harvesting the plantations may result from building roads. Therefore, the objective is to construct a road network with permanent drainage systems. This limits erosion to the first two to three years after road construction. Erosion continues until the embankments and drainage systems get stabilized. Metal surfacing will also mitigate the erosion of the road surfaces.

The permanent system is better installed before extraction begins. However, existing plantations lack permanent roads. Therefore, permanent construction must precede the initial harvesting of the existing plantation areas. Future high forest operations or plantation establishment should be conditional on initial installation of permanent roads.

Manual yarding operations cause minimal disturbance to the soil. The loss of ground cover in an efficient operation should only be for one year, similar to agricultural crops. Providing an understory crop is in place, soil disturbance can be totally eliminated.

Large crews employed in the yarding might cause some disturbances. Take care to ensure that their temporary living quarters are clean and all debris is buried.

RECOMMENDATIONS

Public Extraction Body

Some personnel advocate the establishment of a utilization or harvesting section within the Department to harvest the valuable teak plantations approaching maturity.

BFD's role is best suited to managing and monitoring the forest lands and protecting the environment for the long term benefit of the Country. This recommendation presumes adequate funding, institutional and legislative authority support this role. The commercial aspects of harvesting and conversion of the forest produce can be more efficiently accomplished by other agencies. The Department cannot monitor its own operations without some bias and inefficiencies gradually being introduced. Establishing another public organization to undertake extraction throughout the Country only creates another bureaucratic agency with all its inefficiencies.

BFIDC is a state-owned corporation. It has the experience and is capable of expanding to fill this role if the private sector cannot. BFIDC has the potential to become a reasonably efficient organization providing the labour code revision occurs and the power of the labour unions curtailed. Presently, the agency's managers have very little control over their work force. At the same time the private sector should be encouraged to develop efficient extraction and conversion operations throughout the Country.

Improved Production

Part of the bamboo areas in the Sylhet Forest Division remain unutilized. Developing these areas would increase the market bamboo supply. Alternately, SPPM would benefit by the increase. Some concern exists that construction of roads in these inaccessible areas will result in more illicit cutting. The reverse is equally true. As more area is opened up there is less pressure on the presently accessible areas. The people are going to get their requirements some way. The aim should be to spread these requirements over a sufficient area so that the annual supply is sustainable. Improved access also permits rapid enforcement, providing a will and a supporting enforcement and legal system exist.

In plantation harvesting the annual operations would benefit if more all weather roads existed. The principal advantage is a longer operating period. An extended harvesting period greatly enables the use of a permanent workforce and gives contractors an incentive to train their workers to increase productivity. The trained workers increase yields and are more productive.

The greatest potential for productive improvements is in the utilization of more species from the natural forest. Currently less half the existing volume is commercially used. Further improvement requires two conditions. The first, an adequate technical wood product program determining the best way to use new species. More importantly, markets must be found or developed to accept the new species. In the natural forest the recovery would be increased by five-seven percent if cross cut saws were used with existing felling and bucking standards.

Transportation Improvements

In the Sundarbans, BCIC's management should investigate the use of dumb barges for transporting gewa pulpwood. This would result in cleaner and fresher wood delivered to the pulpmill. It would also likely facilitate longer towing distances.

Constructing all weather roads in the plantations offer several advantages. First, it provides steady employment to the trucking industry. Contractor could then modify their trucks to facilitate loading and unloading. The general cargo box could be replaced by bunks to give a greater load capacity without increasing the gross vehicle weight. For longer hauls, contractors using a tandem axle truck with increased load capacity would operate at lower overall unit costs. The savings in energy use would also be a major contributing factor to lower costs. The major reason for permanent roads is increased control and better forest management and environmental protection standards.

BFIDC's Kassalong RF operation should construct all main roads to a highway standard. These roads will be permanently required for the plantations. Truck speed needs to be maintained at a minimum of 40 km/hour to keep trucking costs within acceptable limits. When the extraction operations reach the northern limits of the reserve the hauling distance will be over 100 km.

Another obvious improvement would be the construction of a network of 6.7 m wide paved highways throughout the country with a special side lane for rickshaw's and bullock carts. Highway congestion is a major contributing factor in the existing high haulage costs.

Rail transport is unlikely to become a major factor in the forest industry. SPPM will continue to use covered rail wagons to transport bamboo as this controls intransit losses. The open gondola or flat cars are more efficiently loaded and unloaded as well as allowing longer lengths of culms. However the attended losses outweigh the benefits of increased loads.

Reserve Forest Development

1. Sangu Matamahuri

The Sangu and Matamahuri Reserve Forests make up one operating unit with a combined natural high forested area about 40,000 ha, but rugged terrain and limited access have prohibited development of these Reserves. Available total estimated wood volume is 1.2 million m³ and the estimated potential annual bamboo supply is 145,00 ADT/A. The proposed working plan assumes a 60 year conversion of the natural forest.

Based on current royalty rates, the potential annual revenue is Tk 29.5 million from wood and Tk 7.8 million from bamboo. At current interest rates of 11 percent, the Department could afford

a development investment of Tk 339 million (US 8.7 million) to break even to extract these volumes.

The GOB should initiate a study of these Reserves to determine the feasible costs and appropriate methods of development. Before this study commences BFD should have topographic maps, scale 1:10,000 with contour interval of five m, prepared to help in the assessment of the harvestable areas. The 1983 photos are adequate for this purpose. The total area of the reserves is 74,500 ha. The estimated cost of making the maps would be Tk 4.6 million.

Good access to these areas would assist the local tribal people in marketing their products. Moreover, The security forces should benefit from good roads in keeping law and order and in securing the border with Burma.

2. Rankhiang Reserve Forest

The Rankhiang Reserve has a total area of over 77,100 ha with 10,300 ha of high forest type. BFIDC ceased harvesting operation in 1977 because they could not make an operating profit. The remaining natural forested area is on very steep ground which is unsuitable for tractor and skidder yarding.

BFD has about 500 ha, mostly teak plantations, which are starting to mature, based on an economic rotation age of 45 years. These, along with the plantations in the Sitapahar Reserve can sustain a modern teak sawmill industry at Kaptai with an annual capacity of 20,000 m³ for the next 20 years. BFIDC is the logical organization to harvest and convert these plantations as they have the infrastructure at Kaptai, most of the equipment, and the trained manpower.

This situation requires a feasibility study to establish the economics of developing the Sitapahar reserve to its full potential. This assessment would include the harvesting costs of both the plantations and the remaining area of natural forests as well as the detailed estimates for establishing a teak mill(s) at Kaptai. Any feasibility study and consequent development will not be possible until the security of the areas can be resolved. The study and subsequent harvesting operations would benefit by having accurate topographic maps at a scale of 1:10,000. The estimated cost of these aerial topographic maps is Tk 4.8 million.

3. Kassalong Reserve

The natural forests of the Kassalong R F can sustain the existing extraction operations for 50 years at an annual production rate of 43,300 m³. A 1984 study of this Reserve recommended developing an industrial complex including a particleboard mill at Bagaihat. This proposed development offered two advantages. First, it eliminates the log transport problems in the Kaptai reservoir. Second, it increases the recoverable volumes as less durable species in the Kaptai reservoir boardmill proves economical and there are sufficient markets, the yields of forest could approach 120m³/ha, rather than the current recovery of 35-45m³/ha.

The Kassalong has over 19,000 ha of plantations, mostly teak, many are starting to mature (45 year rotation). Over the next 20 years an average of 18,000 m³/A of wood is available from these plantations.

BFIDC's logging equipment is very old and has been poorly maintained due to a lack of spare parts. Consequently, continued high forest extraction operation or commencement of plantation harvesting must contemplate providing new equipment for an efficient operation.

This needs a feasibility study to determine the economics of developing an industrial complex at Bagaihat and the costs of rehabilitating and modernizing the harvesting operation. Good aerial

topographic maps would be a great help in determining the net harvestable areas in the natural forests and would be necessary for a development plan.

4. Other

The two feasibility studies should be done concurrently by the same agency to ensure the complete integration of BFIDC's operations and harvesting systems. This development proposal will be further discussed in the following main section and later in the Wood Processing Report.

Forest Department Changes

Introducing permanent roads systems will require new technical skills in the Department. This is best handled by creating an engineering cell to plan, develop and supervise all road system design and construction in the high forest and plantation areas.

PROPOSED DEVELOPMENT

Teak Sawmills

Extensive areas of teak and mixed hardwood plantations are approaching maturity in Bangladesh. A very preliminary estimate of harvestable volumes from these plantations indicates substantial volume become available early next century. The latter assumes a 40-45 year rotation. The Management and Silviculture Specialist will confirm the final estimate. Efficient wood processing standards indicate the need to establish new high yield sawmills, with a unit capacity of 12,000-16,000m³/A to process these valuable logs.

