

Integrated Forest Management Project (IFMP)

Royal Kingdom of Bhutan

STUDY ON FOREST ECONOMY WITHIN FOREST MANAGEMENT UNIT KOTHOKA

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0. Preface

The mission was an interesting and challenging task. The discussions among the Bhutanese responsible was utmost fruitful and as I hope for both sides a success. The mediatorship through both of the GTZ collaborators was very helpful.

Besides that, it was personally a valuable experience not only because of the beauties of Bhutan but also because of the kindness and hospitality of all Bhutanese colleagues. For that I would like to express my sincere thanks to all of them.

I would like to express special thanks to Mr. K. J. Subba, Joint Director of the Forestry Services Division, who initiated this study. Also special thanks go to Mr. A. Baskota, Divisional Forest Officer, Lobesa and Mr. Kesang Dukpa, Divisional Manager of Bhutan Logging Corporation, Thimphu, who facilitated together with their field staff this mission. I am especially grateful to Mr. B.P. Dahal who contributed a lot to the success of this mission with his tremendous experiences about FMU Kothoka. All of them were patiently answering questions and provided the necessary data and shared their professional insight views with this mission as well.

Further I would like to thank Mr. R. Krezdorn, Team leader BG-IFMP, who supported and promoted this mission. Last but not least the acknowledgements go to Mr. Eugen Maier, Forest Advisor of BG- IFMP. Without his regional experience and his professional knowledge the tremendous flow of information would have been not feasible. By his personnel engagement he contributed specially to the success of this mission.

Finally, I would like to express my sincere wish that through this mission the Forestry at FMU Kothoka could step forward a little bit.

Thimphu/ Lobesa, 14.12.1995

1. Executive Summary

The Mission on Forest Economy within FMU Kothoka went on from 30.11.1995 to 14.12.1995. After a field trip to FMU Kothoka and many information provided by responsible staff members the results of this mission are concluded in the following proposals below.

It ought to be emphasised that a new management plan is under consideration. Mainly because of the uncertainty of the allowable cut for the next decade thus, it is at present impossible to come up with definite proposals and recommendations for a more rational organisational set up for FMU Kothoka.

Nevertheless, there are mid-term proposals which will have a serious impact on the entire chain of activities at FMU Kothoka by implementing them. Besides of those, there are recommendations which can be implemented on short notice and with ease. All proposals can be realised step by step whenever it is convenient.

Regarding the annual allowable cut for FMU Kothoka it was found that none of the activities in itself can be considered as the bottle-neck. However, it can be clearly pointed out that solely because of an absence of an integrated organisational steering of the entire forest process with so many parties involved leads to unavoidable shortcomings (cf. 4.1 Overview of activities)

RECOMMENDATIONS:

Each point is structured and specially indicated in the text as: **proposal** - *reason* - effect

- **Direct transportation of all logs from forest road head down to top station at Tashila Depot. Straight afterwards the logs get carried down by the ropeway to Chuzomsa depot. Logs which are too big and too heavy to be carried down by the ropeway can be divided by pit-saws into two or four pieces. The stand for the pit-saws could be up at the top station.**

Direct transport avoids several loading and unloading which is a cumbersome, time consuming and therefore costly undertaking.

It is estimated that approximately 50 % at least of the supervisory staff can be saved. In addition to that cost for loading and unloading arise only once.

- **All mechanical sawing activities should be shifted from Kothoka valley downwards.**

For the sawmills at Kothoka it is difficult and expensive to get provided with fuel and lubricants and spare parts as well. (ropeway transport!). Moreover the season for sawing is remarkably shortened due to the climatic conditions.

Down at the valley bottom the running expenditures are reduced, surely. E.g., instead of fuel electricity might be used. Moreover, the ordinary timber assortments can be produced more comfortably and less expensive by a gangsaw.

- **The organisation should be streamlined. An overall co-ordination for all activities ought to be ensured. This is only possible if the different sections involved are properly informed and co-ordinated in time.**

We found that some works are done twice or three times e.g. measuring. The more sections are involved which work independently of each other the more efforts are necessary to ensure the necessary interfaces. Moreover there is a risk that the overall perspective gets lost.

The supervisory staff get reduced easily down to 50 % of the present status, if the others proposals get realised.

- **Training of field people involved at FMU Kothoka. Aspects to safeguard the workers, to increase the performance in terms of quality and quantity ought to be considered.**

Having in mind the visited logging area shortcomings were realised from the silvicultural point of view, the quality of logging operations (felling directions could not be maintained, heavy damages at the remaining stand etc.).

Continuous training of field staff will increase the performance and the quality of the work done. This will have an immediate positive impact on cost and the value of the produced goods.

- **The present transportation equipment such as tractors with trailers should not be changed. In order to facilitate the repairing and maintenance of the existing equipment a small workshop with fast moving spare parts and a store with fuel and lubricants is required.**

In case of using trucks the existing road has to be improved considerably. Otherwise the trucks will not reach their supposed performance. Due to the rough roads high maintenance and repairing cost can not be avoided. Because of the uncertainty of harvestable volume at Kothoka any decision about high investments can not be taken presently.

The time for repairing and maintaining of the equipment in use would be shortened.

- **For any forest work to be done by contractors minimum standards are prerequisites. This is utmost important for proper monitoring of contractor work by forestry staff.**

During our trip through the forest it was found that due to improper operations losses were unavoidable.

In case of proper forest work, the efficiency can be improved while reducing damages. E.g., by applying of the right felling direction the number of broken trees is getting reduced. Thus, the gain in terms of usable timber will increase.

