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Report No. 7218

PROJECT COMPLETION REPORT

BURMA

FORESTRY II EAST PEGU YOMA PROJECT
(CREDIT 949-BA)

April 28, 1988

Asia Regional Office

CURRENCY EQUIVALENTS

US$1 = Kyat 6.5

WEIGHTS AND MEASURES

1 Hectare = 2.47 Acres
1 Millimeter = 0.04 Inch
1 Hoppus foot (Hf) = 1.273 cubic feet true geometric measure
1 Hoppus ton (ht) = 50 Hf in round logs
or 50 ft^3 of converted lumber
or 63.75 ft^3 true geometric measure
or 1.805 m^3 roundwood under bark
1 metric ton = 2.205 pounds
1 meter = 1.09 yards

GLOSSARY OF ABBREVIATIONS

EEC	European Economic Community
ERR	Economic Rate of Return
FAO/CP	Food and Agriculture/World Bank Cooperative Program
FD	Forest Department
FRI	Forest Research Institute
GBH	Girth breast height
GOB	Government of Burma
GOF	Government of Finland
MAF	Ministry of Agriculture and Forests
OE	Operations Evaluation Department
PSC	Project Steering Committee
PU(TC)	Project Unit (Extraction and Sawmilling)
PU (FD)	Project Unit (Plantations)
TC	Timber Corporation
UNDP	United Nations Development Programme

GOVERNMENT OF BURMA FISCAL YEAR

April 1 to March 31

THE WORLD BANK
Washington, D.C. 20433
U.S.A.

Office of Director-General
Operations Evaluation

April 28, 1988

MEMORANDUM TO THE EXECUTIVE DIRECTORS AND THE PRESIDENT

SUBJECT: Project Completion Report on Burma Forestry II
East Pegu Yoma Project (Credit 949-BA)

Attached, for information, is a copy of a report entitled "Project Completion Report on Burma Forestry II East Pegu Yoma Project (Credit 949-BA)" prepared by the FAO/IBRD Cooperative Program together with an Overview prepared by the Asia Regional Office. Further evaluation of this project by the Operations Evaluation Department has not been made.

Attachment

PROJECT COMPLETION REPORT

BURMA

FORESTRY II EAST PEGU YOMA PROJECT
(CREDIT 949-BA)

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PROJECT COMPLETION REPORT

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FORESTRY II EAST PEGU YOMA PROJECT
(CREDIT 949-BA)

PREFACE

This Project Completion Report (PCR) reviews implementation of the Forestry II (East Pegu Yoma) Project in Burma, for which Credit 949-BA in the amount of US$35.0 million was approved in August 1979. The credit closing date was originally September 1985, but this was extended to September 1986. The final disbursement was made on April 13, 1987. The undisbursed balance of US$10.1 million was cancelled at that time.

The PCR was prepared by the FAO/CP. An Overview, prepared by the Asia Region, is based on the PCR, the Staff Appraisal Report (SAR) No. 2564-BA, dated July 17, 1979, the President's Report (No. P-2611-BA) dated July 24, 1979, the Credit Agreement dated September 21, 1979, and Bank supervision mission reports. The Project Performance Audit Report (OED Report No. 4801, dated November 28, 1983) on the preceding project--Burma Forestry I Project (Credit 493-BA) and reports relating to the ongoing Burma Wood Industries II Project (Credit 1444-BA) were also consulted.

The project has not been subjected to audit by the Operations Evaluation Department.

The draft report was sent to the Borrower on February 22, 1988 for their comments. However, no comments have been received.

BURMA - FORESTRY II (EAST PEGU YOMA) - CR.849-BA

PROJECT COMPLETION REPORT - BASIC DATA SHEET

KEY PROJECT DATA	Appraisal Estimate	Actual	Actual as % of Appraisal Estimate
Total Project Cost (US$ mil.)	86.4	62.4	72
Credit Amount (US$ million)	35.0	24.9	71
Co-financing (EEC) "	8.0	5.2	66
Date Physical Components Completed	12/84	9/86	
Institutional Performance	Adequate	Adequate	
Agro-economic Performance	Adequate	Adequate	
No. of Direct Beneficiaries	3,000 workers 1,700 farmers	2,300 Over 2,000	77 > 118
Economic Rate of Return	Over 100%	Over 100%	

PROJECT DATES	Original Plan	Actual
Project Brief		Feb. 1977
Appraisal Report No.2463-BA		July 1979
Date of Negotiations		June 1979
Date Board Approval		Aug. 1979
Credit Signing		21/9/79
Date of Effectiveness		20/12/79
Credit Closing Date	30.9.85	30/9/86

Cumulative Disbursement

Fiscal Years: (IDA Credit)	FY80	FY81	FY82	FY83	FY84	FY85	FY86	FY87
Appraisal Estimate (US$ million)	0.4	13.9	29.3	33.4	34.5	35.0	-	-
Actual (US$ million)	-	1.2	10.7	16.0	18.8	21.1	24.2	24.9
Actual as % of Appraisal		9	37	48	54	60	69	71

Date of Final Disbursement April 13, 1987

Fiscal Years: (EEC Credit)	FY80	FY81	FY82	FY83	FY84	FY85	FY86
Appraisal Estimate (US$ million)	0.4	5.8	8.0	8.0	8.0	-	-
Actual (US$ million)	-	-	1.0	2.9	3.2	5.2	5.2
Actual as % of Appraisal	-	-	13	36	40	64	66

Date of Final Disbursement April 13, 1987

Mission Data

Mission:	Sent by	Date (month-year)	No. Persons	Man-days in field	Specialization represented 1/	Performance Rating 2/	Trend 3/	Type of problem 4/
Preparation	IDA/CP	5/78	5	60	a,b,c,m	-	-	-
Preparation	IDA/CP	7/78	2	10	a,b	-	-	-
Pre-appraisal	IDA	6/78	1	4	b	-	-	-
Appraisal	IDA	11/12/78	6	192	a,b,c	-	-	-
Follow-up	IDA	2/79	1	4	c	-	-	-
Supervision I	IDA	11/79	3	54	b,c,m	1	-	-
Supervision II	IDA	5/80	1	5	b	2	2	O,M
Supervision III	IDA	2-3/81	3	33	a,b,c	2	1	O,M
Supervision IV	IDA	11/81	3	42	a,b,c	2	1	M,T
Supervision V	IDA	4-5/82	1	14	b	2	2	M,T
Supervision VI	IDA	10/82	1	5	b	2	2	M,T
Supervision VII	IDA	4-5/83	3	60	a,b,c	1	1	M,T
Supervision VIII	IDA	3-4/84	2	36	a,b	1	2	T
Supervision IX	IDA	12/84	1	19	b	1	2	T
Supervision X	IDA	3/85	1	24	b	1	2	T
Supervision XI	IDA	12/85	2	16	a,b	2	2	T
Supervision XII	IDA	6/86	2	12	a,b	3	3	

1/ a = agriculturist; b = economist; c = engineer;
m = management specialist; t = training specialist.
2/ 1 = problem free; 2 = moderate problems; 3 = major problems.
3/ 1 = improving; 2 = stationary; 3 = deteriorating.
4/ F = financial; M = managerial; T = technical; O = Other.

Other Project Data

Borrower	Socialist Republic of the Union of Burma
Fiscal Year	1 April to 31 March
Name of Currency	Kyat
Executing Agency	Ministry of Agriculture and Forests

Currency Exchange Rate:

Appraisal Year	1979/80	US$1.00 =	6.07 Kyat (K)
Intervening Years Average	1980/81	" =	6.61
	1981/82	" =	7.38
	1982/83	" =	7.78
	1983/84	" =	8.04
	1984/85	" =	8.47
	1985/86	" =	8.45

PROJECT COMPLETION REPORT

BURMA

FORESTRY II EAST PEGU YOMA PROJECT
(CREDIT 949-BA)

EVALUATION SUMMARY

Objectives

The project was to be the first phase of forestry and forest industry development in the East Pegu Yoma and was expected to increase teak and hardwood export revenues, increase the supply of sawn hardwood to the domestic market, augment teak supplies through compensatory plantations and select suitable fast growing species and establish land clearing techniques for future large-scale plantation of fast growing species. In the project area, increase in extraction capacity, road construction. rehabilitation of existing hardwood sawmills and construction of new hardwood sawmills were provided for. Rehabilitation of Okkyin teak sawmill in Rangoon, improvement of rail transport capacity for timber and technical assistance and overseas training for extraction, sawmilling and plantations were also included.

Implementation Experience

Implementation was slower than anticipated mainly due to delays in equipment procurement. Disbursement had only reached about 60% of appraisal estimate at the original credit closing date. Credit closing was extended by 12 months, at which time 71% of the credit amount had been disbursed, and the remainder was cancelled. Fuel shortages were another principal reason for delays in implementation.

Results

Though there was some delay in project implementation mainly due to delays in equipment procurement, the project was an overall success. Most appraisal targets were equalled or exceeded. Shortfalls occurred in targets for production of nonteak hardwood logs and sawnwood, mainly due to the inability to promote exports and inadequate sawmilling capacity, and for construction of all-weather and extended logging season roads, mainly due to shortages of fuel and road building materials. The economic rate of return (ERR) at completion is estimated at over 100% as anticipated at appraisal.

Sustainability

The Timber Corporation (TC), which was the principal implementing agency, was considerably strengthened through the project. Its efficiency was improved in part through decentralization of operations which permitted greater flexibility, and in part through improvement in logging and sawmilling infrastructure. The outlook for sustainability appears good, at least over the assumed economic life

of the several processing facilities provided which extends to 25 years in the case of the newly constructed hardwood sawmills.

Findings

The main lessons which emerge from the project's implementation experience are as follows: (i) the economy-wide problem of foreign exchange scarcity, as evidenced by shortages of fuel and building materials, which adversely affected project implementation and may affect post-project maintenance activities, was underestimated at appraisal; (ii) in view of the slow and cumbersome procurement procedures in the country, more lead time should be allowed for procurement activities; (iii) the scope and timeframe for building up an export market for nonteak hardwoods have proven to be overoptimistic as the project failed to meet the nonteak hardwood export target envisaged at appraisal; more work needs to be done to build up nonteak hardwood exports; and (iv) in the plantation program, the effectiveness of the Taungya silvicultural method, using landless hill people and thus eliminating shifting cultivation and the resultant loss of forest, was established.

Other points of interest are:

- The low prices of hardwood (nonteak) products in the local market, together with high average milling costs per ton due to low utilization of capacity and low conversion rates, have led to a deterioration in financial viability of hardwood production. Attempts should be made to increase the proportion of export grade hardwood sold on the local market and to price it accordingly.

- The appraisal expectation that the sawmills constructed and rehabilitated under the project will operate on double shift has not yet materialized due to insufficient power and non--availability of trained operators, the latter factor at least partly resulting from the reluctance of TC to close some of the old sawmills and relocate labor, which is considered politically undesirable.

- Unlike Forestry I Project (Credit 493-BA), technical assistance staff under Forestry II were recruited through a specialized forestry consulting company and this arrangement has proved effective.

- Technical assistance and training under the project have considerably strengthened the TC's organizational structure and performance and continued the process started under Forestry I to decentralize the TC's logging and sawmilling operations.

- The Project Unit concept worked well and facilitated ongoing decentralization efforts.

- Due to fuel shortages and a larger than anticipated availability of elephants, much greater reliance was placed during

project implementation on an elephant/mechanical system of extraction than on fully mechanized extraction envisaged at appraisal.

- While no major negative environmental effects of project activities have been identified, the possibility of an insect or disease attack in large-scale monoculture plantations and possible erosion problems in teak plantations should be kept under review.

BURMA

FORESTRY II - EAST PEGU YOMA PROJECT (CRECIT 949-BA)

PROJECT COMPLETION REPORT

Overview

1. This overview is primarily based on the PCR for the Forestry II Project (Cr. 949-BA) prepared by FAO/CP and presented to the Bank in November 1987. The PCR presents a detailed review of the project's performance and impact and the Region agrees with the findings and conclusions of the PCR. This overview is divided into two sections: section A, which is based on the PCR, summarizes the important aspects of project implementation and impact; and section B, which utilizes information from documents (listed in the Preface) other than the PCR, complements and elaborates some parts of the PCR relating to implementation issues and lessons learned.

A. Project Implementation and Impact

2. Project Objectives and Components. The project was designed as the first phase of forestry and forest industry development in the East Pegu Yoma to increase teak and hardwood export revenues; increase the supply of sawn hardwood to the domestic market; augment teak supplies through compensatory plantations; and select suitable fast-growing species and establish land clearing techniques for future large-scale plantation establishment of fast growing species. These objectives were to be achieved through: (a) investment in new, and rehabilitation of existing extraction equipment which would increase annual extraction capacity by about 290,000 hoppus (H) tons and reduce teak log losses; (b) road construction to improve access to currently inaccessible or poorly accessed forest areas; (c) upgrading mechanical maintenance capacity in the project area; (d) rehabilitation of existing hardwood sawmills and construction of new hardwood sawmills in the project area to increase annual capacity and reduce timber wastage by improved equipment and sawing techniques; (e) rehabilitation of Okkyin teak sawmill in Rangoon and provision of minor spares to private teak sawmills; (f) investment in 29,500 acres of teak plantations; (g) investment in about 6,000 acres of large-scale trial plantations for selection of appropriate fast growing species and the development of land clearing techniques; (h) upgrading of timber wagons and locomotives to provide adequate unit-train timber transport capacity; and (i) technical assistance for extraction, sawmilling and plantations and overseas training for personnel of the Timber Corporation (TC) and Forest Department (FD) in management, extraction, workshops, roads, finance and milling and marketing.

3. Project Cost and Financing. The project was to be implemented over a 5-year period from 1979 to 1984. Total project cost was estimated at K 578.9 million (US$86.4 million equivalent) with a 58% foreign exchange component. Excluding taxes and duties, project cost was estimated at US$65.5

million equivalent, of which IDA was to finance US$33.0 million (53% of project costs), EEC US$8 million (12%) for equipment, Government of Finland US$1.4 million (2%) for technical assistance, UNDP US$0.2 million (less than 1%) for overseas training and Government of Burma (GOB) the remaining US$20.9 million equivalent (32%).

4. Project Implementation. Despite a good start, implementation of the project was slow. By September 1985, the original credit closing date, disbursement was only about 60% of the appraisal estimate. The credit closing date was extended to September 1986 and final disbursement was made on April 13, 1987. By then only 71% of the credit amount had been disbursed; the rest was cancelled. Delays in equipment procurement and fuel shortages were the principal reasons for slower than anticipated project implementation. However, the project eventually achieved most of its targets (see Table 1).

5. Changes in Project Scope and Design. Changes introduced in project during implementation were relatively minor. Of these, the significant change was in harvesting and land clearing methods. At appraisal, mechanical harvesting and land clearing was expected to be introduced on a large scale. Ho ever, during implementation, mechanical harvesting was reduced due to fuel shortages and greater cost-effectiveness of combined elephant/mechanical method of extraction. Moreover, use of power saw was discontinued after a short trial period due to high operation and maintenance cost of these machines and the scarcity of skilled operators. The use of crosscut saws was found to be more economical and socially more acceptable. For plantations, mechanical site preparation was tried on 75 acres but further trials were postponed indefinitely due to high costs, fuel shortages and shortage of suitable equipment and trained operators.

6. Status of the Project at Completion. The total project cost at completion was K 480 million (US$62.4 million equivalent) or 83% of the appraisal cost estimate in Kyat terms and 72% in dollar terms. Major factors contributing to lower costs were reduced procurement of logging and road construction equipment and spare parts, reduced road construction and deletion of the rehabilitation of private sawmills and local consultant components. Costs in dollar terms were lower than those in Kyat terms due to devaluation of the Kyat by about 13% in the project implementation period.

7. Despite the implementation delay and shortfalls in some appraisal targets, the project was an overall success. The re-estimated economic rate of return (ERR) is very high (para. 19). Significant increases in export revenues, employment and efficiency of sawmilling have resulted from the project. The status of major individual components of the project at completion is briefly discussed below and shown in Table 1.

Table 1: PROJECT PHYSICAL DEVELOPMENT

Item	Unit	Appraisal (--FY80/81-86/87--)	Actual
Teak Logs	(000 Ht)	895.0	977.4
Hardwood Logs	(000 Ht)	1,772.0	1,172.0
Hardwood Sawnwood	(000 Ht)	640.7	576.6
All-Weather Road (AW) Construction	(miles)	120.0	18.[illegible]
Extended Logging Season (ELS) Roads	(miles)	240.0	45.5
Feeder Roads	(miles)	1,900.0	2,005.0
AW/ELS Road Maintenance	(miles)	1,600.00	1,872.0
Hardwood Mills Rehabilitation	(units)	16	16
Hardwood Mills Construction	(units)	2	2
Teak Mill Rehabilitation	(units)	1	1
New Workshops and Improvements	(units	7	7
Administrative Building	(units)	1	1
Equipment Rehabilitation	(units)	167	167
Teak Plantations	(acres)	29,500	40,610
Species Trials	(acres)	6,100	6,911
Log Wagons Rehabilitation	(units)	190	190
Locomotives Rehabilitation	(units)	5	5

8. Extraction. The extraction operation has been generally successful. In the case of teak, log production exceeded appraisal targets in the project implementation period (Table 1). However, hardwood log production, which was mostly consumed domestically, has been lower than expected since available sawmilling capacity was inadequate. As mentioned earlier (para. 5), a significant feature was the much greater use of elephant/mechanical method of extraction rather than mechanical logging envisaged at appraisal.

9. Road Construction and Maintenance. The project envisaged improvement of road infrastructure to facilitate the mechanical extraction of logs and reduce reliance on the river rafting system, thus reducing losses and lowering costs. However, while construction of feeder roads (usable for 120 days a year) exceeded appraisal targets, that of all-weather roads (usable for at least 300 days a year) and extended logging season roads (usable for 150 days a year) considerably fell short of appraisal targets (Table 1). This was due to the unforeseen fuel shortage, shortage of road building materials, scarcity of skilled labor and reduced mechanical extraction.

10. Mechanical Equipment Rehabilitation and Maintenance. As envisaged at appraisal, new workshops were established and fully equipped to carry out

the required maintenance work and equipment was rehabilitated (Table 1). The maintenance program and organization established under the project has been working satisfactorily and workmanship is of a high professional quality.

11. Hardwood Sawmill Construction and Rehabilitation. While rehabilitation of 16 existing state sawmills was accomplished early in the project, construction of two new hardwood sawmills and their full operation were delayed due to late and sporadic arrival of equipment, machinery and building materials; insufficient electric power; and scarcity of trained operators. The last two factors also account for non-introduction of double shifts envisaged at appraisal for the new mills. Due to delays in construction of new hardwood sawmills and non-introduction of double shift operation, sawn hardwood supply to the domestic market was 15-20% lower than appraisal expectations. Moreover, the quality of end-products of rehabilitated mills has not improved significantly due mainly to poor sawmill design and green lumber handling techniques.

12. Okkyin Teak Mill Rehabilitation. Though mill rehabilitation was accomplished, the conversion rate (41%) remains low compared to that in existing hardwood saw mills rehabilitated under the project (50-54%) and one of the two new saw mills constructed under the project (60%). The quality of end products also remains low. The reasons for these are low quality of saw logs received (even low quality teak logs have been exported leaving only very poor quality logs for the teak mills), problems of log transfer, worn out head rigs and wood flow patterns in resaw areas. Like the two new mills constructed under the project, the Okkyin mill has also not operated on a double shift basis, as envisaged at appraisal, due to power problems and non-availability of trained and experienced operators, the latter at least partly resulting from the reluctance of TC to close some of the old sawmills and relocate labor, which is considered politically undesirable.

13. This project component had also included provision of spare parts, mainly circular saws, at cost, to 14 private (hire) saw mills operating under contract for the TC. Due to the high cost of these spare parts, the "hire" mills preferred to continue working with the used state sawmill blades which were available at lower cost. The reason for this is partly the low contract price for milling which has not changed appreciably over the last seven years. Funds for the component were, therefore, not utilized.

14. Plantation Program. Both teak plantation and species trial plantation acreages exceeded appraisal targets (Table 1). As envisaged at appraisal, the major silvicultural method used was the well established Taungya system, employing the landless hill people who generally practice shifting cultivation. They were given financial compensation and allowed to use the land for subsistence crop production. The Taungya system, besides achieving lower than anticipated cost of plantation establishment (K 322/acre), had the advantage of settling the landless hill people who would otherwise have continued the shifting cultivation practice, thus depleting forest resources at an average of 2-3 acres per family per year. Each plantation of 600-800 acres required some 400 workers (200 families) and resulted in the saving of 400-600 acres from denudation and of 8-12 Ht of recoverable wood per acre of plantation. Another significant achievement in

this component was the establishment of a teak seed orchard, which is expected to provide quality seed for future plantations. The species trial plantations have provided valuable information on appropriate silvicultural techniques, spacing models and mixed stands which will help formulate methods for establishment of future large-scale plantations. Besides the Taungya method, mechanized methods for site preparation were also tested. However, as mentioned earlier (para. 5), after mechanical preparation of one pilot area, the experiment was discontinued since the available equipment did not have the required handling characteristics and was not considered appropriate in view of the prevailing fuel constraints.