Selling these valuable logs to the existing private mills will result in excessive wastage as they presently have poor sawing techniques. The private sector should be given the opportunity to invest in these new facilities with assurance of a guaranteed log supply. However, private investment should be conditional on efficient utilization and economic return to the Country. BFIDC should install a prototype sawmill at Kaptai to demonstrate the feasibility of the concept.

Table 15 shows the major location and provisional number of sawmill units indicated, providing the forecast plantation yields occur. A note of caution is necessary. The yield of the older plantations will fluctuate widely as the stocking can change rapidly due to illicit felling. Consequently, these yields need proper assessment before embarking on any development program.

Table 15 - Forecast Teak Sawmill Establishment

Forest Division	Five Year Period				
	1990-9	1995-9	2000-0	2005-0	2010-14
Chittagong Hill Tracts	3	-	-	1	3
Chittagong	-	-	1	-	1
Sylhet	1	-	-	-	-
Cox's Bazar	-	-	1	1	-
Total	4	0	2	2	4

The location of the units within the divisions and the establishment date needs confirmation by an intensive inventory of the plantations before soliciting development proposals from the private sector. Other subsequent reports discuss this proposed sawmills development more fully.

Any harvesting operations for new teak sawmill units requires some mechanical yarding equipment to bring the heavy logs to the roadside. This requires modest capital investment in the harvesting operations to ensure a stable supply.

The indicated potential supports two feasibility studies once the CHT security situation allows for unrestricted study access. Both feasibility studies would be more reliable if good topographic maps were made available for all reserves. The studies are:

- a. Rehabilitating BFIDC's operations in the Kassalong RF and new development of the Rankhiang RF. The study should include the assessment of establishing an industrial complex at Bhagiahat to utilize the forest resources more fully and to eliminate the log transport problems.
- b. A detailed study to assess the most economical methods of developing the Sangu-Matamuhuri RF. This study include on assessment of the needs of the local tribal people living in the area.

Other

The pulpwood plantation at Kaptai and Bandarbands are more suitable if primarily used for sawlogs. Thinning and branchwood to a 7.5 cm top diameter is ideal for KPM's Chandragona mill. BFIDC is the logical agency to manage these plantations as the Department cannot fund the activity properly. BFIDC could convert the gamar sawlogs in their Kaptai Complex. The plantation rotation age should be set so that manual harvesting will be possible and the percentage of pulpwood outturn is sufficient for KPM requirements. According to present information, 18-20 years is the likely age.

The mill at Sylhet needs 8,000 ha of suitable forest land on a long term basis to raise their own plantations. If provided, the area would provide a significant part of SPPM's annual raw material supply.

INVESTMENT OPPORTUNITIES

Harvesting improvement and future developments offer several investment opportunities. This section briefly describes and summarizes possible investments. Appendix 6 contains the corresponding estimated costs and proforma project details.

Sylhet Forest Bamboo Development Assessment

A study of the bamboo areas in Sylhet should be made to determine the types of infrastructure required to fully develop potential bamboo supplies in the Division. Presently, the situation is only about 40 percent of the potential available bamboo gets harvested. Moreover, the easily accessible areas are overcut and as a result are degrading.

Sangu-Matamuhuri Feasibility Study

The Sangu-Matamuhuri FR requires a feasibility study to determine the most appropriate methods of transport and extraction. This study has to include manufacturing and marketing the expected outturn.

Provision of Extraction Equipment

Many plantations are close to maturity and will soon be ready for harvesting. The Wood Processing Specialist will recommend that this valuable teak wood is better processed in modern sawmills. Investment in harvesting equipment will provide a more stable log supply to these mills.

Rehabilitating BFIDC's TEX Operations

BFIDC's TEX operations in the Kassalong are inefficient and operate with worn out equipment. The study includes both the manufacturing and raw material operations. A feasibility study would determine the:

1. Funds required for rehabilitation.
2. Quantity and quality of the remaining natural forests and plantations in the tributary RFs. The study would assess the economics of establishing an industrial complex at Bagaihat. This site offers several advantage over Kaptai. These are improved utilization of species and the elimination of Kaptai's log transport problems.

However, this study and subsequent development is impossible until the security situation improves. Presently, consultants can not work safely or move in the area without the constraints of a military escort. Assuming the results of the feasibility study are avourable and donor funding available, rehabilitating BFIDC's operations would begin about one year after study completion.

Topographic Mapping

In all of the above projects there is a major technical need for good topographic maps at a scale of 1:10,000 and contour interval of five m. These maps would be of great assistance to the feasibility consultants. Furthermore, they are an essential tool for the proper development of these areas.

APPENDIX 1
ABBREVIATIONS, TERMS AND CONVERSION FACTORS

WOOD HARVESTING

APPENDIX 1

ABBREVIATIONS, TERMS AND CONVERSION FACTORS

ABBREVIATIONS

ADT	- Airdry Metric Tonne
BCIC	- Bangladesh Chemical Industries Corporation
BFD	- Bangladesh Forest Department
BFIDC	- Bangladesh Forest Industries Development Corporation
cft	- Cubic Feet Hoppus
CHT	- Chittagong Hill Tracts
FAO	- Food and Agriculture Organization of the United Nations
FDTC	- Forest Development and Training Centre
ha	- Hectare
hr	- hour
hp	- Flywheel horse power
KHM	- Khulna Hardboard Mill
km	- Kilometre
KNM	- Khulna Newsprint Mill
KPM	- Karnafuli Paper Mill
kw	- Kilowatt
Lakh	- 100,000
LPC	- Lumber Production Complex (Kaptai)
m	- metre
MAI	- Mean Annual Increment
MOEF	- Ministry of Environment and Forest
NRS	- Natural Regeneration Strip
RF	- Reserved Forest
SIDA	- Swedish International Development Agency
SPPM	- Sylhet Pulp and Paper Mill
TEX	- Timber Extraction (Kaptai)
Tk	- Taka

TERMS

agroforestry	- A set of land-use systems that combine trees with pasture, arable crops, and/or animal production on the same land unit, either simultaneously or in short sequence. This agroforestry is a set of technologies or practices, as distinct from a program or policy. Certain agroforestry technologies find valuable application in programs of social forestry or community forestry.
amenity forestry	- Forestry for the purpose of recreation, pleasure, or general beautification of an area or a settlement.
dao	- Large hand-held work knife
dumb barge	- Barge requiring towing or pushing, a high-sided vessel used for water transportation and without propulsion means on board
mahal	- Separate annual areas of bamboo operations

- yarding - Moving logs from stump site to roadside
- water bar - Earthen berm installed across road ways to control water flow to prevent road erosion.
- social forestry - The use of trees, and/or tree planting, to pursue social objectives (usually betterment of the poor). Social forestry is a program that may include many elements of agroforestry. It often includes, but is not interchangeable with, community forestry, which has a narrower meaning. A broader discussion of the term follows in the chapter section on case studies.
- wasteland - Land that is currently producing useful biomass grossly below its potential. The reasons for underproduction may be many and varied, from technical (salinity, acidity or alkalinity, waterlogging) to social (disputed ownership or rights) or political (forest department or community ownership).

CONVERSION FACTORS

US \$ 1	- Tk 38.80	
1 m ³	- 27.7 cft Hoppus (H)	
1 cft(H)	- 1.2732 cubic feet true - cft(t)	
1 cft(t)	- one cubic foot true solid volume	
maund	- 37.33 kg	
1 km	- 0.621 miles	
1 ha	- 2.471 acres	
1 litre	- 0.220 imperial gallons	
ton	- 2,000 lbs	
tonne	- 1,000 kilograms	
teak	- 1,080 kg/m ³ , green weight	720 kg/m ³
gamar <i>Gmelina</i>	- 650 kg/m ³ , green weight	430 kg/m ³
moluccana <i>D. regia</i>	- 450 kg/m ³ , green weight	305 kg/m ³ air dry
1000 culms muli	- 1.8 ADT	555 cft
1000 culms other	- 1.6 ADT	625 cft
Raw ton <i>1/2 to 2/3 ton</i>	- 0.67 ADT	

APPENDIX 2
TERMS OF REFERENCE

WOOD HARVESTING

APPENDIX 2
TERMS OF REFERENCE

Terms of Reference for the Wood harvesting Specialist are:

- a. Review the present practices for the sale/disposal of all forest products (timber, fuelwood, bamboo, sungrass, etc), through open auction of small lots of produce, and recommend more efficient alternatives. Advise on the suitability of creating a uniform facility (in the public sector) to undertake extraction of forest products;
- b. Review the current policies, strategies, plans and programs of the government and assess their impact on forest production;
- c. Examine all aspects of existing forest production operations including organizational aspects, harvesting techniques, economics of production (comparing manual and mechanized practices), safety, etc. Identify constraints and determine the scope for improvement;
- d. Assess the medium to long term potential for forest harvesting in the country including the potential to exploit currently inaccessible areas (Sangoo, Matamuhri and Upper Rainkheong reserves). If economically and environmentally viable, prepare investment projects designed to utilized forest products on a sustained basis;
- e. Examine current methods of transportation of forest products in Bangladesh and recommend measures for improvement;
- f. Assess the problems of wood wastage and suggest practical ways to improve recovery; and
- g. Prepare guidelines for environmentally benign forest exploitation practices.

