

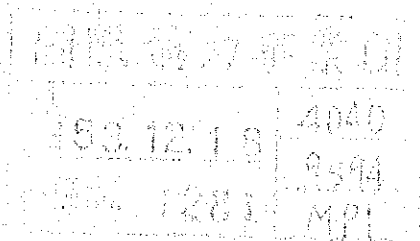
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REPORT OF THE
SURVEY ON THE MODERNIZATION PLAN OF
WOOD PROCESSING INDUSTRIES IN THE
REPUBLIC OF KENYA

NOVEMBER 1978



JAPAN INTERNATIONAL COOPERATION AGENCY

国際協力事業団

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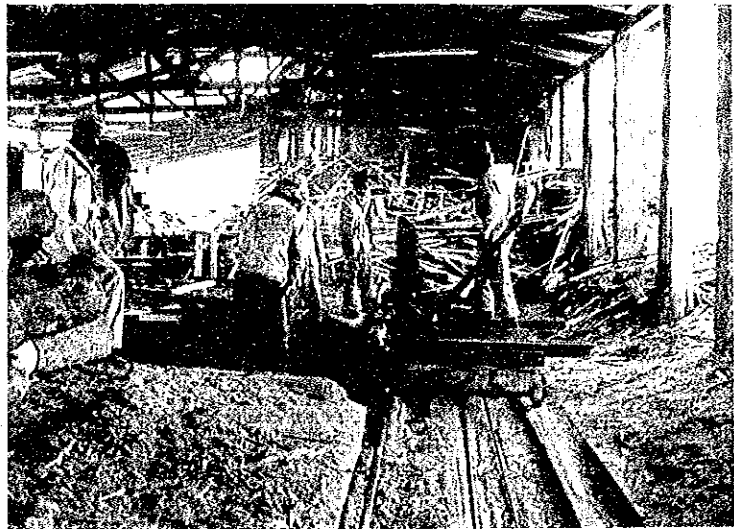
SAWMILLS IN KENYA.

① KIRINYAGA
CO-OP SOCIETY

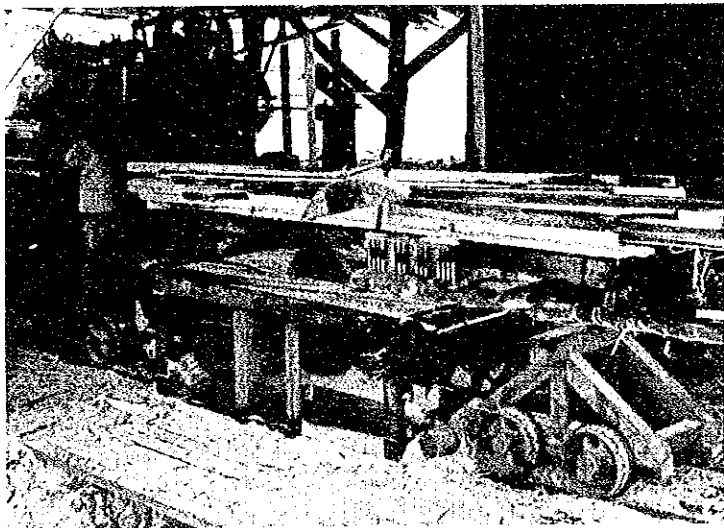


② KIRINYAGA
CO-OP SOCIETY

③ KITIRO SAWMILLS

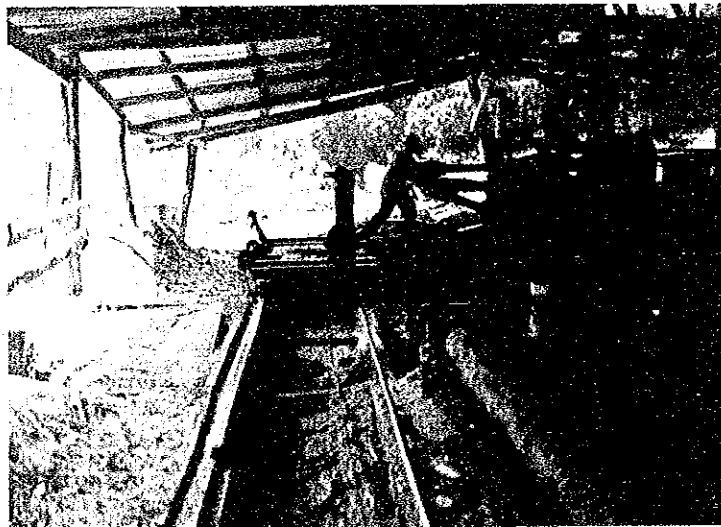


④ KITIRO SAWMILLS
1200 TYPE
Roller Band Resaws

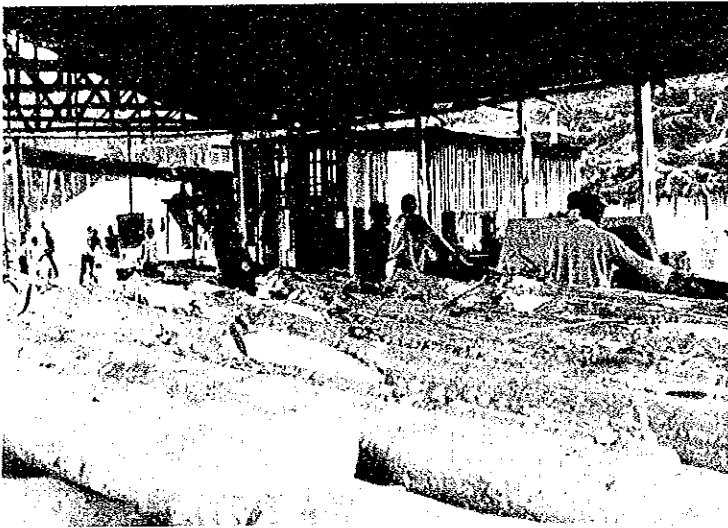


⑤ KIBLESO SAWMILLS
900(36")
Circular Saw Bench

⑥ KIBLESO SAWMILLS
1200(48") TYPE

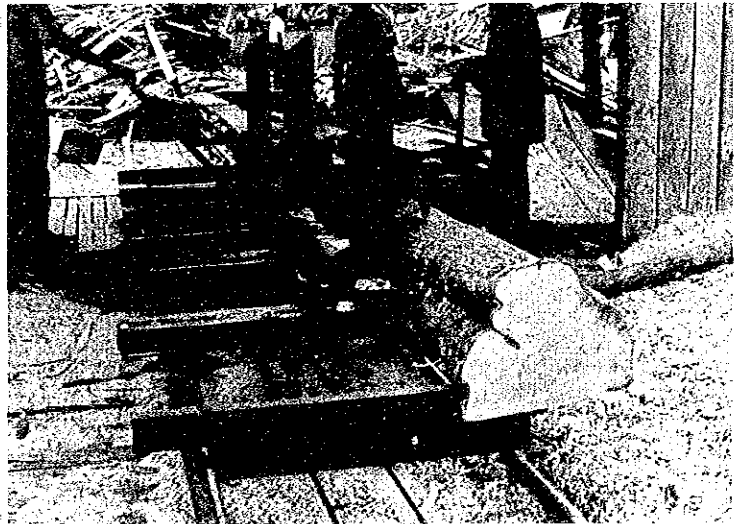


⑦ MWENGE
INTERNATIONAL
SAWMILLS

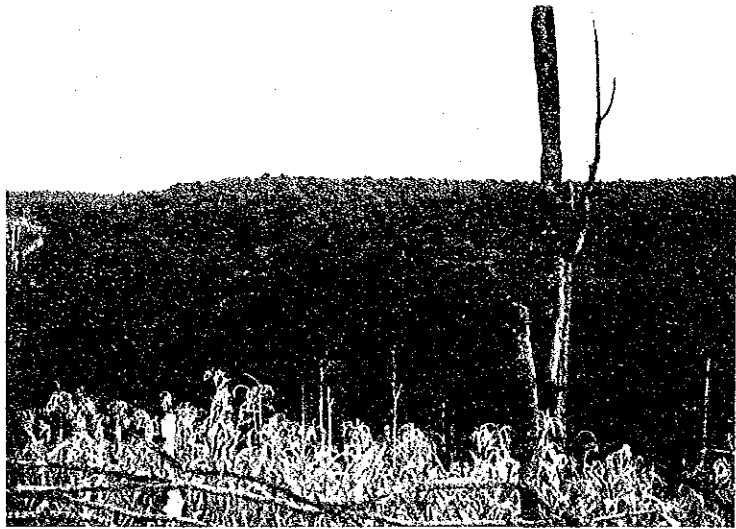


⑧ MWENGE
INTERNATIONAL
SAWMILLS

⑨ MWENJA
NGURE
SAWMILLS

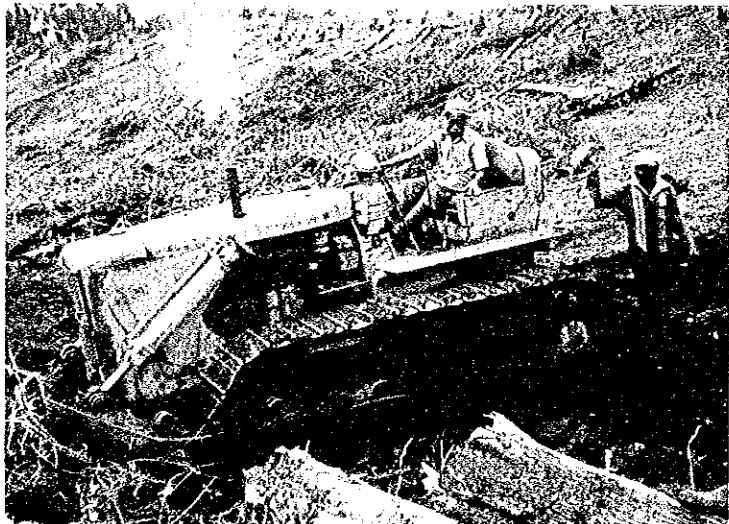


⑩ Man-made Forest
of Cypress
Age : 25years.

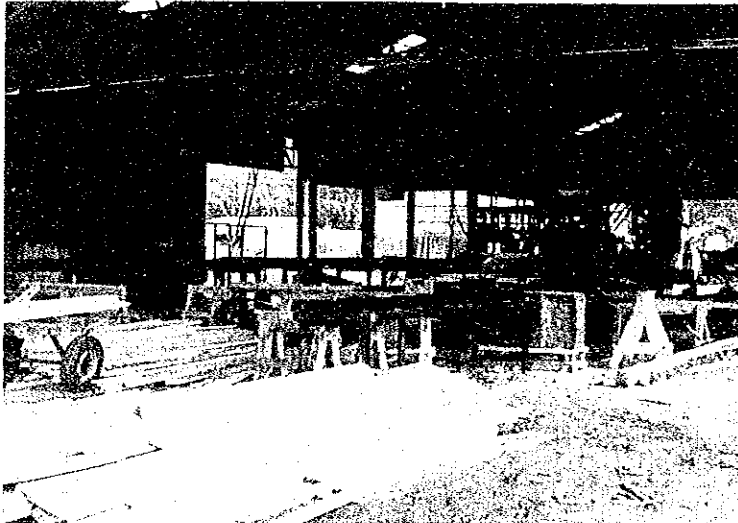


⑪ WANANCHI SAWMILLS.
Logged over area.

⑫ WANANCHI SAWMILLS.
Pre-yarding.

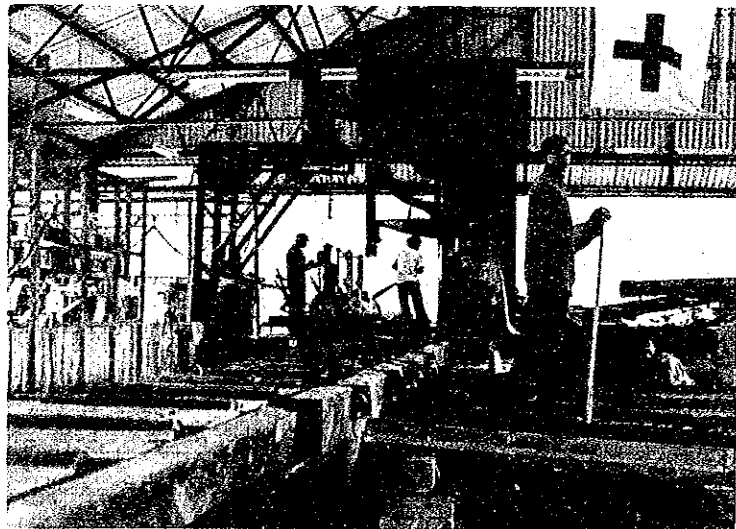


⑬ Indigenous Forest
at Mt. Kenya



⑭ WANANCHI
SAWMILLS.

⑮ WANANCHI
SAWMILLS.



FOREWORD

The Government of the Republic of Kenya, for the purpose of promotion of conservation of forest resources and its development as well as the progress of forestry and timber processing industry in recognition of the necessity of modernization of timber processing industry, asked Japan to cooperate for conducting the feasibility study on the modernization of wood processing industry in Kenya.

In response to the request, The Government of Japan has decided to carry out a survey and entrusted execution of the said survey to the Japan International Cooperation Agency (JICA).

The Japan International Cooperation Agency organized a survey team composed of eight experts with Shizuo Shigesawa of Japan Timber Product Storage Organization as the leader and dispatched this team to Kenya for the period of February 3 through March 3 of 1978.

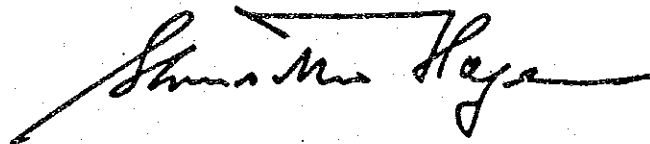
The survey team stayed in Kenya about 4 weeks and carried out collection of data and information required for the practical means of the modernization and the policy to be pursued in connection with the present timber industry as well as actual situation of the related industries.

This report summerized, particularly on the sawmill industry, the various measures for improvement of management in future, the fundamental apprehension for introduction of an essential new industry for Kenya and current required fund for modernization of timber industry and proposed the policy to be adopted by the Government of Republic of Kenya.

On presentation of this report, we wish that this report will make contribution to the modernization of timber processing industry as well as to the development of industry and economy of the Republic of Kenya and that it will be helpful in strengthening the ties of friendship between the Republic of Kenya and Japan.

We would like to take this opportunity to express our heartfelt appreciation to those concerned of the Government of the Republic of Kenya and of the Japanese Embassy in the Republic of Kenya for the kind of cooperation extended to the survey team.

