22

Department of Conservation
and Land Management

Wood Utilisation Research Centre

PREDICTING THE PROFITABILITY OF SMALL HARDWOOD SAWMILLS WHICH DRY TIMBER

D. L. Kent

November 1990
W.U.R.C. Technical Report No. 22

Weir Road Harvey WA 6220 (097) 29 1913
50 Hayman Road Como WA 6152 (097) 367 0333

PREDICTING THE PROFITABILITY OF SMALL HARDWOOD SAWMILLS WHICH DRY TIMBER

D. L. Kent

November 1990
W.U.R.C. Technical Report No. 22

PREDICTING THE PROFITABILITY OF SMALL HARDWOOD SAWMILLS WHICH DRY TIMBER

D. L. Kent

SUMMARY

An economic computer model of the sawmill sector of the forest products industry (GUMTREE©) has been developed at the Wood Utilisation Research Centre. GUMTREE© is used to process data provided by small hardwood sawmillers in Western Australia, to evaluate the difference in profitability expected from their operations with the installation of kiln drying systems (such as the low capital cost/low running cost CALM Drying System), and production of value-added dry timber products. In all cases an increase in profit was demonstrated. In general the installation of kilns was recommended, but for some very small operators running a hardwood mill to complete orders associated with other businesses, the benefit would be doubtful. A hypothetical example is given.

INTRODUCTION

The hardwood sawmilling industry in Western Australia is dominated by two major companies (Table 1). These account for more than 80 per cent of sawlog resource, the remainder being divided among a few medium size sawmills and a large number of small sawmills. Traditionally the major market for sawn hardwood has been the local green scantling market, but this is now being eroded by increasingly available dried pine timber which is light, easy to handle, stable and cheaper. More than 88 per cent of Western Australian sawn hardwood is sold green without further value adding, based on sawmill returns to the Department of Conservation and Land Management. The major sawmillers have been progressively drying more sawn hardwood, because of a perceived increasing market for value-added, quality and more profitable products (Jones, personal communication*). However, most small sawmillers have continued producing timber for the green market. There are several reasons for this, the most important probably being that conventional kiln drying technology has been directed towards drying large volumes of timber using expensive kiln equipment, and is not cost effective for small quantities.

* Mr T. Jones, Marketing Liaison Officer, Department of Conservation and Land Management, Como W.A. 6152.

Table 1
Size distribution of W.A. companies involved in hardwood sawmilling

Annual log volume processed (m^3)	No. of companies
100 000 +	1
50 - 100 000	1
25 - 50 000	2
10 - 25 000	2
5 - 10 000	4
1 - 5 000	20
less than 1 000	40

Many small sawmills consist of old, written-off plant, and often exist as part of a family business which includes farms, transport and logging. These mills tend to have low costs and can be profitable at the moment, but if new plant were required, if they were stand-alone businesses, or if the market for green hardwood became further strained, they would be struggling to survive.

GUMTREE© is an economic model of the sawmill sector of the forest products industry, developed by the Wood Utilisation Research Centre. It simulates the flow of wood through a sawmill taking user-selected component processes, and calculates the cost of wood production at each process, allowing for sales of wood after certain processes. The final result produced by GUMTREE© is a profit/loss statement showing the total cost of production and total sales revenue. The model was used within this study to assess the profitability of participating small sawmills, particularly if the timber produced is dried.

A low cost, essentially solar-powered kiln drying system has been developed at the Wood Utilisation Research Centre (McDonald 1990). This CALM Drying System will become available in single or combined modules for construction of a range of drying needs. Thus it can be easily configured for small or large volumes, and used solely as a pre-drying system, a final drying system, or both, and adapted to the needs of most small sawmillers.

This study was designed to use GUMTREE© to determine the profitability of small sawmilling operations as they currently exist, as well as an expected profitability associated with the installation of a suitably configured low cost /low volume drying system and sales of dry timber products. In line with the overall value-added strategy, the indications were that increased profits could be demonstrated.