WOOD HARVESTING

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APPENDIX 3
BFIDC AND BCIC EXTRACTION OPERATION DETAILS

PROJECT 372001/2
FORESTRY MASTER PLAN
BANGLADESH TA 1355-BAN

ASIAN DEVELOPMENT BANK
MANILA PHILIPPINES
DATE: MARCH 1992

WOOD HARVESTING

APPENDIX 3
BFIDC AND BCIC EXTRACTION OPERATION DETAILS

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1. BFIDC KAPTAL LOG PRODUCTION COSTS

1.a. Financial Statement for the Years from 1981-82 to 1986-87

Year	Units	1981-82	1982-83	1983-84	1984-85	1985-86
Production						
Target	m ³	43,320	43,320	36,1000	37,910	37,000
Actual	m ³	30,180	46,750	36,860	36,930	27,110
Sales						
Quantity	m ³	29,060	46,750	36,860	36,930	27,110
Value	Tk.million	44.84	66.46	56.93	64.01	68.68
Misc Income	Tk.million	6.64	5.71	8.16	8.53	6.79
Extraction	Tk.million	40.26	38.73	47.07	55.93	67.49
Expenditure						
Administration	Tk.million	22.04	18.66	21.08	23.96	22.80
Total	Tk.million	62.24	57.39	67.25	79.89	90.29
Opening Stock						
Quantity	m ³	28,740	30,430	18,010	16,970	12,530
Value	Tk.million	16.49	28.18	17.47	21.17	20.79
Closing Stock						
Quantity	m ³	30,580	18,010	16,970	12,530	33,320
Value	Tk.million	28.18	17.47	21.17	20.79	36.91
Profit/(Loss)	Tk.million	+ .87	+4.07	+1.53	(7.73)	+1.29
Cash/Bank Balance	Tk.million	17.40	8.81	48.64	44.26	19.07

1.a. Financial Statement for the Years 1981-82 to 1990-91 (Cont'd)

Year		1986-87	1987-88	1988-89	1989-90	1990-91	Unit
Production							
Target	m ³	39,710	39,710	39,710	41,520	39,710	40,430
Actual	m ³	38,840	20,110	20,110	14,660	18,190	5,810
Sales							
Quantity	m ³	38,630	20,110	20,110	14,660	18,190	5,810
Value	Tk.million	99.51	55.05	55.05	41.78	69.79	24.94
Misc Income	Tk.million	6.43	6.51	6.51	4.90	4.47	4.38
Extraction	Tk.million	68.94	48.81	48.81	51.06	46.85	29.19
Expenditure							
Administration	Tk.million	24.75	25.86	25.86	16.54	16.18	18.57
Total	Tk.million	93.69	74.67	74.67	62.60	63.03	47.76
Opening Stock							
Quantity	m ³	33,320	16,530	16,530	14,260	24,330	7,400
Value	Tk.million	36.91	25.18	25.18	24.56	47.42	17.26
Closing Stock							
Quantity	m ³	16,530	14,260	14,260	24,330	7,400	3,030
Value	Tk.million	25.18	24.56	24.56	47.42	17.26	7.44
Profit/(Loss)	Tk.million	+ .53	(13.73)	(13.73)	+1.94	(18.93)	(28.26)
Cash/Bank Balance	Tk.million	31.25	25.94	25.94	17.39	11.17	19.12

1b. Annual Timber Sales Volume m³*

Timber Class	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87	Percent
1	2505	3698	1881	3295	694	869	6.0
2	792	787	675	1318	1137	1601	2.9
3	224	196	229	272	466	26933	0.9
4	13274	27615	21369	20415	16716	26933	53.9
5	1695	1770	1528	1480	8306	1358	4.0
6	491	368	174	325	190	155	0.8
7	1342	1328	1189	1427	804	1095	3.3
8	5914	8406	4896	4006	1418	1579	12.2
9	2025	1699	1746	1987	1041	1254	4.5
10	773	890	2911	2355	3679	3439	6.5
	29060	46754	36597	36880	26978	39765	100.0
Teak	-	-	-	55	125	66	-
Pedank	26	-	-	-	-	-	-
Total	29086	46754	36597	36935	27103	39831	100.0

* Converted from cft (H), many not add exactly due to rounding

1c. Log Sales Rate, Tk/m³

Timber Class	Species	TEX to PSO	PSO to Inter project	Other
1	Gamar, jarul, telsure, champaful	5,290	6,040	-
2	Chapalish, chikrashi & boilam	5,180	5,900	-
3	Nageshwar, silkorai, b. hola, barta (tewa)	5,150	5,870	6,700
4	Garjan, toon and kamdev.	5,070	5,790	-
5	Pitraj, tali, gandari, jam, goda, gutgutia baspata, moss	2,940	3,550	4,040
6	Batna, badi, korai, kanak, sonalu and rang	2,630	3,240	3,680
7	Kanjai, raktan, horitaki, bohera, jalpai & other hardwood	2,330	2,910	3,320
8	Civit and chandul	2,050	2,600	-
9	Simul, kadam, pitali, chatian,	1,720	2,270	-
10	Narikeli, ramkala, dumur, other softwoods	-	-	2,580

Note:

1. One m³ = 27.7 cft (H).
2. Handed over rate (transfer rate) from TEX to PSO and sales rate PSO to Inter Project, Government, Semi Government and Private Parties.
3. Other - Government, semi government, and private partices.

1d. BFIDC's Estimated TEX Future Extraction Costs

(Figures in thousand except unit costs)

Item	Alternate 1	Alternate 2	Alternate 3
Variable Cost		1609.20	3580.00
Store consumption	5364.00	630.00	1400.00
spares consumable	2100.00	2502.00	5560.00
P.O.L.	8340.00	19184.00	42636.00
Royalty (New rates)	63948.00	17694.00	19320.00
Other direct expenses	28980.00	41620.00	72496.00
Total	108732.00		
Fixed Cost		10319.00	10319.00
Wages	10319.00	5863.00	5863.00
Staff salary	5863.00	1880.00	1880.00
Officers salary	1880.00	6300.00	6300.00
Security guards	-	600.00	600.00
Spares consumable	600.00	4569.00	4569.00
Other factory expenses	4569.00	7000.00	7000.00
Depreciation	7000.00	593.44	593.44
Insurance	593.44	5455.00	5455.00
Interest on Govt loan	5455.00	70.00	70.00
Interest on foreign loan	70.00	5000.00	5000.00
Head office overhead	5000.00	6417.00	6417.00
Administrative expenses	6417.00	200.00	200.00
Selling expenses	200.00		
Total	47966.44	54266.44	54266.44
Total Cost	156698.44	95886.04	126762.44
Unit Cost Tk/m ³	3,618.00	2,664.00	4,386.00

- Notes: 1. Source: BFIDC, Feb/92. 2. 1m³ = 27.7 cft (H)
3. Alternatives:
 1 - No security problems, felling moratorium lifted, production 43,300m³/A
 2 - Moratorium continuing for plan period of 20 yrs. All logs trucked to Kaptai or Chittagong, production 36,000m³/A.
 3 - Moratorium ends in 1992 but security problems persists through plan period, rafting and barging of log possible, production 28,900m³/A.
4. Based on 1992 price base.

2. BCIC LOG PRODUCTION COSTS

2a. Karnaphuli Pulp Mill Extraction Costs

Item/Extraction Method	Volume (ADT)	Unit Cost (Tk/ADT)	Annual Cost (Tk/million)
Leased Bamboo Area			
Mech (Rankhiang)	-	-	-
Manual(Rankhiang)	3500	900	3.15
Manual(Rankhiang)	6500	1600	10.40
Manual(Kassalong)	5000	1800	9.00
Total	15000		22.55
Private Bamboo Area			
Muli	10000	1600	16.00
Other	5000	1200	6.00
Below Dam	12000	1900	22.80
Kowkhali	5000	2000	10.00
Total	32000		54.80
Firewood	28000	2000	56.00
Total	75000		133.55
Other Costs			
Casual Labour		115	.85
Ansar (Security)		100	.91
Repairs & Maintenance		21.00	7.50
Fuel and Oil			1.20
Misc Costs			31.46
Total			164.81
Operating Fixed Overhead Costs		51.10	215.91
Total			

- Notes: 1. The current cost of raw materials delivered to the mill averages Tk 2,879/ADT
 2. Source: KPM, 1992
 3. Reported current extraction costs.