15. Rail Transport Rehabilitation. The rehabilitation of log wagons and locomotives was accomplished as anticipated at appraisal (Table 1) and helped improve sawnwood and log transportation and reduce transportation costs.

16. Technical Assistance and Training. The technical assistance and overseas training components, financed by Government of Finland and UNDP/FAO respectively, were implemented successfully. The technical assistance, provided through a Finnish consultancy company, was satisfactory to GOB. This was in marked contrast to the disappointing experience with technical assistance under Forestry I Project (Cr. 493-BA). Recruitment of all technical assistance personnel through one company proved advantageous as it facilitated coordination and communication. The impact of technical assistance and training on project implementation and post-project continuation of activities by trained personnel is considered to be substantial.

17. Management and Bank Performance. Throughout the project period, management was of a high professional standard. Local and overseas training is considered to have enhanced staff quality and helped sustain post-project activities. Based on the experience gained under Forestry I project (Cr. 493-BA), the project aimed at decentralizing the TC's logging and sawmilling operations in the project area. Significant progress has been made in this direction and the TC considerably strengthened in its organizational structure and performance. The performance of contractors and suppliers was also satisfactory. However, considerable delays in the procurement of materials and equipment occurred due to the cumbersome and slow procurement procedures prevailing in the country. Preparation of unaudited and audited reports also suffered long delays due to work overloads in the TC, FD and Central Auditor-General's office. IDA's supervision of the project was generally satisfactory. Over the 7-year project period, a total of 12 supervision missions were carried out or approximately two missions per year. The frequency and skill mix of supervision missions were appropriate. However, supervision missions had little success in resolving the issues of low local timber prices (Government regulated) and the lack of efforts to increase hardwood exports (see further paras. 21 and 23).

18. Financial Viability. Excluding costs and benefits from the Okkyin teak sawmill (which is not located in the project area), rail transport rehabilitation, teak plantation, technical assistance and overseas training (grants), but including teak logs transferred to the Okkyin teak sawmill, the estimated net income (after tax) of the East Pegu Yoma project is sufficient to cover debt services and future replacement of equipment. Relative to

appraisal estimates, the cash flow is less favorable due to: (i) the higher log and sawnwood production assumed in the 'without project' situation but lower log and sawnwood production in the 'with project' situation and delayed operation and high operating costs of the sawmills; (ii) a substantial duties and taxes component in project investment and operating costs; and (iii) low product prices for hardwoods (non-teak) (see further para. 21).

19. Economic Impact. The PCR reestimates in 1987 constant terms the economic rate of return (ERR) for the East Pegu Yoma Project (over 100%), Okkyin teak sawmill (over 50%), teak plantation (39%) and the whole project, excluding Okkyin teak sawmill, rail transport rehabilitation and technical assistance and overseas training (over 100%). Compared to estimated opportunity cost of capital of 10% in Burma, these are very attractive rates of return. These ERRs are about the same as expected at appraisal except for teak plantation which substantially exceeds the appraisal estimate of 14%, mainly due to about 40% higher acreage (Table 1).

B. Implementation Issues and Lessons Learned

20. Though implementation issues were not serious enough to prevent the project from being successful, they provide lessons for the design and implementation of similar projects in the future. These issues are discussed below.

21. Timber Pricing. In early 1987, financial prices (Government-determined) of hardwood logs and sawnwood in the local market were 25-50% of the estimated economic prices, under the assumption that they could have been converted to export grade. The divergence between financial and economic prices has remained over the project period as financial prices have not been adjusted appreciably over this period. The low financial prices were a major reason for the disinterestedness of private sawmills in the project component for provision of spare parts (para. 13). The low product prices along with high duties and taxes and high operating costs (mainly due to low conversion rates), have also jeopardized the financial viability of sawmills (para. 18) and will increasingly do so in future, if no price and quality adjustments occur. The pricing issue is being addressed under Wood Industries II project (Cr. 1444-BA). But GOB has not yet taken a decision to increase prices of wood products.

22. Macroeconomic Issue. The economy-wide problem of foreign exchange scarcity was evidently underestimated at appraisal. The shortages of fuel and building materials resulting from the foreign exchange problem considerably affected the project and led to some design modifications (para. 5). The post-project maintenance activities may also be adversely affected by the continuing difficulty in obtaining spare parts.

23. Hardwood Exports. The project aimed to increase teak exports from 7,800 to 17,200 Ht p.a. and hardwood exports from less than 200 Ht to 35,000 Ht p.a. While teak exports have considerably exceeded appprasial targets and expected to stabilize at 38,000 Ht, hardwood exports were negligible and are expected to stabilize at 6,000 Ht (logs only). The scope and time frame for building up a hardwood export market have proven to be overoptimistic mostly

due to lack of quality improvements and to Government's priority allocation of resources to teak extraction. Much more work needs to be done to build up hardwood exports.

24. Procurement. Delay in tendering and procuring equipment, machinery and building materials resulted in delays in construction of the two new hardwood mills and rehabilitation of the Okkyin teak mill. Procurement procedures prevailing in the country were slow and cumbersome. The problem was aggravated by the Government's unfamiliarity with the EEC tender rules for equipment to be purchased under the EEC loan. In future projects, more lead time should be allowed to deal with the complicated procurement procedures in the country.

25. Double Shift Operation. At appraisal, it was anticipated that the two new hardwood sawmills and the rehabilitated Okkyin teak mill will operate on double shift. However, this has not yet materialized due to insufficient power and nonavailability of trained operators, the latter factor at least partly resulting from the reluctance of TC to close some of the old sawmills and relocate labor, which is considered politically undesirable. Thus higher efficiency from double shift operation, at least in the new hardwood sawmills which have a conversion rate of 60% compared to only 50-54% for older mills, has not been achieved and the sawnwood milling capacity and supply of sawnwood in the domestic market continue to be inadequate.

26. Forest Master Plan. Most of the forest inventory data is very old and may not be reliable. Under the project, GOB was to prepare a program for the development of a Forest Master Plan by December 31, 1980. However, this had to be delayed pending the results of the National Forest Survey and Inventory Project supported by FAO/UNDP. The inventory was expected to be completed before the end of 1987. The completion of this inventory and establishment of a forest management plan are high priorities.

27. Environmental Issues. No major negative environmental effects of project activities have been identified. In fact, a positve environmental impact of the project was brought about by the deployment of the hill people in the Taungya plantation, eliminating shifting cultivation and the resultant loss of forest, and replanting large areas of degraded reserve forests with productive forests. However, some issues need further investigation under future projects. The large tracts of land under monoculture plantations could impose a future threat due to insect or disease attack and some concern has also been expressed about possible erosion problems in teak plantations. A significant feature of project implementation was the much greater reliance on elephant/mechanical system of extraction than on fully mechanized extraction envisaged at appraisal (para. 5). This was due to fuel shortages and a larger than anticipated availability of elephants. While the mechanized system of extraction along with use of road transport has undeniable economic advantages over the elephant/float system in terms of reduced losses of logs in transit, reduced time between felling and milling and greater harvesting of non-teak hardwoods, it can also have some negative environmental impact because machinery damages the forest more than elephants. To this extent, greater use of elephants during project implementation had a positive environmental impact.

28. However, environmentalists have expressed concern that the use of elephants in the forests is aggravating the decline in the total elephant population in Burma.[1/] Domesticated elephants do not breed very well and, with a high proportion (estimated over 50%) of the national herd in captivity, this has a significant effect on the overall population dynamics. Environmentalists have suggested that elephant management should be reviewed to determine, among other things, ways in which the management of elephants in captivity could be changed in order to encourage breeding, and changes in the capturing process which would reduce mortality.[1/] Some work on this has been done under an FAO project in Burma and further review deserves consideration.

1/ Project Performance Audit Report (Report No. 4801), Burma Forestry I Project (Cr. 493-BA), OED, November 28, 1983.

BURMA

FORESTRY II (EAST PEGU YOMA) - CR.949-BA

PROJECT COMPLETION REPORT

I. BACKGROUND

A. Introduction

1.1 The Forestry II - East Pegu Yoma Project for which Credit 949-BA for US$35 million was approved on 9 August, 1979 and became effective on 20 December, 1979, was to be implemented over a five-year period. The project complemented the Forestry I project, for which IDA had provided a US$24 million credit in 1974. This second forestry project had been designed mainly to increase teak and hardwood <1> exports, increase the domestic market supply of sawn hardwood and augment teak supplies through plantation development.

B. The Forestry Sector

1.2 Climate and topography have combined to give Burma a rich forest cover containing many tree varieties. The forests of Burma cover about 96 million acres or 57% of the land area; of this some 24 million acres are reserved forest, half of which is teak reserve. Burma has eight forest types, deciduous forest being the most important, and there are over 120 commercial hardwood tree species with teak, Kanyin, Pyinhado, Paduk and Gurgin currently being the preferred species. Other forest types contain bamboo and coniferous species. Currently about 35% of the forest resource (15% of teak) is inaccessible because of topography and security. Taungya shifting cultivation affects about 660,000 ac per year on a 6-year cycle, however, controlled Taungya is used successfully to establish plantations with the farmers intercropping between planted trees.

1.3 Burma has one of the oldest forest departments in the world managing the forests. The first plantations were established prior to 1860; the earlier plantations were for teak enrichment and have since reverted to jungle status. Since 1962, about 2,000 ac of teak, 1,000 ac of Pyinhada and 3,000 ac of other species have been planted annually. Since 1969, some 20,000 ac of Eucalyptus have been planted for watershed protection and fuelwood. Until 1980 about 200,000 ac of plantations had been established, 50% of which was teak.

<1> In this report, 'hardwood' refers to non-teak hardwood.

1.4 Although inventory data on forest stocking and yields are out of date, it is felt that the present rate of extraction can be sustained for the next forty years. GOB has undertaken a forest inventory, the first results of which are expected for the Pegu Yoma area during late 1987. In 1978, the annual output of teak was about 310,000 Ht, out of an AAC <1> of 400,000 Ht (300,000 Ht accessible areas). The annual teak output has been substantially increased to 350,000 Ht in 1986 by reducing the girth at breast height from 7' 6" to 6' 6". Teak yield can also be increased for a short period to eliminate a backlog of approximately 440,000 Ht of girdled, unfelled trees. <2> The production of hardwood in 1978 was about 375,000 Ht and increased to about 720,000 Ht in 1986, well within the range of 1.1 million Ht AAC.

1.5 The geography of Burma is dominated by the Irrawaddy River complex, which drains two-thirds of the country, allowing access to many of the forest areas and providing cheap, if slow, transport for rafting logs from remote forest areas to Rangoon. Insurgency affects significant areas of forests. Where insurgency has been controlled, for example in the project area, rich natural forests are available for development.

1.6 The project area is located northeast of Rangoon on the eastern slope of the Pegu-Yoma mountain range. The area extends from the Sitang river in the east to the Pegu-Yoma Ridge in the west and from just south of Pegu to north of Yamithin. It is roughly rectangular in shape, about 50 x 280 miles, centred around Toungou and measures about 140,000 square miles, of which approximately 6,500 square miles (4 million acres) are reserve forests. The topography of the project area ranges from gently undulating hills along the foothills to ragged, steep terrain broken by many streams and rivers. The elevation ranges from 400 to 2,000 ft. The soils in the area are sandy loams with very limited clay and laterite content making a poorly structured base for road building. The climate is monsoonal with two distinct seasons. The dry season lasts from November till April and has an average monthly precipitation of 10 mm with a low of 1 mm in January, and an average maximum temperature of 34°C, reaching 37°C in April. The wet season from May to October has an average precipitation of 300 mm per month with highs of 833 mm in July and August. The wet season temperature averages around 30°C with a low maximum temperature of 29°C during August.

1.7 The climatic conditions are a predominant factor in the extraction process. Stumping (skidding) is done mostly in the wet and early dry season. Green teak and hardwoods are transported in the dry season on feeder roads to depots located along all-weather roads, for transportation in the wet season to mills and distribution depots. The dry teak is floated along streams t rivers for rafting.

1.8 The project area has a transportation corridor running north-south with the main Mandalay-Rangoon highway and railway. The Sitang River is also an important transportation route for teak logs. East-west transportation is negligible with about four access routes into the forest at present. The present project area population is about 2.5 million, with 10% living in the

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<1> Allowable annual cut.

<2> Standing teak is girdled to kill it and allow natural drying while standing. After three years, the teak is felled and skidded to stream beds for floating/rafting to mills or depots.

urban areas of Pegu, Toungoo, Yadeshi, Lewe and Pyinmana; the rest live in villages located mostly along the transportation corridors, with some scattered as far as the foothills. Although the forest areas are sparsely populated, no problems have been encountered in obtaining labour for forest operations.

1.9 The project area includes 6 of the 36 Divisions in Burma: north and south Pyinmana; north and south Toungoo; and north and south Pegu. The area has 20% of Burma's teak reserve forests and 17% of the reserved hardwood forests; it contains about 20% of the standing teak and 21% of merchantable hardwood inventories with over 4 ft girth at breast height (gbh). About half of the reserve forests have never been felled for hardwood due to a lack of road infrastructure. The area contains some 120 species of potentially commercial trees of which presently about 30 are utilised with a preference for about 6 species.

C. PCR Information Source

1.10 Upon completion of the project, the Timber Corporation had started to gather data and information for the PCR preparation and an internal document had been prepared summarizing the main project achievements. An FAO/World Bank Cooperative Programme mission visited the country in June 1987 to assist with the preparation of the draft. This report is based on the findings of the mission and on project documents and reports prepared by GOB and the World Bank during project preparation, appraisal and implementation.

II. PROJECT FORMULATION

A. Identification, Preparation and Appraisal

2.1 The Forestry I Project (CR.493-BA), signed in December 1974, included Feasibility Studies for further forest development. These studies identified a priority investment area in East Pegu Yoma, on the basis of which GOB prepared a project identification report in 1977, covering extraction, saw milling and plantation establishment for this area.

2.2 Project preparation was undertaken by GOB through a Project Preparation Committee (PPC) comprising the Forestry Department (FD), the Timber Corporation (TC) and the Ministry of Planning and Finance, supported by the Ministry of Agriculture, Planning Department. An IDA and FAO/CP mission visited Burma in May 1978 to assist the PPC with preparation work. A further FAO/CP assistance mission in July 1978 reviewed preparation work of Technical Annexes and provided an outline for the preparation of the final report, which was completed in October 1978.

2.3 On receipt of the preparation report, an IDA mission appraised the project in December 1978 with no substantial changes in project concept and design.

B. Project Description

2.4 The project which was to be implemented over a 5-year period from 1979 to 1984 in the East Pegu and Yoma districts pursued the following major objectives:

1) to increase teak and hardwood export revenues by increasing projected teak log and sawnwood exports to 68,100 Ht and hardwood exports to 42,400 Ht;

2) to increase the supply of sawn hardwood to the domestic market from 36,400 Ht to 105,300 Ht;

3) to augment teak supplies through compensatory plantations; and

4) to select suitable fast growing species and to establish land clearing techniques for future large-scale plantation establishment of fast growing species.

2.5 The project, was designed as the first phase of integrated forestry and forest industry development in the area, and included the following components:

a) setting up project units (PU) in the project area for extraction and saw milling under the Timber Corporation (TC), and for plantations under the Forestry Department (FD);

b) provision of new, and rehabilitation of existing extraction equipment which would increase annual extraction capacity by about 290,000 Ht and reduce teak log losses;

c) construction of roads to improve access to currently inaccessible or poorly accessed forest areas;

d) upgrading the maintenance capacity for mechanical equipment in the project area;

e) rehabilitation of existing hardwood saw mills and the construction of new hardwood saw mills in the project area which would increase existing annual capacity by about 21,000 Ht, add 24,000 Ht of new single shift annual capacity and reduce timber wastage by improved equipment and sawing techniques;

f) rehabilitation of the Okkyin teak saw mill in Rangoon, provision of minor spares to other teak saw mills to provide teak saw milling capacity to meet increased project output, and provision for minor equipment to Timber Corporation Milling and Marketing Department;

g) planting 29,500 acres of teak;

h) large-scale trial plantations on about 6,000 acres for selection of appropriate fast growing species and the development of land clearing techniques;

i) upgrading 190 timber wagons and 5 locomotives on the Taungdwingyi-Rangoon rail line to provide adequate unit-train timber transport capacity to Rangoon;

j) provision of 16 man years technical assistance for extraction, saw milling and plantations; and

k) provision of 137 man months for overseas and various local training.

2.6 Project costs were estimated at US$86.4 million over a period of 5 years. TC and FD would be the main implementing agencies under the overall coordination of MAF. The economic rate of return for the whole project was estimated at over 100%.

C. Negotiations and Effectiveness

2.7 The Council of Ministers approved the Credit on 5 July, 1979, and the credit agreement was signed on 21 September, 1979. It was agreed at negotiations, that the credit would become effective when GOB had established the Project Steering Committee (PSC) and both the Timber Corporation (TC) and Forestry Department (FD) Project Units (PU) had appointed Project Directors for their PUs, with qualifications and experience acceptable to IDA. It was further stipulated that the EEC Special Action Credit and Government of Finland grant would have to be effective.

2.8 All the above conditions were fulfilled in a timely manner and the loan become effective on 20 December, 1979.

2.9 The tenure of the project was for five years, commencing from FY79/80 to the end of September 1985, however, due to delays in procurement and construction/rehabilitation of sawmills, the credit closing date was extended for one year and IDA credit was closed on September 30, 1986. IDA continued to disburse against eligible expenditure up to April 13, 1987 in order to clear the disbursement backlog.

III. IMPLEMENTATION

A. Start-up

3.1 The project had a good start. Even prior to effectiveness, a number of actions were initiated by GOB and the institutions involved, facilitating timely project start-up and subsequent implementation.

3.2 Under the project two separate Project Units (PU) were to be set up. The Timber Corporation was to set up one unit in the project area responsible for extraction, sawmilling, road construction and maintenance. This unit started activities in May 1980, i.e. the beginning of FY80/81.

3.3 The other PU was to be established by the Forestry Department (FD) and was responsible for the implementation of the plantation and species trial components. This unit started its activities immediately after credit effectiveness, in December 1979.

B. Changes in Project

3.4 At appraisal, it was foreseen that mechanical harvesting and land clearing would be a major component of the project and would be introduced on a large scale. During project implementation, it was found necessary to reduce the mechanical harvesting component mainly because of fuel shortages. In addition, it was found that the combined elephant/mechanical method of extraction was more cost effective. For this reason, less logging equipment was acquired and the number of elephants increased from 800 to 1,100 to carry out all stumping. It was however necessary to increase the number of wheeled loaders and 6.5 m ton trucks to achieve the set extraction targets.

3.5 It was also agreed with IDA to discontinue the use of power saws after a short trial period because of the expense of operating and maintaining these machines and the lack of skilled operators. The use of crosscut saws was found to be more economical and socially more acceptable.

3.6 One sawmill location was changed from Kyungon to U Yin Daw because of better site characteristics and improved access to road, rail and power and proximity to a good labour source.

3.7 Mechanical site preparation for plantations was tried on 75 ac but further trials were postponed indefinitely because of high costs, fuel shortages and lack of suitable equipment and trained operators.

3.8 The all-weather (AW) road construction was not carried out to the extent anticipated due to high cost of construction and reduced mechanical extraction.

3.9 Provision of spare parts to private "hire" mills did not take place due to the comparatively high cost.

C. General Implementation Experience

3.10 Despite a good start, project implementation was slower than anticipated mainly due to delays in equipment procurement. With regard to teak extraction, project implementation has been extremely successful although mechanization was not introduced at the anticipated scale. Sawnwood production fell short of expectations mainly due to delays in the construction/rehabilitation of mills and the failure to introduce a double shift operation. Hardwood extraction and production targets were not met resulting in a reduction of project benefits anticipated at full development.

3.11 Throughout the project implementation period, and especially during the last 2-3 years, project implementation suffered from diesel shortages. Whereas the SAR anticipated a requirement of 1.6 million gallons per annum at full development, in the last project year, total diesel allocation was less than 1 million gallons.

3.12 The project substantially strengthened the institutions involved, and in particular assisted the TC in advancing and firming up decentralization efforts. Project management was generally satisfactory and GOB support to the project was good throughout.

3.13 With some delay, (see Table 1) the project achieved most of its physical development targets as shown below:

Project Physical Development

Item		SAR Estimate (. . FY80/81-86/87	Actual . .)
Teak logs	('000 Ht)	895.0	977.4
Hardwood logs	" "	1,772.0	1,172.0
Hardwood sawn wood	" "	640.7	576.6
All-weather road (AW) construction	(miles)	120.0	18.5
Extended logging season (ELS) roads	"	240.0	45.5
Feeder roads	"	1,900.0	2,005.0
AW/ELS road maintenance	"	1,600.0	1,872.0
Rehabilitation hardwood mills	(units)	16	16
Construction hardwood mills	"	2	2
Rehabilitation teak mills	"	1	1
New workshops and improvements	"	7	7
Administrative building	"	1	1
Equipment rehabilitation	"	167	167
Teak plantations	(acres)	29,500	40,610
Species trials	"	6,100	6,911

D. Implementation of Main Components

Extraction

3.14 Annual Timber production at full development was to increase from 130,000 Hoppus tons (Ht) to about 423,000 Ht. Of this, about 45,000 Ht would be dry teak, 88,000 Ht green teak and the remaining 290,000 Ht commercial hardwood.