METHODS

A study team comprising a computer modeller, a kiln engineer, and a marketing specialist, approached most of the small hardwood sawmillers in Western Australia to provide confidential information for the GUMTREE© model on their operating costs, capital structure and sales figures, on the basis that only the aggregated data for the whole industry would be published. Many of those approached expressed an interest in the study and a willingness to cooperate. However, only five exercises were completed owing to the difficulty in obtaining data: some mills had to withdraw because they only received very small volumes of timber, all of poor quality and unsuitable for drying; several more mills could not extract their sawmill data from total company figures including retail sales and logging costs, other mills have promised data, and all will be aggregated in a subsequent report. This report provides only a hypothetical example.

An appropriate drying system for each mill participating in the survey was designed and costed by the engineer who developed the CALM Drying System. The proportion of the sawn output suitable for drying, and the amount that could be sold as high value material, were assessed. These proportions for each mill were based on the species and quality of the logs received, and were conservative. Two runs of GUMTREE© were performed for each mill; one showing the profit /loss of the existing mill and the other showing the expected figures with an included drying component. A final expected increase in profit of the green and dry operation over the green operation was calculated, allowing for interest and stock holding costs. Appendix 1 contains a description of the data and methods used to calculate profitability.

RESULTS AND DISCUSSION

An example of the data input, and results produced by GUMTREE© are given in Appendices 2 and 3.

GUMTREE© was written as a general economic model of the sawmilling industry, and contains many functions not required for this exercise. These include other processes such as dressing and docking, stock facilities, and the potential for multiple processes at a single level (e.g. more than one sawmill cutting a single resource). Similarly, some functions that would have been useful for this exercise, such as interest calculations, are not included in GUMTREE© and were calculated separately. GUMTREE© in its present form is not very user-friendly, and would be difficult for an inexperienced user to understand. However, it was very effective in quickly and accurately producing the results required for this report. Owing to budget constraints, there are no plans at this moment to upgrade GUMTREE©.

The sawmills examined in this study process between approximately 1500 m^3 and 10 000 m^3/annum of jarrah, karri and/or marri logs. Some of these mills operate at a loss and the others record a profit. A reduction in costs, or improvement in recovery at the sawmill level would have a dramatic effect on the overall profitability of an operation, because of the large volume of residues produced during sawmilling, and the small difference between the cost of producing green sawn timber and its selling price. However, an improvement in sawmill efficiency is very difficult for small sawmills to achieve with current plant, because in general they have tailored their operations specifically to their conditions. It would also seem unlikely that they could justify expensive investment in new sawmilling plant.

Variations in drying costs would be less important to the overall profit of an operation, because residues are minimal within this process. The drying costs calculated for these mills based on the CALM Drying System are low compared with sawmilling costs, and the increase in the selling price of dry hardwood over green hardwood is substantial. An increase in profit subsequent to drying was demonstrated for all mills, because the higher selling price of the dried timber far exceeded the cost of drying.

The scenario for each mill was addressed to determine whether this increase in profit was sufficient to justify investment in the Drying System. For one sawmill cutting very small volumes of hardwoods to complete orders, the installation of a Drying System would not be appropriate. In all other cases investment in the Drying System could probably be recommended to improve the profitability of the operation. It is stressed that the economic analysis undertaken for this study is purely preliminary, and any small sawmill owner wishing to investigate further would be encouraged to undertake a full business plan before installing drying equipment.

REFERENCES

DEPARTMENT OF CONSERVATION AND LAND MANAGEMENT (1987). Timber production in Western Australia. A strategy to take W.A.'s south-west forests into the 21st Century. December 1987.

McDONALD, T.J.G. (1990). Development of a solar, low cost, timber drying system. Department of Conservation and Land Management. W.U.R.C. Technical Report No. 23.

APPENDIX 1

DATA REQUIRED BY GUMTREE©, AND THE PROFITABILITY CALCULATIONS FOR THE STUDY

The GUMTREE© model simulates the flow of wood through a sawmill comprising a number of user-selected component processes. The first three mandatory processes are royalty, harvesting and sawmilling: other processes that may be added include pre-drying, drying, dressing, docking, stripping and handling. A final market process is also mandatory, but may contain no data. For the purposes of this study, the processes considered were the four mandatory processes, pre-drying and drying. Another process labelled regrading was included to grade the dried material into high and low value products.

DATA

The model operates on a twelve-month time period. All costs are entered in $, or input $/m^3 per annum, and all volumes in m3 / annum. Data received in other forms are converted to these units.