(Proj. 372001/2, App. 3)

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2b. Khulna Newsprint Mills Limited

Item	1986/87		1987/88		1988/89		1989/90		1990/91						
	m ³	Taka Tk/m ³	m ³	Taka Tk/m ³	m ³	Taka Tk/m ³	m ³	Taka Tk/m ³	m ³	Taka Tk/m ³					
Fell, Buck, Carry,	2,444	894	365	8	-	8	-	0	-	0					
Float, Stack	136,895	9,871	72	131,773	10,186	77	10,674,104	10,674	84	133,089	12,507	94	149,898	16,704	111
Contract Logs	139,339	10,765	77	131,773	10,194	77	10,682,228	10,682	84	133,089	12,507	94	149,898	16,704	111
Net Wood Production	(25,471)	(2,519)	99	(20,418)	(2,143)	105	(1,021,994)	(1,022)	99	-	0	-	-	0	-
Less: Sales of Match Wood	139,339	8,246	59	131,773	8,051	61	127,425	9,660	76	133,089	12,507	94	149,898	16,704	111
Net Wood Procurement	139,733	1,968	14	131,773	1,927	15	127,425	1,599	13	133,089	1,989	15	146,384	2,278	16
Building and Scaling	139,733	705	5	131,773	1,149	9	127,525	1,567	12	133,089	1,938	9	146,384	1,708	12
Booming, Rafting, Towing	144,911	15,451	107	135,517	13,504	100	129,750	17,247	133	135,490	22,094	163	135,432	18,651	138
Marine Transport	138,637	5,187	37	138,996	6,337	46	130,049	7,187	55	139,882	8,024	58	134,327	7,610	57
Raft Breakdown	139,733	31,557	226	131,773	30,969	235	127,425	37,260	292	133,089	46,552	350	146,384	46,951	321
Total Direct Cost	-	1,206	-	-	702	-	-	121	-	744	-	-	-	2,468	-
Change in WIP	139,733	32,763	234	131,773	31,671	240	127,425	38,190	300	133,089	47,296	355	146,384	44,483	304
Direct Cost of Production	139,733	2,026	15	131,773	2,084	16	127,425	2,656	21	133,089	3,536	27	146,384	2,889	20
Forestry Workshop	139,733	3,338	24	131,773	3,375	26	127,425	4,600	36	133,089	4,258	32	146,384	3,662	25
Camp Overhead	139,733	1,866	13	131,773	2,090	16	127,425	1,616	13	133,089	1,910	14	146,384	1,729	12
General Overhead	139,733	39,994	286	131,773	39,220	298	127,425	47,061	369	133,089	56,999	428	146,384	52,762	360
Total Production Cost	(2,690)	(190)	71	(13)	(1)	100	(2)	0	94	-	0	-	-	0	-
Less: Sales of Baling Wood	(1,133)	(715)	631	(692)	(127)	183	-	0	-	-	0	-	-	0	-
Less: Sales of Others	139,331	39,089	281	139,444	39,092	280	131,394	46,927	357	140,155	56,999	407	138,124	52,762	382
Cost of Sales to Mill															

Notes :

1. True cubic meter volume, 1 m³ = 35.3 cft.
2. Source: KNM. (Dec 1990).
3. Total Taka in thousands.

2c. Sylhet Pulp and Paper Mills Ltd. 5-yr Production Volume, ADT

Source/Type	1986/87	1987/88	1988/89	1989/90	1990/91
Reserve Forest	6987	5763	9418	7164	9375
Bamboo	-	932	6283	5245	5266
Softwood	623	921	708	258	-
Reed	7610	7616	16409	12667	14641
Total					
Private Source	26049	23182	19913	22695	17773
Bamboo	-	12321	12869	14271	6090
Softwood	420	1058	4416	2449	1263
Jute Cutting	26469	36561	34198	39415	26126
Total					
Total	34079	44177	50607	52082	40767

- Notes:
- 1990 royalty rates:
Bamboo - Tk 1,071/1,000 culms
Moluccana - Tk 2,295/m³
 - In 1992 GOB plans to increase royalty rates for bamboo to Tk 2,335/ADT, (Tk 3,970/1,000 culms) and for Moluccana to Tk 5,295/m³.
 - 1 m³ = 35.3 cft, true volume

2d. Sylhet Pulp and Paper Mills Ltd. 5-yr Average Production Costs, (Tk/ADT)

Type/Item	1986/87	1987/88	1988/89	1989/90	1990/91
Bamboo					
Cutting and Carrying	1383	1249	1483	1234	1850
Railway	444	488	537	590	649
Total	1827	1737	2020	1824	2499
Softwood					
Cutting and Carrying	-	1575	2069	1818	1481
Railway	-	2550	3407	2551	1067
Total	-	-	-	-	-
Reed					
Cutting and Carrying	1593	1299	1600	1728	-
Railway	90	90	90	90	-
Total	1683	1389	1690	1818	-

- Notes:
- The above cost is excluding establishment cost. Establishment cost is Tk 200/ADT (approx), which includes overhead expenditure, camp maintenance etc.
 - There is no difference in transportation rate of bamboo by truck/railway.
 - For Private Source:
 - There is no establishment cost for mill
 - There is no difference of rate for transportation of bamboo by Truck/railway.
 - Railcars hold five raw tons/wagon or 3.3 ADT/wagon.

**APPENDIX 4
SUNDARBANS INVENTORY COMPARISON
AND BASIC PRODUCTION ESTIMATES**

WOOD HARVESTING

APPENDIX 4
SUNDARBANS INVENTORY COMPARISON
AND BASIC PRODUCTION ESTIMATES

TABLES OF CONTENTS

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10 cm Diameter Class	2
12 cm Diameter Class	2
PLANTATION PRODUCTION ESTIMATES	
Assumptions	2
Log Production Cost	2
Road Transportation Costs	2
Road Construction Costs	3

1. SUNDARBANS WEIGHTED SAMPLE RESULTS

a. 10 cm Diameter Class, Blocks 4 to 8

Block	Area	Joint Sampling		ODA Inventory	
		Aver m ³ /ha	Total	Aver m ³ /ha	Total
4	54227	8	418090	3	170815
54	28127	7	199983	3	73411
53	33832	6	189459	2	62589
6	39647	5	193477	5	191891
7	36050	11	397271	6	232523
8	27517	17	466963	7	182438
Total	219400		1865243		913667

Joint Sample is 2.04 times the ODA Inventory

b. 12 cm Diameter Class, Blocks 4 to 8

Block	Area	Joint Sampling		ODA Inventory	
		Aver m ³ /ha	Total	Aver m ³ /ha	Total
4	54227	6	316686	2	132856
54	28127	4	108570	1	32065
53	33832	4	128562	1	37892
6	39647	3	132421	4	148676
7	36050	8	286598	5	177727
8	27517	14	380835	5	143914
Total	219400		1353672		673130

Joint Sample Inventory is 2.01 times the ODA Inventory

2. PLANTATION PRODUCTION ESTIMATES

2a. Basic Assumptions :

- Carrying Load - 25 kgs per trip
- Walking Speed - 25 m/min on level ground
- Rest Period - 10% every 100 m
- Effective Day - 6 hr
- Wage Rate - Tk 65/Day-includes food allowance
- Green Weights
 - Moluccana - 450 kgs/m³
 - Gamar - 650 kgs/m³

2b. Log Production Cost

Item	Travel Distance, m							
	50	100	150	200	250	300	350	400
Time/trip, minute	2.5x1.1	5x1.2	7.5x1.25	10x1.3	12.5x1.35	15x1.4	17.5x1.45	20x1.5
Trips/day	130	60	38.4	27.6	21.3	17.1	14.2	12
Weight/day, kg	3250	1500	960	690	533	428	355	300
Moluccana, m ³	7.2	3.3	2.1	1.5	1.2	0.95	0.8	0.67
Gamar, m ³	5	2.3	1.5	1.06	0.82	0.66	0.55	0.46

2c. Road Transport Costs

Item	Road Spacing m/ha							
	50	100	150	200	250	300	350	400
Tk 20,000/km								
Trips/day	200	300	400	500	600	700	800	900
Mol, 120 m ³ /ha	1.67	2.5	3.33	4.2	5	5.8	6.7	7.5
Gamar, 100 m ³ /ha	2	3	4	5	6	7	8	9
Tk 50,000/km								
Trips/day	500	750	1000	1250	1500	1750	2000	2250
Mol, 120 m ³ /ha	4.17	6.25	8.33	10.42	12.5	14.6	16.7	18.8
Gamar, 100 m ³ /ha	5	7.5	10	12.5	15	17.5	20	22.5
Tk 50,000/km								
Trips/day	1000	1500	2000	2500	3000	3500	4000	4500
Mol, 180 m ³ /ha	5.56	8.33	11.1	13.9	16.9	19.41	22.2	25
Gamar, 100 m ³ /ha	6.25	9.4	12.5	15.6	18.75	21.9	25	28.1

* - Moluccana

(Proj. 372001/2, App. 4)

2.d Road Construction Costs

Mr Rithaler,
Wood Harvesting

As discussed with you yesterday, the rates you wanted are as follows.