3.15 It was foreseen that three extraction systems would be used to increase the teak and hardwood production in the project area. The three methods were:

i) Elephant/float - elephant extraction of dry girdled teak in steep, remote areas to streams where it is floated in the wet season to rivers for rafting to Rangoon.

ii) Elephant/mechanical - elephant extraction in the steeper areas to skid or feeder roads from where the logs are forwarded to a central loading area by skidders or hauled by light trucks to depots along the all-weather roads.

iii) Mechanical - the use of mechanical logging systems using crawler tractors to bunch logs to be forwarded by skidders.

3.16 Mechanical logging was intended to decrease the dependence on animals and to accelerate the reduction of teak inventory in the extraction process. By adding the use of mechanical equipment to the logging system, it was anticipated that the productivity per elephant would increase from 200 Ht to 350 Ht per year. Teak log production would increase from 60,000 Ht in 1979/80 to 132,500 Ht from 1981/82 onwards and hardwood log production was to increase from 70,000 Ht in 1979/80 to 290,000 Ht from 1982/83 onwards. Increased teak production was to come from efforts to eliminate the backlog of girdled unfelled teak and a temporary reduction in girth cutting limits. Increased hardwood production was to be achieved through increased felling, however, within the limits of the allowable annual cut.

3.17 The extraction of logs was accomplished without the large-scale introduction of the mechanised extraction system, as more elephants were made available - 1,100 instead of the estimated 800 - and the fuel shortage became more critical. Equipment requirements were therefore lower and also changes in the composition of the equipment component were necessary. Fewer tractors were required, however, more front-end loaders were needed and more 6.5 m ton lorries were purchased. Twenty self-loading units were acquired but the units were found to be too light for the heavy logs. Sixty power saws were purchased but were found unsuitable for the project due to operational costs, lack of skilled operators and maintenance difficulties.

3.18 In spite of these changes, the extraction operation has been generally successful and has, in the case of teak, actually achieved more than the projected targets as shown below (see also Tables 3 and 4):

Log Production Summary for Forestry II Project Period
('000 Ht)

	(. . . . . Teak . . . . .)			(. . . . Hardwood . . . .)		
Year	Appraisal	Actual	%	Appraisal	Actual	%
79/80 1/	60.0	-		70	-	
80/81	100.0	131.4	131	122	186.2	153
81/82	132.5	159.6	120	200	140.6	70
82/83	132.5	153.9	116	290	186.5	64
83/84 2/	132.5	165.9	125	290	133.2	46
84/85	132.5	142.1	107	290	182.4	63
85/86 3/	132.5	128.0	97	290	181.6	63
TOTAL 4/	762.5	880.9	115	1,482	1,010.5	68
86/87		96.6 5/	73		161.2	56
87/88 7/		89	67		160 6/	56
88/89		89	67		160	56
89/90		89	67		160	56

1/ Base year cutting without project.
2/ Original end of project.
3/ FY85/86 used in all calculations as end of project.
4/ Total includes FY80/81 to 85/86.
5/ New cutting budget based on allowable annual cut.
6/ Reduced cutting budget based on sawmill capacity.
7/ Projected stabilised cutting budget.

3.19 Teak production was higher than anticipated and peaked during 1983/84 with 166,000 Ht extracted. Since then, due to the reduction of the backlog of girdled teak and a resumption to logging 7' 6" gbh from the reduced 6' 6" gbh used at the start of the project, production decreased to 96,586 Ht in 1986/87. Production is estimated to stabilise at a constant 89,000 Ht from 1988/89 onwards.

3.20 Hardwood log production has been lower than expected since it had to be adjusted to the available saw milling capacity.

3.21 At the beginning of the project, large inventories of hardwood logs had been built up following increased logging during 1979/80, in anticipation of early project start-up. These were only gradually reduced as sawmilling capacity remained below expectations. Under normal circumstances, some inventory is present at all stages of extraction operation, however, logging targets were not adjusted quickly enough to take care of inventories in the system. Thanks to greater experience and better coordination, the situation has shown gradual signs of improvement.

Road Construction

3.22 To accomplish the intended extraction programme, the appraisal report foresaw the need to enhance the road infrastructure. Three major road designations were established:

a) All-weather roads (AWR) would be usable for at least 300 days per year, would have log bridges and a minimum of 4" compacted stone/laterite clay surfaces.

b) Extended logging season roads (ELS) would have log bridges, culverts and side drainage similar to the all-weather roads, but with minimal surfacing, they would be serviceable for only about 150 days per year.

c) Feeder roads, serviceable for 120 days and without bridges and only minor culverts. These units generally have a one-year life span and are mostly constructed by the Extraction Department.

3.23 Construction of 120 miles of all-weather roads, 240 miles of extended logging season roads and 1,900 miles of feeder roads were foreseen at appraisal. In addition, 1,600 miles of roads would be maintained. This basic infrastructure would facilitate the mechanical extraction of logs and reduce reliance on the river rafting system, lowering costs due to smaller inventories required. It would also reduce losses, as it has been estimated that logs are in the river system for an average of three years during which time average losses of 8% have been recorded.

3.24 Changes in the road construction programme have been considerable. This was mainly due to the unforeseen shortage of fuel supply, difficult accessibility of road building material, and a scarcity of skilled labour. Some 1,872 miles of roads were maintained and about 2,000 miles of feeder roads have been built, 75% of which by the Extraction Department and the remaining 25% by the Road Department. The increased feeder road system reflects the greater use made of the 6.5 ton trucks to transport logs from the jungle to depots. A summary of the road construction and maintenance programme is given below (see also Table 1):

AWR, ELS and Feeder Road Construction

	AWR	ELS	Maintenance	Feeder Roads
SAR	120	240	1,600	1,900
Actual	18.5	45.5	1,872	2,005

3.25 To implement the road maintenance and construction programme, the project procured equipment for two road building units in the project area. No major changes were made in the equipment component. Two extra front-end loaders were purchased to facilitate road material loading and hauling, and two additional road rollers were provided for compaction. The project also procured a rock crusher for the production of the required surfacing material (see Table 2).

3.26 The rate of equipment utilisation has been very low due to the reduced construction activities. Most of the time recorders show only 2,000 to 3,000 hours of equipment use after 4-5 years.

Mechanical Equipment Rehabilitation and Maintenance

3.27 The SAR foresaw the rehabilitation of existing equipment which still had an economic life of at least 5 years. In addition, the repair and maintenance facilities in the project area were to be improved to secure proper operation of the mechanical equipment. For this purpose, the existing agency workshops and stores were to be upgraded, two additional ones were to be constructed and a new central workshop and spare part store was to be established. All workshops were established and supplied with tools, equipment and spare parts as foreseen at appraisal and are now fully equipped to carry out the required maintenance work.

3.28 Rehabilitation of equipment took place over the project period and totalled 167 units as foreseen at appraisal (see Table 1).

3.29 The maintenance programme and organization, as established under the project, has been working very satisfactorily and workmanship is of a high professional quality. To sustain the operation it would, however, be necessary to ensure the continuous supply of spare parts.

Rail Transport Rehabilitation

3.30 To improve sawnwood and log transportation and to reduce transportation costs, the rehabilitation of 190 log wagons and repair of 5 locomotives were included in the project. The Timber Corporation was to purchase the required spare parts and provide them to the Burma Railways Corporation which would carry out the repairs and be responsible for the operation of unit trains. A total of US$1,427,000 had been allocated mainly to provide spare parts for five locomotives, brakes and bearings for the wagons.

3.31 BRC carried out the required repairs and unit trains started their scheduled service on the Taungdwingyi-Pyinmana-Rangoon line in 1981 (see Table 7). Over the project period, a total of 194,000 Mt of logs were transported. <1> Savings viz-a-viz road transport, were calculated to be K350 per ton or approximately K68 million (US$10 million) over the project period.

<1> Data for previous years not available.

Teak Wood Arrivals in Rangoon by Rail from Project Area

Units	80/81	81/82	82/83	83/84	84/85	85/86	Total	86/87
Wagons (number)	2,717	2,747	2,128	3,120	3,272	2,411	16,395	2,472
Logs (hundreds)	497	530	403	567	654	455	3,106	446
HT ('000)	33	35	28	23	38	37	194	30

Hardwood Sawmill Construction and Rehabilitation

3.32 In order to increase the production and quality of domestic sawnwood as well as to improve the teak saw milling capacity, the project foresaw the construction of two new hardwood saw mills as well as the rehabilitation of 16 state saw mills and the provision of spare parts to private (hire) mills.

3.33 Two new saw mills were to be constructed with a 12,000 Ht capacity each, increasing to 24,000 Ht on a two-shift basis. The saw mill complexes had been designed allowing for future expansion to 20,000 Ht per shift and the addition of air drying areas, dry kilns, dried lumber storage and a moulding mill. Construction of both mills was to commence in FY81/82 and to be completed by FY82/83.

3.34 Due to late and sporadic arrival of equipment, machinery and building material, the first mill at Payagalay started operation in January 1983 and full production of 12,000 Ht was only reached by FY84/85, due to insufficient electric power and a lack of trained operators. The improved design and equipment of this mill has resulted in the achievement of a conversion factor close to 60% compared to only 50-54% for older mills.

3.35 The second mill to be constructed at U Yin Daw (para 3.6) was not completed until March 1986 and could not commence operations until early 1987 due to the lack of a transformer. However, operations had to cease immediately thereafter as a storm caused severe damage to the mill building. It is now expected that the sawing can recommence by August 1987.

3.36 As indicated, it was anticipated that both new mills would operate on double shifting and were to reach full capacity of 24,000 Ht by FY83/84. Due to insufficient night-time power and a lack of trained operators, this will not, however, be possible in the foreseeable future.

3.37 The rehabilitation of 16 existing state sawmills was accomplished early in the project (1981/82) resulting in increased production, reaching a maximum output of 113,000 tons in 1982/83 or 117% of projections. Production dropped off mainly due to fuel constraints and has stabilised at 100,000 Ht. During the project period a total of 682,500 Ht (109% of SAR) were produced and conversion factors have remained constant at around 50-54%. End-product quality, however, has not significantly improved due mainly to old and poor saw mill design and green lumber handling techniques.

3.38 The project foresaw the provision of spare parts, mainly circular saws, at cost, to 14 private (hire) saw mills operating under contract for the Timber Corporation. Due to the high costs of these spare parts, the 'hire' mills preferred to continue working with the used state saw mill blades which were available at lower cost. The reason for this is partly the low contract price for milling which has not changed appreciably over the last seven years. Furthermore, spare part requirements decreased due to the closure of some of the less efficient private mills. For this reason the component has not been utilised and funds have been reallocated.

Okkyin Teak Mill Rehabilitation

3.39 Although not located in the project area, the project included the rehabilitation of the Okkyin mill as its improvement was expected to have a considerable impact on the export possibilities of teak sawnwood. After project effectiveness, a saw milling expert drew up a rehabilitation plan (1979/80) which recommended the installation of seven new band resaws and sawnwood handling equipment. In addition, the mill's road infrastructure was to be improved, new timber storage sheds and saw mill workshops to be built and the main mill building was to be partly converted to accommodate the improved lumber flow. The rehabilitation was expected to enhance productivity from an estimated 20,000 Ht (27% of original design capacity) to 50,000 Ht (67% of design capacity) per shift and to increase conversion and product quality. Total cost of rehabilitation was estimated to be US$4.6 million.

3.40 Rehabilitation of the mill commenced during 1982 and was completed in 1985 resulting in a total expenditure of about US$3.7 million. It succeeded in increasing throughput capacity which reached a maximum of 55,500 Ht in 1983/84 and has since dropped to 36,800 Ht in 1986/87, with a projected production of 39,000 Ht from 1988/89 onwards. Although maximum capacity is now 50,000 Ht, to maintain this rate of production would be difficult with the problems of log transfer, worn out head rigs and wood flow patterns in resaw areas. Another constraint is the quality of saw logs received. Even low quality logs have been exported (40,000 Ht or 232% of SAR), leaving only very poor quality logs for the teak mills. These and other variables have been major factors in the low conversion return (41%) and lower than expected quality. The Okkyin mill was scheduled to operate on a double shift basis, however, this is not expected to materialise in the near future because of power problems and non-availability of trained and experienced operators.

3.41 Some consideration could be given to relocating this mill to a hardwood producing area and reconstructing as a hardwood mill when the other teak mills in Rangoon reach full production capacity.

Plantation Programme

3.42 The project was to establish 29,500 acres of teak plantation in order to expand the future resource base and to reduce dependency on natural regeneration. At full development, the teak plantation programme was planned to provide an allowable annual cut (AAC) of about 450,000 Ht, equal to the existing AAC of teak in the whole of Burma. The teak plantations were to be distributed evenly over the whole project area and the major silvicultural method to be used would be the well established Taungya system, using the landless hill people who generally practise shifting cultivation.

3.43 In addition, provision was made for the establishment of 6,100 acres of trial plantations for fast growing species and also to establish an experiment with species mixes, spacing densities and mechanical preparation of plantation sites which would be located at the two extremes of the project area.

3.44 Furthermore, this component also provided for tractors and other machinery to establish and maintain plantations, for the construction of field offices and residential compounds, and also for the provision of local building materials for the Taungya villagers.

3.45 Teak plantations. The Forestry Department started operations in September 1979 and completed the activity as foreseen during FY84/85. As shown below, a larger area than anticipated at appraisal has been planted to teak although the FD was only reimbursed by the project up to the appraisal cost. The additional finance required was provided by FD from own resources (see also Tables 8 and 15).

Progress in Teak Plantation Establishment
(acres)

	79/80	80/81	81/82	82/83	83/84	84/85	Total	%
Appraisal	1,700	3,200	3,900	5,650	7,050	8,000	29,500	
Actual	1,701	4,142	6,649	9,190	9,521	9,407	40,610	137

3.46 As anticipated, the landless hill people have been employed to establish and maintain the plantation sites. They were given financial compensation and allowed to use the land for subsistence crop production. Besides resulting in lower than anticipated costs of plantation establishment (K322/acre), the use of the Taungya system had the advantage of settling the landless hill people who would otherwise have continued the shifting cultivation practice, thus depleting forest resources at an average of 2-3 acres per family per year. Each plantation of 600-800 acres required some 400 workers (200 families) and resulted in the saving of 400-600 acres from denudation and of 8 to 12 Ht of recoverable wood per acre of plantation.

3.47 Other benefits derived from the teak plantation programme, which were not anticipated at appraisal, were the reduced loss of marketable trees, potential pole sales from the first two thinnings and post and log sales from the third and fourth thinnings (see Table 16 and Attachment I). Furthermore, a teak seed orchard was established to obtain a superior seed source from selected (plus) trees. This orchard is expected to have an appreciable impact on the availability of quality seed for future plantations.

3.48 The benefits of large-area monoculture plantations should however be carefully monitored for environmental effects such as possible erosion or potential insect or disease epidemics.

3.49 Species trial plantations. Also this programme has been started in FY79/80 and planting was successfully completed in FY84/85, achieving 113% of the appraisal target as shown below (see also Table 8).

Progress in Species Trial Plantation Establishment
(acres)

	79/80	80/81	81/82	82/83	83/84	84/85	Total	%
Appraisal	0	900	1,000	1,400	1,400	1,400	6,100	
Actual	0	1,099	1,193	902	1,059	2,658	6,911	113

3.50 The programme was executed in cooperation with the Forest Research Institute, planting mostly indigenous fast growing commercial species with the aim of testing appropriate silvicultural techniques, spacing models and mixed stands. These trials have provided valuable information and are helping to formulate methods for the implementation of future large-scale plantations. However, no conclusive data are yet available on which future species mix or spacing can be based.

3.51 It was foreseen that, besides the use of the Taungya method for the establishment of plantations, also mechanised methods would be tested for site preparation. However, only one pilot area has been mechanically prepared. It was found that the available equipment did not have the required handling characteristics and was not appropriate in view of the prevailing fuel constraints. The experiment was therefore discontinued.

Office and Communication Facilities

3.52 In order to provide the necessary accommodation for the decentralised administration of the project under the PU (TC), the construction of one administrative building, the extension of the existing headquarters in Toungoo, housing for senior staff and upgrading of the facilities in the six agency offices was foreseen. In addition, offices and staff housing were to be provided for the two new saw mills constructed under the project. Also, the FD Project Unit was to be provided with office facilities and staff quarters.

3.53 The TC administrative offices and quarters were constructed during 1980/81 and the remaining buildings were mainly completed by 1985/86. The FD building programme was completed during the project period with major works during 1979/80 and 1981/82. Out of a planned 669 units, only 273 were constructed. This was considered to be sufficient for project needs as some buildings were transferred from other divisions.

3.54 In order to facilitate communications, the SAR foresaw the purchase of radio transmitters. The TC procured 8 sets and installed two 100 watt units in Rangoon for use by the Timber Corporation and the Project Unit. The Toungoo and Pyinmana offices were provided with 25 watt units. The remaining four 25 watt units were sent to other projects where communication difficulties were more critical.

Technical Assistance and Training

3.55 The appraisal report identified the need for managerial and technical level assistance and training to improve the utilisation of new and existing equipment and make future development in the area self-sustained. The total cost of the project's technical assistance and overseas training component had been estimated at US$2 million of which US$0.4 million would be in local currency. Foreign exchange costs of about US$0.2 million were earmarked to cover 137 man-months of overseas training for TC and FD personnel. These funds were provided as a grant under an UNDP/FAO project (see Table 9).

3.56 After the appointment of a technical assistance coordinator, responsible to the project steering committee (PSC), the training programme was successfully launched and a total of 42 people were sent abroad under the external training programme.

3.57 Sixteen man-years of expatriate consultancy assistance, amounting to US$1.4 million, were provided within the framework of the project under a grant agreement between GOB and the Government of the Republic of Finland. Out of these, assistance to TC amounted to 13.5 man-years in the fields of workshop engineering, mechanic training, as well as logging and saw milling engineering. Timber Corporation management received further technical assistance to improve management accounting and the management information system. The Forestry Department utilised a total of 2 man-years in the fields of silviculture and land clearing operations.

3.58 The actual TC consultancy appointments, starting and finishing dates are listed below:

Specialist	Start	Finish	Man-months
Maintenance engineer	5/80	11/82	30
Fitter instructor	5/80	11/82	24
Foreman fitter	9/80	3/82	19
Foreman fitter	1/84	2/84	2
Logging engineer	5/80	10/82	30
Sawmill engineer	2/80	5/83	39
Management accountant	6/80	12/81	18
TOTAL			162

3.59 The expatriate technical assistance was provided through a Finnish consultancy company to the entire satisfaction of GOB. It has proven advantageous to recruit all technical assistance personnel through one company thus facilitating communication and coordination. Benefits from both the training and technical assistance programmes were substantial. Project start-up and implementation has been facilitated, the quality of existing manpower enhanced and an additional cadre of well trained personnel built up to secure proper continuation of activities even after the closure of the project.

E. Project Costs, Financing and Disbursement

Project Costs

3.60 Total project costs were estimated at K578.9 million (US$86.4 million) including foreign exchange costs of K140 million (US$20.9 million) and duties and taxes of K105.9 million (US$15.8 million). Excluding technical assistance and training, about K495.1 million and K70.4 million were estimated for TC and FD respectively. Tables 10 and 11 present actual project expenditures and a comparison between project cost estimates at appraisal and actual costs. Actual project costs were K480 million, or 83% of the appraisal cost estimates. Major factors contributing to lower costs were mainly reduced procurement of logging and road construction equipment and spare parts, reduced road construction and maintenance, deletion of the rehabilitation of private sawmills and local consultant components, and non-utilisation of the unspecified fund provided to meet physical and price contingencies. The low procurement of equipment resulted in direct savings on duties and taxes of about K35 million (US$4.5 million). Total savings in the project were about K115 million (US$15 million). In terms of US dollars, project costs were 62.4 million, or 72% of the project costs estimated at appraisal. Project costs were much lower due to the above reasons and the devaluation of the Kyat by about 13% during the project implementation period.

Financing and Disbursement

3.61 Total external financing was estimated at US$44.6 million to cover 100% foreign exchange costs (excluding reserve procurement of US$5.1 million which would be procured locally and financed by GOB), or 68% of total project costs net of taxes and duties. The appraised and actual financing is shown in Table 12.

3.62 The actual total external financing was US$32.5 million, or 79% of total project costs net of taxes and duties (US$40.9 million). GOB's contribution was US$29.9 million, or 48% of total project costs, which was higher than appraisal estimates (24%). IDA and EEC financing was only 71% and 68% respectively of the total estimated credits, while the grant from Finland was 43% higher than the estimates and the grant from UNDP was fully utilised.