- **In principle, all hard work should be facilitated as much as possible such as loading of logs, lifting and handling of blocks etc.. Whenever loading is required ramps or small winches should be used. For handling of blocks which is mainly required in the sawmills block and tackle should be applied.**

Lifting and manipulating of heavy loads are dangerous and detrimental for labours health and welfare.

It is truism that only healthy labours are able to maintain a good work performance for the long run. By using lifting or handling facilities the time consuming loading part can be remarkably reduced, thus increasing the overall efficiency.

- **The measurement to be applied ought to be the metric system only. The solid volume of logs is calculated by measuring of the mid-diameter and length. (Ref. Grading of logs, paper given to DivFO by BG-IFMP). The logs must be numbered clearly and permanently.**

The present system by using the Quarter of girth formula is not precise.

Efforts in measurement can be reduced. Calculation and transforming mistakes can be avoided. Monitoring of the gain for sawn timber can be facilitated.

- **Logs should be selected and distributed into three different ranges: smaller size and minor quality logs ought to be sent directly to Tashila ropeway, medium size logs should be sent to the mobile sawmill and the big size logs should be given to the band- sawmill. Sorting of logs directly at the landing place and measuring before loading would facilitate this proposal.**

Only if the appropriate sizes are given to the sawmills they are able to achieve their potential efficiency.

The performance of the sawmills will increase. The interim depot can avoided, loading and unloading can be reduced. Payment of the contractors can be done at an earlier stage.

- **For a market study a grading trial should be made.**

It should be tested how far quality is appreciated by the customers.

We hope that the total profit of timber can be increased. Thus, it gives information about the timber marketing situation and the assortments which are most profitable.

- **In respect to the low overall performance of any section involved at forestry and sawmilling work during wintertime (2-4 working hours per day at the sawmill etc.) the FMU should reduce its activities down to a minimum during winter. The reducing of all activities has to be planned properly.**

The working time during summer could be increased accordingly.

For all people and technical equipment it is cumbersome and least effective to stay up at Kothoka during winter.

The proposal would reduce the fix cost drastically.

2. Brief Description of Forest Management Unit Kothoka

Forest Management Unit of Kothoka is situated at Wangdue District south-east of Wangdue Dzong. The Kothoka valley lies at an average altitude of 2800 masl. (Ref. map 1 and 2)

The FMU Kothoka is linked to the National Highway of Dong Chu valley through Tashila Ropeway. The distance of this ropeway from the bottom station (about 1 300 masl) to the top station (about 2800 masl) is about 5200m. The rope way is the sole access possibility in order to transport timber or any other person and goods from and to Kothoka area. Besides that only steep and difficult footpaths are going up.

From the top station of Tashila ropeway a feeder road reaches after 8 to 9 km the two sawmills and reaches finally the forest after 6-7 km the operation site of the forest.

The area of FMU Kothoka comprises about 4908 ha in total and is divided into the following three Sub - Units Kekephu (1 899 ha), Leckchu (921 ha), Pazachu (2 088 ha).

According to the concerned Management Plan about 3623 ha are classified as forests. About 50 % of the forest area are Mixed Conifer Forests consisting of Hemlock, Spruce and Juniper. The other 50 % are Blue Pine Forests. The annual allowable cut was supposed to be 6900 m³ during the past decade. A new management plan is under consideration. (FRDS, 1984: Forest Management Plan of Forest Unit Kothoka. Period from April 1984 to April 1994).

3. Present Situation in FMU Kothoka

According to the Terms of Reference (ref. Annex No. 1) and the time schedule (ref. Annex No. 2) the Forest Management Unit Kothoka was visited and all responsible persons were contacted. The native data were provided by the key staff.

The general situation and the individual activities as well were thoroughly discussed with the concerned staff members and jointly agreed upon.

The results of these findings are given below in the sub chapters.

Under the heading of different activities the consultant gives his professional impressions.

3.1. Overview on Activities at Forest Management Unit Kothoka

Since we looked for a basis for the recommendations the actual situation were analysed in detail. Each activity of the entire procedure was described in close consultation with the field staff. (ref. Table no 1.)

All parties involved were identified and can be summarised as follows:

- **Forestry Services Division (FSD)** Forestry Management Unit of Kothoka (FMU) and the concerned Incharge (FMU I/C).
- **Bhutan Logging Corporation (BLC)**
 - BLC Production Division (BLC- Prod.)
 - BLC Timber Disposal Division (BLC- TDD)
- **Private Contractor and Sub- Contractors**
 - Under FSD Management: (e.g. Char coal production,)
 - Under BLC Management: (e.g. logging, cable crane transportation, sawing, etc.)
- **Private Entrepreneurs** (e. g., Tashila Ropeway)

The entire production chain were divided into activities and locations.

Minimum 23 of specific activities at 9 distant locations could be identified.

In combination with the different organisations / institutions, it shows that co-ordination is an utmost demanding task.

Because of theoretical research and practical experiences the consultant tends to recommend that the greatest potential for any rationalisations can be found within the existing organisational setup.