FOR ADB FOREST MASTER PLAN

ESTIMATED COSTS OF CULVERT

1x1M Box culvert - concrete	Tk 100,000 each unit
2x2M Box culvert - concrete	Tk 250,000 each unit
0.5M dia round concrete pipe culvert	Tk 25,000 per metre
1.0M dia round concrete pipe culvert	Tk 40,000 per metre

BRIDGES -

10M span - concrete	Tk 100,000 per metre
20M span - concrete	Tk 90,000 per metre
30M span - concrete	Tk 80,000 per metre

4M WIDE ROADS

Cost of preparing sub grade	Tk 50,000 per KM
Paving with Brick (HBB)	Tk 1000,000- 1200,000 per KM

PRICE OF STONE

Stone 25mm down (At source of Sylhet area)	Tk 500 per cum
-----------------------------------------------	----------------

Please contact me if you need any clarification.

With regards,

M Hoq Khan
Sr. Engineer
Bangladesh Consultants Ltd.

**APPENDIX 5
BAMBOO SALE TENDER**

WOOD HARVESTING

APPENDIX 5
BAMBOO SALE TENDER

Bangladesh Gazette, 6th Vol. of the 8th Nov., 1990

Government of the People's Republic of Bangladesh
Office of the Divisional Forest Officer
Sylhet Forest Division

SALE TENDER FOR BAMBOO MAHAL, 1990

Sealed Tenders, subject to undermentioned terms and conditions, are invited from interested bidders by the Divisional Forest Officer, Sylhet Forest Division for sale of the bamboo mahals, described in the schedule below for the year 1991. The tenders should be dropped before 1 pm on the 28th November, 1990 in tender boxes placed at the Offices of the Divisional Forest Officer, Sylhet and of the Conservator of Forest, Central Circle, and the Chief Conservator of Forest, at Ban Bhaban, Gulshan road, Mohakhali, Dhaka-1212.

The tenders will be opened on the same date at 1.30 P.M., in presence of such of the bidders as may be present.

Terms and Conditions of the Tender Notification

1. The interested bidder is required to deposit 2% of the proposed bid value as earnest money in favour of the Divisional Forest Officer, Sylhet, with the treasury/sub-treasury/postal savings bank/any scheduled bank. The treasury chalan or the pass book should be submitted along with the tender forms.

No tender will be accepted without the proof of the deposit of the earnest money. Unsuccessful bidders will be refunded the earnest money. The earnest money deposit of successful bidders may be adjusted against the price of the mahals, if they so desire.
2. The interested bidders may visit the mahals described under different schedules to acquaint themselves regarding quantity and quality of bamboo before submission of the bids. No complaint regarding ignorance of the quantity and quality of bamboo will be entertained after the bid is accepted.
3. Tender bidder must be an enlisted mahaldar of the Sylhet Forest Division. Tender from any person who is not an enlisted mahaldar upto 1990-91, will not be accepted.
4. The tender must be submitted in the form prescribed by the Divisional Forest Officer, Sylhet Forest Division. The form will be available for purchase till 27.11.1990 at Divisional Forest Office, Chandnighat, Sylhet, as well as at the office of the Conservator of Forest, Central Circle, Dhaka and at the office of the Chief Conservator of Forest, Bangladesh at a cost of Tk.200/= non-refundable. The receipt of payment for the purchase of tender forms must be enclosed with the tender documents.
5. The tender is for sale of the sale of the estimated number of bamboos as described in the tender notice. In no case, quantity in excess of the estimated number of stems will be allowed to be cut or extracted. On the other hand if the bidder fails to cut or extract the specified number of bamboos within the period of time allowed, he will lose any claim for unextracted bamboos and he will not be entitled to any concession or refund.
6. Within 3 days of the intimation of acceptance of the tender bid, the successful bidder will be required to sign a contract with the Divisional Forest Officer in the prescribed form after depositing in treasury/sub-treasury/postal savings bank a sum equal to 15% of the value of the bid in favour of the Divisional Forest Officer as security. The Divisional Forest Officer may increase the amount of deposit upto 70% of the sale value in special cases. The prescribed form of the agreement can be seen in the office of the Divisional Forest Officer, Sylhet or in any range office.
7. If the successful bidder fails to deposit the amount described in article 6 or to sign the deed of agreement within the fixed time, the Government may forfeit his earnest money as well as any security deposit.
8. A bidder should be owner of adequate immovable property or be a solvent and established businessman. The bidder should be ready to provide proof of his solvency if required.
9. In case of defaulters with the Forest Department, who did not fully pay the arrears of revenue due, or in case of persons against whom Certificate cases have been lodged or in case of persons found guilty of committing forest offences, the acceptance or rejection of their tenders will be subject to the discretion of the authority.
10. If the buyer breaches any of the terms of the agreement or tender notice, then his security money may be forfeited and the mahal can be resold. If in the process the Government incurs any financial loss, the loss can be recovered from the first buyer in the manner applicable to collection of arrear land revenue.

11. The sale price of the mahals is to be paid as follows :
 - (a) Sale value upto 1 lac is to be paid in a single instalment within 15 days of the approval of sale of the mahal.
 - (b) Sale value above 1 lac and upto 5 lacs is to be paid in two instalments as described below :
 - 1st Instalment - 50% of the auction price is to be paid within the 7 days of the intimation of approval of sale to the bidder.
 - 2nd Instalment - remaining 50% to be paid on or before 31st March,1991.
 - (c) Sale value above 5 lac is to be paid in 3 instalments as described below:
 - 1st Instalment - 50% of the auction price to be paid within 7 days of intimation of approval of sale to the bidder.
 - 2nd Instalment - 30% of the money to be paid on or before 20th May,1991.
 - 3rd Instalment - 20% of the money to be paid on or before the 16th August,1991.
12. The bidder will not be allowed to cut any bamboo in the mahal until the first instalment is paid completely.
13. The Forest Department will have right to stop work in the mahals and cutting bamboos or taking out bamboos from the mahal, in case of non-payment of any instalments within the prescribed dates. This stopping of work will not exempt the bidder from payment of arrear dues. The Government will not be held responsible for any loss to the buyer in such cases.
14. The bidder shall issue permits to local people for home consumption at the schedule of rates prescribed by the Government.
15. The tenure for auction will be from 1st January,1991 to 31st December,1991. But incase of mahals where sale is subject to approval to higher authorities, the tenure will be from the date of announcement of acceptance of the tender. Incase of delays in acceptance of offers by higher authorities, the mahaldar will not get any compensation or time extension.
16. The period from 16th June to 15th August, is considered to be the closed season for bamboo extraction because of technical reasons. All activities in the mahal will be stopped during the closed season.
17. The bidder must take out all the cut bamboos from the mahal before the start of closed season. In no circumstances any bamboo will be allowed to be taken out from the mahal during the closed season (16th June - 15th August.).
18. The bidder or his agent or any other person will not be allowed to enter the mahal either for cutting or for extracting bambooes after the expiry of the date of contract agreement.
19. The cut bamboos remaining in the mahal after the expiry of the date of agreement should be treated as the property of the Government. The Government can resell them and the proceeds will be considered as revenue of the Government.
20. It is prohibited to cut young and immature stems. Moreover one or two mature stems should be left in each clump. The security money of the bidder may be confiscated if immature stems are found to be extracted.
21. The mahaldar must observe utmost caution in extracting mature bamboos so that no young or immaturred stem is damaged during the extraction.
22. In no circumstances any bamboo stem should be cut above 1 foot height from the ground. The buyer will be liable to pay a fine of Tk.10/= for each stem if it is found or proved that the bamboo was cut above 1 foot from the ground level.
23. The mahaldar shall not cut any bamboo outside the mahal. For cutting bamboos outside the mahal, the security money of the bidder will be forfeited and the sale will be cancelled in addition to other legal actions taken against him.
24. The buyer will be held responsible for any theft of forest products in the adjacent unsold forests and he will be liable to compensate the Government for such loss. Otherwise the Government may confiscate the security money deposited under section 6 of the terms and conditions. This condition will be applicable to any area within 1 mile from the boundary of the mahal. He may be exempted from any liability in this regard, if he immediately lodges with the nearest forest office a written complaint of the theft or if he assists in apprehending the culprits.
25. Each consignment of cut bamboos should be checked by the concerned beat officer before it is removed from the forest. The beat officer will write the number of the bamboos on the other side of the D-Form and duly put his official seal and signature with date after the check is complete. Transit pass will be required during the transporting bamboo from mahaldar's depots to other places beyond. The transit pass is required to be checked at each check station.
26. The Divisional Forest Officer retains the right to requisition of 10% of the bamboos from the mahaldar for Government use at the Government approved schedule of rates.
27. The Divisional Forest Officer, Sylhet may further requisition any quantity of bamboo over and above the 10% mentioned in section-26 above, for Government use, for which payment will be made at local market rates as checked by the local range officer.
28. The buyer will not build any road within the mahal without the permission of the Divisional Forest Officer.