Data required for the various processes are:

Royalty	log royalty cost * input log volume *
Harvest	in-forest production costs * transport costs *
Sawmilling	maximum input capacity * recovery and percentage distribution of sawn material into various grades and residues * prices received for residues and any timber not dried * costs associated with sawing * - e.g. depreciation interest on loans insurance log storage costs sprinkler costs labour

power
maintenance
fuel
saw sharpening

Pre-drying/ drying	maximum volume of charge *
	drying time in days *
	prices received for dried timber *
	costs associated with drying *
	- e.g. capital
	heating
	labour.

Notes:

1. Those items marked with an * are mandatory.
2. For many of the older mills, items such as depreciation and interest on loans were not relevant. They were included only if used for taxation purposes.

PROFITABILITY

For each execution, GUMTREE© produces a final cost of production and revenue figure from which can be calculated a profit (loss). The profit (loss) of the green operation is subtracted from the profit (loss) of the green and dry operation to obtain a profit difference before tax. An interest component (17 per cent/annum) is subtracted from this profit difference before a final profit difference is obtained.

Example:

Total cost of green production	$100 000
Total green revenue	$ 80 000
Green profit (loss)	($ 20 000)
Total cost of green and dry production	$120 000
Total green and dry revenue	$130 000
Green and dry profit	$ 10 000
Profit increase	$ 30 000
Investment costs	
Kiln	$ 50 000
Stock holding cost (.33 x .2 x 500 x 250)	$ 10 000

where .33 is the drying time (years)
.2 is the proportion of sawn timber suitable for drying
500 is the total sawn volume
250 is the cumulative cost of sawn production

Total investment costs	$ 60 000
Subtract 17 per cent of investment costs from profit increase .17 x 60000	$ 10 200
Expected increase in profit	$ 19 800

APPENDIX 2

SAMPLE EXERCISE FOR SMALL SAWMILLERS

This hypothetical mill cuts 5000 m^3/annum jarrah logs, of which 10 per cent is first grade and 90 per cent second grade. Sawn output consists of 1350 m^3 of 38 mm and 50 mm scantling which sells for \$350/m^3, and 150 m^3 of sleepers which sell for \$200/m^3. The remainder is residues which consist of 5 per cent firewood and 95 per cent sawdust. Firewood sells for \$15/m^3 and sawdust for \$2/tonne. Conservative estimates are that 20 per cent of the scantling would be suitable for drying, of which 70 per cent would sell for \$800/m^3 and 30 per cent would be downgraded to \$200/m^3.

DATA (per annum)

Royalty
5000 m^3 logs cut
500 m^3 first grade at \$26.30/m^3 = \$13150
4500 m^3 second grade at \$17.54/m^3 = \$78930

Harvest
\$32/m^3 average

Sawmilling

Sawmill capacity	5000 m^3
Logs cut into	1350 + 5000 x 100 = 27 per cent scantling
	150 + 5000 x 100 = 3 per cent sleepers
	100 - (27+3) = 70 per cent residues

Costs

Power	\$5000
	(\$20/day for 250 days)
Labour	\$200 000
	(includes 1 manager)
Fuel	\$2500
Insurance	\$8000
	(includes worker's compensation, mill insurance, public liability)
Maintenance	\$2880
	(2 days/month at \$120/day)
Saw filing	\$300

Drying

20 per cent of scantling suitable for drying =.2 x 27 = 5.4 per cent of log for drying.
Drying time (for 38 mm thickness) 30 days (in limiting chamber), 110 days in total
Maximum volume of charge (for 38 mm thickness) 68 m3 (in limiting chamber).
(The limiting chamber is the second of three in the drying system, in which the maximum drying rate is achieved.)

Cost

$45/m^3

This figure is based on the CALM Drying System costs for this particular mill configuration.

Variables involved in the calculation of this figure include capital, labour (if current employment levels could not maintain the dryer), heating requirements (gas, electricity, wood residues, etc), maintenance and consumables. Capital cost for this example is $150 000.

Revenue (at mill door)

Scantling at $350/m^3
Sleepers at $200/m^3
Residues : 5 per cent of 70 per cent of 5000 m3 = 175 m3 at $15/m^3 = $2625
for firewood 95 per cent of 70 per cent of 5000 m^3 = 3325 m^3 at $2/$m^3$ = $6650 for sawdust (equate 1 tonne to 1 m^3)
Value of residues = $9275 for 3500 m^3 = $2.65/$m^3$
Dried high value at $800/$m^3$
Dried downgraded at $200/$m^3$

RESULTS

Note: All output is rounded to the nearest dollar although calculations are performed on the original figures. This accounts for any apparent discrepancies in costs and revenues.