November 1978



Shinsaku Hogen
President
Japan International Cooperation Agency

**REPORT OF THE
SURVEY ON THE MODERNIZATION PLAN OF
WOOD PROCESSING INDUSTRIES IN THE
REPUBLIC OF KENYA**

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INTRODUCTION

This is the final report of "Survey Mission for Modernization of the Wood Industries" dispatched by the Japanese Government at the request of the Government of the Republic of Kenya.

The Kenya Government in cognizance of the necessity of modernization of the wood industries, requests the Japanese Government to promote conservation and development of forest resources, help the recovery of the industry and raise up the profits of forestry as well as wood processing industries through introduction of higher technology into sawmilling and woodworking sectors, and finding out of more effective utilization of residuals of wood industries.

The Survey Mission organized by the Japan International Cooperation Agency was dispatched February 1978. The Mission stayed in Kenya about 4 weeks and surveyed on existing wood based industries in Kenya to find out concrete direction to modernization and necessary policy. In this report, the direction of improvement of future management of wood industries, particularly sawmilling industry is suggested and the basic informations for introduction of needed new industries are indicated and also the amount of capital required for modernization of wood industries and the measures for its promotion to be taken by the government are also suggested.

Members of Survey Mission

Name	Duty	Organization	Position
SHIZUO SHIGESAWA	Generalization	Japan Timber Products Storage Organization	Researcher
MASAYUKI HORI	Materials & felling	Japan Forestry Technical Association	Executive Director
SHIGERU NODA	Wood processing	Institute of Vocational Training	Asst. Professor
KAZUO MATSUBARA	Management control	Matsubara Management Consultants	Chief Consultant
KOICHIRO KAWABE	Sawmilling Techniques	Kawabe Shoji K.K.	Managing Director
TOSHIHIRO KODAMA	Timber Processing Equipments	Chugoku Kikai Seisakusho Co.	Executive Director
YOSHIYUKI SATO	Marketing	Sangyo Boeki K.K.	Chief, Representative at Nairobi
MASASHI AOKI	Business Coordinator	JICA, Administration Div.	

ITINERARY

Date	Route	Stop	Survey
1 2/3 Fri.	Lv. Tokyo		
2 4 Sat.	Via Frankfurt		(Mr. Kawabe left Tokyo)
3 5 Sun.	Arrv. Nairobi	Nairobi	(Mr. Kawabe arrv. Nairobi)
4 6 Mon.			Arrange with JICA Office (AM). Visit Japanese Embassy (PM)
5 7 Tue.			Visit Ministry of Finance (AM). Arrange with I.C.D.C. (PM)
6 8 Wed.			Visit Timsales (AM). Visit Forest Dept. Collect information
7 9 Thur.			Visit Wood Makers. Survey Holyoak Sawmills
8 10 Fri.			Collect information in the city
9 11 Sat.	Nairobi – Amboseli	Amboseli	Arrange information
10 12 Sun.	Amboseli – Nairobi – Nakuru	Nakuru	
11 13 Mon.			Arrange with FITC. Survey KITI, Kitiro Sawmills
12 14 Tue.			Survey Molo Woodwork, Kibleso Sawmills & Timbwaco Sawmills
13 15 Wed.			Survey West Mau Sawmills & Kedowa Sawmills
14 16 Thur.	Nakuru – Nyahururu	Nyahururu	Survey Mwenja Nygure
15 17 Fri.			Survey Maina Sawmills, Mwenge International, National Pencil Co., Kio Sawmills
16 18 Sat.	Nyahururu – Nyeri	Nyeri	Arrangement of Survey Mission
17 19 Sun.	Nyeri – Aberdare	Aberdare	Forest survey near Mt. Kenya
18 20 Mon.	Aberdare – Nyeri	Nyeri	Survey Mbau Sawmills, Kihari Timber Industries & Wananchi Sawmills
19 21 Tue.	Nyeri – Meru	Meru	Survey Kirinyaga Co-op Society, Rupingazi Sawmills (Mr. Kawabe left Nairobi)
20 22 Wed.	Meru – Nairobi	Nairobi	Survey Njeru Industries Sawmills & Meru Timber
21 23 Thur.			Arrange with Japanese Embassy and JICA Office (Mr. Kawabe arrived Tokyo)
22 24 Fri.			
23 25 Sat.			Prepare the interim report
24 26 Sun.			
25 27 Mon.			
26 28 Tue.			Interim Report Meeting,
27 3/1 Wed.	Lv. Nairobi Arrv. London	London	
28 2 Thur.	Lv. London		
29 3 Fri.	Arrv. Tokyo		

SUMMARY

Kenya can not be said enriched with forest resources and the forest area is only 3% of the total land area in which excellent plantation of 150,000 ha is included.

While most of timber production is consumed as fuels, production of industrial wood is half a million m³ in recent years and there is a possibility of increased production.

The dominant sector in the timber processing industry is the sawmilling and those which hold long term felling licences and those with general licence are accounted for more than 200 mills in operation. Most mills are on small scale and old type circular saw is being used for sawing. The recovery percentage of sawmilling is quite low, 30% on the average resulting to wastage of valuable resources.

Timber industries other than sawmill industry are plywood mill (3), pulp & paper mill (1), fibreboard mill (1) and particle board mill (1) now in operation and the present production is very low.

Based on these actual conditions, the survey team studied on the possibility of modernization and reached the following conclusion.

1. Modernization of existing sawmills

Machines and equipments – existing machines and equipments are quite outdated and of 18 mills surveyed, 16 mills are to be transferred to the modern band-saw mill. From the viewpoint of mill site and possibility of log supply, 2 mill scales are considered and 8 mills each for the scales are to improve their facilities.

Logging facilities – existing sawmills having felling licence fell trees by themselves and transport to their own mills but existing facilities are quite poor and necessitated to expand its capacity 2 times as much as the present ones.

Management improvement – in most of the mills visited, management is still inadequate. It is necessary to introduce proper financial control and cost accounting based on the proper management plan. Unless improvement in this sector is done, even if machines and equipments are improved, its effect can not be fully realized.

2. Introduction of new timber industry

– Manufacture of wood waste briquette – in order to utilize mill waste (mainly sawdust), it is suggested to manufacture wood waste briquette. This industry supplies local population with needed fuel and the products are not only used for house-hold fuel but for industrial purposes. Since the timber felling for fuel is a problem of forest management, the briquette manufacturing industry will help conserve forest resources.

– Construction of secondary processing plant

In order to rationalize the use of sawn timber and to improve profitability of sawmills, it is appropriate to consider building of secondary processing factories to produce furniture and housing components. These factories should be located in cities where sawmills are concentrated and demand for timber products are high. As the construction of such factories requires a large amount of funds, it is desirable to manage them by either a joint investment of sawmills or by co-operatives.

– Construction of plywood mill for tea-chest

In view of recent increase of tea production and its exports, there is a possibility to construct the plywood mill to produce exclusively tea-chest. However, the survey is not thorough enough as to the possibility of future supply of peeler logs or marketability. Calculation is being made on the required fund for construction but prior to the implementation, it is desirable to carry out further survey.

– Construction of particle board mill

For utilization of residuals of sawmill, the construction of particle board mill has been considered. However, under the present conditions are not favorable for the sound operation of particle board mills.

3. Marketing

No noteworthy effort has been made so far to promote either domestic or foreign marketing of sawn timber. With regard to the domestic market, it is suggested that timber yards be established as joint undertakings of sawmillers in major consumer areas under the direction of national authorities in order to rationalize the distribution of timber products.

As for the overseas market, the continuity of supply and the stability of high quality of products are prerequisite to meet its requirements. It is difficult therefore to expect any increase of export with current standards of production. It is only when the modernization of timber industry is realized, that the promotion export could be pursued. In this case, adequate market research is required.

4. Training centre

In order to utilize fully modern machinery and equipments and to improve the management of timber industry, it is necessary to improve the vocational training for the employees engaged in the industry to gain more knowledge and experience in technology and management. It is suggested that the training centre is equipped with sawmill facilities of medium scale to effect such training.

5. Modernization plan and required fund

In order to implement the above-mentioned modernization, a three year plan is proposed. Its cost is estimated as follows:

The rise of prices of machines, etc., is assumed to be at 7% per annum.

Table 1. Plant construction plan and required fund (US\$)

	No. of plant	Foreign money	Domestic money	Total
Training center	1	299,320	452,480	751,800
Sawmill A	8	2,763,810	3,879,030	6,642,840
Sawmill B	8	1,108,630	1,164,540	2,273,170
Briquette plant	3	311,630	156,820	468,450
Secondary process plant	3	1,064,810	608,580	1,673,390
Timber yard	3		300,980	300,980
Sub-total		5,548,200	6,562,430	12,110,630
Chest plant	1	1,936,800	1,900,000	3,836,800
Total		7,485,000	8,462,430	15,947,430

Cost of dispatching experts (US\$)

Training center	115,800
Sawmill	60,500
Briquette plant	29,800
Secondary process plant	24,600
Total	230,700

6. Necessary Government's measures

A large amount of fund is needed to modernize timber industry. At the same time, training of managers and technical staff is also essential. The burden of satisfying these need, however, cannot be borne by the private sector alone, the government should take appropriate administrative measures to promote such modernization. The measures should include, among others, the establishment of a specialized agency responsible for control of funds, training, operation of training centre and marketing of products. Care should be taken, however, the Government initiative do not surpress free marketing and other activities of private enterprises.

CHAPTER I. BACKGROUND AND PURPOSE OF THE SURVEY

The forest land of Kenya is only 3% of the total land area and the country is one of poor nations of forests in the world. In this sense, wood product is necessarily utilized efficiently and economically. Notwithstanding, wood industries, particularly the sawmill industry in Kenya are small scaled and located sporadically in many parts of the country and their facilities are mostly obsolete. The degree of wood utilization is quite low and large volume of wood resources are left unused as residues or saw dusts. On the other hand, wood demand in the country is steadily on the increase along with the development of national economy, and promotion of the modernization of wood processing industry is quite an important issue from viewpoint of conservation and improvement of forest resources as well as raising up of forestry income.

In view of such present status, ICDC (Industrial and Commercial Development Corporation), the governmental agency who is responsible for industrial development carried out the preliminary survey on existing sawmills and as a result, reached to a conclusion that there is a room for technical improvement for wood development and distribution channel and the development of industry is expedited and higher degree technology and facilities are introduced into sawmilling and woodworking sectors to realize higher revenue in the forestry and it is necessary to develop the industry which utilizes more efficiently the residuals of the wood industry and the examination was made to organize an independent agency to carry out the above.

Based on these circumstances, the Kenya Government requested the Japanese Government to carry out the survey on the modernization of wood industry. The purpose of this survey is to find out the direction of the modernization of wood processing industry, particularly existing sawmills and at the same time, examine the possibility of introduction of new wood processing industry and its suggest the necessary measures to be taken for the realization of such plan.

CHAPTER II. FOREST RESOURCES AND PRESENT SITUATION OF WOOD INDUSTRY

2.1. Natural environment

2.1.1. Location

The Republic of Kenya is located at 4°N – 4°S latitude and 34°E – 41°E longitude and its boundary is adjacent to ETHIOPIA and SUDAN in the north, UGANDA in the west, TANZANIA in the south, and SOMALIA in the east and faces Indian Ocean in the east-south. Its total area is about 580,000 km², 1.5 times as much as Japan.

2.1.2 Topography

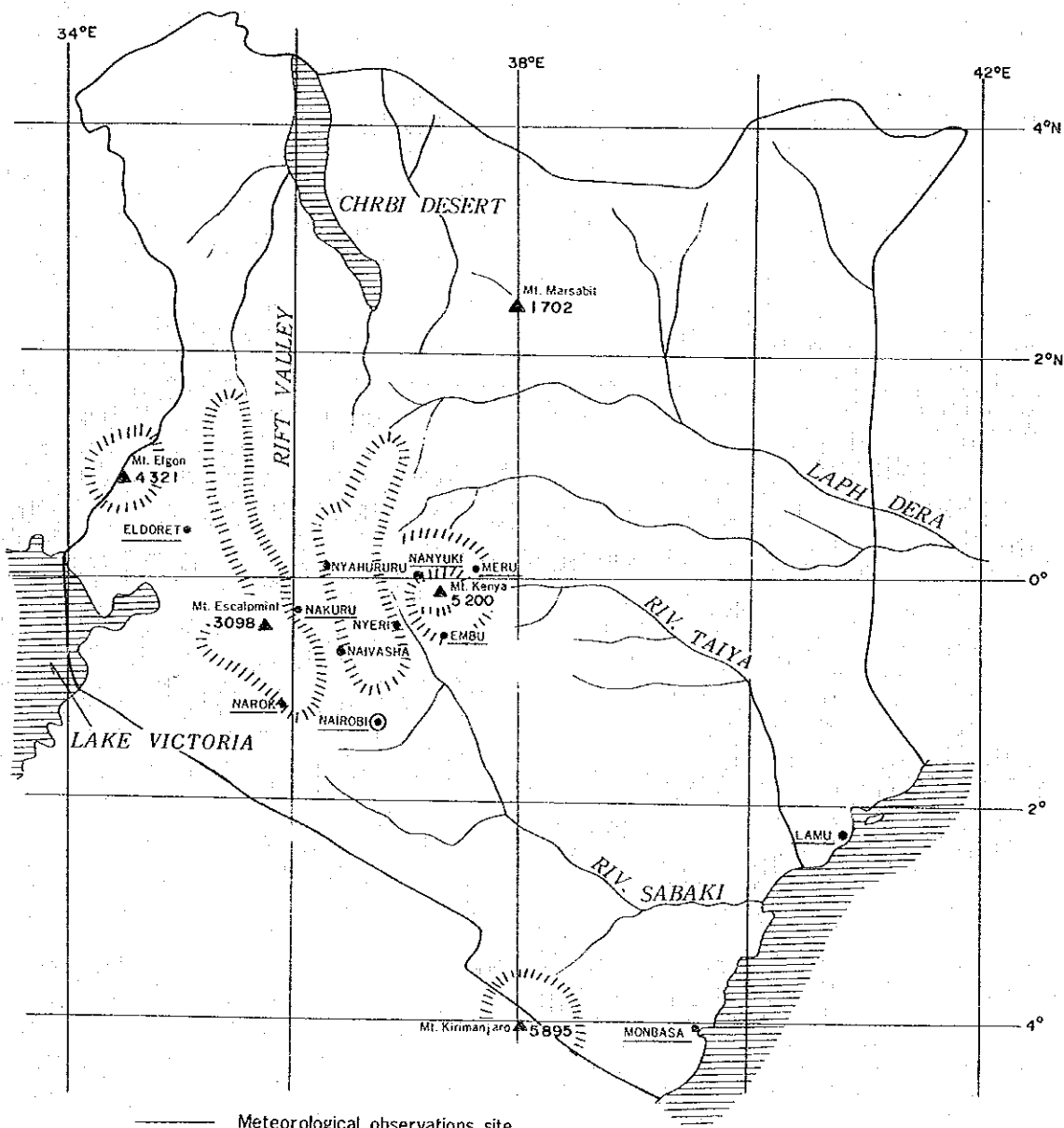
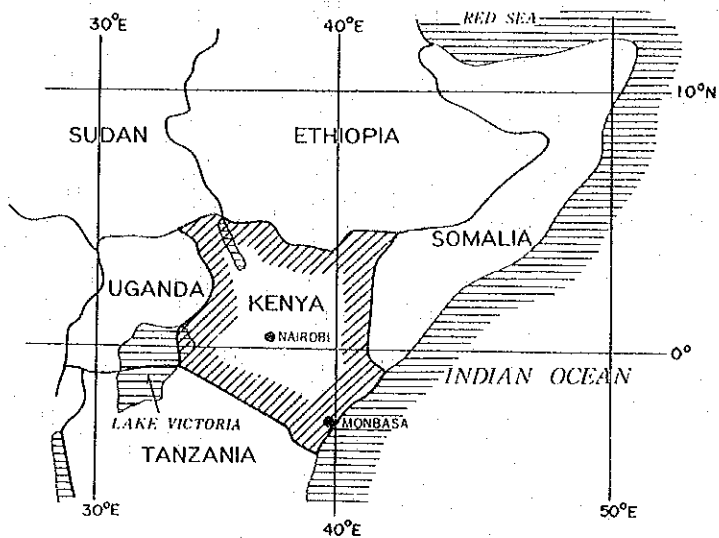
NAIROBI, the capital is almost in the centre of the country and 1,600 m above sea level and the temperature is 16°C – 24°C and mild. MOMBASA, the only city having a port in Indian Ocean is important for trade port and its level is 100 m – 200 m above sea and the temperature is 24°C – 33°C and the city is directly under the influence of tropical oceanic climate, high temperature and high humidity.