29. The buyer is prohibited from using adjacent forest areas outside the limits of the sold mahal, for transport of bamboo streams in closed coupes for transporting bamboos without the permission of Divisional Forest Officer.
30. Bamboos from mahals named after a particular (chhara) stream can be transported only through the chhara. Buyers will not be allowed to use other chharas.
31. If any error due to printing mistake is detected in the tender notice or in the schedule, the Division Forest Officer reserves the right to make the appropriate corrections. In that case no complaints from any quarter will be entertained.
32. The buyer will be held responsible for incidence of fire in the mahal during the tenure of the agreement. He will be liable to compensate the Government in case of loss caused by such fire.
33. The buyer will be responsible for protection of the mahal from the time of execution of the agreement. The Government will not be liable for loss due to act of God or due to internal or border disturbances. The buyer can not claim any compensation from the Government in such cases.
34. In case of unpaid arrear instalment or any loss to the Government caused by cancellation of the contract and retendering of the mahal, the Government may realize the loss, in the manner of collecting of arrear land revenue through certificate case.
35. The Government may stop the sale of any of the mahal mentioned in the schedule of this notification due to special circumstances. No objection will be entertained in such cases from any quarter.
36. In no circumstances, the security money can be adjusted with the last instalment.
37. The mahaldar can buy 'balli' (poles) at the schedule of rates from the forest to facilitate extraction with previous permission from the Divisional Forest Officer.
38. The mahaldars are required to pay income tax @ 3% of the bid value at the time of payment of instalment.
39. Acceptance of highest or any other bids is under the discretion of departmental authorities. They are not liable to show any reason for their decisions.
40. Acceptance of bids above the value of Tk.50,000/= will be subject to approval of higher authorities.
41. If any dispute arises on the interpretation of any condition of this tender notification or regarding the terms of sale of bamboo mahal or any related problems, the decisions of the Conservator of Forest, Central Circle, Dhaka will deemed to be final.

The terms and conditions of the tender are approved.

Ali Akbar Bhuiya

Conservator of Forest
Central Circle
Dhaka

Gulam Quddus Chowdhury

Divisional Forest Officer
Sylhet Forest Division

Schedule

List of Bamboo Mahals to be sold in 1991

Sl. No.	Bamboo Mahal No.	Name of the Mahal	Name of the Forest	Type of Bamboo	Quantity of Bamboo (Nos.)	Boundary of the Mahal
<u>Juri Range</u>						
1.	J/1/Bamboo of 1991	Madhab Chhara	Patharia Reserve Forest	Muli Tengra Muli Dalu Pencha Total:	43,50,000 4,39,350 1,63,850 62,350 <hr/> 50,15,550	North-Nikunjo Chhara Block South-Dhalai Chhara Block East-Indo-Bangladesh Border West-Reserve Area
<u>Habiganj Range</u>						
2.	Haka/1/ of 1991	Taraf Hill Reserve	Taraf Hill Reserve Forest Compartment-8	Tengra Muli Matinga Dalu Bazali Total:	95,000 10,000 20,000 25,000 <hr/> 1,50,000	North-Jangalia Bamboo Road East-East Boarder of the Reserve & West Border of the Sanctuary. South-Chawka Path and the border of the sanctuary. West-Kalenga-Forest Road.
<u>Rajkandi Range</u>						
3.	RA/1/ of 1991	Lewa Chhara 1 and 2	Rajkandi Reserve Forest	Muli Tengra Muli Orah Others Total:	23,00,000 3,00,000 6,00,000 1,12,000 <hr/> 33,12,000	North-top of the Bamboo Hill (Kamarchhara Mahals border). South-Top of the Hill (Border of Dalua Chhara) Mahal. East-Indo-Bangladesh Border. West-Border of the reserve forest and the sanctuary. West-Kalenga-Forest Road.
4.	RA/2/ Bamboo of 1991	Dalua Chhara	Rajkandi Reserve Forest	Muli Tengra Muli Orah Others Total:	13,50,000 1,75,000 3,50,000 67,000 <hr/> 19,42,000	North-Top of the Hill, border of Lewa Chhara-2 Mahal. South-Top of the Hill, border of the Baghachara Mahal. East-Top of the Hill, boarder of the Kumarchhara Mahal. West-Border of the Reserve Forest.

APPENDIX 6
PROJECT INVESTMENT PROFILES AND COST ESTIMATES

PROJECT 372001/2
FORESTRY MASTER PLAN
BANGLADESH TA 1355-BAN

ASIAN DEVELOPMENT BANK
MANILA PHILIPPINES
DATE: MARCH 1992

WOOD HARVESTING

APPENDIX 6
PROJECT INVESTMENT PROFILES AND COST ESTIMATES

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1. FEASIBILITY STUDY OF BFIDC'S CHITTAGONG HILL TRACTS OPERATION

Program : Harvesting

1a. Project Profile

Development Objective : To rehabilitate BFIDC's TEX operations and develop an Industrial Complex near Bagaihat

Problem Addressed : BFIDC is presently inefficient and cannot transport logs to Kaptai economically.

Actions and Immediate Objectives : Preparation of terms of study reference.

Desired Results : Fundable project

Implementing Agency : BFIDC

Beneficiaries/ Positive Impacts : BFIDC would become profitable. Increased production. Better utilization of species and reduced wastage.

Possible Losers/ Negative Impacts : Natural habitat destroyed to make way for plantations.

Conditions Necessary for Success : Security of personnel for the study and in harvesting operations.

Links with other Projects : Preparation of topographic maps. Development of Teak Mills.

Expected Activity Sequence :

1. Prepare of terms of reference
2. Call proposals
3. Complete study
4. Present finished report to donor agencies
5. Project implementation

1b. Estimating Details

Length (Years) : 0.33

Item	Amount	
	Foreign	Local
a. Foreign	US	Tk
4 Consultants - 14 months	168,000	200,000
Air fares 4x7000		28,000
b. Local		
Vehicles + Drivers	-	-
Misc Expenses	-	117,000
2. Education and Training:		
a. Foreign	-	-
b. Local	-	-
3. Equipment Purchases:		
a. Foreign	-	-
b. Local	-	-
4. Construction		
5. Other/Materials		
a. Foreign *	300,000	-
Total:	496,000	317,000

* Topographic maps, scale 1:10000, contour interval of 5 m. Total area of Kassalong, Rankhiang Sitapahar RF, Pulpwood Plantations estimated 180,000ha.

2. SYLHET BAMBOO SUPPLY STUDY

Program	:	Harvesting
2a. <u>Project Profile</u>		
Development Objective	:	To increase the volume of bamboo harvested in the Sylhet Forest Division.
Problem Address	:	Currently only 40 percent of potential yield is extracted.
Actions and Immediate Objectives	:	Four month study to determine economical development of Bamboo Areas.
Desired Results	:	Permanent infrastructures will be built to increase yields and lower costs.
Implementing Agency	:	BFD
Beneficiaries/ Positive Impacts	:	Sylhet Pulp and Paper Mill needs more bamboo. Better supervision of extraction by BFD.
Possible Losers/ Negative Impacts	:	Road access may increase illicit felling.
Conditions Necessary for Success	:	BFD to sell bamboo mahals on long term contract to allow purchaser to amortize development costs.
Links with other Projects	:	Nil
Expected Activity Sequence:		
	1.	Prepare topographic maps
	2.	Complete study
	3.	Long term sales of bamboo mahals
	4.	Develop permanent infrastructure

2b. Estimating Details

Length (Years) : 0.33

Item	Amount	
	Foreign US	Local Tk
a. Foreign Consultant Travel	55,000	-
b. Local Vehicles + Drivers Local Staff	-	390,000
2. Education and Training:		
a. Foreign	-	-
b. Local	-	-
3. Equipment Purchases:		
a. Foreign	-	-
b. Local	-	-
4. Construction	-	-
5. Other/Materials		
a. Foreign *	50,000	-
b. Local	-	-
Total:	105,000	390,000

* Topographic maps, scale 1:10000, 5 m contour interval, area approximately 32,000 ha.