Table No 1: Overview on Activities at Forest Management Unit Kothoka

Location	Activities	Responsibilities			Implementation			Remarks	
		FSD FMU I/C	BLC		FSD	BLC Employees			BLC Contractor
			Prod	TDD		Prod	TDD		
I. Forest operation site	1. Site Selection	X	X		X	X		Controlling officer is FMU I/C. Labours are paid by BLC.	
	2. Corridor / Coupe Survey	X	X		X	X		Controlling officer is FMU I/C. Labours are paid by BLC.	
	3. Marking	X			X	(X)		Controlling officer is FMU I/C. Labours are paid by BLC. Provision of labours by BLC is only done, in case no other labours are available.	
	4. Felling, debranching, cross cutting.		X				X (6-50/ 20 men)	Work given to sub- contractor by BLC. Contract is awarded through tender. A tender committee selects the contractor based on the rate offered by him. Present rate: about 1 NU/ cft.	
	5. Rolling either to cable crane line or down to road head.		X				X	A part of the logs is brought down manually. Roll. rate is about NU 6.-/ cft. Char coal is being produced from lops and tops by contractors	
	6. Cable Craning		X			X winch operator	X (6-10)	Cable Crane is owned by BLC. Winch driver is engaged by BLC. All other craning crew members are under sub-contract. BLC pays fuel and lubricants for the cable crane. The craning crew uses the cable crane. The rates: winch driver is paid by the hour on top of that he gets TA/DA of NU 0.03 / cft. Whereas the crew members are paid on piece rate basis of NU 1,74 /cft till 1000 m of CC- line, NU 2,04/ cft for 1001 till 1500 m and NU 2,45 / cft for > 1500 m CC- line.	
II. Forest Road	7. Loading, tying, transportation from forest road head to Interim- Depot Dolongda (approximately 6 to 7 km), and unloading.		X			X 3 BLC - tractors	X 7 private tractors	3 tractors and trailers are bought by BLC. 7 tractors and trailers are owned by 5 different contractors. BLC engaged one tractor driver permanently and two tractor drivers on a non- permanent basis. On top of their monthly salaries NU 0.20/ cft is paid on production basis to each driver. The tractor contractors are actually paid about 1 NU/ cft/ km. The loading and unloading part is given to sub-contractors. The piece rate for the loading crew (3-4) is 1,40 NU/cft.	

Location	Activities	Responsibilities			Implementation			Remarks	
		FSD FMU I/C	BLC		FSD	BLC Employees			BLC Contractors
			Prod	TDD		Prod	TDD		
III. Interim Depot Dolongda	8. Joint measurement (BLC- Prod, BLC- TDD and contractors)		X	X		X	X	X	The logs get handed over from BLC- Prod to BLC- TDD. Joint measurement is done among the parties involved. The joint measurement earmarks the reconciliation of BLC- Prod. and the timber stocks of BLC- TDD. The measurement is basis for contractors' payment (piece wages). The formula used for the volume calculation is the Quarter of Girth Formula $[(g/4)^2 * 1]$. The logs get stacked at the log yard. Through the Interim Depot, logs with smaller sizes (Diameter < 30 cm) gets directly distributed to Tashila Ropeway. It also serves the 2 sawmills up at Kothoka valley and the Pit- Sawers as well (> 30 cm). On trial basis rotten logs get sorted out, stacked separately and offered for timber auctions. The bidders are supposed to come up to FMU Kothoka and make their offers during the timber auction in P'ling.
IV. Sawmills	9. Transportation of logs (unsorted) to the log yard of sawmill No 1 (Indian Type) and No 2 (Circular Mobile Sawmill). 10. Loading of logs to the sawing trolley. 11. Sawing of different sizes of blocks and scantlings. 12. The bakals get separated. (Sawmill No 2) 13. The off cuts gets transformed into charcoal or into cable bits (sawmill No 1 & 2)			X				X 2 sawmills at Kothoka	There are at Kothoka valley two different types of sawmills: One is an Band Sawmill having 1 horizontal bandsaw, a vertical bandsaw and circular trim saw. The present yearly capacity on sawn timber of the Band Sawmill is estimated to be about 1 200 m ³ . The Band Sawmill has been established at 1992. The other one is a Circular Mobile Sawmill from New Zealand. Year of establishment 1994. After a training phase the present yearly capacity can be estimated of about 1000 m ³ of sawn timber. As per the sawmill policy the sawmills are sawing the logs in transition. The fixed rate paid to them is 9.37 NU / cft for blocks and NU 9,72 for scantlings, including stacking and sorting of sawn timber and off-cuts. Handling of saw dust is in this rate included as well. The sawing rate will be only paid from BLC- TDD to the sawmillers after the sawing timber has reached Tashila Ropeway block yard. Only the blocks and scantlings are sawn in transition. The off-cuts are sold to the sawmills at a rate of NU 75.-/ m ³ stacking volume. A part of the off-cuts is transformed into charcoal, an other part is used as cable bits. Char coal, cable bits and any other off-cuts get directly sold by the sawmills to private parties. Sometimes the off- cuts are given to the villagers nearby free of charges. This is done due to the heavy expenditures involved for transportation and the low revenue generating.