There is a vast valley called RIFT VALLEY which stretches south-east in the centre of the country from TANZANIA to SUDAN where the nomadic people migrate. The south-east region is mostly a plain covered with unused shrub, grassland and swampy land. The region to the north of NAIROBI is hilly and near the boundary of UGANDA, there is Mt. ELGON, 4,321 m high and on its east side, CHERANGANI HILLS, 3,370 m high is traversing in the south north and on its southern end, the ridge line of MAU ESCARPMENT, 2,098 m high is stretching to the south southeast as head water area of VICTORIA lake. Putting this between, on the east side, there is a mountain mass having Mt. KENYA, 5,199 m high, the highest in Kenya from where TANA and SABAKI rivers flow down to Indian Ocean.

Hilly zone of the western half of the country is 1,500 m – 2,500 m high favored with comfortable climate and good for agriculture, forestry and live stock industries. The south-eastern part of the country, 100 m – 1,000 m above sea level is covered with grass and shrub and there are some marshes sporadically which are not utilized owing to adverse factors of climate and rainfall.

2.1.3. Climate

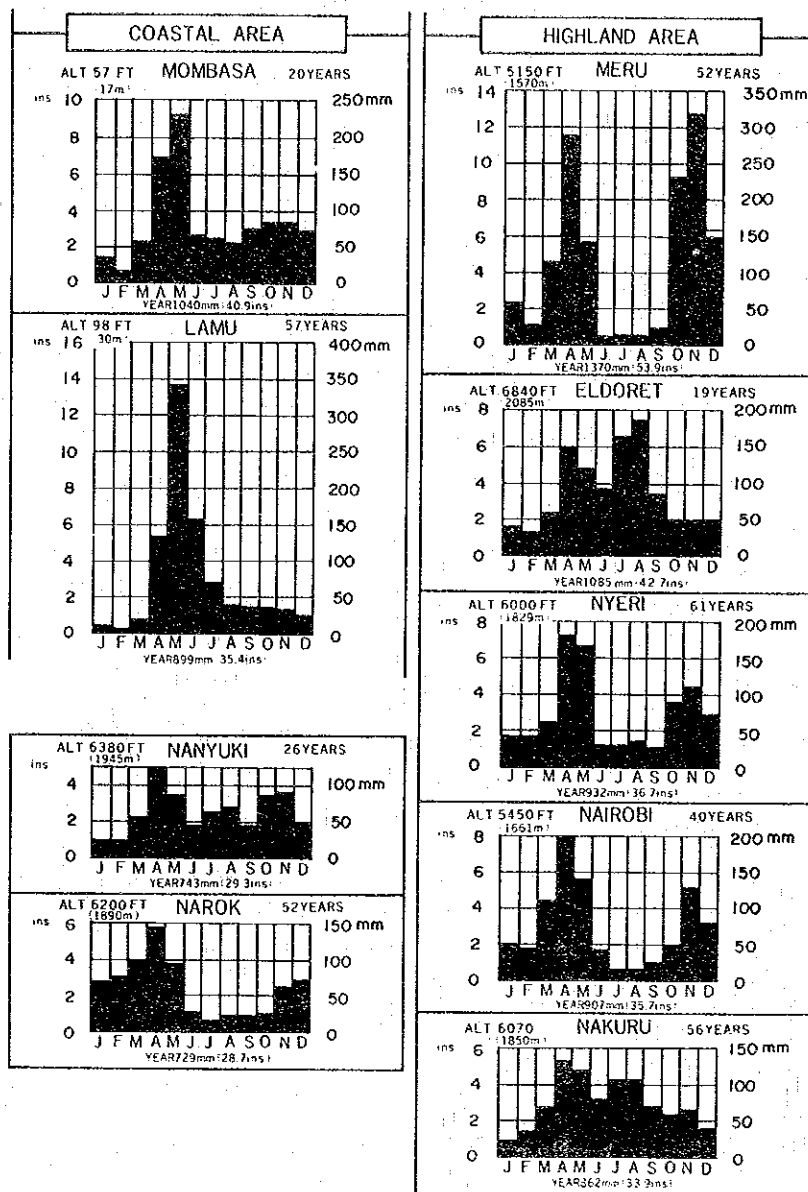
The climate of this country is divided into two; the one is MOMBASA and LAMU under the influence of oceanic climate from Indian Ocean and the other is the climate to the north of NAIROBI, the mountain zone. In the high land area, the center of forestry, the climate and rainfall are favorable to the growth of forest trees. According to NATIONAL ATLAS 1970



edition, the rainfall of selected areas is shown in the table and in MOMBASA, the coastal zone, the rainy season is April and May and the monthly rainfall is 170 mm – 240 mm. In the mountainous zone of MERU and NYERI, there are two rainy seasons dominantly April and October, and the monthly rainfall is 270 mm – 340 mm. The monthly rainfall shows significant variance in each area. Particularly, in ELDORET on the east slope of mountain mass of Mt. ELGON in the boundary area of UGANDA, the rainfall in April to September is 100 mm – 180 mm and only in this season, there is over 800 mm of rainfall and the area is pluvial. Considering the climatic condition, there are many good sites for planting. In this area, particularly from the viewpoint of national defence, large scale expanding reforestation is being carried out. In the locality of sawmills of high land area where we have surveyed, the correlation of above sea level, annual rainfall, and mean annual temperature is high and the area is not only good for growth of forest trees but for farm crops edaphically.

Table 2. Climatic correlation of high land area

Locality	Above the sea m	Annual rainfall mm	Annual mean temperature		
			Max. C°	Min. C°	Mean C°
MOMBASA	17	760 – 1,015	30.3	22.4	26.3
NAIROBI	1,635	760 – 1,015	25.2	13.6	19.4
MERU	1,590	1,270 – 1,525	24.5	8.5	16.5
NYERI	1,800	760 – 1,015	20.6	8.5	14.5
NAKURU	1,820	760 – 1,015	28.5	12.5	20.5
LONDIANI	2,300	1,015 – 1,270	28.5	12.5	20.5



2.2. Forest resources

2.2.1. Area and inventory of forest

The land area of Kenya is 580,000 km² and the forest area is only 3% of total land.

The national forest covers 1.45 million ha (including 1.3 million ha of natural forest and 0.15 million ha of man-made forest), the public forest 0.41 million ha and private forest 0.12 million ha, totaling 1.98 million ha.

According to the first development plan (1974 – 1978), the land use plan covers 1.67 million ha of farm land, 3.94 million ha of permanent grass land, and 2.27 million ha of forest land, totaling 7.88 million ha and 13% of land area is the target of development base of the

land industry.

The inventory of 1.3 million ha of natural forest (indigenous forest) of the national forest is 83.82 million m³ (available inventory) and 65 m³ per ha on the average. The inventory of species of economic value is 47.75 million m³ which is supposed to be approximately 50% of the total inventory. The felling volume available without destruction of the stand is expected 0.15 million m³ annually by 1990. This is corresponding to 30% of the volume to be able to supply.

The man-made forest is dominantly composed of exotic species of cypress and pines and its area covers about 0.15 million ha and the trend of plantation in recent 8 years is tabulated as follows.

Table 3. Trend of areas of plantation by year and by species

Species	Unit: 1,000 ha							
	1969	1970	1971	1972	1973	1974	1975	1976
Cypress	43.0	48.8	47.0	47.4	49.9	53.2	56.7	59.7
Pine	49.0	51.1	52.2	57.6	58.8	61.4	64.9	68.0
Other H/W	8.0	1.5	6.1	6.0	6.4	6.8	6.1	6.1
Ind. S/W	4.6	4.6	4.6	4.6	4.9	4.7	4.7	4.7
Total	111.6	115.6	119.9	123.3	128.1	134.9	142.5	149.4

Source: Economic Survey, 1977.

The plan of Forest Department sets a target to achieve the plantation of 160,000 ha by 1980/81 and in the high land to the north of NAIROBI, the capital, fast growing species of conifers are dominantly introduced with an expectation of 17 m³ per ha of average annual increment under the government management of planting. At present, approximately 450,000 m³ of annual felling of industrial timber is being carried out but since the data concerning the area by species and age class of the plantation was not available, the overall inventory can not be grasped. These man-made forests produce saw logs and the natural forests (indigenous species) produce furniture timber.

Dominant and important species in Kenya are as follows:

Table 4. Important wood species in Kenya

Botanical Name	Common Name	Use
Softwood		
<i>Pinus radiata</i>	Pine	Construction & civil engineering
<i>Pinus patula</i>	Pine	Construction & civil engineering
<i>Pinus canariensis</i>	Pine	Construction & civil engineering
<i>Cupressus torolosa</i>	Cypress	Construction
<i>Juniperus procera</i>	African cedar	Construction
<i>Podocarpus gracilior</i>	Podo	Construction & furniture
<i>Podocarpus milanjanus</i>	Podo	Construction & furniture
Hardwood		
<i>Hagenia abyssinica</i>	Rosewood, Mijogaoja	Furniture
<i>Olea hockstetteri</i>	Musharage	Bridge timber
<i>Lovoa swynnertonii</i>	Walnut, Mukongoro	Furniture
<i>Ocotea usambarensis</i>	Ea Camphor	Furniture & construction
<i>Chlorophora Excelsa</i>	Mvuli	High grade furniture
<i>Cordia Africana</i>	Muringa, Meru Teak	Furniture
<i>Grevillea robusta</i>	Cedar Mirana, Grevillea	Door, resistant to termites
<i>Vitex keniensis</i>	Meru oak	Furniture for export

2.2.2. Afforestation plan and felling plan

Kenya Government has carried out the experiment of right species for promotion of afforestation of fast growing conifers rather than the indigenous species and since 1946, the work started to establish the plantation covering 200,000 ha systematically.

At present afforestation of 8,000 ha per year is being carried out as follows.

New plantation	6400 ha
Replacement plantation	1600 ha

That is, afforestation is 80% and reforestation 20%.

In the long term program, reforestation covers 4,000 ha by 1,990 of which it is estimated that 2,000 ha is for saw log and 2,000 ha for pulpwood.

They have planned the annual felling through expedition of these plantations as follows.

The actual harvesting in 1976 is 487,000 m³ and the target for the time being is set at 500,000 m³ of which 150,000 m³ is for saw log and 300,000 m³ for pulpwood, totaling 450,000 m³ of softwood and 50,000 m³ of hardwood are expected to harvest. The annual harvest by 1980 will rise up to 600,000 m³. The above-mentioned 500,000 m³ include thinnings.

Beside the above, for annual felling, 30,000 – 35,000 m³ are expected for plywood, 11,000 m³ for fiberboard, and 11,000 m³ for particle board. In summary, 550,000 m³ are expected to harvest per year.

2.3. Present status of wood industry

2.3.1. Present status of wood processing industry

The core of the wood industry in Kenya is sawmilling and beside, the plywood industry, pulp and paper industry, fibreboard industry, and particle board industry are in work.

Sawmill industry is consisted of approximately 300 sawmills, almost all of these mills are located near forest with circular saw, with a few exception with modernized equipments. These mills locate to the north of NAIROBI, in high land area where man-made forests and indigenous forests are not a few. Especially, NAIROBI, LONDIANI, NYAHURURU, NYERI, EMBU and MERU are the base of wood industry and mills are working briskly. The capacity of log input of sawmills is about 270,000 m³ per year and the production of 1976 is 109,000 m³.

The facilities related to the wood industry are as follows.

Sawmills:

Long term licence (5 years) for logs from the national forests	62 mills
Short term licence (1 year) for logs from the national forests	21 mills
Sawmills which export a portion of their products	8 mills
For logs from the private forest	200 mills
Plywood mills:	3 mills
Pulp & paper mills:	1 mill
Fibreboard and Particle board mills:	1 mill each

The production and log input of above mills are as follows. (Table 5)

Table 5. Production of wood processing industry in 1976

	Production	Log input (m ³)
Pulp & paper	41,000 ton	200,000
Plywood	11,800 m ²	42,000
Fiberboard	6,000 ton	9,000
Particle board	6,500 ton	15,000

Source: Forest Department.

2.3.2. Wood consumption and production

Wood consumption in Kenya in 1975 is estimated at 12 million m³ roundwood equivalent. Of these, 92% is for fuelwood (according to FAO statistics) and the consumption of industrial wood for sawmilling, pulp and plywood is only 5%. In rural areas, the wood is considered to be the major source of fuel in future and the annual increase of such demand is estimated at 4% per annum slightly exceeding the rate of increase of population.