3.63 IDA's disbursements were slow during the early years of the project, while EEC's disbursements lagged two years behind schedule. Delays in the procurement of equipment and the recruitment of consultants were major reasons. Total disbursements as of 30 June, 1987 were as shown below:

Cumulative Disbursement - (US$ million)

FY	Appraisal Estimate IDA	EEC	Total	Actual IDA	EEC	Total	Actual as % of Appraisal Estimate
80	0.4	0.4	0.8	-	-	-	-
81	13.9	5.8	19.7	1.6	- 2/	1.6	8
82	29.3	8.0	39.3	11.	0.6	11.8	30
83	33.4	-	41.4	16.9	2.9	19.8	48
84	34.5	-	42.5	18.8	3.5	22.3	52
85	35.0	-	43.0	21.2	4.1	25.3	59
86	-	-	-	24.2	5.4	29.6	69
87 1/	-	-	-	24.9	5.4	29.6	69

1/ As of June 30, 1987.
2/ Insignificant.

F. Compliance with Covenants

3.64 GOB complied with most covenants in a timely manner. Only with regard to the preparation of unaudited and audited reports (Section 4.01C of Development Credit Agreement) delays of over 2 years were encountered. According to Section 4.04, GOB was to prepare a programme for the development of a Forest Master Plan by 31 December, 1980 and promptly thereafter discuss the contents of the programme with IDA. The preparation of such a Master Plan, however, had to be delayed pending the results of a Forest Inventory Project under FAO. The inventory is now expected to be completed in fall 1987 and only then a new management plan can be established.

IV. PROJECT IMPACT

A. Intended Impact

4.1 The project aimed to increase teak exports from 7,800 to 17,200 Ht per annum and hardwood exports from less than 200 Ht to 35,000 Ht per annum. In addition, the supply of sawn hardwood to the local market was to increase from approximately 35,000 to 105,000 Ht per annum. Compensatory teak plantations of approximately 29,500 ac would be established to reduce dependency on natural regeneration and augment future teak supply. Trials with fast growing species and mechanical land clearing would provide the required experience for the selection of suitable species and for future large-scale plantation establishment.

4.2 It was anticipated that about 1,700 landless farmers would participate in plantation establishment and maintenance under Taungya cultivation. This would increase the annual income of each Taungya family from K1600 per year to K3000.

B. Incremental Exports

4.3 Teak wood production increased from the estimated 80,000 Ht in the 'without project' situation to 128,000 Ht in 1985/86 with a maximum of 165,900 Ht in 1983/84. In 1986/87, production decreased drastically and is expected to stabilise at 89,000 Ht due to the decline in the standing dry teak inventory as the AAC is being reduced in view of the return to the original diameter cutting limits of 7 ft 6 inches gbh.

4.4 Of this total teak production, already in the first project year 21,000 Ht were exported, exports increased to 53,700 Ht in FY84/85 and subsequently levelled off at 38,000 Ht in FY88/89.

4.5 Teak export revenues at the annual extraction level of 89,000 Ht are estimated at about K260 million (US$40 million) per annum at present prices, of which K210 million (US$32.5 million) or 80% would be from the export of 30,000 Ht logs, and K50 million (US$6.5 million) or 20% from the export of 8,000 Ht sawnwood. This represents an annual incremental teak export revenue of about K95 million (US$15.5 million) over the assumed export revenues of K139 million (US$14.6 million) from 7,800 Ht logs and 13,500 Ht sawnwood in the 'without project' situation.

4.6 Hardwood production increased in the early stages of the project to a maximum of 186,500 Ht in 1982/83 and stabilised around 160,000 Ht (Table 14). Although the SAR anticipated that approximately 35,000 Ht would be exported annually, exports were negligible. Annual incremental hardwood export revenues at the annual extraction level of 160,000 are estimated to be marginal at only K13 million per annum (US$2 million), derived mainly from the export of 6,000 Ht logs. In this respect, the project failed to achieve its impact on export revenues.

C. Sawnwood Production

4.7 Sawn hardwood supply to the domestic market increased substantially as a result of the project, however, it never achieved SAR projections. Already in 1980/81, sawnwood out-turn reached 76,700 Ht and peaked in 1982/83 with 89,100 Ht (see Table 5). The main reason for the persistent shortfall of about 15% in supply of sawnwood can be attributed to the delays in the construction of new mills and postponed double shift operation. Therefore the supply of sawnwood in the country remains critical.

D. Plantation Production

4.8 The establishment of teak plantations progressed better than anticipated, and exceeded the 29,500 ac planned to be planted by about 11,000 ac. The maintenance of these plantations require substantial financial and manpower resources (Tables 15 and 16) but Government is committed to provide the required finance for the continuation of the programme.

4.9 At this stage, it is too early to assess the impact of the plantation programme in full. However, the plantations which were established at the beginning of the project show already promising financial results. A pilot sales operation of the poles of the first thinning was succesfully carried out in 1986/87 and resulted in the sale of 5,000 Ht valued about K6.5 million (US$1 million).

E. Trial Plantations

4.10 The trial plantations have provided valuable information and are helping to formulate the methods of implementing future large-scale plantations. However, no final data are available yet. Mechanical land preparation has been discontinued.

F. Technological Changes in Logging and Milling

4.11 The project provided for the incorporation of mechanical extraction and transportation of logs to reduce losses and the reliance on animal power. These technological changes were not completely achieved, partly due to fuel shortages and a larger than anticipated availability of elephants. Thus a greater than expected use was made of the elephant/mechanical system, using small 6.5 ton lorries to transport logs to depot areas.

4.12 The use of self-loading equipment was not successful due to the lightness of the units. The project also encountered problems with the road building programme, limiting the need for the more sophisticated technological concepts proposed in the extraction process.

4.13 The improvement of sawmilling technology through construction of new mills achieved the goals set and the conversion went up from average 52% in the old mills to 61% in the new mills.

G. Environmental Effects

4.14 The major environmental impact of the project was brought about by the deployment of the hill people in the Taungya plantation, eliminating shifting cultivation and the resultant loss of forest. Large areas of degraded reserve forests have been replanted with productive forests. However, the large tracts of land under monoculture could impose a future threat due to insect or disease attack and some concern has also been expressed about possible erosion problems in the teak plantations.

4.15 No lasting negative environmental effect could be identified as a result of project activities.

H. Employment

4.16 The incremental employment provided by the project was expected to amount to 3,000 posts. Due to the lesser than anticipated employment under the forest component, additional posts created are now estimated to be 2,200 - 2,400.

4.17 The land preparation, planting and plantation maintenance was expected to provide employment on a more permanent basis for about 1,700 Taungya farmers in the various areas. The response to this approach was better than foreseen and over 2,000 are presently engaged in these activities.

V. INSTITUTIONAL PERFORMANCE AND DEVELOPMENT

A. Implementing Agencies

5.1 As all extraction and plantation activities were to take place in reserved forest areas, the Ministry of Agriculture and Forestry (MAF) was given responsibility for project implementation, except for the rehabilitation of the rolling stock to be carried out by BRC.

5.2 Under MAF, the Timber Corporation carried out the extraction, road building and saw milling components, whilst the Forestry Department implemented the teak plantation and trial component. As foreseen at appraisal, a Project Steering Committee (PSC) was set up to coordinate activities among these agencies and with other agencies and Ministries as required.

5.3 For the purpose of project implementation, the Timber Corporation established a Project Unit (PU) within its headquarters in Toungoo. As foreseen, the PU (TC) had six Department Heads, viz. Extraction, Roads, Workshops, Milling and Marketing, Finance and Accounts, and Internal Audit. All Departments, sections and agencies were established as designed and only minor staffing problems were encountered throughout implementation.

5.4 The Forestry Department also established a PU with its headquarters in Toungoo to execute the plantation and species trial components. As foreseen, plantations were established and handed over by the PU to the FD after a period of five years.

5.5 Throughout the project period, management was of a high professional standard and on a continuous basis. Furthermore, staff quality of the TC and FD was enhanced at managerial and operational level through local and overseas training. All this has greatly contributed to the continuing success of the project.

5.6 Based on the experience gained under Forestry I, the project aimed at decentralising the Timber Corporation's logging and district sawmilling operations in the project area. Within the framework of the decentralised project, however, strong coordination was required which had been carried out by the Project Coordinating Committee.

5.7 Coordination between the various departments/agencies improved considerably and resulted in more streamlined operations. The supply of logs to end-users was executed in a more systematic way and logging was adjusted to processing capacities and inventories which had been building up at the end of each logging season.

5.8 Through the project, especially the Timber Corporation has been considerably strengthened in its organizational structure and performance and has taken a considerable step ahead in further decentralising its operations. Within the overall framework of the Timber Corporation, the PU (TC) operated successfully in an autonomous way throughout the project period.

B. Contractors and Suppliers

5.9 The performance of contractors and suppliers was considered satisfactory. Minor delays and deviations from specifications occurred in many instances, but did not affect project implementation as a whole. Only in the case of the U Yin Daw sawmill did the slow supply of roofing material delay the completion of the building.

5.10 Considerable delays in the procurement of material and equipment occurred, especially at the beginning of the project, due to the cumbersome and slow procurement procedures prevailing in the country. The problem was further aggravated in the case of equipment to be purchased under the EEC loan, as procurement had to be carried out under EEC tender rules, limiting also the number of suppliers to EEC member countries.

C. Reporting and Accounting

5.11 Quarterly and annual reports were prepared in time, within two months after the end of each fiscal year. Special accounts were prepared in line with IDA's required format and maintained properly by the Timber Corporation and Forestry Department. However, the preparation of unaudited and audited reports suffered long delays due to work overloads in the TC, FD and Central Auditor-General's office. The unaudited reports were completed between 8-25 months after the end of each fiscal year, while the audited reports were completed 12-29 months after the end of each fiscal year.

VI. IDA PERFORMANCE

6.1 The basic concept of the project, i.e. to enhance teak and hardwood exports and the supply of sawnwood to the local market through the improvement of logging and sawmilling infrastructure facilities and equipment, was sound. Also, the need to establish large-scale teak plantations and carry out species trials had been well identified.

6.2 Certain assumptions which at the time of appraisal were based on sound judgement, however, turned out to be too optimistic. Thus the significant change from an extraction system largely depending on animal power to a mechanised one, did not take place on a large scale partly due to fuel constraints which were not foreseen at appraisal. Also the scope and time frame for building up a hardwood export market have proven to be over-optimistic mostly due to lack of quality considerations and partly due to Government's priority allocation of resources to teak extraction.

6.3 Supervision of the project from IDA was regular and mostly by staff from headquarters. Over the 7-year project period, a total of 12 supervision missions were carried out. In general, the period between missions did not exceed 7 months. One large gap, however, occurred between May 1980 and March 1981 which might have contributed to slower than expected ordering of equipment.

6.4 Overall, IDA's supervisory effort was satisfactory and of sufficient continuity, however, more attention should have been given to the issue of low local timber prices and the lack of efforts to enhance hardwood exports.

VII. FINANCIAL AND ECONOMIC RE-EVALUATION

A. Financial Analysis

Extraction and Hardwood Sawmills

7.1 Actual and estimated operating income statements were prepared for the 16 State-rehabilitated hardwood sawmills, 14 hired private hardwood sawmills, two new hardwood sawmills and a consolidated income statement for the project (East Pegu Yoma) as shown in Tables 17-21. Sawnwood production, sale volumes and prices are given in Tables 5 and 6.

7.2 The hardwood sawmills have been operating on a one-shift basis and their out-turns have been low, ranging between 50% and 53%. For both the State and hired private sawmills, about 90% of the sawnwood was sold to mainly Government agencies and some private individuals. The remaining 10% was transferred for local sales at the Timber Corporation's selling depot located outside the project area. For the two new hardwood sawmills about one-third of sawnwood was for local sale, two-thirds for transfer and only 100 Ht for annual export. Present prices of sawn hardwood for local sale and transfer are low and estimated at K967/Ht and K985/Ht respectively. Operating costs have been high and accounted for about 80-90% of the total operating revenues mainly because of low out-turns. Due to low prices for local sales and transfer and high operating costs, the estimated operating incomes over the project period were low, but satisfactory with an average of K7.4 million per year for the State sawmills and K4 million per year for the hired private sawmills, except for the operating income of the new sawmill which was estimated to generate only K0.6 million per year. However, under GOB's heavy taxation <1> levied on the Timber Corporation's operations which is as high as 50% of the operating incomes, the estimated net income after taxes for all sawmills was reduced by 50% to about K3.8 million, K2 million and K0.3 million respectively.

7.3 The financial analysis of the East Pegu Yoma Project excludes costs and benefits from the Okkyin teak sawmill, wagon rehabilitation (BRC), teak plantation (FD), technical assistance and overseas training (grant from UNDP and GOF), but includes teak logs transferred to the Okkyin teak sawmill. The estimated net income of the project, after taxes, is satisfactory and averaged about K79 million annually over the project period which is sufficient to cover debt services and future replacement of equipment (Table 24). The high net income of the project is contributed mainly by the sale of logs which generate about 80% of the total project revenues, of which about 65% is from teak log export, 12% from local sales and transfer of teak logs and 3% from hardwood log export and local sales. Tables 22 and 23 present the actual and estimated sources and applications of funds and balance sheet summary of the project which indicate a satisfactory financial status. Current ratio has

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<1> See relevant Tables 17-19 and 21. Including export produce equalization fund, commodity and service taxes and state's contribution.

remained high between 3.1 to 6.9 times during FY80/81 to 87/88 and is expected to continue due to the high log inventory during April and May of each year which is the peak logging season. Debt service coverage ratio is high and estimated to be about 20 times over the project period.

7.4 The calculations of the internal rates of return (IRR) have been carried out in 1987 constant prices. The past project investment costs were adjusted to 1987 prices by GDP deflator factors. All equipment replacements are based on an assumed economic life of 7.5 years. Extraction and sawmilling costs are based on the 1987 estimated unit costs. The estimated 86/87 prices of logs and sawnwood are based on actual FY85/86 prices (Table 20). The IRR, calculated over 30 years (Table 24), is re-estimated at 9% compared with 14% estimated at appraisal. Major negative factors contributing to a lower IRR are the higher log and sawnwood production assumed in the 'without project' situation but lower log and sawnwood production in the 'with project' situation and delayed operation and high operating costs of the sawmills.

Okkyin Teak Sawmill Rehabilitation

7.5 Tables 25 and 26 present the income statement and calculation of IRR for the Okkyin teak sawmill. The sawmill has been operating on a one-shift basis with throughputs between 35,000 - 55,000 Ht per year during FY80/81 - 86/87 and is expected to stabilise at 39,000 Ht per year in FY87/88 and thereafter, with a low average out-turn of about 40%. Approximately 20% of total sawnwood is for local sales, 65% for export and the remaining 15% for transfer to other Timber Corporation selling depots for local sales. The operating ratio (before taxes) is satisfactory averaging between 50-65%. The operating income before taxes averages about K30.8 million per annum over the project period and the net income (after taxes) is estimated at K5.4 million per annum. The re-estimated IRR, calculated in 1987 constant prices over 15 years, is reasonable at 12%.

B. Economic Analysis

7.6 A re-estimation of the economic rate of return (ERR) has been carried out for the East Pegu Yoma Project, the Okkyin teak sawmill, the teak plantation and the whole project on the basis of 1987 constant prices. The past project investment costs, net of duties and taxes, were adjusted to 1987 constant prices by using GDP deflator factors. Foreign exchange costs were valued at the official exchange rate of US$1 = K6.5 and local costs were converted into border prices by the standard conversion factor (SCF) of 0.80. Costs of extraction and sawmilling are based on current 1987 prices, as actual prices for earlier project years were not available. The financial unit costs were then adjusted to economic costs by using SCF and several specific conversion factors (CF) as shown in the relevant tables. Replacement of equipment is based on the assumed economic life of 7.5 years. The economic prices for export sales are based on the actual average/weighted average f.o.b., Rangoon projected for 1987, while economic prices for local sales including transferred log and sawnwood are based on the world price projected for 1987 by the World Bank for similar timber, as shown in Table 27. The assumed, actual and projected log and sawnwood production and sale volumes in the without and with project situations are presented in Tables 3 to 6.

7.7 The analysis periods based on the assumed economic life of buildings and production cycle vary from 10 years for the existing hardwood sawmills, 15 years for the Okkyin teak sawmill, 25 years for the newly constructed hardwood sawmills to 65 years for teak plantations. However, since the discount value beyond Year 50 is insignificant, the analysis of the teak plantation has been carried out over 40 years excluding the final benefit from log production during Years 60-65. Tables 28 to 31 present cost and benefit streams for the individual components and the East Pegu Yoma Project. The results of ERRs are summarised below:

	ERR (%)	
	SAR	PCR
East Pegu Yoma Project 1/	90	over 100
Okkyin teak sawmill	-	over 100
Teak plantation 2/	14	39
Whole project 1/ 2/	over 100	over 100

1/ Excluding technical assistance and overseas training, Okkyin teak sawmill and wagon rehabilitation.

2/ Excluding benefits from Taungya and final teak log production (Years 60-65).

7.8 The re-estimated ERRs are all very favourable compared to an estimated opportunity cost of capital of 10%. Factors contributing to higher ERRs are significant incremental log and sawnwood production during the early project period (Years 1 to 6) and reduced project costs. Since the ERR of the teak plantation alone is high, it is unnecessary to carry out separate analyses which include benefits from Taungya and final teak log production. Costs of technical assistance and overseas training were also small, and were therefore excluded from the analysis.

VIII. SUMMARY AND CONCLUSIONS

8.1 The project aimed at the development of an integrated system of extraction, saw milling and marketing to secure an increase in teak and hardwood export revenues and enhance the local market supply of sawn wood. Teak and trial plantations were to be established to secure and broaden the teak production base and develop the supply of other hardwoods. Although with some delay, the project achieved most of its physical development targets.

8.2 Hardwood extraction fell short of expectations due to the lower than expected saw mill capacity and the lack of hardwood log exports. The distance of the road construction sites from available road building and surfacing material and the fuel supply constraint impeded the planned construction of AW and ELS roads. Constraints in tendering and procuring

equipment, machinery and building materials resulted in delays in construction of the two new hardwood mills and the rehabilitation of the Okkyin teak mill.

8.3 Under the project, decentralised logging and sawmilling operations had been established thus allowing for greater flexibility. Within the overall TC operation, project management was given more independence; financial autonomy, however, remained limited. Following the success of the decentralisation efforts, TC is now committed to decentralising its operations on a nationwide basis.

8.4 During the project period, extraction of teak and hardwood was considerably enhanced, from about 80,000 Ht and 85,000 Ht to about 160,000 Ht and 186,000 Ht, respectively. This incremental extraction has also significantly augmented export revenues from teak, from K166 million (US$26 million) per annum to K260 million (US$40 million) per annum. The project has also improved sawmilling capacities and conversion factors, but has failed to have an impact on the quality of sawnwood. It only partly achieved its objective to enhance the availability of sawnwood for the local market as the supply increased only to about 85,000 Ht per annum against SAR estimates of 105,300 Ht; the project did not manage to promote hardwood exports.

8.5 A greater than estimated average of teak plantations was established, potential production of poles and posts was estimated at 1.48 million Ht and 2.43 million Ht of logs over the production cycle. Two thousand landless farmers have also benefitted from the plantation programme and Taungya cultivation has provided higher annual income at about K5,000 per family compared with about K3,000 estimated at appraisal.

8.6 Total project costs were only K480 million (US$62.4 million or 83% of appraisal estimate), due mainly to a reduction in procurement of logging, workshops and road building equipment and spare parts as well as a reduced road building programme.

8.7 Because of low out-turn which directly caused high sawmilling costs and the prevailing low prices for local sales and transfers, the operating incomes before taxes of all sawmills have been low, but satisfactory averaging between K4 million and K7.4 million per annum, except for the newly constructed hardwood sawmills which generated only about K0.6 million per annum. Moreover, under GOB's heavy taxation, the net incomes after taxes of all sawmills were reduced by 50%. Due mainly to the considerable increase in teak log sales and exports, the estimated net incomes of the East Pegu Yoma Project are satisfactory and, with an average of K79 million per annum, are sufficient to cover all investments, debt service and future equipment replacement.

8.8 The re-estimated IRRs are 9% for the East Pegu Yoma Project and 12% for the Okkyin's teak sawmill. Major negative factors contributing to the lower IRRs are the higher log and sawnwood production assumed in the "without project" situation as well as delayed construction and high operating costs of the sawmills. The re-estimated ERRs, however, are very favourable ranging from 39% for the teak plantations, over 50% of the Okkyin teak sawmill to over 100% for the East Pegu Yoma Project and the whole project.