Location	Activities	Responsibilities			Implementation			Remarks	
		FSD FMU I/C	BLC		FSD	BLC Employees			BLC Contractor s
			Prod	TDD		Prod	TDD		
V. Block yard of Sawmills	14. Sorting of blocks and scants and bits species- wise and category- wise before transporting to Tashila ropeway. (Tashila Depot)			X				X Transporters and Sawmillers	Sorting of sawn timber and prepare the different lots for transport to Tashila block yard (Tashila Depot). Loading is done manually. The rejected off-cuts are being converted into charcoal. The charcoal gets directly sold to BCCI. The royalty gets paid to FSD Wangdue Range.
VI. Transport from Sawmills to Tashila Ropeway	15. Transport by tractors			X				X Transporters	The transport distance between the sawmills and Tashila Depot (Top station) is about 6 to 7 km. The transport is done by private transporters only. The rate is NU 1.04/ cft/ km.
VII. Block yard at top station of Tashila Ropeway. (Tashila Depot)	16. Unloading of timber (sawn timber and smaller logs). 17. Rough sorting of timber. 18. Stacking / Preparation of timber for transport through Tashila Ropeway. 19. Joint measurement by BLC-TDD, transporters, sawmillers and Tashila Ropeway representatives.			X				X BLC TDD, Transport contractors and Representatives of Tashila Ropeway	Joint measurement. As per that, the transporters and sawmillers gets paid and the ropeway, too.
VIII. Tashila Ropeway	20. Transport through Tashila Ropeway			X				X Tashila (8 staff members at top and bottom station)	Capacity of the ropeway: 0,8 ton per ride. About 6000 m ³ per year. Approximate rate: NU 14. - / cft. (485.- NU/ m ³).

Location	Activities	Responsibilities			Implementation			Remarks	
		FSD FMU I/C	BLC		FSD	BLC Employees			BLC Contractors
			Prod	TDD		Prod	TDD		
IX. Chuzomsa Depot/ Tashila Ropeway bottom station	21. Timber unloading of Tashila Ropeway. 22. Sorting out of different sizes. 23. Measurement of lots before selling and disposal to third parties and to Bajo- Depot.			X				X Tashila Ropeway Private trucks As soon as the timber reaches at Chuzomsa it gets unloaded and sorted out. The small sizes get stacked. Some of the logs, blocks and scantlings get arranged in form of lots for timber auction. The bidders come to Chuzomsa to have a look to the lots. However, the auction is done in P'ling. Other timber gets either directly sold into the urban and commercial timber markets or get transported to Bajo Depot about 20 km away from Chuzomsa Depot. At Bajo the timber will be sorted, stacked and sold by auction or dispatched to P'ling Export Depot. Finally the timber gets sold into the Export market to India. The sale proceeds get collected by TDD Wangdue through Divisional Forest Officer on behalf of BLC- TDD.	

3.2. **Marking, Felling and Logging**

The observations refer mainly to the site visited at Kothoka Pazachu Unit, Compartment no. 5 where presently the logging activities are going on.

Unfortunately, it wasn't possible to had a look to the ongoing logging operations due to the fact that felling was finished yet and cable crane transportation were interrupted due to a serious and sad accident.

Nevertheless, it was possible to get an impression about the efficiency and the quality of work done.

- **MARKING:**

The remaining stand of the coupe didn't reflect a cautious and careful silvicultural treatment because quite a number of trees were still of minor quality (forked , knotty or rotten trees). Future trees were not strictly promoted.

- **FELLING**

Felling is done through contractor. The contractor gets selected by tender through BLC Tender Committee organised by BLC Production Division.

Felling operations, cross cutting and debranching of big branches are carried out by gasoline powered chainsaw. The branches of smaller size are cut by axe. Cross cutting is done into logs between 3 and 4 m in order to get transportable sizes for the cable crane.

A felling layout couldn't be made out. E.g., some big trees felt transversal to a small valley bottom and got broken. The damage was predictable and could have been avoided. Through felling along the slope the damage could have been side-stepped. That could have been facilitated the cable craning, too.

Some huge trees were marked, partly sawn but not felt.

The annual cut was in	1993:	2350 m ³
	1994 :	5510 m ³
	1995:	3340 m ³
	Mean annual cut:	3633 m ³

The annual allowable cut according to the management plan 1984 -1984 was 3900 m³.

All above volumes are measured as per the Quarter of Girth Formula.

- **CABLE CRANING**

The cable crane operations were interrupted but not finished yet. The equipment used is a gravity ropeway. The winch on a sled is manufactured by Gantner, the carriage by Koller. Both manufacturers are Austrian Companies.

Since the equipment is from the technical and economical point of view very demanding only trained staff in all terms technically and safety measures will use the equipment at its optimum.

On the remaining stands mayor hauling damages occurred. The reasons for those damages can only find out during the course of operations.

It is estimated that the Cable Crane Crew can reach the target of about 2 000 (3000) m³ log volume as annual productivity.

A part of the felled logs are hauled directly by manual rolling down to the forest road.

Cable craning and transportation by tractor are not interlinked. That leads to huge stocks at the landing place.

3.3. Road and Transportation Equipment

- **ROAD SITUATION**

A stone soling road is built from Tashila Ropeway top station passing the TWBI (Thundrup Wood Based Industry/ Band Sawmill) and the timber depot at Dolongda (ONGDI Mobile Circular Sawmill) into the forest area of Pazachu Unit.

The total distance is about 14 km the width is about 3 m and the inclination about up to 12%. The road was build into two stretches:

1984- 87: the first stretch with about 9 km and

1992: the 2nd stretch with about 5 km.

The first stretch is starting at Tashila Ropeway Top station and was financed by HELVETAS.

The cost for the 2nd stretch was about 2 lakhs (200 000) NU/km and was financed through BLC.

The bearing capacity tallies more or less with the actual transport facilities (tractors + trailers, loading capacity about 5 to). For heavier loads the bearing capacity of the stone soled road is not sufficient.

As per our general impression the 1st stretch of the road appears to be in a comparatively good shape. Whereas the 2nd stretch of the stone soling road is washed out, mainly due to the higher gradient. The road shoulders are partly eroded.