It is the policy of the Government to meet the demand of fuelwood by private forests and those owned by the local public entities. As it is hard to secure logs from private forests to meet the local demand for fuelwood, the substitute is now under examination.

The prospect of demand for industrial wood is listed in the following table and the supply (roundwood equivalent) exceeds about 440,000 m³ to demand and the Government expects that in future, the supply increases and there will be a surplus for export of processed wood.

Table 6. Supply and demand for construction, industrial use and export

	Unit: 1,000 m ³ (Roundwood equivalent)				
Supply	1974	1975	1976	1977	1978
Saw log & peeler log	490	549	608	667	726
Fibreboard	80	80	80	80	80
Pulp & paper	115	230	320	410	500
Total	685	859	1,008	1,157	1,306
Demand					
Sawn wood	437	460	490	513	543
Plywood	51	56	61	65	70
Fibreboard	14	14	22	22	22
Pulp & paper	115	230	230	230	230
Total	617	760	803	830	865
Surplus	68	99	205	327	441

Source: Development Plan (1974–1978), Part I, Table 11-1.

2.3.3. Felling licence

The Kenya Government supplies logs to sawmills on stumpage sale basis and based on the application of the mill owner, the licence is granted in writing by Chief Conservator of Forest Department.

Two types of licence are issued, long term (5 years) and short term (1 year). The licence states the stand age and area by compartment and sub-compartment where felling can be done and the area by final cutting and thinning and by year. These trees are almost planted and composed of cypress and pines.

Of indigenous forest, felling species, term of permission, and total volume of allowable cutting are designated. Of the mills surveyed, No. 15, No. 16 and No. 17 come under this category.

Licensed mills by the national forest are 62 of long term license (5 years) and 21 of short term licence (1 year) and other 8 mills are designated as mills for export a portion of their products. Unlicensed mills are accounted for 200 but their actual conditions are not clarified.

Log consumption of licensed 18 mills surveyed is as follows.

*(Some mills are not available for details of licence)

- a. Mills having a licence of annual felling of 10,000 m³ or more 6 mills
- | | |
|----------------------|--|
| No. 2 KITIRO S/M | No. 12 MBAU S/M |
| No. 4 KIBLESO S/M | No. 14 WANANCHI S/M |
| No. 8 MWENJAGURE S/M | No. 15 KIRINYAGA Cooperative Society S/M |

- b. Over 5,000 m³ under 10,000 m³ of annual felling . . . 5 mills
No. 6 WEST MAU S/M No. 9 MAINA S/M
No. 7 KEDOWA S/M No. 16 RUPINGAZI S/M
No. 8 MWENJA NGURE
- c. Under 5,000 m³ of annual felling
No. 3 MOLOLO WOODWORKS S/M
No. 10 MEWENGE INTERNATIONAL S/M
No. 17 NJERU INDUSTRIES S/M

Conditions of individual licence of the mill surveyed as follows.

Table 7. Details of licence of mills surveyed

No.	Mill (Locality)	Term of licence	Designated harvest in 1978						
			Species	Stand age	Area	Clear felling	Thinning	Total	
1	Holyoak Sawmills (South Kinangop)	—	—	—	—	—	—	—	
2	Kitiro Sawmills (Elburgon)	1976 ~ 1978	C. LUS.	30	40.0	14,200	—	14,200	
			C. LUS.	20, 22, 23	61.0	—	2,195	3,442 (17,642)	
			P. rad.	19, 22	37.0	—	1,247		
3	Mololo Sawmills (Sorget)	1974 ~ 1978	C. LUS. P. rad.	31 25.22	16.1 25.9	1,720	1,670	1,720 1,670 (3,390)	
4	Timwaco Sawmills (Malagat)	—	—	—	—	—	—	—	
5	Kibleso Sawmills (Makutamo)	1974 ~ 1978	C. macro	24, 25 23, 24	7.3 16.3	13,943	—	13,943	
			C. LUS.					418	1,948 (15,891)
			P. rad.					1,530	
			C. Lus.					—	
6	West Mau Sawmills (Kirisoi)	1978 ~ 1982	C. Lus.	36	8.5	3,400	—	5,950	
			C. macro.	30	8.5	2,550	—		
			C. lus.	—	5.0	—	600	600 (6,550)	
7	Kedowa Sawmills (Kedwa)	1978 ~ 1982	C. tor.	43	6.1	2,440	—	6,000 (6,000)	
			C. lus.	42	4.9	1,860			
			C. macro.	28	5.0	1,600			
			—	—	—	—			
8	Mwenja Ngureu Sawmills (Nyahururu)	1977 ~ 1981	C. Lus.	30	3.0	690	—	8,574	
			P. rad.	28	13.0	3,510			
			P. rad.	30	16.0	4,374			
			P. rad.	16, 20	15.4	—			899
			P. rad.	16	14.6	—			443.8
			C. Lus.	17	2.0	—			60.8
9	Maina Sawmills (Nyahururu)	1977 ~ 1981	C. Lus.	30	5.0	1,150	—	1,150	
			P. pat.	18	8.5	—			340
			C. lus.	22	48.6	—			3,596
			P. species	19	4.6	—			414

Details of licence of mills surveyed (Cont'd)

No.	Mill (Locality)	Term of license	Designated harvest in 1978					
			Species	Stand age	Area	Clear felling	Thinning	Total
10	Mewenge International (Nyahururu)	1977 ~ 1981	C. lus.	30	50	1,150	—	1,150
			P. pat.	18	36.4	—	346	2,957 (4,107)
			C. ben.	15	40.5	—	1,231	
			C. lus.	17, 19	26.7	—	528	
			P. rad.	19, 21, 22	44.5	—	852	
11	Kio Sawmills (Nyahururu)	General license	Because of new mill, one year license for the time being					
12	Mbau Sawmills (Kiganjo)	1976 ~ 1980	C. ben	27	20.0	1,800	—	13,340
			C. lus	27	43.5	11,540	—	
			C. ben.	20	50.0	—	200	3,075 (16,415)
			P. pat.	20, 17	24.0	—	552	
			P. rad.	16, 19	115.0	—	2,323	
13	Kihari Timber Industries (Kiganjo)	General license	Because of newly improved mill, instead of 5 year license, the license issued every year					
14	Wananchi Sawmills (Nyeri)	1976 ~ 1980	Cup. lus.	32	33.0	13,403	—	13,403
			Cup. lus.	19, 16, 20	71.0	—	766	766 (14,169)
15	Kirinyaga Timber Co-op. (Kerugoya)	1976 ~ 1981	Hardwood			Selective felling 60,000/ 5 years	—	Annual felling 12,000
16	Rupingazi Sawmills (Embu)	1975 ~ 1979	Meruoak Softwood Hardwood	—	—	Selective felling 40,000/ 5 years	—	Annual felling 8,000
17	Njeru Industries (Meru)	1973 ~ 1977 extended automati- cally	Camphor Podo Musharage Mueri Mana	—	—	3,600/ year	—	Annual felling 3,600
18	Meru Timber Sales (Meru)	General license	C. lus. P. pat.	—	—	—	—	—

C. Tor. = Cupressus Torolosa
C. Lus = C. Lustanica
C. macro = C. Macrocarpa

C. Ben = C. benthamii
P. rad = P. radiata
P. pat = P. patula
P. can = P. canariensis

CHAPTER III. PROBLEMS OF PRESENT SAWMILLS AND DIRECTION OF MODERNIZATION

3.1. Ways and means of survey

In order to grasp not only the sawmill industry but the manufacturing industry as producing area, in general, the following procedures are usually taken.

(1) Implementation of preliminary survey

When the implementation of survey is decided by application, at the survey site, prior to the field survey, the survey sheet is distributed to each mill to find out the outline of the details of the establishment of the mill, the capital, the employees, log supply, and distribution of processed goods and the survey sheets are counted up by items.

(2) Execution of field survey

After the preliminary survey, the field survey of each mill as producing site is carried out and the survey on present condition of each mill and the mill as sawnwood producing site is performed and the actual situation of management of each mill and problems are grasped.

(3) Analysis and adjustment of problems

The findings of preliminary survey and field survey are overall analysed and problems of each mill and improvement matters as producing site are adjusted in relation to each other.

(4) Report on findings

Through these procedures, the matters analysed and examined are overall systematized and reported.

In this survey, despite preliminary investigation of ICDC needed informations were not available in advance and the preliminary survey and the field survey were undertaken simultaneously. For this reason, after the field survey, the findings of the preliminary survey were arranged and it was necessary to grasp the actual condition of producing site and confirm the position of the mill in the producing site.

The actual procedures taken in this survey are as follows:

(1) Collection of basic informations from various agencies related to the Government

(2) Direct interviews with present sawmill managers.

Through the preliminary survey of ICDC, 18 sawmills selected on the ground that the mill has a volition of modernization were visited and the actual production activity was surveyed and at the same time, the managers were interviewed and based on the prepared questionnaires, informations concerning felling licence of the mill, machinery and equipments, production and management were obtained.

(3) Visits to furniture and wood processing mills.

In order to get informations relating to the existing wood processing industry, several wood based industries were visited and actual conditions of wood processing were surveyed.

3.2. Implementation of field survey

With the preliminary survey, each surveyor made the field survey in each speciality field. The purpose of the field survey is:

- (1) Grasp of actual condition of operation of each sawmill.
- (2) Grasp of direction of rationalization and modernization of each sawmill
- (3) Of improvement matters, classification of those to be improved in short term and those in long term.

In order to get full informations as far as possible, particular attention was payed to the following points of view.

- (1) From the viewpoint of site condition of sawmill.
 - a. Timber collection capacity
 - b. Sawmilling scale and layout
 - c. Marketing of sawnwood

Considering the factors affecting the site conditions, the examination was also made on the position of the mill near the forest, mills surrounding small cities and those surrounding medium size cities.

(2) From the viewpoint of production technology

Of the production technology, there is a considerable disparity compared with those of mills in Japan. The survey was made stressing the improvement of production technology.

- a. Improvement of recovery rate of sawmilling
- b. Improvement of processing of sawnwood and productivity
- c. Improvement of quality of sawnwood
- d. Safety of sawmill operation and improvement of hygiene
- e. Disposal of residuals of sawmill
- f. Profitable management of sawmill

(3) From the viewpoint of management and control

- a. Thoroughness of management and control
- b. Production control and process control
- c. Financial control and cost control

- (4) The field survey of sawmill is quite extensive related to the sawmill management. However, few figures concerning these items are available and most of informations were obtained from the field observations.

3.3. Outline of sawmills in the preliminary survey table

Present preliminary survey was made on 18 sawmills and of these, 3 mills were excluded from the entry of the preliminary survey table.

Because some mills surveyed did not enter the items of the preliminary survey table, the judgement was made only on the findings of mills which informations were available.

(1) Mills surveyed by districts

Outskirts of NAKURU	7 mills
Outskirts of NYAHURURU	4 mills
Outskirts of NYERI	3 mills
Outskirts of EMBU	2 mills
Outskirts of MERU	2 mills
Total	18 mills

Mills and their localities are stated in the attached table.

(2) Scale of capital

The scale of capital of 10 companies entered in the questionnaire is classified as follows

(Unit: ksh):

Over 1,000,000	1 mill
The 1,000,000	3 mills
Below 1,000,000	6 mills
700,000	2 mills
400,000	1 mill
300,000	1 mill
200,000	1 mill
100,000	1 mill

The above classification shows a significant disparity of the capital among enterprises and the mills surveyed.

(3) The inauguration of the mill is almost unknown. This may be because of the fact that many mills were purchased from the former owners.

a. By inauguration

1928	1 mill	1951	1 mill
1940	1 mill	1968	2 mills

b. The year of the present management system of mills brought in by purchase or construction is as follows:

1967	1 mill	1973	1 mill
1968	1 mill	1974	2 mills
1970	1 mill	1976	3 mills
1971	1 mill	1977	1 mill
1972	2 mills		
		Total	13 mills

c. The above classification shows that it is in the recent years that the sawmills have introduced the present system. Therefore, it can be said that they have few experiences in the management of sawmill.

(4) Only five sawmills have branch mills and branch offices and two sawmills manage agriculture as side business and it is said that many sawmill managers themselves hold a farm in some form or other.

(5) The item of products of the sawmill surveyed are as follows.

Sawnwood products only	10 mills
Sawnwood products and beams	1 mill
Sawnwood products and doors and shutters	1 mill
Sawnwood products and furniture	3 mills
Sawnwood products and components of pre-fabricated housing	1 mill
Sawnwood products and sawnwood for export	1 mill
Sawnwood products and palette	1 mill

(6) There is a wide variation in the sawmill site depending upon the scale. Generally, the site of sawmill is estimated at 2 – 3 acres.

(7) Term of licence of saw log

Almost all of saw logs are supplied by the national forest. Wood from the national forest are supplied by affording long term or short term licence. Mills having licence are as follows.

Mills having long term licence	13 mills
Mills having forest general licence	3 mills
Information not available	2 mills
Total	18 mills

Majority of mills have long term licence and it can be said that log supply is relatively stable.

(8) Situation of licence in 1978

Mills having licence in 1978 by volume are as follows.

a. Over 10,000 m ³ annual felling	6 mills
b. Over 5,000 m ³ and below 10,000 m ³ a.f.	5 mills
c. Below 5,000 m ³ a.f.	2 mills
Total	13 mills

Other mills than the above seem to be taking the procedure of licence when the survey is made.

(9) Receipt of saw log

The receipt of saw logs at the sawmill is unexpectedly obscure and many mills are uncertain in this respect. Moreover, the various units of volume are adopted by individual mill, ton or m³ or piece and the actual condition is hard to secure.

The receipt of logs by indication of unit is as follows.

a. Indicated by per day:	120 pcs./day	1 mill
b. Indicated by per month:	2,500 pcs./month	1 mill
	300 – 800 m ³ /month	3 mills
	1,500 m ³ /month	1 mill
	360 tons – 400 tons/month	2 mills
c. Indicated by per year:	3,000 m ³ /year	1 mill
	10,000 – 14,000 m ³ /year	3 mills
d. Information not available:		4 mills
Total		16 mills

Such diversified stocking of saw logs at the sawmill is due to the fact that the national forest timber is sold on stumpage by licence and the mill itself do felling, bucking and hauling and there are some differences in time and methods of securing the volume of saw logs. It also depends upon the method of delivery and office business of log transportation.

