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KIBIASHARA
PRIVATE FORESTRY PROGRAMME

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TFS ECONOMICS IN FORESTRY
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TFS Economics in Forestry Operations

Integrated – Cut-to-Length Harvesting Options

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Abbreviations and Acronyms

CTL	Cut-to-length
MPM	Mufindi Paper Mill
PFP	Private Forestry Programme
SHFP	Sao Hill Forest Project
SHI	Sao Hill Industries
SME	Small and medium enterprises
TAFF	Tanzania Forest Fund
TFS	Tanzania Forest Service
TZS	Tanzanian shilling
VAT	Value-added tax

1. INTRODUCTION

This report analyses cut-to-length (CTL) harvesting as one option for selling and distributing the trees growing in government plantations.

At present, government forest resources are sold as stands to beneficiaries who pay for the standing trees based on an estimate of the volume of wood present. The standard for harvesting has been neither monitored nor controlled and data collection has clearly shown that this process is inefficient and inaccurate.

Mechanical harvesting both increases the efficiency of harvesting and maximises the economic yield of a forest stand. It allows for the efficient felling of trees and their conversion into graded logs suitable for various locally-based industrial needs. It is both flexible and controllable and can provide real-time reporting on the harvesting output.

In order to understand the viability of CTL harvesting, it is important to understand the economics of the operation and compare the resulting output with the current system.

The potential for forest income could increase by 50% if optimal harvest grading rules were followed. If, instead, harvesting is adjusted to take into account the Mufindi Paper Mill pulp log requirement, there will be a 43% increase in income.

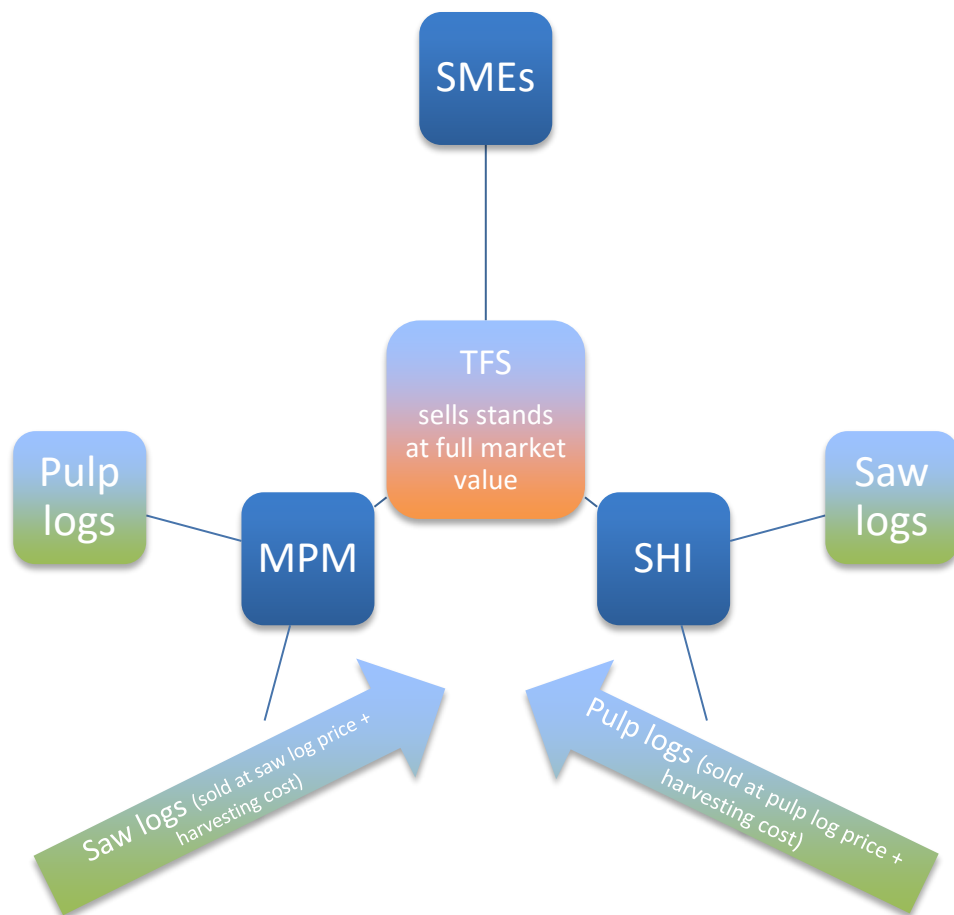
2. INTEGRATED HARVESTING PROCESS

Integrated harvesting is currently being studied in a pilot programme involving SHI and MPM at the Sao Hill Forest Project (SHFP).