The expenses for maintenance are little and arise about 100 000 NU/ year for the entire stretch.

- **TRANSPORTATION EQUIPMENT**

- **Tashila Ropeway:**

Built under Swiss assistance in 1982 /83.

Total length 5200 m.

Elevation: 1500m (from 1300 to 2800 masl)

Capacity: 800 kg/ ride. (approximately 1 m³ of solid timber volume)

Duration per trip: 30 min

The total transportation capacity of Tashila Ropeway can be estimated of about 5000 m³ / year.

(2 m³/ hour, 10 hours / day, 250 days / year).

- **Tractors with Trailers:**

For transport of logs and sawn timber on the road 10 tractors with trailers are available at FMU Kothoka. 3 of the tractors are owned by BLC. The 7 other contractors with trailer are owned by 5 different private contractors.

Due to the rough road conditions tractors trailers and are often out of order. This fact has to be considered by estimating the transport capacity:

2-5/ 3 tractors are running daily.

1 to max. 2 trips a day.

Per trip the tractors are carrying between 3 and 5/ 4 m³ of timber.

Per year is estimated to have about 200 working days. (Winter conditions!).

Thus, the annual transport capacity is about 3000 to 3500 m³.

Due to the absence of a workshop minor repairs and maintenance of the equipment has to be done by the drivers themselves. For mayor repairing a mechanic has to be called from Wangdue, Thimphu or Phuntsholing (P'ling).

- **LOADING**

Loading is only done manually. Each procedure of loading or unloading needs to have 3-4 people. Any loading facilities such as tier for, ramps or winches are missing. Therefore loading and unloading are one of the most time-consuming part works within the entire sequence of work procedure.

3.4. **Volume Timber Measurement**

- **STANDING VOLUME MEASUREMENT**

The standing volume of marked trees (marking volume) is resolved by local volume tables. The local volume tables are attached to the Management Plan covering the period from 1984 - 1994. The entrance data is diameter breast height in centimetres. The marking volume is a metric measurement (m³).

- **LOG MEASUREMENT**

The volume of logs gets measured according to the Quarter of Girth Formula :

$$V_{\log} = \left(\frac{g}{4} \right)^2 * l$$

V_{log}: solid volume in cubic feet [cft]

g : girth in inches [inch]

l : length in feet [ft]

The volume measurement as per Quarter of Girth formula reflects not the solid log volume but the anticipated volume of the main product. The difference between the volumes per Quarter of Girth formula and the volume as per the metric measurement (mid diameter and length of the log) is approximately 27% less.

At FMU Kothoka it was observed that the girth is calculated by measuring a diameter in centimetres, the length of the log is measured in meter and converted into feet.

The **first log measurement** is done at interim depot Dolongda and indicates the formal handing(taking over between BLC- Production and BLC Disposal. The logs get enumerated after having unloaded. Later on, these logs get jointly measured by BLC- Production Division, BLC Depot I/C (BLC-TDD) and the contractors.

This measurement is the basis for payment of felling, cable craning/ rolling and transportation from forest to Dolongda Depot.

A **second joint measurement** is done at Tashila Ropeway Top-station. The parties involved are BLC- TDD through Depot I/C Dolongda Depot, BLC- TDD through Depot I/C Tashila top-station Depot, representatives of Tashila Ropeway and transport contractors.

This measurement is the basis for payment the transportation by tractor from Dolongda Depot respectively from forest and by Tashila Ropeway.

A **third joint measurement** is done at Tashila Ropeway bottom station for transport to Bajo Depot or for stacking in different lots for export.

- **SAWN TIMBER MEASUREMENT**

The logs get converted in the 2 sawmills into the following assortments:

- Blocks
- Scantlings
- Bits
- Bakals
- Off-cuts
- Sawdust

The volume of the major (main) products, *blocks* and *scantlings*, are measured by length, breath and width.

The minor product are measured as followings:

Bits: are assorted as per length and numbered

Bakals: are numbered only.

Off-cuts: are measured as per stack volume.

Sawdust: is a none commercial product. However it is used by the villagers to be brought out of their fields and by BLC-Production for depositing on the road. It is given free of charge.

The measurement of the commercial products is done jointly, too. The procedure is done in a similar way as it is already described under the chapter 'log measurement'.

The different measurements as formal acts are done by a substantial number of multiple challans. The entire procedure demands a lot of staff involved. The measurements are often timely separated from the activity for which the volume measure is needed. The measurement procedure itself is time consuming and imposes any errors.

3.5. **Sawmills**

- **Band Sawmill** (named as Indian sawmill):

This sawmill is owned by Thudrup Wood Base Industry (TWBI) and was established in 1992.

The **horizontal bandsaw** allows to saw logs up to 1,30 m diameter. The logs on a trolley get manually pulled through the bandsaw.

The saw quality of the products seems to be satisfactory.

In general this sort of bandsaw is an appropriate technology in order to saw big dimensions. Only then, the productivity will be high.

Through the **vertical band** saw the scantlings are trimmed laterally. By all means the first cut is has to be done by eye only. Thus, the quality of cut is not satisfactory.

By the **circular saw** cable bits are trimmed.

The yearly sawing capacity under the condition of FMU Kothoka is presumed to be 1200 m³ of sawn timber.

It was observed that the handling of any sizes of logs and blocks were done manually. By introducing of simple and cheap technical measures, e.g., pulley block the handling (moving and loading) of heavy timber can be facilitated.