(10) Input of logs

Input of logs at the sawmill, as stocking of logs being obscure, could not be secured accurately.

The classification by indication is as follows.

a. Indicated by per day:	10 – 50 m ³ /day	3 mills
	40 – 100 pcs./day	2 mills
b. Indicated by per month:	400 m ³ /month	1 mill
	360 tons/month	1 mill

c. Indicated by per year:	1,500 – 3,600 m ³ /year	3 mills
	10,000 – 14,000 m ³ /year	3 mills
d. Information not available:		5 mills
	Total	18 mills

Judging from above figures, it may be concluded that the log input of the sawmill for softwood is roughly divided into two groups, below 5,000 m³ per year and over 10,000 m³ per year, and in case of sawmill for hardwood log input is on the level of more or less 3,000 m³ per year.

(11) Logging

Almost all of saw logs are depending upon the supply of national forest timber with a few exception.

When the national forest timber is sold on stumpage, the sawmill itself performs logging operation and does not depend on the sub-contractor.

(12) Logging facilities

When each mill is allocated the national forest timber, he himself has to do logging operation. Each mill has logging facilities and workers.

The transporting facilities include lorry, tractor, trailer, and caterpillar. Mills having logging facilities are as follows.

a. Lorry:	one	2 mills
	two	6 mills
	three	2 mills
	five	1 mill
b. Tractor:	one	6 mills
	two	3 mills
	six	1 mill
c. Tractor:	two	1 mill
d. Caterpillar:	two	2 mills
e. Chainsaw:	three – eight	6 mills
f. Others are winches and landrover:		

Most of these logging facilities are timeworn and because of the poor repairing capacity of machinery, even the minor troubles can not be repaired quickly and the performance is not satisfactory.

(13) Sawmill machinery and facilities

As for the machinery and facilities of the existing sawmills, almost all of them are using old fashioned circular saw for breakdown and some mills where band-saw mill is installed, these saws, with 2 exceptions, are quite old and precision of processing is low

and many of them have no scales to regulate the dimension of the product. Few consideration is paid to secure the safety of the machine. While we visited a mill, the band saw was cut off and the work piece jumped over the carriage. Fortunately there was no one injured. There was no safety cover on the band-saw and the job site was in dangerous situation. The number of machines and types of the machines of the mill we visited are classified as follows.

a Type (outmoded):	Circular-saw mill with carriage	1
	Circular resaw	2
	Cross-cut saw	1
b Type (improved type):	Circular-saw mill with carriage	1
	Roller band saw	1
	Table band-saw or resaw	1
	Cross-cut saw	1
c. Type (intermediate type):	Band-saw mill with carriage	1
	Roller band-saw mill	1
	Table band-saw mill	1
	Cross-cut saw	1
d. Type (modern mill type):	Band-saw mill with auto-carriage	1
	Auto-table band-saw mill	1
	Table band-saw mill	1
	Cross-cut saw	1
	Saw sharpener and fitting equipments	1 set

The power of the sawmill machine is diesel and electricity, but as the modernization develops, electricity gets more popularity.

(14) Sale amount of sawnwood products

At the many mills visited, we could not get accurate figures on the amount of sales of their products.

Sawnwood products are usually sold in the unit of m^3 or ton, and in our survey the indication of sale amount was as follows.

a. Indicated by per day:	50 m^3 /day	1 mill
b. Indicated by per month:	300 – 400 m^3 /month	2 mills
	1,500 m^3 /month	1 mill
	150 – 400 ton/month	4 mills
c. Indicated by per year:	2,500 m^3 /year	1 mill
	5,000 – 10,000 m^3 /year	2 mills
	1,000 – 5,000 ton/year	4 mills
d. Information not available:		3 mills
	Total	18 mills

The amount of sales of sawnwood products seems to be not secured accurately. The figures of output and sales should be secured more accurately.

(15) Recovery rate of sawnwood

Summary of the recovery rate of the mills which entered is as follows.

Recovery rate:	25%	2 mills
	30%	2 mills

The recovery rate of the modern mill is said to be around 50%.

(16) Royalty

Because of complication of royalty when the national forest timber is sold on stumpage, detail data on the paid money could not be obtained. The uncertainty of the cost of stumpage which is the major raw material of a sawmill links to the uncertainty of the manufacturing cost of sawnwood.

(17) Unit price of sawnwood and the total sales amount

The unit of the sawnwood for sale is ton or m³. The unit price for sale is classified by the indication of the mills visited as follows.

a. Indicated in ton:	Cypress	600 – 900 ksh/ton
	Pine	400 ksh/ton
b. Indicated in m ³ :	Cypress	225 ksh/m ³
	Pine	210 ksh/m ³
c. Unit price for sale of hardwood:		2,000 ksh/m ³

Total sale amount is as follows.

250,000 – 300,000 ksh/year	3 mills
550,000	1 mill
1,000,000	1 mill
3,000,000	1 mill

(18) Number of employees

The number of employees of the sawmill includes those for logging and sawmill proper. Therefore, they are quite different from the employees of sawmill itself.

Mills ranked by the total employees are as follows.

11 persons	1 mill	70 persons level	3 mills
38 persons	1 mill	88 persons level	1 mill
40 persons level	3 mills	99 persons level	1 mill
55 persons level	1 mill	130 persons level	1 mill
60 persons level	1 mill	201 persons level	1 mill

(19) Average wage

Wage of sawmill workers varies greatly with job series.

The average wage of sawmill workers in general is as follows. (Unit: ksh)

Minimum		Maximum	
175 & over	1 mill	300 & below	1 mill
200 & over	1 mill	305 & below	1 mill
205 & over	1 mill	310 & below	1 mill
210 & over	2 mills	330 & below	1 mill
212 & over	1 mill	350 & below	2 mills
225 & over	1 mill	400 & below	2 mills
250 & over	1 mill		
300 & over	2 mills		

The wage for the woman varies not so much with that of the man and is slightly lower than that of the man.

(20) Average age class of the employee

The average age of the employee is 25 – 35 for the man and 18 – 32 for the women which means relatively young age structure.

3.4. Problems of existing sawmills

In the survey of sawmills, the common problems of the sawmill through the preliminary survey and the field survey are as follows.

3.4.1. Location of sawmill

Mills surveyed are scattered in hilly zone of inconvenient situation with some exception. The reason why sawmills selected such locality may be due to the supply of wood from the national forest. Particularly, since the logging operation in the national forest has been carried out by the sawmill itself, such tendency seems to be expedited. Recently as clearing of cut-over area and reforestation operation are done by the national forest itself, sawmills are being constructed at the outskirts of cities. Especially, modernization of sawmills and dependence on electricity as power source gives stimulus to such trend. At present, considerable number of sawmills are still depending on diesel for power source.

When sawmills locate near forests, there are various merits and demerits.

- (a) Collection of logs near sawmills is facilitated, but when logs from the licenced area are cut over, the condition is adverse.
- (b) Generally, most of the sawmill areas are less conveniency.
 - a. Road condition is not good and it is inconvenient to communicate.
 - b. Repair of logging facilities is unfavorable.

- (c) In case of using diesel oil for power source, the sawing capacity is often limited.
- (d) Emergency measures are hard to take for troubles of sawing machinery.
- (e) Local people are easily employed and are settled without difficulty, but stimulus to advancement of technology is few and in consequence, mills have to depend upon unskilled labour.
- (f) The sale of sawnwood products is unfavorable because less information on market condition is available.
- (g) Effective utilization of wood, particularly of wood residuals and saw dust are unfavorable.

The location of sawmill near or in the forest brings about various problems for modernization of sawmill.

Location of sawmill, whether it locates near the forests or in the city, involves common the sale in the form of log is prohibited. of the road condition in Kenya.

The fact that log supply is greatly influenced by road condition is also a grave effect on the management of sawmill.

3.4.2. Log supply situation

All logs, with some exceptions, which are the major raw material of sawmill are supplied to each mill based on the licence of the national forest.

All logs supplied from the national forest have to be sawn at the licencees' own mill and sale in the form of log is prohibited.

The licence from the national forest is afforded taking consideration of site condition of sawmill, mill scale, and sawing capacity.

The royalty of national forest timber should be paid by licencees according to the fixed rate by diameter class and length.

The standard of royalty of licenced timber varies with pruned and unpruned and roughly speaking, it is as follows.

Class	Up to July 1977 (ksh/m ³)	Present (ksh/m ³)
I.	15.87	19.60
II.	23.27	28.74
III.	31.32	38.69
IV.	46.74	57.74
V.	55.80	68.93
VI.	62.92	77.72

(Note: According to the recommendation of the World Bank, the royalty is planned to raise up 10% per year)

In general, dimensions of bucked logs are in disorder and many are of random length. In such a manner, it is considered that recovery rate of sawmill could be lowered.

Logs are transported to mills by lorry, trailer and caterpillar. Loading and unloading of these logs are mostly done by man power.

Generally, the log transportation road is mostly poor and many transporting facilities are damaged because such facilities carry heavy logs. However, because of lack of maintenance and repair system, the operational ratio is low and there are many troubles in the log supply to mills.

In rainy season, log transportation is very difficult and as a result, log collection is said to be hard.

3.4.3. Machines and facilities of sawmill

Since most sawmills started as the mill near the forest, the sawmilling machines and facilities are generally simple.

(a) Not a few sawmill using diesel oil for the power source, but as the mill location comes near to the town, more mills use electricity.

(b) The standard machines and facilities are:

Breakdown	Circular saw of 48 – 60' with carriage	1
Second breakdown & resawing	Circular saw of 20 – 24'	2
Cross cutting	Cross-cut saw	1

Modern equipments such as band-saw mill have been introduced in some mills. Some mills are using rip saw and woodworking machine depending upon their products.

Many sawmill machines are of the old type and have been used for many years. Because the capacity of repair and maintenance for troubles of machines is in short, many scrapped machines are left as they are.

(c) The layout of the sawmill neglects somewhat the process control. For this reason there are stocks of unfinished goods everywhere in the mill. It is considered that poor layout of the sawmill is the cause of low work efficiency.

The saw blade in the sawmill is generally thick in gauge which produces much saw dusts.

(d) Severe horizontal vibration of circular saw is the cause of crooked and irregular sawings. Poor sawn surface is unavoidable to some extent for circular saw but too much of such poor surface is noticeable.e.

- (e) The carriage is not attached with setworks. After all, the carriage is working only as a carriage of heavy articles.

3.4.4. Situation of sawmill operation

Production control inside of the mill leaves much room for improvement.

- (a) Since the layout of sawmill machinery neglects the process control, the flow from the input of logs to first breakdown, second breakdown, resawing and cross cutting is often not balanced. Because of deviation of flow of sawing, workers have much time to wait and it is witnessed that they stop the work and stand doing nothing.

- (b) Sawing operation by circular saw with carriage, in many cases, is only to cut off one or two slabs and transfer to the next operation.

In such breakdown operation, the breakdown machine has surplus in sawing capacity and resultantly makes haste the following process. Still more, as they usually many thick boards produced, it is advisable that the first and second breakdown operations should be done simultaneously.

- (c) Second breakdown and resawing operations are generally done by circular resaw of 24" but it is noticed in many cases that the second breakdown operation by resaw is unreasonable. It is desirable that resawing is done by resaw only and the second breakdown operation is to be done by the first breakdown machine. Some workers are doing the second breakdown operation by roller band-saw, since large timber is forced into the roller, there is an excessive load on the sawing machine and an adverse influence will be brought about upon the sawnwood.

- (d) Because sawyers in general have not enough knowledge in wood conversion of sawmilling, in many cases, they repeat wasteful operations. It is desired that the wood conversion techniques should be studied.

- (e) In general, the appearance of sawnwood is poor.

Especially following defects are noticed:

- a. Irregular thickness
- b. Crooked sawing
- c. Poor sawn surface

These defects are quite important which can be said as loss of life of sawnwood. Careful examination is desired.

- (f) The recovery rate of sawnwood is differed in each sawmill but generally it is estimated at more or less 25%. The same rate of some modernized mill is said to be about 50%.

- (g) The main specifications of sawnwood produced at the sawmill are as follows. (mm)

50 x 25	150 x 25	300 x 25
50 x 50	75 x 50	100 x 50

- (h) Timber transportation in the sawmill almost depends on manpower. There is much space for the improvement of material handling in the sawmill.

3.4.5. Sales situation of sawnwood

Because the sawmills locate generally in remote area, the market information on sawnwood are not sufficient enough. Still more, they are in the environment where progressive marketing activities can not be carried out.

From the viewpoint of present sawmill, while the modernization and renewal of machines and equipments are the most important factors for improvement of sawmill, it is considered that the promotion of marketing activity is also necessary.

- (a) The management control of each sawmill is performed by the field manager but the sales activity is not systemized yet.

The field manager is not much familiar with the actual condition of sales activity and the information network of market condition seems to be not enough. At present, in many cases, as the manufacturing cost of sawnwood is not secured clearly, it seems to be difficult to promote the profitable sales of their own products.

- (b) Most of sawnwood are produced on the order of the customers and the expected production seems to be few except in case of hardwood.

Not a few sawmillers deal with leading traders such as Timsales or Wood Maker.

- (c) Considering the low capacity of the sawmill, the quality of sawnwood produced, and uncertain manufacturing cost, it may be unavoidable to some extent that the market tends to be the buyer's priority.

- (d) The sales invoice of the sawnwood includes deliveries at the mill or the yard but there seems no custom of delivery at the shop front of the retailers.

There is about 40% of the price difference between the mill delivery price and that of the yard delivery and the latter is said to be more profitable.

3.4.6. Labour situation

There seems to be a considerable room for supply and demand of labour in the sawmill. However, sawing engineers and experts are few.

- (a) In general, the sawing technology is poor.
- (b) Each mill employs engineers for saw setting of circular saw but not for band-saw except some mills.

- (c) There are almost no engineer for wood conversion and the technology is mostly poor.
- (d) Repairing capacity of sawing machinery and motor cars is not adequate.
- (e) Middle class managers under the field manager are few and their power of control and supervision seems low.
- (f) Generally, there seems few labor management problems but in the mills near the city, various problems are said to be broken out.

3.4.7. Management

The effete management control is fully recognized through this survey. If management control is not enough, the capacity of sawmill can not be realized even if the machines and facilities are modernized and the personnel is replenished. Reinforcement of management control is quite important.