Lessons Learned

8.9 From the experience gained during project implementation, the following lessons could be learned for the design and implementation of similar projects in the future:

a) The project's approach to integrate logging and sawmilling has resulted in more streamlined operations and in a better adjustment of supply to demand.

b) The establishment of Project Units has proven to be a well working concept, enhancing flexibility and further promoting on-going decentralization efforts.

c) The interdependance of different technical activities, within the same unit provided a strong staff motivation to work towards the common goals and resulted in a good staff morale. The success of the project can be greatly attributed to these factors.

d) At appraisal more attention should have been given to the socio-economic implications of the intended large-scale introduction of a fully mechanised logging system.

e) More detailed information on the availability of road building material and transport distances involved should have been sought at appraisal.

f) Already at appraisal, diesel availability was precarious. A scenario, assuming further restrictions should have been elaborated.

g) The introduction of double shift sawmilling was impeded by the reluctance of TC to close some of the old saw mills and relocate labour, which is considered politically undesirable.

h) Hardwood exports were not given the required attention. More promotional work and quality improvement will be required.

i) More attention should also have been given to sawnwood pricing. The Timber Corporation should urgently review the local sales and transfer prices to reflect sawmilling costs and ensure that sufficient incomes are generated to cover investment, debt service as well as future equipment replacement.

j) More lead time should have been allowed for tender formulation and ordering of equipment given the complicated procedures in the country.

Attachment I

BURMA

FORESTRY II (EAST PEGU YOMA) - CR.949-BA

Planting and Maintenance Schedule

Year		
1	-	Prepare land, clear fell and utilise timber, burn and prepare planting site. Benefit - 10-15 Ht/acre.
1	-	Plant in wet season 8.5' x 8.5' spacing, 3 weedings, Taungya cultivation, 75-80% survival.
2	-	Two weedings - no Taungya cultivation, use 5 workmen/acre.
3	-	Two weedings.
4	-	One weeding.
5	-	Plantation considered established and handed over to Territorial Conservator within the Forest Department.
6-8	-	First thinning, reduce stand to about 225 trees per acre. About 50% of the stems exceed a diameter of 4-5" mid-girth and are saleable.
15	-	Second thinning, reduce stems to 110 per acre producing 11 Ht saleable poles.
25	-	Third thinning - reduce stems to 80 per acre producing 9 Ht of saleable posts.
35	-	Fourth and last thinning - reduce stems to 50 per acre, producing 15 Ht of small logs.
60	-	Clear fell by Timber Corporation - production of good logs at 60 Ht per acre - start new cycle.

Note: In 1987, 5,000 Ht of poles were exported at a price of K1,300 (US$180) per Ht. Local price for poles is K70.

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Table 1

BURMA

FORESTRY II (EAST PEGU YOMA) - CR.949-BA

Phasing of Project Physical Development Targets

AGENCY OPERATION	Unit	79-80 SAR	79-80 Act.	80-81 SAR	80-81 Act.	81-82 SAR	81-82 Act.	82-83 SAR	82-83 Act.	83-84 SAR	83-84 Act.	84-85 SAR	84-85 Act.	85-86 SAR	85-86 Act.	TOTAL 1/ SAR	TOTAL 1/ Act.
ROAD CONSTRUCTION & MAINTENANCE																	
AW Road Construction	Mile	-	-	30	2.0	30	2.5	30	3.5	30	2.0	-	5.5	-	3.0	120	18.5
ELS Road Construction	Mile	-	-	60	-	60	2.0	60	2.0	60	5.0	-	16.5	-	20.0	240	45.5
AW/ELS Maintenance	Mile	-	-	400	320	400	360	400	390	400	280	-	247	-	270	1,600	1872
Feeder Roads	Mile	Annual program prepared during implementation															
					280		340		387		315		39.3		330	1,900	2,093
CONSTRUCTION & REHABILITATION																	
Rehab. Hardwood Mills	Unit	-	-	8	-	8	8	-	8	-	-	-	-	-	-	16	16
Constr. Hardwood Mills	Unit	-	-	-	-	2	-	-	1	-	-	-	-	-	1	2	2
Rehab. Teak Mill	Unit	-	-	1	-	-	-	-	-	-	1	-	-	-	-	1	1
New Workshops, Stores & Improvements	Unit	3	-	4	3	-	3	-	1	-	-	-	4	-	-	7	7
Administration Building & Housing	Unit	1	-	-	1	-	-	-	-	-	-	-	-	-	-	1	1
Equipment Rehab.	Unit	-	-	167	21	-	39	-	62	-	90	-	68	-	67	167	364 2/
F.D. PLANTATIONS																	
TEAK																	
Land Preparation	Acre	3,200	4,142	3,900	6,646	5,650	9,193	7,650	9,521	8,000	9,407	-	-	-	-	27,800	38,906
Planting	Acre	1,700	1,781	3,200	4,142	3,900	6,646	5,650	9,190	7,650	9,521	8,000	9,407	-	-	29,900	40,607
TRIAL																	
Land Preparation	Acre	900	1,099	1,000	1,193	1,400	902	1,400	1,059	1,400	2,658	-	-	-	-	6,100	6,911
Planting	Acre	-	-	900	1,099	1,000	1,193	1,400	902	1,400	1,059	1,400	2,658	-	-	6,100	6,911
Plantation Centres	Site	10	10	-	-	5	5	2	2	1	1	-	-	-	-	18	18
Road Construction	Mile	-	-	30	5	46	90	54	69	82	90	-	-	-	-	191	254
T.C./B.R.C. RAILWAYS REHABILITATION																	
Timber Wagons	Unit	-	-	150	75	20	75	20	20	-	20	-	-	-	-	190	190
Locomotives	Unit	-	-	4	2	-	2	1	1	-	-	-	-	-	-	5	5

1/ Includes Production Project Period FY 80/81 to FY 85/86.

2/ Includes Old Equipment Rehabilitation and major maintenance of newer equipment.

Table 2

BURMA
FORESTRY II (EAST PEGU YOMA) - CR.949-BA
Summary of Major Equipment Procurement
Now

	Extraction		Roads		Administration		Sawmills		(Bikyin) Mill		Marketing		Plantation		Total	
	SAR	Act.	SAR	Act.	SAR	Act.	SAR	Act.	SAR	Act.	SAR	Act.	SAR	Act.	SAR	Act.
240 HP Crawler Tractor	-	-	2	3	-	-	-	-	-	-	-	-	-	-	2	3
140 HP Crawler Tractor	73	48	4	4	-	-	-	-	-	-	-	-	4	5	81	57
80 HP Crawler Tractor	-	-	-	-	-	-	-	-	-	-	-	-	5	5	5	5
60 HP Wheeled Tractor	-	-	-	-	-	-	-	-	2	0	-	-	18	0	20	0
125 HP Grader	-	-	8	8	-	-	-	-	-	-	-	-	-	-	8	8
85 HP Grader	-	-	-	-	-	-	-	-	-	-	-	-	2	3	2	3
Roller	-	-	0	2	-	-	-	-	-	-	-	-	0	1	0	3
Rock Crusher	-	-	0	1	-	-	-	-	-	-	-	-	-	-	0	1
125 HP Log Loader	25	40	-	-	-	-	-	-	-	-	-	-	-	-	25	40
Bucket Loader	-	-	2	4	-	-	2	0	-	-	-	-	1	1	5	5
135 HP Skidders	15	15	-	-	-	-	-	-	-	-	-	-	-	-	15	15
Trucks																
15 M. Logging Trucks	154	98	-	-	-	-	-	-	-	-	-	-	-	-	154	98
15 M. Tippers	-	-	20	20	-	-	-	-	2	0	-	-	5	0	27	20
6.5 M. Logging Trucks	58	90	-	-	-	-	-	-	-	-	-	-	-	-	58	90
6.5 M. G.P.	-	-	-	-	12	12	-	-	5	6	-	-	18	0	35	18
6.5 M. Public Service	-	-	-	-	6	7	-	-	-	-	-	-	-	-	6	7
Recovery Vehicle	-	-	-	-	6	6	-	-	-	-	-	-	-	-	6	6
Utility Truck	-	-	-	-	2	1	-	-	-	-	-	-	-	-	2	1
3.5 M. Tow Truck	-	-	-	-	-	-	2	0	3	2	-	-	-	-	5	2
12 M. Truck	-	-	-	-	-	-	-	-	-	-	-	-	1	1	1	1
4 m/2 x 4 SMR/LMR	-	-	2	0	32	31	2	0	-	-	4	4	29	0	69	35
Minibus	-	-	-	-	-	-	-	-	-	-	-	-	1	0	1	0
Low Bed	-	-	-	-	-	-	-	-	-	-	-	-	0	1	0	1
Self Load Equip.	58	20	-	-	-	-	-	-	-	-	-	-	-	-	58	20
Power Saws	120	60	-	-	-	-	-	-	-	-	-	-	0	40	120	100
6.5 M. Fuel Bowser	-	-	3	3	10	4	-	-	-	-	-	-	4	0	17	7
2000 Gal. Water Bowser	-	-	-	-	-	-	-	-	-	-	-	-	18	0	18	0
Fork Lift	-	-	-	-	-	-	4	3	4	6	-	-	-	-	8	9
Portable Lift	-	-	-	-	-	-	4	5	3	5	-	-	-	-	7	10
Rotary Slasher	-	-		-	-	-	-	-	-	-	-	-	14	0	14	0
20 Ton Trailer	154	40				-	-	-	-	-	-	-	-	-	154	40
1 1/2 M. Trailer	-	-	-	-	-	-	-	-	-	-	-	-	1	0	1	0
Radios	-	-	-	-	8	8	-	-	-	-	-	-	-	-	8	8
	257	411	41	45	76	69	14	8	19	19	4	4	121	57	532	613

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Table 3

BURMA

FORESTRY II (EAST PEGU YOMA) - CR.949-BA

Summary of Hardwood Log Extraction and Distribution
(Mt '000)

		80-81	81-82	82-83	83-84	84-85	85-86	TOTAL 80/81-85/86	86-87	ESTIMATE 87-88
Extraction										
- Estimate										
SAR	Mt	122.0	200.0	290.0	290.0	290.0	290.0	1482.0	-	-
Actual	Mt	186.2	140.6	186.5	133.2	182.4	181.6	1010.5	161.2	160.0
Actual % of SAR	%	153	70	64	46	63	63	68	-	-
Distribution of Logs										
- Export										
SAR	Mt	-	24.0	35.0	35.0	35.0	35.0	164.0	-	-
Actual	Mt	3.3	5.6	5.2	4.3	3.7	1.0	23.1	2.0	6.0
Actual % of SAR	%	-	23	15	12	11	3	14	-	-
- Local Sales										
SAR	Mt	12.0	49.0	88.0	64.0	64.0	64.0	341.0	-	-
(inc. Plymill) Actual	Mt	18.1	23.2	29.1	22.6	27.9	20.0	141.9	70	12
	%	159	47	33	35	44	31	42	-	-
- State Sawmill Arrivals										
SAR	Mt	63.0	80.0	96.0	96.0	96.0	96.0	527.0	-	-
Actual	Mt	79.4	88.9	113.3	100.6	105.4	106.5	594.1	84	94
	%	136	77	91	65	82	86	89	-	-
Ultra Mill Arrivals										
SAR	Mt	47.4	47.0	47.0	47.0	47.0	47.0	282.4	-	-
Actual	Mt	61.1	60.0	52.0	38.7	38.6	41.1	289.5	35	38
	%	131	99	125	79	107	105	108	-	-
- New Sawmill Arrivals										
SAR	Mt	-	-	24.0	48.0	48.0	48.0	168.0	-	-
Actual	Mt	-	-	1.3	6.8	12.4	12.1	32.6	17	24
	%	-	-	25	14	25	29	25	-	24
- Other Transfer										
Actual	Mt 1/	23.3	<37.1>	<14.4>	<39.8>	<3.6>	1.0	24.3	2.0	12.0

1/ Negative volume reflects the use of logs out of inventory created by accelerated logging in 1979/80 and 1980/81.

Table 4

BURMA

FORESTRY II (EAST PEGU YOMA) - CR.949-BA

Summary of Teak Log Extraction and Distribution
(Mt '000)

		80-81	81-82	82-83	83-84	84-85	85-86	TOTAL 80/81-85/86	ESTIMATE 86-87	ESTIMATE 87-88	88-89 onwards
Extraction											
SAR	Mt	100.0	132.5	132.5	132.5	132.5	132.5	762.5	-	-	-
Actual Production	Mt	131.4	159.6	153.9	165.9	142.0	128.0	880.8	96.6	89.0	76.0
Actual % of SAR	%	131	120	116	125	107	97	116	-	-	
Distribution of Logs											
- Export											
SAR	Mt	13.0	17.2	17.2	17.2	17.2	12.2	99.0	-	-	-
Actual	Mt	21.0	34.3	28.2	51.5	53.7	40.3	229.0	40.0	40.0	30.0
Actual % of SAR	%	162	199	164	299	312	234	231	-	-	-
- Local Sales											
SAR	Mt	2.5	4.0	4.0	4.0	4.0	4.0	22.5	-	-	-
Actual	Mt	23.9	24.2	42.3	61.7	48.1	49.3	249.5	25.0	20.0	20.0
Actual % of SAR	%	956	605	1057	1542	1202	1232	1108	-	-	-
- Local Sawmills (in Project Area)											
Arrivals	Mt	15.1	10.3	10.7	19.7	14.5	4.1	74.4	3.8	2.5	2.0
- (Outside Project Area) 1/											
Arrivals	Mt	71.4	90.8	72.7	33.0	25.7	34.3	327.9	28.5	44.0	41.4
Export Log as % of Production											
SAR	%	13	13	13	13	13	13	13	-	-	-
Actual	%	16	22	18	31	38	32	26	41	45	40

1/ Includes all logs distributed by T.C. Export and Marketing Department.

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GHANA

FORESTRY II (EAST PRAM YONA) - CR.[illegible]

Hardwood Sawnwood Production and Distribution
(M³ '000)

		80-81	81-82	82-83	83-84	84-85	85-86	TOTAL 80/81-85/86	ESTIMATE 86-87	87-88
State Sawmills										
- Throughput	M³	79.4	88.8	113.3	100.6	105.6	106.5	594.1	84.6	90.0
- Out-turn	M³	43.4	46.8	60.5	55.4	57.9	48.7	312.4	46.2	49.1
- Conversion	%	54.6	52.9	53.4	55.3	54.9	46.7	52.6	55.0	54.5
Micro Mills										
- Throughput	M³	61.1	60.0	52.0	39.7	36.6	41.1	269.5	36.0	38.0
- Out-turn	M³	33.3	31.2	27.0	20.0	19.4	21.6	154.1	17.0	19.0
- Conversion	%	54.5	50.0	53.0	54.0	53.0	52.3	53.2	49.0	52.2
Mini Mills										
- Throughput	M³	-	-	1.3	6.6	12.3	14.1	34.3	17.0	24.0
- Out-turn	M³	-	-	0.8	3.8	7.4	9.0	20.0	10.2	14.4
- Conversion	%	-	-	61.5	57.5	60.1	61.0	60.0	60.0	60.0
TOTAL THROUGHPUT	M³	140.5	148.8	166.6	146.9	154.3	161.7	917.9	136.6	150.0
OUT-TURN	M³	78.7 54.0	77.7 52.2	89.1 53.5	80.1 54.0	84.7 54.9	78.0 48.7	487.1 53.1	73.4 53.97	82.3 54.0

Table 5

Table 6

BURMA

FORESTRY II (EAST PEGU YOMA) - CR.949-BA

Teak Sawnwood Production and Distribution
(Mt '000)

		80-81	81-82	82-83	83-84	84-85	85-86	TOTAL 80/81-85/86	ESTIMATE 86-87	ESTIMATE 87-88
Teak Production										
Project Area Mills										
- Log Throughput Actual	Mt	13.3	11.2	11.8	19.4	15.3	4.1	75.1	4.1	4.0
- Out-turn	Mt	5.5	4.8	4.7	8.5	7.2	2.0	32.7	1.7	1.6
- Conversion	%	41	43	40	44	47	48	44	-	-
Okkyin Sawmill										
- Log Arrivals SAR	Mt	35.0	50.0	80.0	100.0	100.0	100.0	465.0	-	
- Log Throughput Actual	Mt	36.5	35.0	43.6	55.5	50.8	44.4	265.8	36.8	39.0
- Out-turn	Mt	15.8	15.2	17.7	22.5	21.0	18.1	100.3	14.1	15.0
- Conversion	%	43	43	41	41	41	41	42	38	-
Teak Sawnwood Production										
- (Out-turn) TOTAL	Mt	21.3	20.0	22.4	31.0	28.2	[illegible].1	133.0	15.8	-
DISTRIBUTION										
Teak Sawnwood										
- Local Sales	Mt	3.4	4.6	3.5	8.0	3.5	3.2	26.2	3.0	-
- Export Sales	Mt	10.0	11.6	9.6	14.7	12.6	14.1	72.6	8.0	8.0
- Transfer	Mt	3.7	3.3	2.4	2.4	4.8	4.6	21.2	-	-
TOTAL SALES	Mt	17.1	18.5	15.5	25.1	20.9	21.9	120.0	-	-
EXPORT % OF PRODUCTION	%	47	58	43	47	45	70	54	-	-

BURMA

FORESTRY II (EAST PEGU YOMA) - CR.949-BA

Teak Wood Arrivals in Rangoon by Rail from Project Area

	Unit	80-81	81-82	82-83	83-84	84-85	85-86	TOTAL	86-87
From N. Pyinmana	Wagon	1,415	1,311	604	1,828	1,766	1,698	8,622	1,691
	Logs 00	261	246	105	312	354	315	1,593	308
	Ht 000	17	16	8	2	19	20	82	20
From S. Pyinmana	Wagon	1,302	1,204	1,399	1,260	1,479	606	7,250	774
Green Teak	Logs 00	236	245	278	250	296	117	1,422	137
	Ht 000	16	16	19	17	19	8	95	10
Dry Teak	Wagon	-	184	100	-	26	65	375	7
	Logs 00	-	32	16	-	4	16	68	1
	Ht 000	-	2	1	-	-	8	11	-
Lewe Pk	Wagon	-	48	25	32	1	42	148	-
	Logs 00	-	7	4	5	-	7	23	-
	Ht 000	-	1	-	4	-	1	6	-
TOTAL	Wagon	2,717	2,747	2,128	3,120	3,272	2,411	16,395	2,472
	Logs 00	497	530	403	567	654	455	3,108	446
	Ht 000	33	35	28	23	38	37	194	30

Table 7

Table 8

BURMA

FORESTRY II (EAST PEGU YOMA) - CR.949-BA

Plantation Establishment and Teak Production
(Ht '000)

		Year	1	2	3	4	5	6	
			79-80	80-81	81-82	82-83	83-84	84-85	TOTAL
Teak Plantation	SAR	Ac	1,700	3,200	3,900	5,650	7,050	8,000	29,500
	Actual	Ac	1,701	4,142	6,646	9,190	9,521	9,407	40,607
Trial Plantation	SAR	Ac	-	900	1,000	1,400	1,400	1,400	6,100
	Actual	Ac	-	1,099	1,193	902	1,059	2,658	6,911
TOTAL	SAR	Ac	1,700	4,100	4,900	7,050	8,450	9,400	35,600
TOTAL	Actual	Ac	1,701	5,241	7,839	10,092	10,580	12,065	47,518

Production

		Year	8	9	10	11	12	13	
- 1st Thinning 1/ Poles	Export	Ht	4,700	5,000	5,000	5,000	5,000	5,000	29,700
	Local	Ht	-	6,500	13,000	20,000	21,000	26,000	86,500
- 2nd Thinning		Year	15	16	17	18	19	20	
	Export	Ht	5,000	5,000	5,000	5,000	5,000	5,000	30,000
	Local	Ht	13,700	36,000	60,000	85,000	89,000	88,000	371,700
- 3rd Thinning Posts		Year	25	26	27	28	29	30	
		Ht	15,300	37,000	59,000	82,000	85,000	84,000	362,300
- 4th Thinning		Year	35	36	37	38	39	40	
		Ht	25,000	82,000	99,000	137,000	142,000	141,000	606,000
- Harvest (Low)		Year	80	81	82	83	84	85	
		Ht	102,000	248,000	398,000	551,000	571,000	564,000	2,434,000

1/ 1st Thinning - half of trees are saleable.