Surely, the gain of bigger block sizes could be increased. Then, the crew would not try to saw smaller and not so heavy sizes instead of the higher valued bigger sizes.

- **Mobile Sawmill**

Below of the Interim Depot of Dolongda a mobile sawmill manufactures in New Zealand has been established semi-permanently. This sawmill is owned by Mr. Tshering Sherpa, Thimphu. The mobile sawmill consists out of a horizontal and a vertical circular saw which are running simultaneously on a guide bar. the maximum size to be sawn is horizontally 6” and vertically 12”.

The sawing quality is very accurate. The mobile sawmill is appropriated for producing medium sized blocks and all other assortments especially scants.

The yearly sawing capacity under the condition of FMU Kothoka is presumed to be 1000 m³ of sawn timber.

This type of sawmill is appropriate to medium size logs.

- **Pit-Sawing**

Irregularly and whenever it is required pit-sawers are used to fill the gap of sawing capacity.

3.6. Training and Security

It has to be repeated once more that felling and logging operations has not been observed during the field trip. Thus, conclusions ought to be drawn from the condition of the remaining stands.

However, it was obvious that all felling operations have not been up to the standard. This was made out on stamps, felling direction and on the cross cuts of logs. It was observed again and again that these operations were not done always at its optimum.

The same conclusions can be drawn for the cable crane operations, too, because of the hauling damages on remaining stems. It can be expected that hauling of such short logs can be done with least damages on the remaining stands. This is purely caused due to a lack of professional training and insufficient supervision during logging operations.

3.7. Organisation

Logging, transportation and sawing are implemented by three different organisational respectively institutional bodies such as FSD- FMU, BLC- Production and BLC- Disposal. However, their work to be done is interwoven, thus, they are dependent on each other.

The field staff of these three bodies is subordinated to different superiors in Lobesa (Divisional Forest Officer) and Thimphu (BLC- Production Officer resp. BLC- Divisional Manager and BLC- Manager Timber Disposal Division / Manager Timber Marketing Division). The direct contact to the parent organisations/ institutions is laborious and time consuming due to distance and difficult regional conditions.

There is no local co-ordinator who is responsible for the overall procedure from felling to selling.

The different independent organisational bodies make use out of permanent labours and out of seasonal contractors resp. sub-contractors as well. Partly the work is done by private entrepreneurs, too.

This needs a high effort from the human resources management and administration point of view for the different activities such as planning, steering, supervision and accounting.

Moreover, due to the difficult site conditions (climate and cumbersome spare parts supply) bottle-necks are unavoidable and therefore staff and equipment are lying idle again and again.

The present organisation which involves 20 supervisory staff either engaged by BLC or FSD, not taking into account numerous helpers and labours seems at a glance very voluminous.

Any interactions amongst the above mentioned bodies leads to the necessity having a good information exchange such as meetings, numerous challans and other information / communication facilities. Any friction in communication, errors or mistakes leads to problems and losses unavoidably.

It could be observed that some work is even done doubled and tripled, e.g., measuring of timber.

Payment of the work done is mainly paid by fixed rates. Cost data are not collected. Thus, an detailed overview about the real cost situation doesn't exist. Any decisions based on economic facts are rendered most difficult.

4. Discussion of the Proposals

4.1. General Issues

Due to time constraints it was not possible to get an detailed view about the procedures within FMU Kothoka. A definitive appraisal is hampered because of the non availability about the future utilisation potential of FMU Kothoka

.On principal there are two scenarios conceivable:

- Harvesting of the mature forest within the next few years. Then a longer period without any logging operations (about 50 years)has to be kept. That would mean the FMU would be only operated non permanently.
- Reducing of the harvesting volume aiming at a balanced cutting volume in order to reach a sustainable forestry (permanent FMU).

Having not such basic decisions at hand, any proposals implying vast investment at FMU Kothoka itself can not be recommended. E.g., reconstruction of the existing forest road.

Nevertheless, having in mind the actual situation and after joint and thorough discussion with the key staff involved some solid proposals can be made which will improve the existing situation by all means.

The proposals can be realised either on short or on long term notice. On principal the targeted stage can be reached step by step.

It has to be acknowledged that the staff and the contractors involved are actually doing a good job regarding the tough site conditions.

Points of attachments can be earmarked on three different levels in order to improve the procedure as a whole:

- **Organisational Structure and Personnel Management**
- **General Conditions**
- **Technical Equipment**

Implementing proposals the different levels are often interwoven with each other.

4.2. Particular Proposals

- **Direct transportation of all logs from forest road head down to top station at Tashila Depot. Straight afterwards the logs get carried down by the ropeway to Chuzomsa depot. Logs which are to big and to heavy to be carried down by the ropeway can be divided by pit-saws into two or four pieces. The stand for the pit-saws could be up at the top station.**
- **All mechanical sawing activities should be shifted from Kothoka valley downwards.**

Both of these proposals are dependent on each other. In order to assess the feasibility of these proposals a rough calculation was figured jointly out between Wangdue Forestry Division, BLC, BG-IFMP and the consultant.