- (a) In many mills, the sawmill owner and field manager are separated. Both are not necessarily to be together but their communication should be close. In fact, in many cases, they are isolated in remote area and scarcely communicate each other. The field manager of many mills surveyed is something like only the boss of the mill and they have few knowledge of management control and financial management and what is worse, they seem not to try to solve the problems which they are confronting. In such manner, it seems that the modernization does not make any headway.
- (b) The system of books of the mills surveyed is not well arranged.
 - a. Books and slips for log input and output of the products are almost none. Consequently, informations for recovery of sawnwood and productivity of the mill can not be ascertained.
 - b. A ledger for shipment of products is not well arranged. Especially, shipped products, quality, volume and weight are entirely uncertain.
 - c. No expenses book is available in many mills. They have a file of invoices but no total and arrangement by each item.
 - d. They may have payrolls but few of such payroll are well arranged.
- (c) Financial statements are not available at the mills. These statements are prepared at the accounting office but no analysis of the contents is made at the mill. These financial statements should be utilized in the management.

3.4.8. Marketing of products

One of purposes of this survey is marketing. So far no noteworthy effort has been made for marketing.

- (a) Since the quality of most of sawnwood is poor, as a first step, mill manager should inspect the products of other mills and the actual condition of timber market and timber supply and find out the need for improvement.
- (b) It is desirable that manufacturing cost of products of own mill is secured and then, keeping in mind of the manufacturing cost, the sales business starts.
- (c) In order to keep the profitable sales of sawnwood, the market research is necessary but for the scattered mills near the forest, it seems difficult.
- (d) The sales of sawnwood needs a salesman but individual mill near the forest is hard to employ a specific salesman. Establishment of timber yard is beneficial for marketing but its management is difficult for individual remote mill.

3.4.9. Grasp of manufacturing cost

Each mill surveyed procures logs on sale on stumpage and fells, bucks and transports to the mill. As the cost accounting of the sawmill, the log cost at the mill is to be grasped. But actually, this cost is not secured accurately. Even if the stumpage price is known, the freight and overhead cost are entirely unknown. We can witness such instance always in the mill where the continuous operation from the forest to the mill is done. If it is left as it is, as the actual situation is unknown, we apt to overlook the mill in deficit and the financing is acute and the mill is driven into danger, for which we should pay attention in advance. If the volume and the price of logs on the carriage are not secured clearly, accurate figures on the recovery rate, operational ratio or sawing cost are not be obtained.

3.4.10. Financial situation

At the mills surveyed, any matter concerning the finance was not available. A balance sheet, a statement of profit and loss and a statement of manufacturing cost are available at some mills. However, the financing table was not available during the survey. Efforts were made to get materials on how much each enterprise profits, how much the capital can be invested for rationalization or modernization of the mill, but such informations were not fully obtained.

Since the findings of management control of enterprise are summarised in the financial statement, the preparation of these statements and analysis should be promoted.

3.4.11. Matters to be considered from the viewpoint of the rationalization and modernization of sawmill

The actual management of the mill surveyed and the problem of the sawmill as producing site were examined and when the rationalization and modernization are promoted as a producing site or as an individual sawmill, general matters to be paid attention are listed hereunder.

(a) Examination of site of sawmill

The sawmill has been located at the site accessible to log supply but in these days, it is necessary to place an importance on the log supply as well as sale of the sawnwood. In order to raise up the efficiency sawmill machinery and facilities, the problem of power should be fully examined.

The common and serious problem of the sawmill surveyed is logging but efficient coordination of log supply and sawing efficiency are considered to be more important from now on.

(b) Effective utilization of idle machines and facilities

It is noticed in many sawmills surveyed that idle facilities and unrepaired machines, equipments and motor cars are left as they are. It is considered quite necessary to set up the system to make intelligent utilization of these idle machines, equipments and motor cars.

(c) Promotion of operational education

In sawing operations of the workers in the sawmill, many difficult points in operation were noticed. This is considered due to shortage of experience in sawing operation as well as insufficiency of visits to better mills.

It is considered necessary to promote the operational education to workers.

(d) Thoroughness of management

Mills surveyed are provided with field manager, assistant, mill manager, and foreman who are in charge of sawmilling operation and process control. Despite huge organization, poor results were brought about. Thorough management is quite necessary. In short, the re-education of the supervisory staff is important.

(e) Thoroughness of financial management

Most mills surveyed do not perform the manufacturing cost account and actual financial condition is not clarified.

Financial statements seem to be prepared for each enterprise but it is quite doubtful whether the statement of profit and loss is based on the actuality of the mill or not.

It is considered quite difficult to promote the management control with such financial statements. Still more, since most mills surveyed have strong volition of rationalization and modernization of the mill, there may be many cases to be forced definite decision in promotion of rationalization and modernization or investment to new companies.

To meet such situation, quick consolidation of management control is desired for.

(f) Promotion of marketing activities

Many mills surveyed are confronting difficulty in collection of market information of the sawnwood. However, the owner, the director or the manager who are directly in charge of management are doing efforts to collect market information and they seem to have much interests in promotion of marketing.

With present machines and equipments and production capacity, since there are many problems in marketing, if rationalization and modernization develop in future, all the more. It is desired to build up the system to develop the new market and collect market information of sawnwood.

(g) Preparation of management plan

In the management of sawmill, there are problems of procurement of logs, skilled workers, market and financing. In promoting rationalization and modernization, the management plan for coming 5 years are necessarily prepared. It is important to take the actual findings into account each time and cope with the economic changes and revise the plan and target to meet the times.

3.5. Direction of rationalization and modernization of each mill surveyed.

Examination is made on the problems of each mill surveyed and the direction of rationalization and modernization in future.

However, most machines and facilities are needed to renew overall into modern type and here, we will discuss the direction of rationalization from the viewpoint of management.

In discussing the problems of each mill, the common matters to note particularly are as follows.

- (1) Secret matters for each mill are excluded as much as possible.

- (2) Most of financial statements, particularly a balance sheet, and a statement of profit and loss were not submitted.

As a result, for the enterprise,

1. It is unknown whether the enterprise gets profit or not.
 2. It is also unknown whether there is a surplus of the fund enough to invest in equipment or promote rationalization or modernization or not.
 3. There is no prospect of recovery years of invested fund.d.
- (3) It seems that the cost accounting at most of sawmills was not conducted. As a result, the manufacturing cost of sawnwood was obscure, and the productivity too.
- (4) Input of logs and output of sawnwood can not be secured definitely. Therefore, the rate of recovery too.
- (5) There are common defects in sawnwood as irregular thickness, cooked sawing, and poor sawned surface.

No. 1 Holyoak Sawmills(South Kinangop)

A. Problem of management

a) Lack of repairing capacity of sawmill

The employees of this mill including logging and sawmilling operators are 9 and the repairing capacity of machinery is lacking and moreover, because of the mill being remote and near the forest and difficulty of transportation, once the machines are in trouble, their repair is impossible and resultantly, the operational efficiency is hindered.

b) Supplementary facilities in the sawmill are in shortage and the operational efficiency is not adequate. Especially, because of insufficient transporting facilities of logs and products, the sawmilling operation is going on slowly.

c) Because log transportation in rainy season is apt to be difficult, in many cases, the sawing efficiency is lowered.

B. Matters for improvement

a) In case of circular saw with carriage saw blade is heavily vibrated.

Since the mill is provided with 2 table band-saw for resawing, the band-saw mill with carriage is better than circular saw for breakdown. It is necessary that band head saw for breakdown performs not only the first breakdown but the second breakdown to reduce operational burden of table band-saw mill.

- b) Two of table band-saw mills are left-hand operation.
Such operation may be due to the practice but it is considered that right-hand operation produces higher efficiency.
- c) It is desirable to examine that the transportation control in the mill is to improve and the operational efficiency is to raise up.
- d) It is desired that the repair system for sawing machines and motor cars is to complete and the working ratio is to raise up.
- e) It is desired that sales system of the sawnwood is to improve to raise up the sales price.
- f) Production control business should be strengthened and particularly it is necessary that input of log and output of sawnwood are clearly secured and the accounting of income and expenditure is carried out.

No. 2 Kitiro Sawmills (ELBURGON)

A. Problem of management

- a) Concerning sawmill machinery, the machine type to select is necessitated to change depending upon the products of specially ordered or of estimated production.
- b) It is necessary to replenish the machines and facilities for logging.
- c) Because the quality of saw logs is lowered, eventually the work ratio as well as the recovery ratio is lowered.
- d) Because the sawmill locates in the urban area, the labour problem is often broken out.
- e) The flow of process in the sawmill is reverse from the location of woodworking sector. Sawmilling operation is quite irregular and much loss occur in processing. Since there is no check device on the rail of carriage of circular saw for breakdown, the wheel is sometimes off.

B. Matters for improvement

- a) As this mill produces blockboard and furniture beside sawnwood, semi-finished goods, and supplementary materials are piled up in and out of the mill. It is necessary to make efforts to intensify the inventory control to reduce the stock piles and lessen the burden of fund to reduce the cost.
- b) The whole mill is in condition of adding of construction. Therefore, it is necessary to re-examine the arrangement of the mill and the layout of machines and equipments.
- c) Reexamination of material handling system in the mill is needed.
- d) There are too many machines and equipments in wreck and ruin. The repair system of machines and equipments should be improved.

- e) When the layout of the mill is improved, introduction of band-saw mill with carriage is advisable.
- f) Since the mill is in the urban area, introduction of production facilities for charcoal briquette in future should be examined.

No. 3 Mololo Wood Works (Sorget Area)

A. Problem of management

- a) Because the mill locates in the low land area, it is susceptible to flood damage.
- b) Because the mill stands in the unfavorable site, the plan is under way to construct a mill in other area.
- c) The layout of machines and equipments is not adequate.
- d) Sawmill operation is rough and disorder.

B. Matters for improvement

The present mill is to be abandoned and a new mill is planned to construct.

Even if moved to the new mill, it is necessary to give employees thorough education on the sawmilling techniques.

No. 4 Timbwalo Sawmills (Malagat Forest)

A. Problem of management

- a) Repletion of logging facilities is necessary.
At present, collection of saw logs is done by one lorry and one tractor but as it is required to collect logs of 50 m³ per day, the present capacity is insufficient.
- b) Introduction of band-saw mill is desirable.
Although the circular saw mill with carriage is used for breakdown, from the viewpoint of efficiency and quality, the band-saw mill is desired to introduce.
- c) Introduction of one more line of sawmilling facilities is planned.
- d) It is necessary to introduce fund for housing construction for employees.
- e) A mill on the top of hill is out of common sense as a sawmill site. It seems that such site is selected from the viewpoint of licence but it is felt uneasy that some problems on log collection and sales may happen in future.

B. Matters for improvement

- a) While this mill started 1978, it does not take any consideration in the layout of flow of the working process. If possible, it is desirable to improve the layout.
- b) Breakdown by circular saw is only cut off one face and timber is sent to next process. As a result, the resaw burdens too heavy. Resultantly, the quality of the product is apt to lower. It is considered effective that the resaw only performs resawing and the

circular head saw performs the primary and secondary breakdown.

- c) Although the live rollers are equipped, they are not much used in actual operation. It is necessary to use more effectively.
- d) There is a need to put the stacking of log and arrangement of sawnwood in order.
- e) It is desirable in the transportation operation of the mill to introduce some improved apparatus of handling materials such as handcarts.
- f) It is necessary to set up immediately some measures for log transportation in rainy season and stable supply of logs to the mill.

No. 5 Kibleso Sawmills (Makutano)

A. Problems of management

- a) According to the field manager, since the felling site is near, there are no serious problems of management.
- b) The mill was built in 1940's and many machines are old fashioned and the layout is poor.
- c) The whole of the mill looks buried in sawdusts and in disorder.

B. Matters for improvement

- a) Performance of old frame saw takes too much time and as it is considered that it is the time to replace, it is also the time to consider the replacement of other type of machine.
- b) The introduction of carriage with setworks should be considered, or taking the opportunity of overall improvement of the layout of inside of the mill, the band-saw mill should be introduced.
- c) Since the processing of flooring board and panels for prefabricated house is rough and many products are irregular, there is a need to improve the operational methods.
- d) The capacity of repair of machines, equipments and motor cars is necessary to replenish.
- e) As a means of utilization of sawdust, it is desirable to consider the production of wood waste briquette.
- f) Introduction of transportation facilities in the mill is needed to examine.

No. 6 West Mau Sawmills (Keriso Forest)

A. Problems of management

- a) Circular head saw is old fashioned and has to be replaced.
- b) It is necessary to introduce a tractor for logging.

- c) Power of caterpillar engine is used and connected with sawmill machine through long belt.
- d) Since machines and equipments are added by and by, many knotty points are found in layout.
- e) Winch is used for loading and unloading of input logs but it is very old and now in danger.
- f) Because of shortage of repairing capacity of machines, many ruins of sawmill machines, power machines and motor cars are left as they are.

B. Matters for improvement

- a) Replacement of winch should be considered from the viewpoint of safety.
- b) Taking the opportunity of improvement of layout of sawmill machines, replacement of caterpillar engine should be considered. Depending on the capacity of power, introduction of band-saw mill is to be considered.
- c) Vibration of circular head saw is high and the carriage is liable to be in trouble. Replacement is to be considered.
- d) It is desirable to make efforts to complete the repairing capacity of machines and equipments.
- e) It is desirable to make sawdust utilization through the joint work with nearby mills.

No. 7 Kedwa Sawmills Ltd. (Kedwa)

A. Problems of management

- a) Mill manager has a desire to introduce one more production facility.
- b) Power should be made larger.
- c) Modernization of sawmill machines is under consideration.
- d) Mill manager wants to get more logs from the forest near the mill.
- e) There is stage difference in the mill. Breakdown products are lifted up to the upper stage of secondary breakdown or resawing work site by man power. The layout having stage difference of inside-mill is inefficient.

B. Matters for improvement

- a) Although the safety device is not attached to the bandsawmill, it is desirable to equip such device.
- b) When we visited, band-saw of the band-saw mill was cut off during operation. Improvement of saw doctoring is desired.
- c) After the leveling of the land, it is desirable to consider the introduction of band-saw mill.
- d) For utilization of sawdust, introduction of wood waste briquette manufacturing facilities is to be considered.

No. 8 Mwenja Ngure Sawmills (Nyahururu)

A. Problems of management

- a) Modernization of machines and equipments is needed. Particularly, introduction of forklift is desired.
- b) Introduction of band-saw mill is now under consideration.
- c) The old mill is now under re-construction but the desires of manager of a) and b) are not fully taken into consideration.
 - i) Introduction of electricity as power source is planned.
 - ii) Introduction of band-saw mill is planned.
 - iii) Indigenous species are being used.
- d) There is a need to introduce a logging tractor. At present, many ruins of sawmill machinery and tractor are left as they are in the mill yard. Some problems on repair capacity are unsettled.
- e) Town mill locate near the station and is convenient for transport but sawmill facilities are quite simple. The resaw machine has no roof.