Integrated harvesting allows for the full value of each government stand to be realized by TFS because each stand is sold at its full market value regardless of who the end user is and regardless of the value of the end-user product value.

Companies which participate in integrated harvesting operations pay the same price for each stand but are allowed to trade in log grades that they do not use. The prices of traded logs reflect their grade value so a pulp producer will be able to sell saw logs at a higher price than he pays sawmills for pulp logs.

Figure 2.1 integrated harvesting process



3. CUT-TO-LENGTH HARVESTING PROCESS

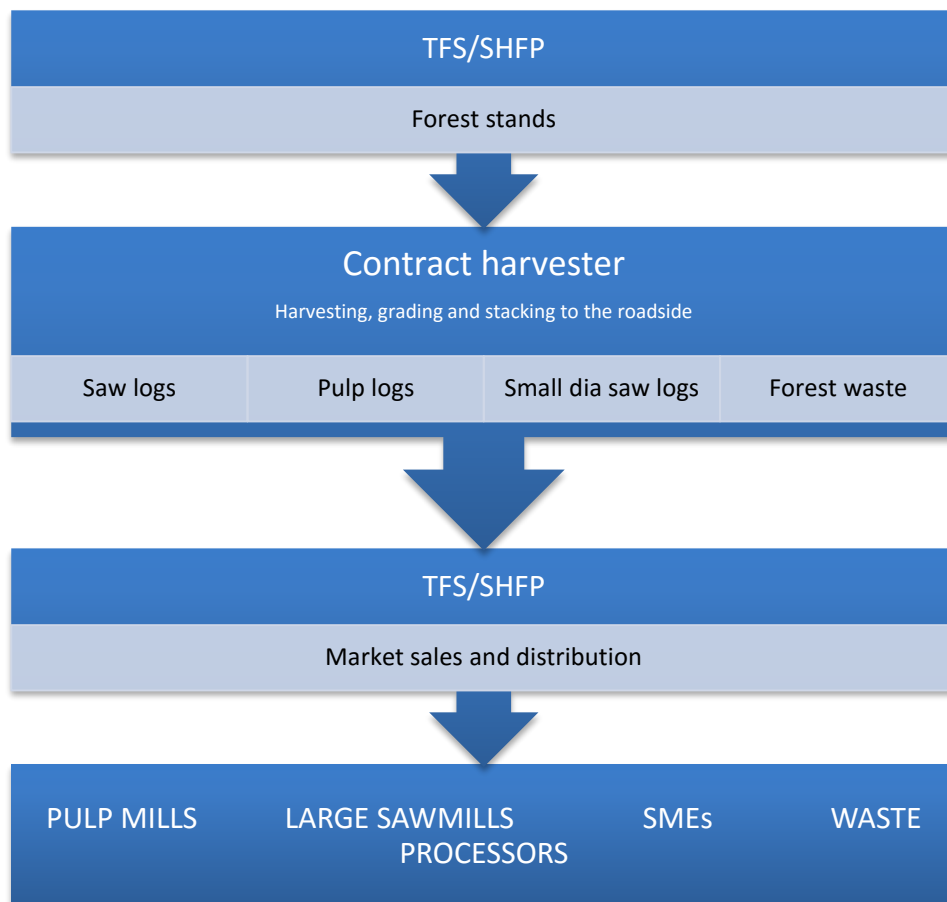
Mechanical harvesting is a harvesting system that could allow TFS to sell industrial products rather than forest stands.

The CTL harvesting system would enable TFS to sell a graded product at the full market value and to record exact data regarding volume, size, and specifications.

Using this system will increase earnings because recovery, quality, and sorting will improve, thereby enabling TFS to use forest resources economically and to sell waste for a profit.

TFS will maintain its control of forest resources and the quality of harvesting and have the opportunity to consider a number of market-based sales options for the products produced which are fairer than the current system.