Table 9

BURMA

FORESTRY II (EAST PEGU YOMA) - CR.949-BA

Summary of Overseas Training and Consultancy

		SAR Total		79-80		80-81		81-82		82-83		83-84		84-85		TOTAL	
Overseas Training		M	MMM	M	MMM	M	MMM	M	MMM	M	MMM	M	MMM	M	MMM	M	MMM
	T.C.	35	84	-	-	15	30	-	-	31	22	3	6	5	10	34	70
	F.D.			-	-	-	-	3	38	2	6	2	8	1	2	8	52
	TOTAL			-	-	15	38	3	38	13	28	5	14	6	12	42	120
Costs	US$	200,000		-	-	58,910		55,810		43,410		21,710		20,160		200,000	
Consultancy		MMM		MMM		MMM		MMM		MMM		MMM		MMM		MMM	
	T.C.	160		1		60		63		34		4		-		162	
	F.D.	30		-		12		7		-		5		-		24	
		190		1		72		70		34		9		-		186	
Costs																	
Finn Markkaa '000						3,480		3,075		1,830		270		-		8,655	
Exchange Rate / US$						3.84		4.36		5.29		5.68		-		-	
US$ Equivalent						906,250		705,275		345,935		47,703		-		2,005,163	

Table 10

BURMA - FORESTRY II (EAST PEGU YOMA) - CR.949-BA

Project Expenditures - (K '000)

FISCAL YEAR:	79/80	80/81	81/82	82/83	83/84	84/85	85/86	86/87	TOTAL Foreign Exchange	TOTAL Local Costs	TOTAL Total
Administration & Export											
Civil works, buildings	-	-	5	-	71	571	-	-	-	647	647
Equipment	-	-	4,704	86	476	545	226	52	461	5,628	6,089
Sub-total	-	-	4,709	86	547	1,116	226	52	461	6,275	6,736
Road Construction											
Civil works	-	519	761	808	1,190	1,254	1,738	-	-	6,270	6,270
Equipment	-	1,007	12,623	12,093	2,113	9,688	2,263	10,156	31,015	18,928	49,943
Sub-total	-	1,526	13,384	12,901	3,303	10,942	4,001	10,156	31,015	25,198	56,213
Logging, Transport & Maintenance											
Civil works	-	-	37	-	527	549	20	-	-	1,133	1,1[illegible]
Equipment: logging	-	5,537	45,637	72,105	34,562	13,206	25,356	8,996	112,602	92,797	205,39[illegible]
: maintenance	-	3,573	971	2,693	-	1,337	-	38	2,734	5,878	8,612
: supervision	-	1,497	-	129	-	-	-	-	101	1,525	1,626
Sub-total	-	10,607	46,645	74,927	35,089	15,092	25,376	9,034	115,437	101,333	216,770
Equipment Rehabilitation	-	4,344	4,036	1,123	79	34	1,001	3,302	8,262	5,657	13,919
Kate Hardwood Sawmill Rehab.											
Civil works	-	-	-	126	-	836	-	-	-	962	962
Equipment	-	-	6,258	222	-	530	-		4,504	2,506	7,010
Sub-total	-	-	6,258	348	-	1,366			4,504	3,468	7,972
Kate Hardwood Sawmill (new)											
Civil works	-	-	-	-	2,488	4,292	3,091	-	-	9,871	9,871
Equipment	-	-	11,859	24,498	-	7,286	3,452	-	30,182	16,933	47,095
Sub-total	-	-	11,859	24,498	2,488	11,578	6,543	-	30,182	26,804	56,966
Oak Sawmill Rehabilitation											
Civil works	-	1,374	1,674	303	458	-	-	-	-	3,809	3,809
Equipment	-	930	-	15,273	448	1,425	908	8,024	14,712	10,286	24,998
Sub-total	-	2,304	1,674	15,586	906	1,425	908	8,024	14,712	14,095	28,807
Railway Equipment Rehabilit.		-	9,496	-	-	-	-	-	6,528	2,968	9,496
FD Plantation											
Civil works & building	789	2,615	769	1,060	129	-	-	-	-	5,362	5,362
Equipment	5,388	6,301	4,696	3,391	161	1,589	-	-	11,801	9,725	21,526
Oak plantation	1,436	3,639	5,645	7,475	9,325	6,169	-	-	-	33,689	33,689
Species trials	314	795	936	1,016	1,468	957	-	-	-	5,486	5,486
Sub-total	7,927	13,350	12,046	12,942	11,083	8,715			11,801	54,262	66,063
Technical Assistance	-	7,026	5,459	2,678	369	-	-	-	15,532	-	15,532
Overseas training	-	456	432	336	108	156	-	-	1,548	-	1,548
TOTAL	7,927	39,613	115,998	145,405	54,032	50,424	38,055	28,568	239,962	240,060	480,022

Table 11

BURMA

FORESTRY II (EAST PEGU YOMA) - CR.949-BA

Comparison Between Project Cost Estimates and Actual Costs

		Appraisal Estimates 1/			Actual Costs			Percentage Changes in Terms		
	Unit	Qty	KM	US$ M	Qty	KM	US$ M	Qty	KM	US$ M
Administration and Export										
Civil Works and Buildings	No.	1	2.4	0.3	1	0.6	0.1	100	25	33
Equipment			6.7	1.0		6.1	0.8		91	80
Sub-Total			9.1	1.3		6.7	0.9		74	69
Road Construction										
Civil Works	Mile	3,860	32.1	4.8	651.5	6.3	0.8	17	20	17
Equipment			38.8	5.8		49.9	6.5		129	112
Sub-Total			70.9	10.6		56.2	7.3		79	69
Logging, Transport & Maintenance										
Maintenance Workshop	No.	7	0.8	0.12	7	1.1	0.15	100	138	125
Equipment			306.9	45.8		215.6	27.9		70	61
Sub-Total			307.7	45.9		216.8	28.1		70	61
T.C. Equipment Rehabilitation	Unit	167	12.7	1.9	364	13.9	1.8	218	109	95
State Hardwood Sawmill Rehab.										
Civil Works	No.	16	0.8	0.1	16	1.0	0.1	100	125	100
Equipment			11.7	1.8		7.0	0.9		60	50
Sub-Total			12.5	1.9		8.0	1.0		64	53
Private Hardwood Sawmill Rehab. Equipment			1.6	0.2		-	-		-	-
State Hardwood Sawmill Construction										
Civil Works	No.	2	3.1	0.5	2	9.9	1.3	100	319	260
Equipment			28.3	4.2		47.1	6.1		166	146
Sub-Total			31.4	4.7		57.0	7.4		182	157
Teak Sawmill Rehab.										
Civil Works	No.	1	7.8	1.2	1	3.8	0.5	100	49	42
Equipment			29.7	4.4		25.0	3.2		84	73
Sub-Total			37.5	5.6		28.8	3.7		77	66
Plantation (F.D.)										
Civil Works and Buildings			14.1	2.1		5.4	0.7		38	33
Teak Plantation Establishment	Acre	29,500	12.9	1.9	40,607	33.7	4.5	138	261	237
Fast Growing Species Trials	Acre	6,100	4.4	0.7	6,911	5.5	0.7	113	125	100
Equipment			39.0	5.8		21.5	2.9		55	50
Sub-Total			70.4	10.5		66.1	8.8		94	84
Equipment for Railways	Wagon	190	11.7	1.8		9.5	1.2		81	67
Overseas Training	MM	137	1.6	0.2	129	1.5	0.2	94	94	100
Technical Assistance	MM	286 2/	11.8	1.6	186 3/	15.5	2.0	98	131	111
TOTAL			570.9	80.4		480.0	62.4		83	77

1/ Including physical and price contingencies.
2/ 190 MM foreign consultants and 96 MM local consultants.
3/ Only foreign consultants.

Table 12

BURMA

FORESTRY II (EAST PEGU YOMA) - CR.949-BA

Financing Plan
(US$ Million)

Appraisal Estimates

	IDA	EEC	FINLAND	UNDP	GOB	TOTAL	%
Timber Corporation	30.9	8.0	-	-	15.0	53.9	82
Forestry Department	3.9	-	-	-	5.7	9.6	15
Technical Assistance	0.2	-	1.4	-	0.2	1.8	3
Overseas Training	-	-	-	0.2	-	0.2	-
TOTAL	35.0	8.0	1.4	0.2	20.9	65.5	100

Actual

	IDA	EEC	FINLAND	UNDP	GOB	TOTAL	%
Timber Corporation	21.5	5.1	-	-	24.8	51.4	82
Forestry Department	3.4	0.3	-	-	5.1	8.8	14
Technical Assistance	-	-	2.0	-	-	2.0	3
Overseas Training	-	-	-	0.2	-	0.2	-
TOTAL	24.9	5.4	2.0	0.2	29.9	62.4	100

BURMA

FORESTRY II (EAST PEGU YOMA) - CR.849-BA

Teak Production Benefits
(Mt '000)

	Year	0 1/	1 2/ 80/81	2	3	4	5	6	7	8	9-10	11	12	13-15	16-27	28-30
Teak Log Production																
Teak Logs	SAR	60.0	100.0	132.5	132.5	132.5	132.5	132.5								
	Actual	80.0	131.4	159.6	153.9	165.9	142.0	128.0	96.6	89.0	89.0	89.0	89.0	89.0	89.0	89.0
Benefit	Actual	-	31.4	79.6	73.9	85.9	62.0	48.0	16.6	9.0	9.0	9.0	9.0	9.0	9.0	9.0
Teak Log Export	SAR	7.8	13.0	17.2	17.2	17.2	17.2	17.2	17.2							
	Actual	17.0	21.0	34.3	28.2	31.5	33.7	40.3	40.0	40.0	30.0	30.0	30.0	30.0	30.0	30.0
Benefit	Actual	-	3	17.3	11.2	14.2	16.7	23.3	23.0	23.0	13.0	13.0	13.0	13.0	13.0	13.0
Local Log Sales	SAR	1.8	2.5	4.0	4.0	4.0	4.0	4.0	4.0							
	Actual	20.0	23.9	24.2	42.3	61.7	48.1	49.3	25.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Benefit	Actual	-	3.9	4.2	22.3	41.7	28.1	29.1	5.0	0	0	0	0	0	0	0
Ohhyin Sawmill	SAR	25.0	35.0	50.0	80.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	-	-
	Actual	25.0	36.5	35.0	43.6	52.7	48.2	38.4	31.6	29.0	39.0	39.0	39.0	39.0	-	-
		-	11.5	18.0	18.6	27.7	15.2	13.4	6.6	4.0	14.0	14.0	14.0	14.0	-	-
Teak Log Transfers	SAR	25.4	49.5	61.3	31.3	11.3	11.3	13.2								
	Actual	18.0	50.0	66.1	39.8	-	-	-	-	-	-	-	-	-	39.0	39.0
		-	32.0	48.1	21.8	0	0	0	0	0	0	0	0	0	21.0	21.0
Sawnwood Sales 3/																
Export	SAR	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8
	Actual	7.5	10.0	11.6	9.6	14.7	12.6	14.1	9.8	8.0	8.0	8.0	8.0	8.0	-	-
Benefit	Actual	-	2.5	4.1	2.1	7.2	5.1	6.6	2.3	.5	.5	.5	.5	.5		
Local Use	SAR	7.4	12.1	11.6	9.3	7.0	4.6	4.6	4.6							
	Actual	1.8	3.4	4.6	3.5	8.8	3.5	3.2	2.3	4.8	3.0	3.0	3.0	3.0	-	-
Benefit	Actual	-	1.6	2.8	1.7	6.2	1.7	1.4	0.5	2.2	1.2	1.2	1.2	1.2	-	-
Transfer	SAR	-	-	-	-	-	-	-	-							
	Actual	2.5	2.7	3.1	2.4	2.4	4.8	4.7	3.2	5.4	6.4	6.4	6.4	6.4	-	-
Benefit	Actual	-	0.2	0.8	-0.1	-0.1	2.1	2.2	0.7	2.9	3.9	3.9	3.9	3.9	-	-

1/ Production Estimates Without Project.
2/ Production Estimates With Project.
3/ Sale of Sawnwood include wastage.

Table 13

Table 14

BURMA

FORESTRY II (EAST PEGU YOMA) - CR.949-BA

Hardwood Production Benefits

(Mt '000)

	Year	0 1/	1 2/ 80/81	2	3	4	5	6	7	8	9-10	11	12	13-15	16-27	28-30
Hardwood Logs	BAR	70	122.0	200.0	290.0	290.0	290.0	290.0	290.0							
	Actual	85	186.2	140.6	186.5	133.2	182.4	181.6	161.2	160.0	160.0	160.0	160.0	160.0	160.0	160.0
Benefit	Actual	-	101.2	55.6	101.5	48.2	97.4	96.6	76.2	75.0	75.0	75.0	75.0	75.0	75.0	75.0
Log Export	BAR	-	12.0	49.0	88.0	84.0	64.0	64.0	64.0							
	Actual	3	3.3	5.6	5.2	4.3	3.7	1.0	2.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Benefit	Actual		0.3	2.6	2.2	1.3	0.7	(2.0)	(1.0)	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Local Sales	BAR	-	19.0	58.0	34.0	34.0	34.0	34.0	34.0							
	Actual	15	19.1	23.2	29.1	22.6	27.9	20.0	7.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
Benefit	Actual		4.1	8.2	14.1	7.6	12.9	5.0	(8.0)	(3.0)	(3.0)	(3.0)	(3.0)	(3.0)	(3.0)	(3.0)
State Mill	BAR	-	63.1	80.0	96.0	96.0	96.0	96.0	94.0							
	Actual	32	79.4	88.9	113.2	100.6	105.4	106.6	84.0	94.0	94.0	47.0	-	-	-	-
Benefit	Actual		47.4	56.9	81.2	68.6	73.4	74.6	52.0	62.0	62.0	15.0	-	-	-	-
Mire Mill	BAR		47.4	47.0	47.0	47.0	47.0	47.0	47.0							
	Actual	8	61.1	60.0	52.1	38.6	36.6	41.1	35.0	36.0	36.0	-	-	-	-	-
Benefit	Actual		53.6	52.0	44.1	30.6	28.6	33.1	27.0	28.0	28.0	-	-	-	-	-
New Sawmill	BAR		-	-	24.0	48.0	80.0	100.0	100.0							
	Actual	-	-	-	1.3	6.8	12.4	12.1	11.2	17.0	24.0	24.0	24.0	24.0	24.0	12.0
Benefit	Actual				1.3	6.8	12.4	12.1	11.2	17.0	24.0	24.0	24.0	24.0	24.0	12.0
Transfer	Actual	27	23.3	-	-	-	-	.9	22.0	-	-	71.0	118.0	118.0	118.0	130.0

Physical Benefits of Project

Hardwood Sawnwood Production Distribution

3/	Year	0	1	2	3	4	5	6	7	8	9-10	11	12	13-15	16-27	28-30
State Sawmills																
Local Sales		14.6	36.5	40.5	55.8	53.8	57.9	48.7	43.9	49.1	49.1	49.1				
Transfer		3.0	7.4	5.8	5.3	5.1	2.6	2.6	2.3	2.6	2.6	2.6				
Mire Mills																
Local Sales		3.2	17.3	30.3	28.2	21.5	19.6	14.3	15.3	16.9	16.9	-				
Transfer		1.1	6.0	5.2	2.8	3.2	3.5	2.2	1.7	1.9	1.9	-				
New Mill Export Sales		-	-	-	-	0.1	-	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Local Sales		-	-	0.8	3.7	5.0	2.8	2.4	3.7	5.1	5.1	5.1	5.1	5.1	5.1	2.6
Transfer		-	-	-	.4	2.4	4.8	4.4	6.6	9.2	9.2	9.2	9.2	9.2	9.2	4.5
TOTAL SALES	BAR	39.0	59.6	68.5	91.4	105.3	105.3	105.3	105.3							
	Actual	21.9	67.2	82.6	96.2	91.1	91.2	74.7	73.6	84.9	84.9	66.1	14.4	14.4	14.4	7.2
Benefit	Actual		45.3	60.7	74.3	69.2	69.3	52.8	51.7	63.0	63.0	44.2	(7.5)	(7.5)	(7.5)	(14.7)

1/ Production Estimates Without Project.
2/ Production Estimates With Project.
3/ Sale of Sawnwood include wastage.

Table 15

BURMA

FORESTRY II (EAST PEGU YOMA) - CR.949-BA

Labour Intensive Plantation Establishment - Typical Inputs and Cost

Activity		Unit	Input/Acre SAR	Input/Acre Actual	Cost/Acre Kyats SAR		Cost/Acre Kyats Actual	
A. LAND CLEARING								
1. Surveying	- Labour	Man days	0.5	0.5	2.70	2.70	3.25	3.25
2. Land Clearing	- Labour	Man days	15	17	81.00		110.50	
	- Tools		SUM	SUM	13.60	94.60	6.25	116.75
3. Burning & Reburning	- Labour	Man days	9	7.69	48.60	48.60	50.00	50.00
4. Staking	- Labour	Man days	2	1.54	10.80		10.00	
	- Stakes		SUM	SUM	15.00	25.80	10.00	20.00
PLANTING COSTS								
5. Nursery Costs	- Seed		-	SUM			15.00	
	- Plastic Bag/Pot		-	SUM			15.00	
	- Soil		-	SUM			15.00	
	- Labour	Man days	-	3.8			25.00	
	- Transport		-	SUM			30.00	
	- Stump/Seed			-	29.40	29.40		100.00
6. Planting & Replanting	- Labour	Man days	2.5	3.1	13.50		20.00	20.00
	- Tools		SUM	-	8.50	22.00		
7. Camp Costs	- Labour	Man days	-	0.8	-	-	4.00	
	- Materials		-	SUM			8.00	12.00
8. Total Establishment Cost						223.10		322.00
B. MAINTENANCE COSTS 1/								
1. 1st Year Weeding	- Labour	Man days	5.0	5.0	27.00		32.50	
	- Tools		SUM	SUM	7.50		2.50	
	x 3					34.50		105.00
2nd Year Weeding	x 2					34.50		70.00
3rd Year Weeding	x 2					34.50		70.00
4th Year Weeding	x 1					34.50		35.00
2. Protection	- Labour	Man days	-	1.54	-		10.00	
	- Tools		-	SUM	-		3.00	13.00
3. Total Maintenance Cost						138.00		293.00

1/ SAR did not recognize the weeding routine and protection requirement for 1st 5 years.

Table 16

BURMA

FORESTRY II (EAST PEGU YOMA) - CR.949-BA

Plantation Cost and Benefits
(K '000)

	Year	1	2	3	4	5	6	
		79-80	80-81	81-82	82-83	83-84	84-85	TOTAL
Cost of Establishment	Teak	1,436	3,639	5,645	7,475	9,325	6,169	33,689
Maintenance and OH	Trial	314	795	936	1,010	1,468	757	5,280
	TOTAL	1,750	4,434	6,581	8,485	10,793	6,926	38,969
Maintenance Costs 1/	Year	7	8	9	10	11	12	13
Weeding	Kyats	1,887	1,210	422	-	-	-	-
Protection	Kyats	596	528	426	295	157	-	-
	Sub-Total	2,483	1,738	848	295	157	-	-
Extraction Costs - 3/ 1st Thinning	Kyats	-	1,175	2,875	4,500	6,250	6,500	7,500
Transport (Export)	Kyats	-	564	600	600	600	600	600
	TOTAL 2/	2,483	3,477	4,323	5,395	7,007	7,100	8,100
2nd Thinning	Year	15	16	17	18	19	20	
Thinning Cost	Kyats	4,675	10,250	16,250	22,500	23,500	23,250	
Handling & Transport (Export)	Kyats	600	600	600	600	600	600	
	TOTAL	5,275	10,850	16,850	23,100	24,100	23,850	
3rd Thinning	Year	25	26	27	28	29	30	
	Kyats	9,272	22,422	35,754	49,692	51,510	50,904	
4th Thinning	Year	35	36	37	38	39	40	
	Kyats	15,150	37,572	59,994	83,022	86,052	85,446	
Final Felling	Year	80	81	82	83	84	85	
	Kyats	61,812	150,288	241,188	333,906	346,026	341,784	

1/ Including Weeding and Protection.
2/ Includes Maintenance Costs.
3/ Extraction Cost 1st and 2nd Thinning @ 250 K/Ht ; 3rd, 4th and final logging @ 606 K/Ht.

Table 17

BURMA

FORESTRY II (EAST PEGU YOMA) - CR.949-BA

Operating Income - Rehabilitated Hardwood Sawmills
(K Million in Current Prices)

Year	0	1 80/81	2	3	4	5	6	7	8-11	12
Production Data										
Throughput (Mt)	32,000	79,357	88,923	113,255	100,629	105,428	106,550	84,000	94,000	
Out-turn (Mt)	17,510	43,427	46,534	60,542	55,426	57,936	57,191	46,200	51,700	
Sales (Mt) - Local Sales	14,555	36,535	40,491	55,812	53,814	57,936	48,678	43,890	49,115	
- Transfer	2,955	7,418	5,792	5,281	5,082	2,605	2,557	2,310	2,585	
Price (K/Mt)										
Local Sales	700	813	917	813	855	906	933	930	967	
Transfer	853	853	572	572	572	1,020	985	985	985	
Revenues										
Local Sales	10.2	29.7	37.1	45.4	46.0	52.5	45.4	40.8	47.5	
Transfer	2.6	6.3	3.3	3.0	2.9	2.7	2.5	2.3	2.5	
Sub-Total	12.8	36.0	40.4	48.4	48.9	55.2	47.9	43.1	50.0	25.0
Operating Costs										
Log Costs	6.3	15.6	25.8	34.0	40.0	34.6	39.4 1/	31.1	34.8	
Sawmilling & Overheads	1.2	3.0	5.7	8.2	7.3	5.7	8.4 2/	6.8	7.6	
Sub-Total	7.5	18.6	31.5	42.2	47.3	40.3	47.8	37.9	42.4	21.2
Operating Profit (Deficit)	5.3	17.4	8.9	6.2	1.6	14.9	0.1	5.2	7.6	3.8
Taxes 3/	2.7	8.9	4.6	3.2	0.9	7.6	-	2.7	3.9	2.0
Net Income after Taxes	2.0	8.5	4.3	3.0	0.7	7.3	0.1	2.5	3.7	1.8
Operating Ratio (%)	59	52	78	87	97	73	100	88	85	85
Return on Sales (%)	41	48	22	13	3	27	-	12	15	15

Source : Timber Corporation

1/ Estimated at K 80/Mt.
2/ Estimated at K370/Mt.
3/ State contribution.