B. Matters of improvement

- a) The old mill is now under re-construction and one cross-cut saw is desirable to introduce.
- b) Stock control of the sawnwood is insufficient in both old and new mills. Particularly, disposal of residuals is extremely poor for which improvement is desired.
- c) It is desired that town mill is provided with band-saw mill and the resaw is roofed.
- d) For intelligent utilization of enormous amount of sawdust of two mills, the construction of wood waste briquette mill is to be worth to consider.

No. 9 Maina Sawmills (Nyahururu)

A. Problems of management

- a) Even if the log transportation charge is expensive, the buyers do not pay much consideration in the expense. It seems that such unprofitable condition may be eased by joint shipment system.
- b) Control and coordination of labour of specific work as logging and sawmilling in the mill constitute an important problem.
- c) Because of poor layout of sawmill, there are piles of unfinished goods and residuals.
- d) Owing to lack of repairing capacity of machines and transportation equipments, many ruins are found.

B. Matters for improvement

- a) Because breakdown operation by circular head saw is not work sufficiently, resaw performs all of secondary breakdown and resawing and the operational process is often deviating. It is necessary that breakdown operation is to increase and if it is impossible, another set of resaw should be installed.
- b) It is considered necessary to make efforts to improve the sawmill techniques as well as assorting technique of sawnwood to raise up the value of the products.
- c) At the stage of installation of electricity in near future, it is desired to install the band-saw mill.
- d) It is desired to consider that as a means of utilization of sawdust, a joint processing plant is to construct.
- e) Office work on production is insufficient and it is desirable to strengthen this sector.

No. 10 Mwenge International (Nyahururu)

A. Problems of management

- a) There are some troubles in log transportation.
- b) Sometimes logs are in short to meet the order of special sized products.
- c) There is a need to introduce new machines and equipments to full the facilities.
- d) The distance from breakdown to resawing operation is too long. Modernization is to realize connecting this distance with chain conveyor and roller conveyor. Because the distance is too long, the operation seems slow and inefficient.

B. Problems for improvement

- a) For sawing relatively small dimension logs, the diameter of circular head saw mill is small. The allotment of work of resawing is to be difficult in such case. After all, one face of log is cut off by breakdown saw and easy to send to resaw by conveyor. It is felt that the operations are only distributed to available 3 sawmill machines each. In order to improve the operational efficiency, it is necessary to have the process control to share independent operation to each sawmill machine.
- b) It seems that the frame saw does not work so much.
- c) It seems that the output of sawnwood products at the mill is not secured accurately and many data are not well arranged.

No. 11 Kio Sawmills (Nyagururu)

A. Problems of management

- a) It locates 30 km far from the felling site. Log transportation is a problem.

- b) Lorry is easy in trouble and as a result, transportation is often in difficulty.
 - c) The worker is not much pleased with the basic wage only. The labour problem is said to be broken out.
 - d) Sawnwood market is not enough.
 - e) There are many problems of finance, particularly in tiding over difficulties.
- B. Matters for improvement
- a) It is desired that the mill floor is leveled and the layout of machines and equipments is rearranged. Any slope of the floor of the mill causes troubles in operation and wood transportation. That should be corrected. When the ground is leveled, it is necessary to introduce the band-saw mill and correct the layout.
 - b) It is necessary to improve the sawmill techniques to elevate the quality of the products.
 - c) When the dimension of sawnwood on the roller table is decided, the sawyer is working too close to the saw but it is dangerous from the viewpoint of safety. It is desirable to decide the dimension from the direction of input of wood.
 - d) The marketing activity should be promoted positively. For this purpose, efforts are made to improve the quality of the goods as well as positive collection of market information. If necessary, appointment of salesman is effective.
 - e) Data of management control should be arranged and based on these data, management control is to be carried out.
 - f) Sawmill experts seem few. It is necessary to make efforts to educate experts and skilled workers.

No. 12 Mbau Sawmills (Kiganjo)

A. Problems of management

According to the mill managers problems of management are considered as follows.

- a) Introduction of logging machines is needed.
- b) Concerning sawmill machinery, they are considering which is better whether the old mill is to be modernized or a new modern mill is to be constructed.
- c) In order to strengthen the timber sale, it is necessary to improve the sales system.
- d) The method of intelligent utilization of by-products is to find out.
- e) Introduction of effective machines should be made for labour saving.
- f) The mill is examining how the sawmill should be in order to contribute to the development of wood industry.
- g) There is a need to educate and train the employees of the sawmill.

- h) There is a need to fill up the logging machines and equipments.
- i) The manager of this mill was educated at FITC and has a deep knowledge of industrial environment for development of wood industry.
- j) Problem of old mill
 - i) Layout of the mill is not so good.
 - ii) There are many unevenness on the floor in and out of the mill and such condition is inconvenient for operation and transportation.
 - iii) Transportation control in the mill is insufficient.
 - iv) Many crooked sawing and irregular sawing are found in the sawnwood.
 - v) Sawdust are piled up for nearly half a year.
- k) Problems of new mill
 - i) This is a new mill equipped with Japanese made sawmill machinery with investment of about ksh 600,000.
 - ii) Because head sawing by breakdown machine is few, the burden of resaw is heavy.
 - iii) Because the mill is constructed based on the mass supply of logs and mass production as in Japan, when the supply of logs is irregular, the mill is likely to be unable to make a good use of merit of mass production.
 - iv) Because the mill is constructed based on the mass production, when the forklift is introduced and still material handling is not effective, the production efficiency is hard to raise up. As there are floor irregularities at the end of flow of the process, introduction of forklift seems difficult.

B. Matters for improvement

- a) Problem of old mill
 - i) It seems necessary that the machine type of existing facilities is rearranged and the layout is revised.
 - ii) Improvement of sawmill operation and the working process are to be promoted.
 - iii) Construction of wood waste briquette mill for utilization of sawdust is worth to consider.
- b) Problems of new mill
 - i) Introduction of forklift is to consider.
 - ii) Operating method of head saw is to be improved.

No. 13 Kihari Timber Industries (KIGANJO)

Now, a new sawmill is under construction.

Comments on the new mill are as follows.

- a) Sawmill machines are composed of 1 band-saw mill with auto carriage, 2 roller band-saw mill and 1 gang edger made by DANKERT, Belgium and the conveyor system is fully introduced.

- b) Location of cross-cut saw is not definite yet.
- c) There are two stages on the floor in the mill. The purpose of the stage is not clear but the operational efficiency seems to be greatly influenced.

A. Problems of management

The present mill is in work and a modern new mill is under construction adjacent to the old mill. As a result, no entry was made in the preliminary survey and only hearing survey was made.

Until the new mill starts its operation, the amount of sawdust is uncertain but as saw dust from new and old mills seems large in quantity, as a link to utilization of sawdust, it may be worthwhile considering the manufacture of wood waste briquette.

- a) The old mill is rather old but large.
 - i) There may be 3 sets of machines and equipments and flow of process.
 - ii) Arrangements in the mill is in disorder but rails are laid in the mill for transportation and the trolley transportation is being carried out.
 - iii) The flow of operation in the mill is relatively good and the moral of workers seem high.
 - iv) The mill is provided with the warehouse of sawnwood and assortment and arrangement are performed but not enough.

B. Matters for improvement

- a) If some machines and equipments are replaced in the old mill, the operational efficiency seems to rise.
- b) For input of logs to the mill, it is necessary that the transportation method is to improve to aim at the smooth log supply. More study on material handling is desired.
- c) Efforts to raise up the quality of sawnwood and the marketability are needed.

No. 14 Wananchi Sawmills (Nyeri)

Wananchi Sawmills is a special type of mill which is under joint-management of ICDC, Sangyo Boeki Ltd. and the local investors. In this survey, we have much interests as a model case of the mill management by suggested TDC and by ICDC.

While the entry of field survey and preliminary survey was made, a balance sheet, statement of profit and loss account and manufacturing cost account which show the important actual condition of management were not presented. Therefore, the actual conditions of management is estimated based on the findings of field survey.

A. Problem of management

- a) Since the establishment of the mill in 1974, it is said that the dividend was not paid to the investors.

It was uncertain whether the profit was counted up in the management or the profit was counted up but the dividend was reserved. The actual condition was not heard of.

- b) It is an urgent need to fill up logging facilities.

Logging facilities of this mill consist of 3 lorriers, 2 tractors, and 1 D-6. Present log input is said to be 50 -- 60 m³ per day. If the vehicle is not in trouble, log transportation could be carried out without difficulty. If the trouble occurs or it is in the rainy season, the capacity of log supply is instantly reduced.

Felling and yarding facilities, particularly yarding machines are in shortage.

If the management of the sawmill continues as it is, the mill always confronts the shortage of log and the operational rate has to be lowered.

- c) Lack of communication between the felling site and the mill.

The distance between the felling site and the mill is at least 15 km. Still more, the capacity of log transportation is low. When the mill works on order, it is difficult to obtain enough timbers. Such situation causes dissatisfaction on those in the logging site as well as those in the mill.

Ordinarily, the sawmill which performs logging operation by itself is to require the stock piles of raw materials at least for 2 -- 3 months' operation at the mill yard.

Unless the logging capacity is raised and the stock at the mill yard is increased, the dissatisfaction of both mill operator and logging crew seems to come up to the surface as lack of communication.

- d) Improvement of operational ratio of the sawmill

Machinery and equipments of this mill are particularly excellent and sawing capacity is high. If the log supply is done smoothly, these facilities, if in Japan, could produce as much as 100 m³ per day. The restriction on the log supply lowers the operational ratio and resultantly constitutes a problem of management.

B. Matters for improvement

- a) Efforts should be made to pile the saw logs at the mill for running at least 2 months.

i) Logging facilities are to be reinforced to be able to supply at least 100 m³ of saw logs a day.

ii) If possible, it is desirable to get a special allocation of the national forest timber and hire the external transportation facilities in order to pile up the stock of raw materials of the mill enough to run at least two months.

- b) Operational ratio of the sawmill is to raise up.
For this purpose, all possible measures needed to achieve full operation of the mill capacity are to be taken.
 - i) In order to secure the buyers and the clients for sale of sawnwood, strengthening of sales activity and positive action of marketing should be carried out.
 - ii) By the introduction of forklift, speedy and effective loading of logs and sawnwood on truck can be done.
 - iii) With an introduction of pushcart, effective transportation in the mill is to be aimed at.
- c) When the fullness of logging facilities and raising up of operational ratio of the sawmill are difficult to attain, re-examination should be made on the management scale just fit to the remuneration point of the mill.

No. 15 Kirinyaga Timber Co-op. (Kirinyaga)

A. Problems of management

- a) Owing to poor road conditions, there are many problems on transportation.
- b) Log supply is often restricted by volume or by other factors.
- c) As the operation is one shift, the productivity is low.
- d) Owing to insufficient technology of wood industry, there are some weak points in management.
- e) There is an urgent need to expand the marketing activities.
- f) This mill is the only one which managed under the cooperative society among the mills surveyed. It is provided with double saw and the furniture mill is attached.
- g) As this mill loaned ksh 800,000 from cooperative Bank of Kenya Ltd. for mill construction, it pays 9% of annual interest every month.

B. Matters for improvement

- a) Dead roller in front of cut saw is almost unused. There is a need to use it more intelligently.
- b) There is a need to correct the halfway control which often occurs in the management by the cooperative society. Particularly, operation control should be strengthened.
- c) It seems that the financial statements are prepared but it is only for the enterprise as a whole. It is necessary that a statement of profit and loss account and cost accounting of the mill's own are prepared every month. Since it is managed under the cooperative society, more accounting figures are desired to prepare.

No. 16 Rupingaji Sawmills (Embu)

This mill is processing hardwood exclusively.

A. Problems of management.

No hearing of the preliminary survey table was made.

- a) The mill is entirely in the forest and sawmill facilities for hardwood are quite simple.
- b) Hardwood sawn products are stored in warehouse and shipped every time when order is placed.
- c) It can be said that the mill is pertinent as the hardwood sawmill and is under stable management. Material handling method from breakdown to two resaws, including study of layout, should be improved to make effective utilization of resaw saw.
- d) However the electricity can be used as power source, as the mill locates far from the market, it is necessary to activate marketing activity in order to reduce the disadvantages in sales of products.

B. Matters for improvement

- a) The recovery rate of sawmilling of hardwood is generally lower than softwood. Its rate of this mill is not clear but it seems fairly low. Since the mill is for hardwood, it is desired that the sophisticated sawing operation should be done for raising up the recovery rate.
- b) As a step to strengthen the sales, it is desired to consider possibility of establishment that the common timber yard of hardwood products at the consuming area.

No. 17 Njeru Industries (Meru)

The mill is mainly for hardwood and resaws rough sawn squares of rosewood and also performs sawmilling of camphor and Meru oak. The layout is relatively good.

A. Problems of management

- a) Because the capacity of this mill is insufficient and improper, the recovery rate is only 30%.
- b) Production can not meet with orders and there is no problem in marketing or promotion of sales.

B. Matters for improvement

- a) The floor of the mill is littered with sawdust and unstable for operation. The floor should be fixed for operation.
- b) Many lozenge-shaped wood are mixed in purchased rough sawn squares which is a cause of reduction of recovery rate. Generally, the recovery rate of resawing of squares is more or less at 80% in the band-saw mill but it is considered necessary to keep the recovery rate of about 50% even in case of circular saw mill.

It is desired to do strict inspection of purchased rough sawnwood. Introduction of band-saw mill will be advisable.

- c) Hardwood is high in value as fuel. As to waste wood, it is desired the circular saw mill for production of fuel is introduced for production and sale of fuels.
- d) In the sawmill, the grasp of input of logs and output of the sawnwood is the vital step of management. It is necessary to make efforts to secure basic data for management.

No. 18 Meru Timber Sales (Meru)

A. Problem of management

Because of absence of the manager, the entry of the preliminary survey table and hearing of the situation could not be done.

- a) The impression of the sawmill as a whole is the less positive attitude of the management of the mill.
- b) Stock of sawlogs and sawnwood products is quite few.
- c) The layout of sawmill machines is poor and the inside of mill left no space to plant a foot on.
- d) Vibration of a band head saw is high and sawmilling operation is rough. Sawn surface of the products is poor and there are many crooked and irregular sawings.
- e) Assortment of the sawn products is in disorder.

B. Matters for improvement

- a) Since the layout of the sawmill is poor, it is considered more effective to make an overall fresh start than partial revision.
- b) Higher moral of employee is needed.
- c) Performance of training of sawmilling techniques and skill is needed. Also, method of assortment of products should be improved.