Figure 3.1 Cut-to-length (CTL) harvesting process



4. SUMMARY OF THE ECONOMICS OF CUT-TO-LENGTH HARVESTING

Table 4.1 Volumes of Each Log Grade

Current log allocation (2015/16 season)	
	Price (in TZS)
Saw logs	340,400
Pulp logs	200,000
Total	540,400
Projected optimum log recovery from CTL harvesting (m ³)	
	Price (in TZS)
Small saw logs	88,285
Saw logs	273,767
Pulp logs	97,288
Waste	81,060
Total	540,400

Table 4.2 Current estimated TFS earnings from the SHFP

	Price (in TZS)
Total royalty	13,188,462,000
Total TAFF	408,842,322
Total silviculture	4,255,650,000
Total roads	4,255,650,000
Total VAT	2,447,514,778
Total	24,556,119,100

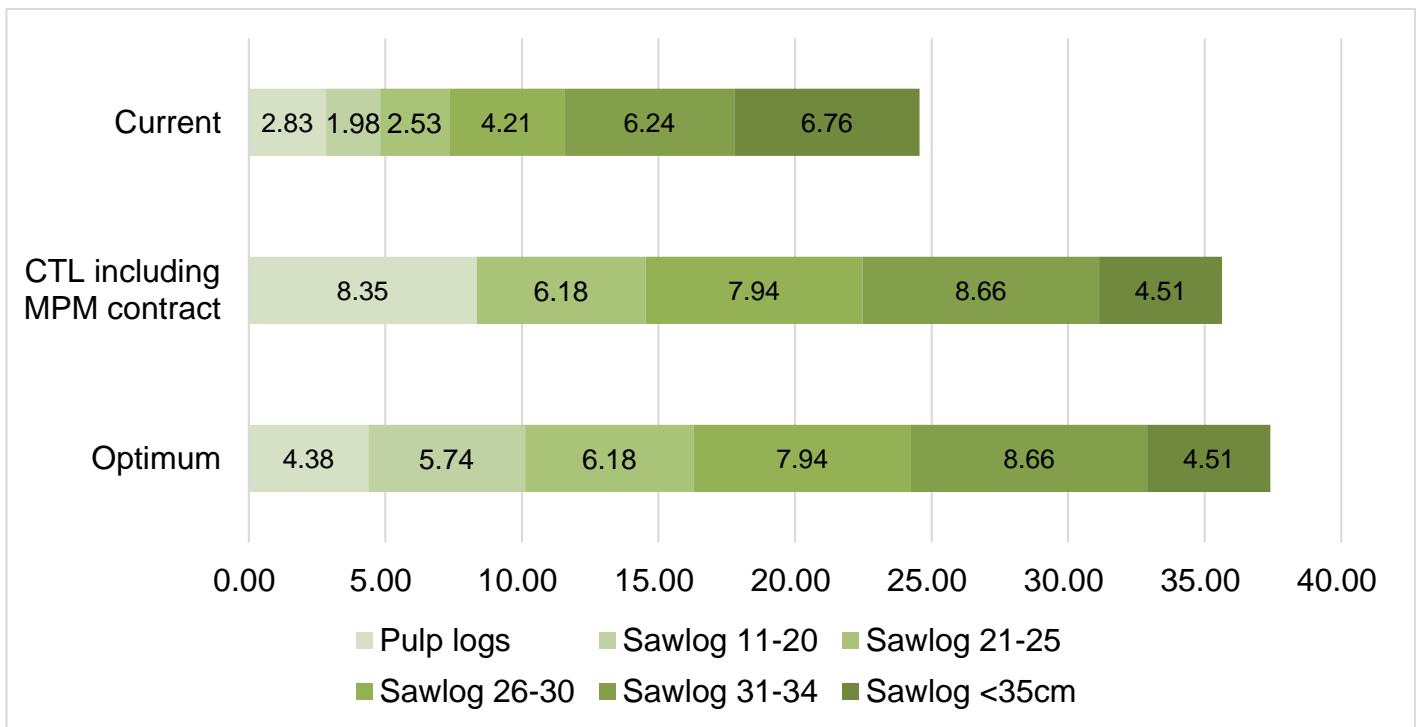
Table 4.3 Option 1: Estimated optimum projected earnings from CTL harvesting

	Price (in TZS)
Small saw logs	7,945,663,320
Saw logs	34,135,392,760
Pulp logs	6,810,174,840
Waste	1,296,960,000
Total	50,188,190,920
Less harvesting costs	13,242,772,200
Net earnings - projected	36,945,418,720
Increase over current estimated earnings	12,389,299,620
Increase over current estimated earnings (%)	50%

Table 4.4 Option 2: Projected earnings from CTL with pulp log commitment

	Price (in TZS)
Small saw logs	
Saw logs	34,135,392,760
Pulp logs	12,990,135,200
Waste	1,296,960,000
Total	48,422,487,960
Less harvesting costs	13,242,772,200
Net earnings, projected	35,179,715,760
Increase over current estimated earnings (TZS)	10,623,596,660
Increase over current estimated earnings (%)	43%

Figure 4.1 Increase in potential income (in billions of TZS)



5. CONCLUSIONS

Introducing CTL harvesting utilizing independent companies with expertise in harvesting and access to modern technology will allow TFS to increase its income from current forest resources by at least 43%. At best, it will earn 50% more than it currently does.