Table 18

BURMA

FORESTRY II (EAST PEGU YOMA) - CR.949-BA

Operating Income - Hired Hardwood Sawmills
(K million in Current Prices)

Year	0	1 80/81	2	3	4	5	6	7	8-10
Production Data									
Throughput (Ht)	8,000	61,141	59,991	52,104	38,652	36,552	41,132	35,000	36,000
Out-turn (Ht)	4,363	33,348	31,165	27,792	20,883	19,358	21,524	17,000	18,800
Sales (Ht) - Local Sales	3,242	17,269	30,298	28,178	21,513	19,552	19,337	15,300	16,920
- Transfer	1,121	5,972	5,159	2,770	3,189	3,492	2,157	1,700	1,880
Price (K/Ht)									
Local Sales	700	813	917	813	855	906	933	930	967
Transfer	853	853	572	572	572	1,020	985	985	985
Revenues									
Local Sales	2.3	14.0	24.9	22.9	18.4	18.6	18.0	14.2	16.4
Transfer	1.0	5.1	3.0	1.6	1.8	3.6	2.1	1.7	1.9
Sub-Total	3.3	19.1	27.9	24.5	20.2	22.2	20.1	15.9	18.3
Operating Costs									
Log Costs	1.6	12.0	17.4	15.6	15.3	12.0	15.2	13.0	13.3
Sawmilling & Overheads	0.03	0.3	2.0	3.4	3.1	2.3	3.3	2.3	2.6
Sub-Total	1.6	12.3	19.4	19.0	18.4	14.3	18.5	15.3	15.9
Operating Profit (Deficit)	1.7	6.8	8.5	5.5	1.8	7.9	1.6	0.6	2.4
Taxes 1/	0.8	3.5	4.3	2.8	0.9	4.0	0.8	0.3	1.2
Net Incomes after Taxes	0.9	3.3	4.2	2.7	0.9	3.9	0.8	0.3	1.2
Operating Ratio (%)	48	64	70	78	91	64	92	96	87
Return on Sales (%)	52	36	30	22	9	36	8	4	14

Source : Timber Corporation

1/ State contribution.

Table 19

BURMA - FORESTRY II (EAST PEGU YOMA) - CR.949-BA

Operating Income - New Hardwood Sawmills

		Year 1 (81/82)	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	8-27	28-30
Production Data										
Throughout - teak	(Ht)	-	-	2,218	418	-	-	-	-	-
- hardwood	"	-	1,321 1/	6,806	12,400	12,050	11,231	17,000 2/	24,000	12,000
Out-turn - teak	"	-	-	1,172	187	-	-	-	-	-
- hardwood	"	-	804	4,039	7,514	7,375	6,867	10,200	14,400	7,200
Sales of teak										
- Local sales	"	-	-	144	22	-	-	-	-	-
- Exports	"	-	-	955	93	-	-	-	-	-
- Transfer	"	-	-	87	152	-	-	-	-	-
Sales of hardwood										
- Local sales	"	-	846	3,678	5,037	2,754	2,442	3,690	5,200	2,600
- Exports	"	-	-	-	192	-	125	100	100	100
- Transfer	"	-	-	388	2,457	4,817	4,401	6,560	9,244	4,500
Price of Hardwood										
- Local sales	"	-	831	912	907	927	930	967	-	-
- Exports	"	-	-	-	2,710	-	2,500	2,986	-	-
- Transfer	"	-	-	572	1,020	985	985	985	-	-
Revenues		. . . . . (K million in current prices)								
- Teak		-	-	5.9	0.9	-	-	-	-	-
- Hardwood : local sales		-	0.7	3.4	4.6	2.6	2.3	3.6	5.0	2.5
: exports		-	-	-	0.5	-	0.3	0.3	0.3	0.3
: transfer		-	-	0.2	2.5	4.7	4.3	6.5	9.1	4.6
Sub-total		-	0.7	9.5	8.5	7.3	8.9	10.4	14.4	7.4
Running Costs										
Teak		-	-	2.7	1.4	-	-	-	-	
Hardwood: log costs		-	0.4	2.7	4.1	4.5	3.5	5.3	7.4 4/	3.7
: sawmilling & overheads		-	0.2	0.8	3.2	3.3	3.1	4.6	6.4 5/	3.2
Sub-total		-	0.6	6.2	7.7	7.8	6.6	9.9	13.8	8.9
Operating Profit (Deficit)		-	0.1	3.3	0.8	(0.5)	0.3	0.5	0.6	0.5
Taxes 3/		-	0.1	3.1	1.3	0.4	0.6	0.2	0.2	0.1
Net Income after Taxes		-	-	0.2	(0.5)	(0.9)	(0.2)	0.3	0.4	0.4
Operating Ratio (%)		-	86	65	91	107	98	95	98	93
Return on Sales (%)		-	14	35	9	-	4	5	4	7

Source: Timber Corporation. Export produce equalization fund.

1/ Only 3 months.
2/ Second sawmill starts operating with an estimated throughput of 5000 Ht.
3/ Including export produce equalization fund (EPEF) - see Table 25 for teak products; service taxes (5% on fixed export price of K74.6/Ht for sawn hardwood); commodity tax (at fixed export price of K124.62/Ht).
4/ Estimated at K308/Ht.
5/ Estimated at K267/Ht.

BURMA

FORESTRY II (EAST PEGU YOMA) - CR.949-BA

Financial Prices
(K/Ht)

	Appraisal Estimate (79/80)	Actual 79/80	Estimates 86/87	Estimates 1987
Teak Log				
Local Sale	745	745	982	1,015
Export	4,965	5,697	6,406	7,046
Transfer	-	901	843	843
Hardwood Log				
Local Sale	353	203	203	203
Export	1,710	1,710	1,880	2,070
Transfer	-	243	365	365
Teak Sawnwood				
Local Sale	700	601	1,996	2,119
Export	3,975	3,975	5,753	6,100
Transfer	-	1,701	2,473	2,473
Hardwood Sawnwood				
Local Sale	860	700	930	967
Export	920	-	2,500	2,986
Transfer	-	853	985	985

Table 21

BURMA

FORESTRY II (EAST PEGU YOMA) - CR.949-BA

Operating Income of the East Pegu Yoma
(K Million in Current Prices)

Year	0	1 80/81	2	3	4	5	6	7	8	9-10	11	12	13-15	16-27	28-30
Revenues	Actual									Estimate					
Extraction	165.2	256.8	359.7	359.4	495.5	490.2	401.6	292.5	317.0	257.5	283.4	300.6	300.6	322.5	326.9
Sawmeeds	16.1	55.2	68.3	73.6	78.5	85.8	75.4	69.4	82.7	82.7	64.4	39.4	14.4	14.4	7.4
Sub-Total	181.3	312.0	428.0	433.0	574.0	576.0	477.0	361.9	399.7	340.2	347.8	340.0	315.0	336.9	334.3
Operating Costs															
Extraction	70.0	99.2	131.1	132.3	165.2	182.9	133.9	70.6	59.0	61.0	28.7	107.0	107.0	107.0	111.7
Sawmills	9.1	30.8	50.9	61.7	81.0	62.1	74.1	63.1	72.1	72.1	56.2	35.0	13.8	13.8	6.9
Other Costs and Provision	3.0	3.0	4.0	12.0	17.0	19.0	30.0	10.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
Sub-Total	46.2	133.0	186.0	206.0	264.0	264.0	238.0	143.7	146.1	148.1	159.9	157.0	135.8	135.8	133.6
Operating Profit (Deficit)	135.1	179.0	242.0	227.0	310.0	312.0	239.0	218.2	253.6	192.1	187.9	183.0	179.2	201.1	200.7
Taxes	95.9	116.0	166.0	154.0	221.0	213.0	169.0	141.8	152.2	115.3	112.7	109.8	107.5	120.7	120.4
Net Incomes after Taxes	39.2	63.0	76.0	73.0	89.0	99.0	70.0	76.4	101.4	76.8	75.2	73.2	71.7	80.4	80.3
Operating Ratio (%)	25	43	43	48	46	46	50	40	37	44	46	46	43	40	40
Return on Sales (%)	75	57	57	32	54	54	50	40	63	56	56	54	57	60	60

Source : Timber Corporation

BURMA

FORESTRY II (EAST PEGU YOMA) - CR.949-BA

Sources and Application of Funds - East Pegu Yoma Project
(K million in current prices)

	Actual						Projection														
	Yr. 1 80/81	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20-26	27	28-30
e of Funds																						
Incomes	63.0	76.0	73.0	89.0	99.0	70.0	76.4	101.4	76.8	76.8	75.2	73.2	71.7	71.7	71.7	80.4	80.4	80.4	80.4	80.4	80.4	80.3
ciation 1/	1.0	4.4	20.0	40.0	41.1	43.6	30.0	30.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	15.0	15.0	10.0	10.0
-total	64.0	80.4	93.0	129.0	140.1	113.6	106.4	131.4	101.8	101.8	100.2	98.2	96.7	96.7	96.7	105.4	105.4	105.4	95.4	95.4	90.4	90.3
al																						
EC Loan	2.7	54.4	92.6	4.7	19.6	17.6	-	-	-	-	-	-	-	-	-	-	-	-	-			-
Bank of Burma	16.0	43.6	36.8	37.6	21.9	20.4	28.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-total	18.7	98.0	129.4	42.3	41.5	38.0	28.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	83.5	178.4	222.4	171.3	181.6	151.6	134.9	131.4	101.8	101.8	100.2	98.2	96.7	96.7	96.7	105.4	105.4	105.4	95.4	95.4	90.4	90.3
cation of Funds																						
al	18.7	98.0	129.4	42.3	41.5	38.0	28.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
t Servicing																						
/EEC	-	-	-	-	-	8.3	5.7	15.1	15.6	17.6	19.4	19.4	19.4	19.4	19.4	19.1	13.7	4.3	3.8	1.9	-	-
on Bank 2/	-	3.2	11.9	19.3	26.8	31.2	32.1	29.1	21.7	14.2	9.8	5.7	-	-	-	-	-	-	-	-	-	-
erest 3/	-	1.5	9.0	17.5	17.0	16.3	18.4	23.1	17.6	12.5	13.8	11.2	8.8	7.1	5.4	3.6	1.9	0.8	0.4	0.1	-	-
-total	-	4.7	20.9	36.8	43.8	47.8	56.2	67.3	54.9	44.3	43.0	36.3	28.2	26.5	24.8	22.7	15.6	5.1	4.2	1.9	-	-
ng Capital & r Assets	64.8	76.7	72.1	92.2	96.3	65.8	50.2	64.1	46.9	57.5	57.2	61.9	68.5	70.2	71.9	82.7	89.8	100.3	91.2	93.5	90.4	90.3
	83.5	178.4	222.4	171.3	181.6	151.6	134.9	131.4	101.8	101.8	100.2	98.2	96.7	96.7	96.7	105.4	105.4	105.4	95.4	95.4	90.4	90.3

: Timber Corporation.

placement of equipment starts in Year 9 (FY88/89) - see Table 28.
payment over 10 years at interest rate of 9% per annum plus 5 year grace period.
payment over 5 years at 8% per annum and no grace period.

Table 2

Table 23

BURMA

FORESTRY II (EAST PEGU YOMA) - CR.949-BA

Balance Sheet Summary of the East Pegu Yoma
(K Million)

	80-81	81-82	82-83	83-84	84-85	85-86	86-87	87-88
Assets								
Net Fixed Assets	17	104	194	167	145	129	126	122
Other Assets	1	35	59	19	45	54	42	44
Current Assets	244	300	453	649	696	793	824	853
TOTAL ASSETS	262	439	706	835	886	976	992	1,019
Liabilities								
Current Liabilities	46	59	144	179	133	163	130	123
Long-Term Debt								
IDA/EEC	3	57	150	154	174	191	186	171
Other	16	56	81	100	95	84	80	51
Sub-Total	19	113	231	254	269	275	266	222
Government Capital	134	129	129	129	129	129	129	129
Retained Earnings 1/	63	138	202	273	355	409	467	545
TOTAL LIABILITIES	262	439	706	835	886	976	992	1,019
Current Ratio (times)	5.3	5.1	3.1	3.6	5.2	4.9	6.3	6.9
Debt Service Coverage Ratio	-	17.4	4.9	4.0	3.6	2.7	2.2	2.3
Return on Assets (%)	15	14	11	9	10	10	7	7

Source : Timber Corporation

1/ Table 21 less interest charges to long-term debts.

BURMA

FORESTRY II (EAST PEGU YOMA) - CR.949-BA

Financial Analysis of the East Pegu Yoma
(K million in 1987 Constant Prices)

	COSTS			BENEFITS						
					Production Costs 4/					
	Investment Costs 1/	Equipment Replacement 2/	Total	Revenues 3/	Extraction	Saw Milling	Taxes	Net Benefits	Incremental Net Benefits	Balance
Year 0				256.3	100.6	3.2	108.3	42.2	-	-
1	18.5		18.5	380.1	209.9	11.0	103.2	56.0	13.8	(4.7)
2	93.4		93.4	511.5	204.4	11.1	203.0	93.0	50.8	(42.6)
3	119.9		119.9	449.9	233.4	13.1	138.0	65.4	23.2	(96.7)
4	42.8		42.8	657.3	207.3	14.3	310.6	125.1	82.9	40.1
5	40.5		40.5	658.8	208.1	14.8	296.4	139.5	97.3	56.8
6	37.5		37.5	417.0	213.4	14.7	133.6	75.3	33.1	(4.4)
7	22.7		22.7	387.9	176.5	13.7	134.5	63.2	21.0	(1.7)
8		-	-	399.7	129.5	16.6	152.2	101.4	59.2	59.2
9		14.0	14.0	340.2	131.5	16.6	115.3	76.8	34.6	20.6
10		25.0	25.0	341.2	131.5	16.6	115.3	76.8	34.6	9.6
11		153.4	153.4	347.8	145.9	14.0	112.7	75.2	33.0	(120.4)
12		(10.6)	(10.6)	340.0	146.8	10.2	109.8	73.2	31.0	41.6
13		(0.6)	(0.6)	315.0	129.4	6.4	107.5	71.7	29.5	30.1
14		-	-	315.0	129.4	6.4	107.5	71.7	29.5	29.5
15		25.0	25.0	315.0	129.4	6.4	107.5	71.7	29.5	4.5
16		-	-	336.9	129.4	6.4	120.7	80.4	38.2	38.2
17		6.5	6.5	336.9	129.4	6.4	120.7	80.4	38.2	31.7
18		178.7	178.7	336.9	129.4	6.4	120.7	80.4	38.2	(140.5)
19		-	-	336.9	129.4	6.4	120.7	80.4	38.2	38.2
20		-	-	336.9	129.4	6.4	120.7	80.4	38.2	38.2
21		-	-	336.9	129.4	6.4	120.7	80.4	38.2	38.2
22		-	-	336.9	129.4	6.4	120.7	80.4	38.2	38.2
23		25.0	25.0	336.9	129.4	6.4	120.7	80.4	38.2	13.2
24		-	-	336.9	129.4	6.4	120.7	80.4	38.2	38.2
25		31.0	31.0	336.9	129.4	6.4	120.7	80.4	38.2	7.2
26		153.4	153.4	336.9	129.4	6.4	120.7	80.4	38.2	(115.2)
27		-	-	336.9	129.4	6.4	120.7	80.4	38.2	38.2
28		(13.3)	(13.3)	334.3	130.4	3.2	120.4	80.3	38.1	51.4
29		-	-	334.3	130.4	3.2	120.4	80.3	38.1	38.1
30		(64.2)	(64.2)	334.3	130.4	3.2	120.4	80.3	38.1	102.3

IRR = 8.9%

1/ Table 10 adjusted into 1987 constant prices by using GDP's deflator factors of 0.88, 0.89, 0.93, 0.95, 0.97, 0.99, 0.99 and 0.99 during FY 79/80 - FY 86/87.
2/ Assuming an economic life of 7.5 years (See also Table 10 for individual equipment groups).
3/ Tables 13-14 and Table 20.
4/ Using 1987 estimated costs of K606/Ht for extraction of teak log and K350 for hardwood log, K80/Ht for sawmilling in the old mills and K267/Ht in the new mills.

Table 24

BURMA

FORESTRY II (EAST PEGU YOMA) - CR.949-BA

Operating Income - Okkyin Teak Sawmill
(K million in Current Prices)

	Year	0 79-80 Est.	1 80-81	2	3	4	5	6	7	8	9-15
		Actual							Projected		
Production Data											
Throughout	Ht	25,000	36,536	35,002	43,575	55,519	50,830	44,423	36,859	39,000	39,000
Total Outputs	%	43	43	44	41	41	41	41	38	41	41
	Ht	10,750	15,812	15,232	17,692	22,535	21,005	18,194	14,104	16,000	16,000
Local Sales 1/	Ht	1,758	3,381	4,657	3,509	7,989	3,482	3,202	2,306	4,000	3,000
Exports	Ht	7,500	10,042	11,644	9,607	14,668	12,630	14,109	9,839	8,000	8,000
Transfer	Ht	2,460	3,716	3,296	2,416	2,415	4,764	4,653	3,228	5,440	6,440
Price (K/Ht)											
Local Sales		601	622	579	1410	1195.1	1395.2	1880	1996	2119	2119
Exports		3975	5081	4915	5721	5500	6289	6194	5753	6100	6100
Transfer		1701	1701	1719	1719	1719	2130	2473	2473	2473	2473
Revenues											
Local Sales		1.1	2.1	2.7	4.9	9.5	4.9	6.0	4.6	8.5	6.4
Exports		29.8	51.0	57.2	55.0	80.7	79.4	87.4	56.6	48.8	48.8
Transfer		4.2	6.3	5.7	4.2	4.2	10.1	11.5	8.0	13.5	15.9
Sub-Total		35.1	59.4	65.6	64.1	94.4	94.4	104.9	69.2	70.8	7
Running Costs											
Log Cost		11.4	16.8	16.2	20.0	28.5	27.4	25.9	22.3	23.6	23.6
Sawmilling and Overhead		11.4	16.8	15.6	21.4	28.4	26.7	23.2	18.0	20.4	20
Sub-Total		22.8	33.6	31.8	41.4	56.9	54.1	49.1	40		
Operating Profit (Deficit)		12.3	25.8	33.8	22.7	37.5	40.3	55.8	28.9	26.8	27.1
Taxes 2/		11.4	24.2	29.1	24.4 3/	37.9 3/	35.6	42.4	22.0	20.4	20.6
Net Income after Taxes		0.9	1.6	4.7	(1.7)	(0.4)	4.7	13.4	6.9	6.4	6.5
Operating Ratio (%)		65	57	48	65	60	57	47	56	62	62
Return on Sales (%)		35	43	52	35	40	43	53	42	38	38

Source : Timber Corporation

1/ Including wastage.
2/ Including export produce equalization fund (30% of export value); commodity taxes (fixed rate at K505.33 per Ht on export and local sale volumes; service taxes (5% on fixed f.o.b. price of K2045.5/Ht and local sale of K1843.65 Ht; and state contribution at 30% on net profits after taxes.
3/ No state contribution.
4/ Estimated at K606/Ht.
5/ Estimated at K488/Ht.

Table 25

Table 26

BURMA

FORESTRY II (EAST PEGU YOMA) - CR.949-BA

Financial Analysis - Okkyin Teak Sawmill
(K million in 1987 Constant Prices)

	Investment Costs 1/	Replacement Costs 2/	Revenues 3/	Saw Milling & Log Costs 4/	Taxes	Net Benefits	Incremental Net Benefits	Balance
Year 0	-		55.6	27.4	24.8	3.4	-	-
1	2.6		77.7	40.0	33.3	4.4	1.0	(1.6)
2	1.8		89.1	38.3	41.7	9.1	5.7	3.9)
3	16.4		72.0	47.7	24.7	(0.4)	(3.8)	(20.2)
4	0.9		112.4	60.7	50.5	1.2	(2.2)	(3.1)
5	1.4		101.2	55.6	29.7	15.9	12.5	11.1
6	0.9		104.4	48.6	41.3	14.5	11.1	10.2
7	6.1		72.9	40.3	24.8	7.8	4.4	(1.7)
8		1.0	70.8	42.7	20.4	7.7	4.3	3.3
9		-	71.1	42.7	20.6	7.8	4.4	4.4
10		16.1	71.1	42.7	20.6	7.8	4.4	(11.7)
11		0.4	71.1	42.7	20.6	7.8	4.4	4.0
12		1.4	71.1	42.7	20.6	7.8	4.4	3.0
13		0.9	71.1	42.7	20.6	7.8	4.4	3.5
14		0.1	71.1	42.7	20.6	7.8	4.4	(1.7)
15		(9.0)	71.1	42.7	20.6	7.8	4.4	13.4

IRR = 12%

1/ Table 1, adjusted into 1987 constant prices by using GDP's deflator factors.
2/ Assuming an economic life of 7.5 years.
3/ Table 25 adjusted by estimated price for 1987.
4/ Estimated at K1095/Ht.