Cumulative cost of production ($/m^3)

Royalty	18 (round)
Harvest	50 (round)
Sawmill	314 (sawn)
Drying	359 (dry sawn)

Sales Figures

Green only Operation

	Volume sold (m^3)	Cost of production ($)	Revenue ($)
Green			
Scantling	1350	423 684	472 500
Sleepers	150	47 076	30 000
Residues	3500	0	9 275
Total	5000	470 760	511 775

Profit = $41 015

Green and Dry Operation

Green			
Scantling	1080	338 947	378 000
Sleepers	150	47 076	30 000
Residues	3500	0	9 275
Dry			
Rough sawn	189	67 821	151 200
Rough sawn downgraded	81	29 066	16 200
Total	5000	482 910	584 675

Profit = $101 765

Profit increase	$101 765
	- $ 41 015
	$ 60 750

Investment costs

Kiln	$150 000
Stock holding cost	
(.33 x .2 x 1350 x 314)	$ 279 77
	$177 977

Subtract 17 per cent of investments costs from profit increase .17 x 177 977 $ 30 256

Expected Increase in Profit = $30 256

APPENDIX 3

DATA AND OUTPUT AS DISPLAYED BY GUMTREE©

DATA

RESOURCE

Process Costs

	FIXED COSTS - ($) DESCRIPTION	COST		VARIABLE COSTS - ($/M3) DESCRIPTION	COST
1	FIRST GRADE	13150.00	1		
2	SECOND GRADE	78930.00	2		
3			3		
4			4		
5			5		
6			6		
7			7		
8			8		
9			9		
10			10		
11			11		
12			12		
13			13		
14			14		
15			15		
16			16		
17			17		
18			18		

ENTER VALUES AT THE CURSOR
TYPE 'Z' TO FINISH OR 'N' TO TOGGLE COLUMNS

RESOURCE VOLUME

Source Volume = 5000

Enter new volume at the cursor, or return

HARVEST

PROCESS COSTS

	FIXED COSTS - ($) DESCRIPTION	COST		VARIABLE COSTS - ($/M3) DESCRIPTION	COST
1			1	HARVEST	32.0000
2			2		
3			3		
4			4		
5			5		
6			6		
7			7		
8			8		
9			9		
10			10		
11			11		
12			12		
13			13		
14			14		
15			15		
16			16		
17			17		
18			18		

ENTER VALUES AT THE CURSOR
TYPE 'Z' TO FINISH OR 'N' TO TOGGLE COLUMNS

SAWMILL

PROCESS COSTS

	FIXED COSTS - ($) DESCRIPTION	COST		VARIABLE COSTS - ($/M3) DESCRIPTION	COST
1	POWER	5000.00	1		
2	LABOUR	200000.00	2		
3	FUEL	2500.00	3		
4	INSURANCE	8000.00	4		
5	MAINTENANCE	2880.00	5		
6	SAW FILING	300.00	6		
7			7		
8			8		
9			9		
10			10		
11			11		
12			12		
13			13		
14			14		
15			15		
16			16		
17			17		
18			18		

ENTER VALUES AT THE CURSOR
TYPE 'Z' TO FINISH OR 'N' TO TOGGLE COLUMNS

KILN PARAMETERS		
	Time To Dry Wood (Days)	Max Volume of Charge (Cubic metres)
25 mm	30	34
38 mm	30	17
50 mm	30	17

Enter values at the cursor, or return to leave the same

MARKET

PROCESS COSTS

	FIXED COSTS - ($) DESCRIPTION	COST		VARIABLE COSTS - ($/M3) DESCRIPTION	COST
1			1		
2			2		
3			3		
4			4		
5			5		
6			6		
7			7		
8			8		
9			9		
10			10		
11			11		
12			12		
13			13		
14			14		
15			15		
16			16		
17			17		
18			18		

ENTER VALUES AT THE CURSOR
TYPE 'Z' TO FINISH OR 'N' TO TOGGLE COLUMNS

NOTE: There are no market costs

SAWMILL

RECOVERY DISTRIBUTION (%)