The result is summarised in the table below:

Table No. 2: COST COMPARISON (NU / cft in approximate figures)

Sl No	ACTIVITIES	PRESENT STAGE	PROPOSED STAGE
		NU / 1 cft	NU / 1 cft
1	Felling, debranching, cross-cutting,	1.50	1.50
2	Debarking	0.60	0.60
3	Rolling up to the road head or Cable Craning - Cost	12.00	12.00
4	Transport to Interim Depot	8.00	
5	Loading and unloading (1*) (in the forest and at Tashila Top Depot)		2.00
6	Loading and unloading (2*/ Forest, Interim Depot, Tashila Depot)	4.00	
7	Stacking	1.10	
8	Sawing	10.00	10.00
9	Transport up to Tashila Depot - Tashila Ropeway Top Station	7.00	20.00
10	Stacking at Top Station	1.10	1.10
11	Transport by Tashila Ropeway Tashila Ropeway Bottom Station	14.60	14.60
12	Stacking at Chuzomsa	1.10	1.10
13	Royalty	18.00	12.80
14	Establishment Cost	5.00	5.00
15	Grand Total NU for 1 cft sawn timber at Chuzomsa Depot	84.00	80.70

This calculation takes into account that the log volume is completely converted into sawn timber. All products (excluding sawdust) are transported down to Chuzomsa Depot- Tashila Ropeway Bottom Station.

For the proposed stage, additional profitable effects are not valued, e.g., less staff, less cost for fuel and lubricants, spare parts and repairing cost etc.

The overall transport cost up at FMU Kothoka (including loading) for the present and the proposed stage (NU 19/cft versus NU 20/cft) are based on fixed rates only. These rates don't show the real cost situation.

Most probably the rates for sawing would be less in case the logs get sawn down at the valley bottom.

It could not be reasoned out why the sawmills were established at Kothoka. Also it was not foreseen in the Management Plan. Considering the fact that all sawn timber has to be transported down to Chuzomsa any economical advantage doesn't occur.

By all means, realising the proposed stage, BLC on one hand would be more flexible in order to meet the demands and requirements of the urban market and on the other hand to sell timber profitably to the export market.

- **The organisation has to be streamlined. An overall co-ordination for all activities ought to be ensured. This is only possible if the different sections involved are properly informed and co-ordinated in time.**

A critical analysis results that the present organisational set-up, which is divided into different organisational sections and involving so many people is utmost sensitive for doubled efforts and any fractions. That can be seen, e.g., by timber measurement which is accompanied by numerous challans. TDD by dealing in timber measurement only handles 12 different challans.

It is highly recommended to reduce the number of challans and to simplify their layout.

Firstly it has to be seen who is handling these challans.

Secondly for which purpose the challan is meant for. Therefore the challans are to be designed simply and in such a way that the information collected has only to be raised once and not several times.

Thirdly the challans has to be interlinked, e.g., before transportation all logs ought to be measured and enumerated permanently. This enumeration has to be kept till the log gets either sold or sawn. The measurement can be controlled by everybody at any time and at any time. A joint measurement is no more needed.

Such basic procedural issues are prerequisites for a clear line of responsibilities and competences. Only then a lean management can be achieved.

There should be an accounting system used which takes not only care for the running expenditures and revenues but also for a cost accounting to different cost units. Only then the cost effectiveness can be monitored.

- **Training of field people involved at FMU Kothoka. Aspects to safeguard the workers, to increase the performance in terms of quality and quantity ought to be considered.**

Adequate professional training increases performance and quality of all operations to be done in the forests. E.g., the silvicultural training has to ensure that a minimum standard will be applied and the remaining s improve in terms of quality and increment or natural regeneration.

A rational assignment of personnel, needs trained man power. It would be not sufficient to provide only once an introductory training. Actually all levels are called to think upon how to improve the work to be done more efficiently in a more rational way. This impression is based on observation in the forest and on the work manually carried out. Training has to be ensured that no permanent damages occur not only on the forest but also not on human beings.

Trained chainsaw operators and loggers (craning crew included) are the prerequisites for any quality oriented silvicultural operations.

The introduction of basic technologies, e.g., ramps, winches etc. could reduce the physical burden of the loggers and loading crews and increases the work performance as well.

Safety aspects have to be an integral part of professional training.

However, concluding a syllabus of such practice oriented training programmes is not subject of this mission.

- **The present transportation equipment such as tractors with trailers should not be changed.**

In order to facilitate the repairing and maintenance of the existing equipment a small workshop with fast moving spare parts and a store with fuel and lubricants is required.

The transportation equipment and condition of the present forest road has to be seen together. It is obvious that the present forest road is not made for bearing higher loads. To increase the bearing capacity of the existing road would be only possible by providing a bearing layer of crushed material. (about 30 to 40 cm thickness).

Due to the eroded shoulders it boils down that conversion of the existing stone soling into crushed gravel would be the most appropriate solution. This can be only done by a mechanical stonebreaker since the manually crushed gravel will not give a good mixture of different gravel sizes.

Furthermore, it has to be considered if different types of tractors are feasible in view of maintenance and repairing.

- **For any forest work to be done by contractors minimum standards are prerequisites. This is utmost important for proper monitoring of contractor work by forestry staff.**

For any contractor a minimum professional knowledge and skills are required.

The field staff has a great responsibility for monitoring and supervision. It should be a point that unskilled and untrained labours should not be employed for forest work. Forest work is dangerous and demanding. It should be made a condition for any tender that the contractor has to engage a certain percentage of trained loggers.

- **In principal, all hard work should be facilitated as much as possible such as loading of logs, lifting and handling of blocks etc.. Whenever loading is required ramps or small winches should be used. For handling of blocks which is mainly required in the sawmills block and tackle should be applied.**

Such most basic facilities take care for the health of the labours and increases simultaneously their performance.

In the long run it counts for every party involved: for the employee who can save his health, for the employer who benefits from a better performance and for the public because the health cost are less.