In order to meet contractual obligations to supply pulp logs, trees will be graded. This will ensure that high-quality saw logs are no longer used in processes which require only low-quality logs. The savings accrued due to proper use will account for the vast majority of the increase in income.

Using a mechanical harvesting system like CTL will enable forest waste to be collected economically and sold to waste processors for a profit.

6. NOTES AND SOURCES OF DATA

6.1 Sources of data

All the information regarding forest resources and market prices was collated from the field work conducted for a value chain study between October 2015 and December 2015.

Map of the stands for the survey analysis



Two compartments of pine stands in the SHFP were analysed and the length, diameter, grade and end-use of each log harvested was recorded. The compartments studied were in Division 2 -1/17 and Division 2 - 5/20, which were planted in 1977 and 1986 respectively.

A total of 12,656.10 m³ of logs (64,531 pieces) was analysed. The average log volume was 0.196 m³ under bark and the average length was 4.75 m.

Market data was collected from private woodlot sellers in June and July of 2015. Both the prices of logs sold as well as the age of the woodlots at the time of sale were recorded.

6.2 Analysis of the prices of logs

Stumpage price

The study identified a large range between the highest and lowest prices paid per m³ of wood bought on stumpage, or by volume of standing trees, on conditions that the stump is left after harvest. Government forest stands had the lowest rate, just TZS 65,000 per m³. Private forest stands, in contrast, charged rates of TSZZS 80,000 – TZS 120,000 per m³. Stumpage prices in the Southern Highlands tend to be similar to government royalty rates, but they vary significantly among private forest stands due to variations in diameter, age, accessibility, and the seller's level of market knowledge. There was surprisingly little price difference between saw logs with large and small diameters. Even young stands with small average diameters were sold at prices per m³ that were not much less from average market prices. This was an unexpected finding as logs with small diameters have lower recovery rates than those with large diameter and should therefore cost less.

Since most pine sawn-timber in the Southern Highlands originates in government plantations, where buyers pay for the whole tree, government royalties are used as the stumpage price in this analysis. Saw millers and pulp log users report that about 70% and 80-85% of the volumes they respectively invoice can be used. The average

recovery rate for all the stands surveyed was 75%. Using this log yield rate, the rates for government royalties, and the **actual** cost of logs, the stumpage price was estimated to be TZS 60,587 per m³ for all logs. The **actual** average for saw logs TZS 85,105 per m³ of standing trees and for pulp logs was TZS 46,529 per m³.

6.3 Harvesting costs

We analysed harvesting operations in government stands on which no other industrial operation took place. Any harvesting or sawmilling conducted in compartments, as happens in private stands, was omitted from the analysis.

The costs of all types of operators in government stands, including sawmill operators' own harvesting operations, contractor harvesting operations and large industry operations, were considered. The analysis considered labour, consumables, insurance, administration and depreciation on machinery. It examined only pine harvesting. The harvesting of utility poles from eucalyptus stands was not included.

The cheapest cost of harvesting was TZS 8,500 per m³ of harvested logs. This sort of operation was fully manual; other than chainsaws no machinery was used. The labourers employed also operated ding-dong saws, so they served a dual function. Logs were handled and loaded manually, and because the lorries collecting the logs were driven into the forest stands, the need for skidding logs to the roadside was reduced. The volumes harvested and processed did not exceed 50 m³ per month.

Large sawmills with industrial locations in Mafinga reported significantly higher average costs because they used machinery and employed a large workforce. The volumes harvested exceeded 200 m³ per month and the operation was structured to be fast and efficient using small and medium-sized machinery for skidding logs to the roadside and loading them onto trucks. The cost of harvesting to the roadside average TZS 22,000 per m³ of logs harvested and although some operators rented some of the tractors and bell loggers they used, the depreciation of machinery was a significant part of the cost of operations. Increasing capacity would require a significant investment, thereby increasing the costs of logging and, as a result, the price of logs.

The largest industries use large industrial feller bunchers and chainsaw operators. Log handling, including skidding and loading, is done completely by large industrial machines. Because of economies of scale, the cost of such operations is slightly below the average. That said, efficiency of recovery was still less than optimal because the main lopping and cutting to length was done manually.



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