WIDTH (mm)

THICKNESS		45	70	90	115	135	185	235	285
	(S)								
25mm	(M)								
	(L)								
	(S)								
38mm	(M)	50.00							
	(L)								
	(S)								
50mm	(M)	50.00							
	(L)								
TOTALS		100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

TOTAL FOR ALL CLASSES 100.00

ENTER VALUES AT THE CURSOR
TYPE 'Z' TO FINISH OR 'N' TO MOVE TO THE NEXT COLUMN

S : Short
M : Medium Length
L : Long

DRYING

PROCESS COSTS

	FIXED COSTS - ($) DESCRIPTION	COST		VARIABLE COSTS - ($/M3) DESCRIPTION	COST
1			1	DRYING	45.0000
2			2		
3			3		
4			4		
5			5		
6			6		
7			7		
8			8		
9			9		
10			10		
11			11		
12			12		
13			13		
14			14		
15			15		
16			16		
17			17		
18			18		

ENTER VALUES AT THE CURSOR
TYPE 'Z' TO FINISH OR 'N' TO TOGGLE COLUMNS

ORDER OF PROCESSES

NEW ORDER OF FLOW FOR REPORT 2.FLO

1	RESOURCE
2	HARVEST
3	GREEN CONVERSION
4	REGRADING
5	DRYING
6	MARKETS

OUTPUT

GREEN ONLY OPERATION

G U M T R E E results summary file

NO	PROCESS	GRADE	COST($/m3)	%	VOLUME(m3)
1	RESOURCE		18		
2	HARVEST		50	100	
3	SAWMILL	1	314	27.00	0
		2	314	3.00	0

GREEN ONLY OPERATION

G U M T R E E revenue file

	GRADE	VOLUME SOLD	COST	REVENUE
SAWMILL				
	1	1350	423684	472500
	2	150	47076	30000
	3	0.	0	0
	4	3500	0	9275
TOTAL		5000	470760	511775
FINAL TOTAL		5000	470760	511775

GREEN AND DRY OPERATION

G U M T R E E results summary file

NO	PROCESS	GRADE	COST($/m3)	%	VOLUME(m3)
1	RESOURCE		18		
2	HARVEST		50	100	
3	SAWMILL	1	314	21.60	0
		2	314	3.00	0
		3	314	5.40	0
7	REGRADING	1	314	3.78	0
		2	314	1.62	0
5	DRYING	1	359	3.78	0
		2	359	1.62	0

HIT RETURN TO CONTINUE

GREEN AND DRY OPERATION

G U M T R E E revenue file

		GRADE	VOLUME SOLD	COST	REVENUE
SAWMILL					
		1	1080	338947	378000
		2	150	47076	30000
		3	0	0	0
		4	3500	0	9275
	TOTAL		4730	386023	417275
REGRADING					
		1	0	0	0
		2	0	0	0
		3	0	0	0
		4	0	0	0
	TOTAL		0	0	0
DRYING					
		1	189	67821	151200
		2	81	29066	16200
		3	0	0	0
	TOTAL		270	96887	167400
	FINAL TOTAL		5000	482910	584675

HIT RETURN TO CONTINUE

Interpretation of Results

1. Residue costs are \$0/m^3. The cost of producing residues is added to the sawn timber cost. Sales of all residues are considered as profit.
2. GUMTREE © allows for three sawn timber grades and one grade of residues. Grade 1 for the Sawmill Process is scantling, Grade 2 is sleepers and Grade 4 is residues. For the Green and Dry Operation, the grades for the Drying Process are Grade 1 for high value dried timber and Grade 2 for downgraded dried timber. The Regrading Process exists solely to allow the one dry timber grade to be divided into two dry timber grades. This is necessary because of the three sawn grade limits of GUMTREE ©.
3. The % column shows the percentage of input logs produced within the process and grade.
4. The Volume column shows the volume remaining in the stocks for the process after execution is complete. In this example all timber is sold and there are no stocks.
5. The process labelled Regrading is included solely to allow the dried timber to be separated into 70% high value and 30% low value.

Interpretation of Revenues

1. The units for the Volume Sold are m^3.
2. The units for Costs and Revenues are \$.