Table 27

BURMA

FORESTRY II (EAST PEGU YOMA) - CR.949-BA

Estimated Economic Prices
(Kyat H/t)

	SAR (1987)	PCR (1987)
Teak Log		
Local Sale 1/	4,620	4,460
Export 3/	8,965	7,046
Hardwood Log		
Local Sale 2/	1,050-1,220	1,360
Export 3/	940-7,310	3,000
Teak Sawnwood		
Local Sale 4/	5,485	4,575
Export 3/	7,215	6,100
Hardwood Sawnwood		
Local Sale 2/	2,310-2,550	2,045
Export 3/	1,770	4,015
Teak Post 5/	-	2,470
Teak Pole 5/		
Local Sale	-	500
Export	-	13,000

1/ Based on actual f.o.b. price of lowest quality teak log.
2/ Based on world market price, c.i.f. Rangoon for similar log and timber.
3/ Weighted average f.o.b., Rangoon.
4/ Based on f.o.b. price less 25% quality discount.
5/ Based on actual export and local sale prices.

Table 28

BURMA

FORESTRY II (EAST PEGU YOMA) - CR.949-BA

Economic Cost Streams - East Pegu Yoma Project
(K million)

	(. . . . . Investment Costs 1/ . . . . .)							(. . . . . Production Costs . . . . .)			
								Extraction Costs			
Year	Adminis. & Export	Roads	Logging & Transport	Workshop	State Sawmill Rehab.	New Sawmills	Total	Teak 2/	Hardwood 3/	Sawmilling 4/	Total
0	-	-	-	-	-	-	-	32.8	31.3	5.7	69.8
1	-	1.2	6.4	2.9	-	-	10.5	53.9	68.5	20.0	142.4
2	3.3	9.1	27.1	2.6	4.3	8.2	54.6	65.4	65.3	21.1	151.8
3	0.1	8.6	45.3	0.7	0.3	16.5	71.5	63.1	74.0	23.7	160.8
4	0.4	1.4	19.7	0.1	-	2.1	23.7	68.0	63.7	20.7	152.4
5	0.8	7.1	8.4	-	1.0	8.2	25.5	58.2	68.4	21.9	148.[illegible]
6	0.1	2.8	13.8	0.6	-	4.7	22.0	52.5	66.8	22.7	142.0
7	-	6.4	4.9	2.0	-	-	13.3	39.6	59.3	18.5	117.4
8	-	-	-	-	-	-	-	36.5	60.7	20.9	118.1
9	4.2	-	-	-	4.8	-	9.0	36.5	63.3	21.9	121.7
10	-	-	-	-	-	16.0	16.0	36.5	63.3	21.9	121.7
11	-	32.0	122.0	8.7	-	-	162.7	36.5	58.9	10.1	105.5
12	-	-	-	-	(1.8)	-	(1.8)	36.5	58.9	3.4	98.8
13	-	-	-	-	(1.3)	-	(1.3)	36.5	58.9	3.4	98.8
14	-	-	-	-	-	-	-	36.5	58.9	3.4	98.8
15	-	-	-	-	-	16.0	16.0	36.5	58.9	3.4	98.8
16	-	-	-	-	-	-	-	36.5	58.9	3.4	98.8
17	4.2	-	-	-	-	-	4.2	36.5	58.9	3.4	98.8
18	-	32.0	122.0	8.7	-	16.0	178.7	36.5	58.9	3.4	98.8
19	-	-	-	-	-	-	-	36.5	58.9	3.4	98.8
20	-	-	-	-	-	-	-	36.5	58.9	3.4	98.8
21	-	-	-	-	-	-	-	36.5	58.9	3.4	98.8
22	-	-	-	-	-	-	-	36.5	58.9	3.4	98.8
23	-	-	-	-	-	16.0	16.0	36.5	58.9	3.4	98.8
24	-	-	-	-	-	-	-	36.5	58.9	3.4	98.8
25	4.2	-	-	-	-	16.0	20.2	36.5	58.9	3.4	98.8
26	-	32.0	122.0	8.7	-	-	162.7	36.5	58.9	3.4	98.8
27	-	-	-	-	-	-	-	36.5	58.9	3.4	98.8
28	-	-	-	-	-	(8.5)	(8.5)	36.5	58.9	1.7	97.1
29	-	-	-	-	-	-	-	36.5	58.9	1.7	97.1
30	(1.1)	(13.0)	(49.0)	(0.5)	-	-	(63.6)	36.5	58.9	1.7	97.1

1/ Table 10, adjusted into 1987 constant prices by using GDP deflator factors. Costs of equipment are net of duties and taxes (40% for administration, 38% for roads, 46% for logging and transport, 41% for workshop, 36% for state sawmill rehabilitation and for new sawmills, 41% for teak sawmills and 45% for plantations. Local costs were further adjusted by SCF of 0.80. Replacement is based on an economic life of 7.5 years.

2/ Estimated at K410/Ht (felling K16 + other expenses K50, adjusted by SCF plus transport K340 x CF of 1.05).

3/ Estimated at K368/Ht (felling K15 + other expenses K25, adjusted by SCF plus transport K320 x CF of 1.05).

4/ Weighted average at K177/Ht, adjusted by SCF of 0.80.

BURMA

FORESTRY II (EAST PEGU YOMA) - CR.949-BA

Economic Analysis - East Pegu Yoma Project
(K million in 1987 Constant Prices)

	Log Export 1/		Log Local Sales 1/ 2/		Sawn Hardwood 1/			Investment 3/	Production 3/		
	Teak	Hardwood	Teak	Hardwood	Export	Local Sales	Total Benefits	Costs	Costs	Net Benefits	Net Incremental Benefits
Year 0	119.8	9.0	281.0	57.1	-	44.8	511.7	-	69.8	441.9	-
1	148.0	9.9	492.4	57.7	-	137.4	845.4	10.5	142.4	692.5	250.6
2	241.7	13.8	558.8	31.6	-	168.9	1017.8	54.6	151.8	811.4	369.5
3	198.7	15.6	560.6	39.6	-	196.7	1011.2	71.5	160.8	778.9	337.0
4	362.9	12.9	510.2	30.7	0.4	186.1	1103.2	23.7	152.4	927.1	485.2
5	378.4	11.1	393.8	37.9	-	186.5	1007.7	25.5	148.5	833.7	391.8
6	284.0	3.0	391.1	28.0	0.4	152.3	858.8	22.0	142.0	694.8	252.9
7	281.8	6.0	252.4	39.4	0.4	150.3	730.3	13.3	117.4	599.6	157.7
8	281.8	18.0	218.5	16.3	0.4	173.4	708.4	-	118.1	590.3	148.4
9	211.4	18.0	263.1	16.3	0.4	173.2	682.0	9.0	121.7	551.3	109.4
10	211.4	18.0	263.1	16.3	0.4	173.2	682.0	16.0	121.7	544.3	102.4
11	211.4	18.0	263.1	112.9	0.4	135.0	740.8	162.7	105.5	472.6	30.7
12	211.4	18.0	263.1	176.8	0.4	29.2	698.9	(1.8)	98.8	601.9	160.9
13	211.4	18.0	263.1	176.8	0.4	29.2	698.9	(1.3)	98.8	601.4	159.5
14	211.4	18.0	263.1	176.8	0.4	29.2	698.9	-	98.8	600.1	158.2
15	211.4	18.0	263.1	176.8	0.4	29.2	698.9	16.0	98.8	584.1	142.2
16	211.4	18.0	263.1	176.8	0.4	29.2	698.9	-	98.8	600.1	158.2
17	211.4	18.0	263.1	176.8	0.4	29.2	698.9	4.2	98.8	595.9	154.0
18	211.4	18.0	263.1	176.8	0.4	29.2	698.9	178.7	98.8	421.4	(20.5)
19	211.4	18.0	263.1	176.8	0.4	29.2	698.9	-	98.8	600.1	158.2
20	211.4	18.0	263.1	176.8	0.4	29.2	698.9	-	98.8	600.1	158.2
21	211.4	18.0	263.1	176.8	0.4	29.2	698.9	-	98.8	600.1	158.2
22	211.4	18.0	263.1	176.8	0.4	29.2	698.9	-	98.8	600.1	158.2
23	211.4	18.0	263.1	176.8	0.4	29.2	698.9	16.0	98.8	584.1	142.2
24	211.4	18.0	263.1	176.8	0.4	29.2	698.9	-	98.8	600.1	158.2
25	211.4	18.0	263.1	176.8	0.4	29.2	698.9	20.2	98.8	579.9	138.0
26	211.4	18.0	263.1	176.8	0.4	29.2	698.9	162.7	98.8	437.4	(4.5)
27	211.4	18.0	263.1	176.8	0.4	29.2	698.9	-	98.8	600.1	158.[illegible]
28	211.4	18.0	263.1	193.1	0.4	14.5	700.5	(8.5)	97.1	611.9	170.0
29	211.4	18.0	263.1	193.1	0.4	14.5	700.5	-	97.1	603.4	161.5
30	211.4	18.0	263.1	193.1	0.4	14.5	700.5	(63.6)	97.1	667.0	225.1

ERR = Over 100%

1/ Tables 13 and 14 multiplied by economic price in Table 27.
2/ Including log transferred to Okkyin and hardwood sawmills outside the project areas.
3/ Table 28.

Table 29

Table 30

BURMA

FORESTRY II (EAST PEGU YOMA) - CR.949-BA

Economic Analysis - Okkyin Teak Sawmill
(K million in 1987 Constant Prices)

	Investment Costs 1/		3/			Benefits (Sawnwood)				
	Civil Works	Equipment	Log Costs	Saw Milling 4/	Total Costs	Export	Local Sales 5/	Total	Net Benefits	Incremental Net Benefits
Year 0	-	-	10.3	10.5	20.8	45.8	19.3	65.1	44.3	-
1	1.2	0.6	15.0	15.3	32.1	61.3	32.5	93.8	61.7	17.4
2	1.4	-	14.4	14.6	30.4	71.0	36.4	107.4	77.0	32.7
3	0.3	9.5	17.9	18.2	45.9	58.6	27.1	85.7	39.8	(4.5)
4	0.4	0.3	22.8	23.2	46.7	89.5	47.6	137.1	90.4	46.1
5	-	0.9	20.8	21.3	43.0	77.0	37.7	114.7	71.7	27.4
6	-	0.5	18.2	18.6	37.3	86.1	35.9	122.0	84.7	40.4
7	-	3.6	15.1	15.4	34.1	60.0	25.3	85.3	51.2	6.9
8	-	0.6 2/	16.0	16.3	32.9	48.8	43.2	92.0	59.1	14.8
9	-	-	16.0	16.3	32.3	48.8	43.2	92.0	59.7	15.4
10	-	9.5	16.0	16.3	41.8	48.8	43.2	92.0	50.2	5.9
11	-	0.3	16.0	16.3	32.6	48.8	43.2	92.0	59.4	15.1
12	-	0.9	16.0	16.3	33.2	48.8	43.2	92.0	58.8	14.5
13	-	0.5	16.0	16.3	32.8	48.8	43.2	92.0	59.2	14.9
14	-	3.8	16.0	16.3	35.9	48.8	43.2	92.0	56.1	11.8
15	-	(5.4)	16.0	16.3	26.9	48.8	43.2	92.0	65.1	20.8

ERR = Over 100%

1/ Table 10 (Local costs x SCF of 0.80, equipment including duties and taxes (41%), adjusted into 1987 constant prices by [illegible]ing GDP's deflator factors.
2/ [illegible]lacement costs with annual economic life of 7.5 years.
3/ [illegible]/Ht (Financial costs x SCF).
4/ [illegible] /Ht (Financial costs x SCF).
5/ Including sawnwood transferred to selling depots outside the project area.

Table 31

BURMA

FORESTRY II (EAST PEGU YOMA) - CR.949-BA

Economic Analysis - Teak Plantation
(K million in 1987 Constant Prices)

	Investment Costs			Extraction	Total	Benefits		
	Civil Works	Equipment	Plantation	Costs 4/	Costs	Poles 5/	Post 5/	Net Benefits
Year 1	0.7	3.4	1.3	-	5.4	-	-	(5.4)
2	2.4	3.9	3.3	-	9.6	-	-	(9.6)
3	0.7	2.8	4.9	-	8.4	-	-	(8.4)
4	0.9	2.0	6.3	-	9.2	-	-	(9.2)
5	0.1	0.1	7.7	-	7.9	-	-	(7.9)
6	0.2 1/	0.9	5.0	-	1.6	-	-	(1.6)
7	0.2	-	2.0 3/	-	2.2	-	-	(2.2)
8	0.2	-	1.4	1.5	3.1	61.1	-	58.0
9	0.2	6.6 2/	0.7	2.9	10.1	68.3	-	58.2
10	0.2	-	0.2	4.2	4.6	71.5	-	66.9
11	0.2	-	0.1	5.6	5.9	75.0	-	69.1
12	0.2	-	-	5.8	6.0	75.5	-	69.5
13	0.2	-	-	6.6	6.8	78.0	-	71.2
14	0.2	-	-	-	0.2	-	-	(0.2)
15	0.2	-	-	4.4	4.6	71.9	-	67.3
16	0.2	6.6	-	8.8	15.6	83.0	-	67.4
17	0.2	-	-	13.6	13.8	95.0	-	81.2
18	0.2	-	-	18.6	18.8	107.5	-	88.7
19	0.2	-	-	19.4	19.6	109.5	-	89.9
20	0.2	-	-	19.4	19.6	109.0	-	89.4
21-22	0.2	-	-	-	0.2	-	-	(0.2)
23	0.2	6.6	-	-	0.2	-	-	(0.2)
24	0.2	-	-	-	6.8	-	-	(6.8)
25	0.2	-	-	7.4	7.6	-	37.8	30.2
26	0.2	-	-	17.9	18.1	-	91.4	73.3
27	0.2	-	-	28.6	28.8	-	145.7	116.9
28	0.2	-	-	39.8	40.0	-	202.5	162.5
29	0.2	6.6	-	41.2	48.0	-	210.0	162.0
30	0.2	-	-	40.7	40.9	-	207.5	166.6
31-34	0.2	-	-	-	0.2	-	-	(0.2)
35	0.2	-	-	12.1	12.3	-	61.8	49.5
36	0.2	6.6	-	30.1	36.9	-	153.1	116.2
37	0.2	-	-	52.6	53.0	-	244.5	191.5
38	0.2	-	-	66.4	66.6	-	338.4	271.8
39	0.2	-	-	68.8	69.0	-	350.7	281.7
40	0.2	(2.2)	-	68.4	66.4	-	348.3	281.9

ERR = 39%

1/ Assuming 5% of the investment costs for annual maintenance.
2/ Assuming economic life of 7.5 years and taking only 50% of total investment costs for plantation maintenance and extraction.
3/ Maintenance costs (Table 16 x SCF).
4/ Estimated at K250 per Ht x SCF for first and second thinning and K410/Ht for third and fourth thinning (see Table 16).
5/ See Table 8 for production x economic prices in Table 27.

Table 32

BURMA

FORESTRY II (EAST PEGU YOMA) - CR.949-BA

Plantation Program - Additional Output and Benefits of Taungya Plantation

Additional Outputs of Taungya Farmers

PRODUCT	SEED		YIELD		NET YIELD		PRICE K/BASKET		NET REVENUE K/ACRE	
	SAR	Actual	SAR	Actual	SAR	Actual	SAR	Actual	SAR	Actual
Hill Rice) Mixed 1/	1.0	1	30	20	29	19	9	10.00	261.00	190.00
Cotton) 2/	-	2 Viss	-	70 Viss	-	68 Viss	-	45 Viss	-	305.00
Groundnuts	.75	.75	10	20	9.25	19.25	34.0	60.00	315	1155.00
Sesame	-	.03	4	3	4	2.97	85.0	180.00	340	535.00

1/ This mixture realizes best return for basic cropping.
2/ Viss = 3.6 pounds.

BENEFITS

		79-80	80-81	81-82	82-83	83-84	84-85	
Beneficial Cultivation 1/	Ac	1,020	3,100	4,700	6,100	6,300	7,200	28,420
Breakdown - Rice/Cotton	Ac	610	1,550	2,350	3,050	3,150	3,600	14,210
Groundnut	Ac	255	775	1,175	1,525	1,575	1,800	7,105
Sesame	Ac	255	775	1,175	1,525	1,575	1,800	7,105
Benefits in K'000s								
Rice/Cotton	K	252.5	767.3	1,163.3	1,509.8	1,559.3	1,782.0	7,034.2
Groundnut	K	294.5	895.1	1,357.1	1,761.4	1,819.1	2,079.0	8,206.2
Sesame	K	136.4	414.6	628.6	815.9	842.6	963.0	3,801.1
TOTAL	K	683.4	2,077.0	3,149.0	4,087.1	4,221.0	4,824.0	19,041.5

1/ Based on 2 acres required per family - 200 families to establish 600-800 acre plantation - or .6 of area planted will be under cultivation.
2/ Breakdown = 1/2 Rice/Cotton, 1/4 Groundnut and 1/4 sesame.

Table 33

BURMA

FORESTRY II (EAST PEGU YOMA) - CR.949-BA

Economic Cost and Benefit Streams - Whole Project
(K million)

Year	Costs				Benefits				Net Benefit	Balance
	East Pegu	Okkyin	Teak Plantation	Total	East Pegu	Okkyin	Teak Plantation	Total		
0	69.8	20.8	-	90.6	511.7	65.1		576.8	486.2	-
1	152.9	32.1	5.4	190.4	845.4	93.8		939.2	748.8	262.6
2	206.4	30.4	9.6	246.4	1,017.8	107.4		1,125.2	878.8	392.6
3	232.3	45.9	8.4	286.6	1,011.2	85.7		1,096.9	810.3	324.1
4	176.1	46.7	9.2	232.0	1,103.2	137.1		1,240.3	1,008.3	522.1
5	174.0	43.0	7.9	224.9	1,007.7	114.7		1,222.4	997.5	511.3
6	164.0	37.3	1.6	202.9	858.8	122.0		980.8	777.9	291.7
7	130.7	34.1	2.2	167.0	730.3	85.3		815.6	648.6	162.4
8	118.1	32.9	3.1	154.1	708.4	92.0	16.1	816.5	662.4	176.2
9	130.7	32.3	10.1	173.1	682.0	92.0	68.3	842.3	669.2	183.0
10	132.7	41.8	4.6	184.1	682.0	92.0	71.5	845.5	661.4	175.2
11	268.2	32.6	5.9	306.7	740.8	92.0	75.0	907.8	601.1	114.9
12	97.0	33.2	6.0	136.2	698.9	92.0	75.0	866.4	730.2	244.0
13	97.5	32.8	6.8	137.1	698.9	92.0	78.0	868.9	731.8	245.6
14	98.8	35.9	0.2	134.9	698.9	92.0	-	790.9	656.0	169.8
15	114.8	26.9	4.6	146.3	698.9	92.0	71.9	862.8	716.5	230.3
16	98.8		15.6	114.4	698.9		83.0	781.9	667.5	181.3
17	103.0		13.8	116.8	698.9		95.0	793.9	667.1	190.9
18	277.5		18.8	296.3	698.9		107.5	806.4	510.1	23.9
19	98.8		19.6	118.4	698.9		109.5	808.4	690.0	203.8
20	98.8		19.6	118.4	698.9		109.0	807.9	689.5	203.3
21	98.8		0.2	99.0	698.9		-	698.9	599.9	113.7
22	98.8		0.2	99.0	698.9		-	698.9	599.9	113.7
23	114.8		6.8	121.6	698.9		-	698.9	577.3	91.1
24	98.8		0.2	99.0	698.9		-	698.9	599.9	113.7
25	119.0		7.6	126.6	698.9		37.8	736.7	610.1	123.9
26	261.5		18.1	279.6	698.9		91.4	790.3	510.7	24.5
27	98.8		28.8	127.6	698.9		145.7	844.6	717.0	230.8
28	88.6		40.0	128.6	700.5		202.5	903.0	774.4	288.2
29	97.1		48.0	149.1	700.5		210.0	910.5	765.4	279.2
30	33.5		40.9	74.4	700.5		207.5	908.0	833.6	347.4
1-34			0.2	0.2			-	-	(0.2)	(0.2)
35			12.3	12.3			61.8	61.8	49.5	49.5
36			36.9	36.9			153.1	153.1	116.2	116.2
37			53.0	53.0			244.5	244.5	191.5	191.5
38			66.6	66.6			338.4	338.4	271.8	271.8
39			69.0	69.0			350.7	350.7	281.7	281.7
40			66.4	66.4			348.3	348.3	281.9	281.9

ERR = Over 100%