CHAPTER IV. MODERNIZATION PLAN OF TIMBER INDUSTRY

Eighteen sawmills which are considered to require modernization as a result of the preliminary survey conducted by the Government of Kenya and the objects of the current survey are mostly located near the forest and forest resources-directed. (Beside the above, some mills are located near big cities as Nairobi and market-oriented.)

Many mills in this survey are using superannuated circular-saw mills and as a result, recovery percentage is quite low and much forest resources are being wasted. For promotion of modernization of these mills, it is needed that the machine is replaced by modern band-saw mill and the industry which utilizes the mill waste effectively is introduced and the processing techniques are to raise up. For this purpose, the modernization plan of timber industry should be planned and the rationalization of timber utilization should be promoted systematically.

The recommendable modernization plan is considered as follows.

- (1) Of mills being surveyed, the existing machines are to be replaced by modern band-saw mills (2 mills have reached the desirable standard). In this case, considering availability of logs and others, the mills are divided into 2 types as medium size mill (8 mills) and small size mill (8 mills).
- (2) Along with improvement of machines and equipments, logging facilities are to be reinforced.
- (3) For effective utilization of sawdust, waste wood briquette manufacturing plants are to establish (3 plants).
- (4) For promotion of rationalization of timber utilization, timber processing mills are to establish in local cities where furniture and its parts and housing components are manufactured. In this case, it is desirable that the processing mill is managed jointly with the sawmill (3 mills).
- (5) For effective utilization of peeler logs from indigenous forest, it is planned to establish the plywood mill exclusively for tea-chest. Further detailed survey is needed for establishment of tea-chest mill as to site condition, availability of logs and acceptability of the product.
- (6) For rationalization of distribution of timber products, it is suggested that timber yards be established in major cities (3 cities) under the direction of the government agencies. In this case, it is desirable that such yards are managed as joint undertakings of saw-millers.
- (7) For effective promotion of modernization of timber industry, it is necessary to replenish the guidance and training organ for timber industry and the facilities of the existing FITC (Forest Industries Training Centre) are improved to strengthen the function.

(8) For successful implementation of these modernization plans, the Government should take effective administrative measures and if necessary, an independent executive organ is to be established.

The detailed contents for such modernization and required fund are described in Chapter V and follows.

CHAPTER V. IMPROVEMENT OF MACHINERY AND EQUIPMENTS OF SAWMILLS

5.1. Switchover from circular saw to band-saw

The scale of existing sawmill industry was smaller than expected prior to the field survey. Of 18 mills we have surveyed, except two mills, the production facilities of 16 mills are provided with old fashioned circular saw mills and the machine itself is superannuated. Even if the management is planned to improve, so far as these facilities are used, it is difficult to expect the modernization of the whole industry.

In general the modernization of the mill located near the forest is more difficult than the one near the consumer area.

As a direction to the basic modernization which is common to many mills, we should like to propose that modern band-saw mill should be installed instead of old fashioned circular saw mill.

If the band-saw mill is introduced, many demerits of circular saw mill are corrected.

- (1) Generally, as the diameter of circular saw is larger, thickness of the saw requires to be thicker and eventually the recovery rate tends to lower. On the other hand, the band-saw can reduce saw thickness to some fractions of circular saw and increase the recovery rate.
- (2) Generally, when the large diameter of circular saw blade is used, it tends to cause heavy horizontal vibration. Even if the circular saw mill with carriage is used, horizontal vibration of circular saw causes crooked sawing or irregularity of thickness of the product and as a result, the commercial value of sawnwood lowers.
The band-saw mill can reduce such demerits.
- (3) Because the revolution of circular saw mill is less than the band-saw mill, sawn surface of the sawnwood is easy to be rough. The band-saw mill produces a fine surface.
- (4) Sawing capacity of circular saw mill is usually less than the band-saw mill.
- (5) Resawing by circular saw mill tends to show above demerits more clearly and there are wide difference in quality between the products by circular saw mill and those by band-saw mill.
- (6) Sawmilling operation by circular saw has such demerits but in special wood conversion like squares or medium thickness board, sometimes this circular saw mill shows its merits; but in such case, there is a precondition of excellent sawmilling and wood conversion techniques so that such operation is not always practical.

In case of hardwood products where the products are mainly used for furniture and fittings, because the consumers re-process or dry it, defects in wood quality are permissible

to some extent but it is desirable to supply a good quality wood produced by band-saw mill.

As above, the profitability of introducing a band-saw mill into the sawmill is outlined, but accompanied by introduction of band-saw mill, what we must pay consideration as a matter of course is as follows.

- a. When the band-saw mill is introduced, sawmilling capacity is naturally increased. In order to exhibit the maximum capacity of sawmilling, we have to take the appropriate measures.
 - a) There is a need to keep regular supply of logs. Even in rainy season, low operational efficiency because of the short supply of logs should absolutely be avoided. For this reason, it is necessary that logging operation is to be improved and log supply facilities to the mill is to be fortified.
 - b) It is necessary to aim at thorough process control and operation control in the sawmill.
 - c) It is necessary to complete the transportation control inside the sawmill and establish a system to cope with the sawmilling capacity.
- b. With introduction of the band-saw mill, utilization of electricity as power source is desirable. At present, some mills using diesel oil. These mills may have a need to reconsider basically as to the location of mill.
- c. a result, there is a need to establish a system to accept an order and a system to sell the products. If this aspect is not enough, the sawmilling capacity can not be realized in full. Still more, when the marketing activity is insufficient confusion in sale of sawnwood may arise.
- d. Unless efforts are made to improve the sawmilling techniques and skill, the band-saw mill may be unable to work in full.
- e. With introduction of band-saw mill, it is necessary to improve the control of the mill, particularly the control of production office business. In order to expedite modernization of sawmill, it is necessary to take the safest and wisest measures for not only grasp of production efficiency and recovery rate but also for measurement of operational degree and productivity, and coordination of log and storage of sawnwood.

5.2. Model plan of sawmill

As a model plan of modernized sawmill, following 2 plans are considered.

5.2.1. Type A Saw Mill -- Medium scale band-saw mill

(a) General descriptions of sawmill

Monthly log input:	1,200 m ³ /month
Power required:	170 KWH
Intended recovery rate:	45 – 55 – 60%
(While ultimate target is 60%, for the first year it will stand at around 45%)	
No. of employees (including logging):	50
Building area	1,620 m ²
Total investment	6,261,870 Ksh
(Including costs for machines and equipments CIF MOMBASA with import duty)	

(b) Major machines and equipments

Machines	Quantity	US\$ (FOB Japanese port)
1. Band-saw mill (Type 1200)	1	18,300
2. Auto carriage (Type 900)	1	23,200
3. Band-saw mill with auto table	1	26,900
4. Band-saw mill with roller table	1	18,800
5. Cross-cut saw	2	3,000
6. Air compressor	1	1,850
7. Log turner	1 set	5,500
8. Dust collector	1 set	13,800
9. Chain live deck	1 set	11,600
10. Live roller	1 set	6,600
11. Lift skid	2 set	3,700
12. Connection roller	2 set	5,600
13. Dead roller	2 set	5,100
14. Bridge separator	16 pcs.	13,600
15. Truck	16 pcs.	8,800
16. Band-saw sharpener	1	2,100
17. Band-saw stretcher	1	1,950
18. Tools, band-saw etc.		9,950
Sub-total		180,350
	Freight and insurance	33,450
	Import duty	85,520
Grand total		US\$299,320

Type A is one of modern medium scale mill. Breakdown operation is done by band-saw mill with auto carriage and resawing by auto table and roller table. This machine arrangement is optimum as sawmill in Kenya where resawing operation is performed on unit of 25 mm but when further resawing or board sawing is performed, in addition to the above, the installment of another table band-saw will be desirable.

A log turner is installed to transfer logs to lorry and then, in order to aim at effective hauling of sawn products in the mill, conveyor system is introduced to a large extent to promote the improvement of material handling.

It is considered that with introduction of Type A, modernization of sawmill is greatly promoted.

5.2.2. Type B Saw Mill – Small scale band-saw mill

(a) General descriptions of sawmill

Monthly log input:	320 m ³
Power required:	77 KWH
Intended recovery rate:	45 – 55 – 60%
(While the ultimate target is 60%, for the first year it will stand at around 45%.)	
No. of employees	15
Building area	575 m ²
Total investment	2,134,280 Ksh
(Including costs for machines and equipments CIF MOMBASA with import duty)	

(b) Major machines and equipments

Machines	Quantity	US\$ (FOB Japanese port)
1. Band-saw mill (Type 1100)	1	14,200
2. Auto carriage (Type 800)	1	21,400
3. Table band-saw	1	12,800
4. Cross-cut saw	1	1,500
5. Dead roller	1 set	1,500
6. Dust collector	1 set	8,350
7. Band-saw sharpener	1	2,100
8. Band-saw stretcher	1	1,950
9. Tools, band-saw blade etc.,		4,950
Sub-total		68,750
	Freight & insurance	13,000
	Import duty	32,700
Grand total		US\$114,450

Type B mill is a model plan when the facilities of present sawmill are to be modernized with relatively small capital investment. It is smaller in scale than Type A mill but contribute much to rise of recovery rate, improvement of quality and reduction of sawmilling cost and considered ideal as a local sawmill.

5.3. Implementation of modernization

Of 18 mills surveyed, equipments of 2 mills are fairly modernized but it is considered pertinent that of 16 mills, 8 mills introduce Type A and the rest of 8 mills introduce Type B.

The investment in equipment and management plan of these mills are shown in 5.4.

5.4. Management plan of sawmill

The examples of investment in equipments and profit and loss accounting of A and B types which are the sawmill model plan are as follows.

The cost of machines and facilities is calculated on CIF MOMBASA and the depreciation cost is calculated on the basis of the legal depreciation rate of Japan.

5.4.1. Investment in equipment

(1) Sawmilling machine facilities are outlined in 5.2.1 and 5.2.2.

(2) Cubicle

The particulars of cubicle are as follows.

(Unit: Ksh)

Item	A Plant	B Plant
Cubicle	115,000	52,000
Primary wiring	28,000	13,000
Cabinet panel	85,000	38,500
Secondary wiring	48,590	21,500
Control panel	Included in machine	Included in machine
Total	276,590	125,000

(3) Foundation work cost

A Plant

1200 Type Band-saw mill with carriage	$50 \text{ m}^3 \times 2,200 \text{ ksh} = 110,000 \text{ ksh}$
1100 Type Band-saw mill	$7 \text{ m}^3 \times 2,200 \text{ ksh} = 15,400$
1100 Type Band-saw mill	$7 \text{ m}^3 \times 2,200 \text{ ksh} = 15,400$
Conveyor system	$110 \text{ m}^3 \times 1,300 \text{ ksh} = 143,000$
Log turner	$7 \text{ m}^3 \times 1,300 \text{ ksh} = 9,100$
Total	292,900

B Plant		
1100 Type Band-saw mill	$30 \text{ m}^3 \times 2,200 \text{ ksh} =$	66,000
Table Band-resaw	$7 \text{ m}^3 \times 2,200 \text{ ksh} =$	15,400
Input of logs	$4.8 \text{ m}^3 \times 1,300 \text{ ksh} =$	6,240
2. Sale cost	Total	87,640

(4) Installation work cost

In case of Japan, the installation work uses forklift and wrecker, but in Kenya, as it is difficult to use machinery, many workers have to be employed.

A Plant		
For installation work	20 workers \times 60 days =	1,200 course
Wages	1,200 course \times 20 ksh/day =	24,000 ksh

B Plant		
For installation work	10 workers \times 50 days =	500 course
Wages	500 course \times 20 ksh/day =	10,000 ksh

(5) Building cost

The building of sawmill is of steel-frame and slate roof.

A Plant		
	Size of main plant	54 m \times 30 m
	Size of incidental plant	45 m \times 6 m
	Total	1,647 m²
Construction cost	Roofing work (20%)	478,000 ksh
	Steel frame work (60%)	1,434,000 ksh
	Building foundation work (20%)	478,000
	Total	2,390,000
	(Cost per m ² : 1,450 ksh)	

B Plant		
	Size of main plant	40 m \times 13 m
	Size of incidental plant	5 m \times 11 m
	Total	575 m²
Plant construction work cost:	Roofing work	166,800 ksh
	Steel frame work	500,400 ksh
	Building foundation work	166,800
	Total	834,000 ksh
	(Cost per m ² : 1,450 ksh)	

(6) Domestic transportation cost of machines

In estimating the transportation cost of machines from MOMBASA to the sawmill construction site, the calculation is made on basis of the distance to Nyeri.

A Plant: Transportation cost of machines to plant site		
	About 50 ton \times 430 ksh (639 km) =	21,500 ksh
B plant: Transportation cost of machines to plant site		
	About 20 ton \times 430 ksh (639 km) =	8,600 ksh

(7) Prices of lorry and caterpillars are those when the survey was made and other costs are estimated taking consideration of the local condition.

(8) The total of the amount of facilities investment for Plants A and B is as follows.

Table 8. Investment for sawmills and their recovery

US\$1 = ¥220 = 7.82 ksh

(Unit: ksh)

Item	A Plant				B Plant			
	Investment		Recovery		Investment		Recovery	
	Foreign currency	Domestic currency	years	Recovery	Foreign currency	Domestic currency	years	Recovery
Machines & equipments	2,341,800		12	195,150	894,500		12	74,540
Cubicles	276,590		12	23,050	125,000		12	10,430
Foundation work		292,900	12	24,410		87,640	12	7,300
Installation work		24,000	12	2,000		10,000	12	830
Buildings		2,390,000	24	99,580		834,000	24	34,750
Micellaneous expenses		80,000	2	40,000		32,000	2	16,000
Withdrawal of existing mills		100,000	2	50,000		40,000	2	20,000
Domestic hauling of machines		21,500	2	10,750		8,600	2	4,300
Sub-total	2,618,390	2,908,400		444,940	1,019,000	1,012,242		168,140
Land preparation	—	30,000				20,000		—
Dispatching experts	105,080		2	52,540	52,540	—	2	26,270
Sub-total	105,080	30,000		52,540	52,540	20,000		26,270
Lorry		200,000		67,000		100,000		33,330
Tractor		400,000	3	133,000		200,000	3	66,670
Sub-total		600,000	3	200,000		300,000	3	100,000
Grand total	2,723,470	3,538,000		697,480	1,072,040	1,062,240		294,410
	6,261,870 Ksh				2,134,280 Ksh			