3. SUNGOO-MATAMUIHURI FEASIBILITY STUDY

Program	:	Harvesting
3a. <u>Project Profile</u>		
Development Objective	:	To determine appropriate methods of transportation, extraction and manufacturing facilities.
Problem Addressed	:	Economic development of these two forest reserves.
Actions and Immediate Objectives	:	Preparation of terms of reference for study
Desired Results	:	Fundable project
Implementing Agency	:	BFIDC/BFD
Beneficiaries/ Positive Impacts	:	Wood supply and bamboo supply will increase and help alleviate shortages. Access for tribal people.
Possible Losers/ Negative Impacts	:	Destruction of habitat in natural forest.
Conditions Necessary for Success	:	Positive financial projections. Security of personnel.
Links with other Projects	:	Nil
Expected Activity Sequence	:	1. Prepare terms of reference 2. Call for proposals from qualified companies 3. Complete study 4. Present report to funding agencies 5. Project implementation.

3b. Estimating Details

Length (Years)

<u>Item</u>	<u>Amount</u>	
	<u>Foreign</u> US	<u>Local</u> Tk
a. Foreign	7 man month consultancy	84,000
	Air Travel	21,000
b. Local	Transport Expenses	156,000 234,000
2. Education and Training:		
a. Foreign		-
b. Local		-
3. Equipment Purchases:		
a. Foreign		-
b. Local		-
4. Construction		
		-
5. Other/Materials		
a. Foreign *		120,000
b. Local		-
Total:		245,000
		390,000

* Topographic maps, scale 1:10000, contour interval of 10 m. Area covered 74,500 ha.

4. **HARVESTING EQUIPMENT FOR NEW TEAK SAWMILLS**

4a. Project Profile

Program : Harvesting

Development Objective : To provide mechanical means to extract teak/hardwood plantations.

Problem Addressed : Teak logs are heavy and require power to yard uphill.

Actions and Immediate Objectives : To supply 12 proposed team mills with logs in next 20 years.

Desired Results : Sufficient volumes at reasonable cost to keep Sawmills operating efficiently.

Implementing Agency : Private sector/BFIDC

Beneficiaries/ Posting Impacts : Mills assured of supply of logs

Possible Losers/ Negative Impacts : Some loss of employment. Minor environmental impact.

Conditions Necessary for Success : BFD would assign plantation area to sawmill or guarantee annual supply in long term contract.

Links with other Projects : Wood Processing

Expected Activity Sequence :
1. Machines to be purchased by private contractor at least six months before Teak Mill commissioning.

4b. Estimating Details

Length (Years) : 1.7

Item	Amount	
	Foreign US	Local Tk
a. Foreign	-	-
b. Local	-	156,000
2. Education and Training:		
a. Foreign	-	-
b. Local	-	-
3. Equipment Purchases:		
a. Foreign	2 - Tractors (D4) 1 - Transport Tools	165,000 10,000
		4,480,000 850,000
4. Construction		
5. Other/Materials		
a. Foreign		
b. Local		
Total:	175,000	5,330,000

5. BFIDC TEX OPERATION REHABILITATION

5a. Project Profile

Program	:	Harvesting
Development Objective	:	Increase production to 65,00m ³ per annum and improve BFID's operation. Logs to be delivered to new complex at Bagaihat.
Problem Addressed	:	Logs are difficult to transport to Kaptai and BFIDC's operation are inefficient
Actions and Immediate Objectives	:	Complete feasibility study and obtain financing.
Desired Results	:	Assured supply of logs to the new complex and harvesting of teak plantation Increase species utilized in natural forest.
Implementing Agency	:	BFIDC
Beneficiaries/ Positive Impacts	:	Increased log supply to meet public demands. BFIDC should become profitable
Possible Losers/ Negative Impacts	:	Conversion of natural forests to plantations with loss of habitat for some Flora and Fauna.
Conditions Necessary for Success	:	Security for consultants and for extraction operations.
Links with other Projects	:	Relocating Kaptai manufacturing complex at Bagaihat.
Expected Activity Sequence	:	1. Complete feasibility study 2. Obtain financing 3. Procure equipment 4. Construction of industrial complex

5b. Estimating Details

Program	:	Harvesting
Project Name	:	In Kassalong RF. TEX Improvement Program
Length (Years)	:	5 Years

		Amount	
<u>Item</u>		<u>Foreign</u>	<u>Local</u>
		US	Tk
a.	Foreign 5 experts for 2 years	0.88	-
b.	Local	-	46.8
2.	Education and Training:		
a.	Foreign	0.34	-
b.	Local On the Job training	-	-
3.	Equipment Purchases:		
a.	Foreign	2.9	-
b.	Local Taxes, Duty, VAT, etc.	-	981.7
4.	Construction	-	-
5.	Other/Materials		
a.	Foreign	-	-
b.	Local	-	-
	Total:	4.12	-
		<u>6.77</u>	<u>1028.5</u>

APPENDIX 7
BFIDC TEX OPERATIONS INVESTMENT COST ESTIMATES

WOOD HARVESTING

APPENDIX 7

BFIDC TEX OPERATIONS INVESTMENT COST ESTIMATES

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1. REQUIRED EQUIPMENT AND COSTS

1a. Production 28,900 m³/A

Equipment	No. Unit	CIF Price	Million Taka		Total Costs
			Local Costs	Unit Costs	
224 KW Crawler Tractor, Ripper, U Blade	-	16.2	11.3	27.5	-
149 KW Crawler Tractor, Ripper S Blade	-	12.8	8.9	21.7	21.7
149 KW Crawler Tractor, Winch A Blade	-	13.0	9.1	22.1	-
116 KW Crawler Tractor, Winch A Blade	-	8.8	6.1	14.9	14.9
125 KW Front End Loader, Log Forks	1	7.8	5.5	13.2	13.2
89 KW Hydraulic Loader - 20 T	1	9.5	7.3	16.7	-
89 KW Rubber Tyred Skidder	-	5.2	3.7	8.9	-
200 KW Log Truck and trailer (Est.)	-	8.3	5.8	14.1	-
100 KW Grader	-	7.7	5.4	13.1	-
125 KW Front and Loader, Bucket	-	7.8	5.5	13.2	-
6-8 m ³ Capacity Tippers (3 Axle Hino)	2	2.3	1.3	3.6	7.3
Bowser - 9000 L. Truck and Pump	1	.6	.5	1.1	1.1
Transport Trucks, (Hino 2 Axle)	2	.6	.5	1.1	2.7
4 x 4 Diesel LWB	1	.4	.8	1.2	1.2
Pick Up - Diesel Crew Cab	1	.3	.6	1.0	1.0
Cars 1	.2	.7	.9	.9	-
Power Saws	10	.07	.03	.1	1.0
Speed Boat - Outboard Motor (Est)	1	.2	.6	.8	.8
Hand Saws, Tools, Etc.	-	-	-	-	-
Housing (Staff from Kaptai)	-	-	-	-	-
D4H with Winch	1	3.2	2.2	5.4	5.4
Subtotal					49.5
Spare Parts - 10% of New Equipment					4.9
Subtotal					54.4
Add Spare Parts for Old Equipment					3.9
Total*					58.3

* Equivalent to US 1.50 million

1b. Production 43,300 m³/A

Equipment	No. Unit	CIF Price	Million Taka		Total Costs
			Local Costs	Unit Costs	
224 KW Crawler Tractor, Ripper, U Blade	-	16.2	11.3	27.5	-
149 KW Crawler Tractor, Ripper S Blade	1	12.8	8.9	21.7	21.7
149 KW Crawler Tractor, Winch A Blade	1	13.0	9.1	22.1	22.1
116 KW Crawler Tractor, Winch A Blade	1	8.8	6.1	14.9	14.9
125 KW Front End Loader, Log Forks	2	7.8	5.5	13.2	26.5
89 KW Hydraulic Loader - 20 T	-	9.5	7.3	16.7	-
89 KW Rubber Tyred Skidder	-	5.2	3.7	8.9	-
200 KW Log Truck and trailer (Est.)	-	8.3	5.8	14.1	-
100 KW Grader	-	7.7	5.4	13.1	-
125 KW Front and Loader, Bucket	1	7.8	5.5	13.2	13.2
6-8 m ³ Capacity Tippers (3 Axle Hino)	4	2.3	1.3	3.6	14.6
Bowser - 9000 L. Truck and Pump	1	.6	.5	1.1	1.1
Transport Trucks, (Hino 2 Axle)	3	.6	.5	1.1	3.4
4 x 4 Diesel LWB	2	.4	.9	1.2	2.4
Pick Up - Diesel Crew Cab	2	.3	.6	1.0	1.9
Cars 2	.2	.7	.9	1.8	-
Power Saws	15	.07	.03	.1	1.5
Speed Boat - Outboard Motor (Est)	2	.2	.6	.8	1.6
Hand Saws, Tools, Etc.	-	-	-	-	1.0
Housing (Staff from Kaptai)	-	-	-	-	-
D4H with Winch	1	3.2	2.2	5.4	5.4
Subtotal					133.1
Spare Parts - 10% of New Equipment					13.3
Subtotal					146.4
Add Spare Parts for Old Equipment					6.5
Total*					152.9