- **The measurement to be applied ought to be the metric system only. The solid volume of logs is calculated by measuring of the mid-diameter and length. (Ref. Grading of logs, paper given to DivFO by BG-IFMP). The logs must be numbered clearly and permanently.**

The metric volume calculation referring to the mid diameter and the length of a log results into the following formula:

$$V_{\log} = \frac{\pi}{4} * d^2 * l$$

V_{\log} : solid log volume [m³]
 d: Diameter in centimetres [0,01 m]
 l: length in meter [m]
 π : $\approx 3,14$

The metric volume should be also used to assess the gain of sawn timber.

Actually the volume of logs and sawn timber is calculated in cubic feet (1 m³ \cong 35,32 cft) In the long run an optimisation of the gain in terms of sawn timber can be realised.

A timber measurement as proposed with a clear and durable enumeration of logs guarantees the possibility of any control by everybody and at any time. A proper enumeration would allow the interlinkages from each step to another.

At least a better connection with the marked standing volume will be possible.

- **Logs should be selected and distributed into three different ranges: smaller size and minor quality logs ought to be sent directly to Tashila ropeway, medium size logs should be sent to the mobile sawmill and the big size logs should be given to the band- sawmill. Sorting of logs directly at the landing place and measuring before loading would facilitate this proposal.**

The most simple way to increase the productivity of the sawmills is to provide the two sawmills with the required sizes of logs corresponding to their technical equipment. Though, the sawmill would be able to reach their potential productivity.

In case sawmilling will be done at the valley bottom it is worthwhile to consider the establishment of a gangsaw. Because the required assortments such as seen could be easily, cheaper and more comfortably produced than by the sawmills presently in use.

- **For a market study a grading trial should be made.**

At present FSD and BLC is responsible to procure the urban and commercial timber market with required timber, mainly for construction purposes. The rates for timber are fixed. Only timber which is rejected is sent for auctioning to the export market (Phuntsholing). Timber in log form or sawn is mainly sold to India for much higher prices (e.g., 214 NU / cft \cong 7560 NU / m³).

It was reported that mainly quantity is appreciated by the customers whereas quality is not so important.

For testing the urban, commercial and export market it is strongly recommended to offer different homogeneous lots in terms of species, sizes and quality. (e.g., knotty and limbless).

Such a trial should be done in a systematic way and over a certain period.

The outcome of such a trial can lead to a better supply of the different markets and simultaneously a better gain of timber will be achieved.

- **In respect to the low overall performance of any section involved at forestry and sawmilling work during wintertime (2-4 working hours per day of the sawmill etc.) the FMU should reduce its activities down to a minimum during winter. The reducing of all activities has to be planned properly.**

The running of the forestry enterprise during winter time needs enormous efforts in all respects. Simultaneously the working hours and the performance get reduced due to the weather conditions.

By proper planning of the periodical works to be done throughout the year (marking - harvesting - hauling - transporting - sawing - marketing - road maintaining etc.) the working time could be increased during summer. In spite of a winter pause the working time throughout the year and the annual productivity of the system will be the same. Only cost will be reduced.

The life conditions at Kothoka during winter time speak well for an interruption of the work. The tough winter life urges the villagers to migrate into warmer regions.

Before any proposal is going to be realised it has to be discussed with the people involved. So, other ideas and valid points can be considered, too.

Only if all responsible people are convinced upon the aimed improvements the success can be materialised.

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6. Annexes

6.1. Contacted Persons

- 1 Territorial Forest Services Division (FSD)**
 - 1.1 Mr. K. J. Subba, Joint Director Forestry Services Division, Section Head Forestry Resources Development Section. Thimphu
 - 1.2 Mr. A. Baskota, Divisional Forest Officer. Wangdue
 - 1.3 Mr. Thinley Dorji, Forest Ranger, Wangdue Range
 - 1.4 Mr. Ugen Tshering, NRTI Diploma Holder, FMU I/C Kothoka
 - 1.5 Mr. B.P. Dahal, Forester, FMU I/C Bosachu, former FMU I/C Kothoka
 - 1.6 Mr. Karma Dorji, Forest Guard. Forest Management Unit Kothoka
- 2 Bhutan Logging Corporation - Production Staff (BLC- Prod)**
 - 2.1 Mr. Kezang Dukpa, Divisional Manager BLC, Thimphu
 - 2.2 Mr. D. B. Sunar, Forest Ranger. Forest Management Unit Kothoka
- 3 Bhutan Logging Corporation - Timber Disposal Division Staff (BLC- TDD)**
 - 3.1 Mr. P. K. Chetri, Forester Forest Management Unit Kothoka
 - 3.2 Mr. K. Chimi, Forest Guard, Interim Depot Dolongda
 - 3.3 Mr. K. Dukpa, Forester, Tashila Depot -Tashila Ropeway Top Station
 - 3.4 Mr. B. S. Rai, Forester, Chuzomsa Depot -Tashila Ropeway Bottom Station
- 4 Tashila Ropeway**
 - 4.1 Mr. Karchung Dukpa, owner of Tashila Ropeway
- 5 Bhutan German - Integrated Forest Management Project (BG- IFMP)**
 - 5.1 Mr. Rolf Krezdorn, Team Leader BG- IFMP
 - 5.2 Mr. Eugen Maier, Forestry Advisor BG- IFMP

6.2. *Terms of Reference*

6.3. *Time Schedule of the Mission*

6.4. *Maps*

6.5. Photos