* Equivalent to US 3.9 million

1c. Production 65,000 m³/A

Equipment	No Unit	CIF Price	Million Taka		
			Local Costs	Unit Costs	Total Costs
224 KW Crawler Tractor, Ripper, U Blade	1	16.2	11.3	27.5	27.5
149 KW Crawler Tractor, Ripper S Blade	1	12.8	8.9	21.7	-
149 KW Crawler Tractor, Winch A Blade	1	13.0	9.1	22.1	22.1
116 KW Crawler Tractor, Winch A Blade	1	8.8	6.1	14.9	14.9
125 KW Front End Loader, Log Forks	2	7.8	5.5	13.2	26.5
89 KW Hydraulic Loader - 20 T	-	9.5	7.3	16.7	-
89 KW Rubber Tyred Skidder	-	5.2	3.7	8.9	-
200 KW Log Truck and trailer (Est.)	-	8.3	5.8	14.1	-
100 KW Grader	-	7.7	5.4	13.1	-
125 KW Front and Loader, Bucket	1	7.8	5.5	13.2	13.2
6-8 m ³ Capacity Tippers (3 Axle Hino)	4	2.3	1.3	3.6	14.6
Bowser - 9000 L. Truck and Pump	2	.6	.5	1.1	2.7
Transport Trucks, (Hino 2 Axle)	5	.6	.5	1.1	5.7
4 x 4 Diesel LWB	4	.4	.9	1.2	4.8
Pick Up - Diesel Crew Cab	4	.3	.6	1.0	3.8
Cars	2	.7	.9	1.8	-
Power Saws	20	.07	.03	.1	2.0
Speed Boat - Outboard Motor (Est)	2	.2	.6	.8	1.6
Hand Saws, Tools, Etc.	-	-	-	-	2.0
Housing (Staff from Kaptai)	-	-	-	-	34.0
D4H with Winch	1	3.2	2.2	5.4	5.4
Subtotal					182.6
Spare Parts - 10% of New Equipment					18.3
Subtotal					200.9
Add Spare Parts for Old Equipment					8.5
Total*					209.4

* Equivalent to US 5.4 million

1d Production 13,000 m³/A

Equipment	No Unit	CIF Price	Million Taka		
			Local Costs	Unit Costs	Total Costs
224 KW Crawler Tractor, Ripper, U Blade	-	16.2	11.3	27.5	-
149 KW Crawler Tractor, Ripper S Blade	-	12.8	8.9	21.7	-
149 KW Crawler Tractor, Winch A Blade	-	13.0	9.1	22.1	-
116 KW Crawler Tractor, Winch A Blade	1	8.8	6.1	14.9	14.9
125 KW Front End Loader, Log Forks	-	7.8	5.5	13.2	-
89 KW Hydraulic Loader - 20 T	-	9.5	7.3	16.7	-
89 KW Rubber Tyred Skidder	-	5.2	3.7	8.9	-
200 KW Log Truck and trailer (Est.)	-	8.3	5.8	14.1	-
100 KW Grader	-	7.7	5.4	13.1	-
125 KW Front and Loader, Bucket	1	7.8	5.5	13.2	13.2
6-8 m ³ Capacity Tippers (3 Axle Hino)	2	2.3	1.3	3.6	7.3
Bowser - 9000 L. Truck and Pump	-	.6	.5	1.1	-
Transport Trucks, (Hino 2 Axle)	1	.6	.5	1.1	1.1
4 x 4 Diesel LWB	-	.4	.9	1.2	-
Pick Up - Diesel Crew Cab	2	.3	.6	1.0	1.9
Cars	2	.7	.9	-	-
Power Saws	5	.07	.03	.1	.5
Speed Boat - Outboard Motor (Est)	1	.2	.6	.8	.8
Hand Saws, Tools, Etc.	-	-	-	-	-
Housing (Staff from Kaptai)	-	-	-	-	-
D4H with Winch	-	3.2	2.2	5.4	-
Sub-total					39.7
Spare Parts - 10% of New Equipment					4.0
Subtotal					43.7
Add Spare Parts for Old Equipment					3.3
Total*					47.0

* Equivalent to US 1.2 million

2. EQUIPMENT REPLACEMENT SCHEDULE, Annual Production Target 65,000 M³

Item/Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Annual Numbers																				
224 KW Crawler Tractor, Ripper, U Blade								1							1					
149 KW Crawler Tractor, Ripper S Blade			2	2					2	2								2	2	
149 KW Crawler Tractor, Winch A Blade								1												
116 KW Crawler Tractor, Winch A Blade		1	1			1							1	1						1
125 KW Front End Loader, Log Forks			2		2		2		2	2			2	2	2			2		2
89 KW Hydraulic Loader-20 T								1			1									
89 KW Rubber Tyred Skidder			1	1																
200 KW Log Truck and trailer (Est.)		2			2		2					2				2			2	2
100 KW Grader				1											1					
125 KW Front and Loader, Bucket							1							1						
6-8 m ³ Capacity Tipper (3 Axle Hino)							2	2						2	2					
Bowser-9000 L Truck and Pump									1											
Transport Trucks, (Hino 2 Axle)					2	2		2	3							2	3			2
4 x 4 Disc LWB					2	2				2					2	2				2
Pick Up - Diesel Crew Cab					2						2							2		
Cars				2																
Power Saws																				
Speed Boat-Outboard Motor (Est)					2					2										2
Hand Saws, Tools, Etc.																				
Housing (Staff from Kaptai)																				
D4H with Winch																				1
Total (Million Tk)																				
- Equipment	43.1	93.5	60.9	64.9	16.8	80.6	108.5	18.3	68.4	62.8	28.2	32.7	61.9	43.5	70.6	31.6	61.9	60.9	66.2	
- Parts	4.4	9.5	6.1	1.7	1.7	8.4	11.5	1.7	6.6	6.2	2.8	3.3	6.1	4.5	7.4	3.4	6.1	6.1	6.8	
Total	47.5	103.0	67.0	71.0	18.5	89.0	120.0	20.0	75.0	69.0	31.0	36.0	68.0	48.0	78.0	35.0	68.0	68.0	73.0	

3. TECHNICAL TRAINING PROGRAMME Cost US\$

Category	Term Years	Basic Salary/A	Air Fares (2.5)	Local Costs	Total Annual
Consultants					
Logging Engineer	2	60,000	12,000	24,000	96,000
Road Supervisor	2	50,000	12,000	24,000	86,000
Logging Supervisor	2	60,000	12,000	24,000	106,000
Management	2	70,000	12,000	24,000	86,000
Accountant	2	70,000	12,000	24,000	86,000
Total	2	50,000	12,000	24,000	86,000
					<u>470,000</u>
Total Estimated Cost (2 years)					940,000
Contingency					60,000
Total					<u>1,000,000</u>

Education and Training	Project Year			
	1	2	3	4
Study Tours				
Air Fares Various	-	4,000	4,000	4,000
Living Allowances(4 Men)	-	8,000	8,000	8,000
Subtotal		12,000	12,000	12,000
Forestry Schools				
Air Fares (4)	12,000	12,000	-	-
Tuition	12,000	24,000	24,000	24,000
Allowances	12,000	24,000	24,000	24,000
Subtotal	36,000	48,000	48,000	48,000
Technical Training				
Air Fares & Allowances	30,000	30,000	30,000	30,000
Total	66,000	90,000	90,000	90,000

Notes:

1. Production target 65,000 m³/A

4. ESTIMATED EXTRACTION COST, KASSALONG RF

The cost estimate assumes that BFIDC improves their efficiency and productivity achieving an annual production of 65,000 m³. No increase in manpower is needed to meet this production target if BFIDC management has the authority to control their workforce. Adequate foreign exchange is made available. Other Assumptions are:

- All of the logs from Kassalong are trucked to Bagaihat.
- Sufficient Management Staff are transferred from Kaptai to make production decisions.
- Trucking distances increase by 2 km/A which is equivalent to Tk 6.5 m³/km.
- No allowance included for inflation, increased labour costs and or higher royalty rates.
- No security problems.

Item	Annual Cost Estimate, Tk/m ³	
	1992	2012
Variable Costs	830	1,090
Fixed Costs	500	500
Subtotal	1,330	1,460
Royalty	1,476	1,476
Total	2,806	2,936

Note: Cost of water transport including loading and unloading by self propelled barge from Rankhiang is estimated for Teak to be Tk.133/m³.

**APPENDIX 8
REFERENCES**

PROJECT 372001/2
FORESTRY MASTER PLAN
BANGLADESH TA 1355-BAN

ASIAN DEVELOPMENT BANK
MANILA PHILIPPINES
DATE: MARCH 1992

WOOD HARVESTING

APPENDIX 8
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