The potential of small Scale Sawmills, milling radiata Pine: A Case study of North Otago Sawmilling Ltd
Introduction

- Location Oamaru, South Island, New Zealand
- Study period 4 days

Study conducted:
- Gross time study
- Work sampling time study
- Discounted cash flow analyses
The material flow of the mill

- Waste Slabs
- Sawhorse
- Edger
- Accumulation Table
- Green Chain
- Conver Belt
- Mill
- Log Infeed
- Packets of finished Timber

Indicates Material Flow
Three main Points:

- Things that North Otago Sawmill can improve
- Factors that make this operation successful
- How small scale sawmilling can be applied to New Zealand
Things that can be improved

- Waiting
- Waste disposal
- Changing run volume
Results: Waiting

- W1 5.5%, W2 3.6%, W3 0.6%, W4 4.1%
- Whole operation waiting for 3.6% of a 47 hour week
- Equates to 6.7 hours for one worker waiting per week
Waste disposal accounts 10.6% of the whole operations time which was broken down into:

- Moving sawdust 4.4% equates to 2.1 hours for the operation.
- The remaining 6.2% of waste disposal was fire wood related equating to 2.9 hours for the operation.
- Mill should focus on primary production. An extra 13 m³ of log infeed can be processed.

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### Work Sampling Study for Worker 3

<table>
<thead>
<tr>
<th>Activity</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>FIREWOOD ACTIVITY</td>
<td>3.9%</td>
</tr>
<tr>
<td>CLEANING LOGS</td>
<td>12.4%</td>
</tr>
<tr>
<td>WAITING</td>
<td>0.0%</td>
</tr>
<tr>
<td>DELAY OPERATIONAL</td>
<td>3.6%</td>
</tr>
<tr>
<td>DELAY SOCIAL</td>
<td>8.0%</td>
</tr>
<tr>
<td>MAINTANCE OF MACHINERY</td>
<td>3.3%</td>
</tr>
<tr>
<td>OPERATING EDGER</td>
<td>27.6%</td>
</tr>
<tr>
<td>CLEANING FLOOR</td>
<td>3.3%</td>
</tr>
<tr>
<td>OTHER</td>
<td>3.9%</td>
</tr>
<tr>
<td>MOVING SAWDUST</td>
<td>10.5%</td>
</tr>
<tr>
<td>MOVING WASTE WOOD</td>
<td>4.1%</td>
</tr>
<tr>
<td>ASSISTING MILLER</td>
<td>10.2%</td>
</tr>
</tbody>
</table>

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Changing Run Volume

- Increases average number of logs per run from 3 to 4
- Average log volume was $1.2 \pm 0.03 \, m^3$
- Resulting in increase in average productivity from $2.6 \, m^3/hr$ to $3 \pm 1 \, m^3/hr$

Productivity = \( \frac{60}{\text{Total run time}} \times \text{Run volume} \pm 0.11 \)
Factors that make this operation successful

- Simple operation
- Low capital investment
- Experience of employees
- Single customer
- The Goal
- Value recovery

<table>
<thead>
<tr>
<th>Capital costs</th>
<th>$NZ</th>
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</thead>
<tbody>
<tr>
<td>LT-70 Super Hydraulic Wood-Mizer</td>
<td>80000</td>
</tr>
<tr>
<td>Loader</td>
<td>15000</td>
</tr>
<tr>
<td>Edger</td>
<td>25000</td>
</tr>
<tr>
<td>Chain saws</td>
<td>3000</td>
</tr>
<tr>
<td>Blade sharpening and maintenance equipment</td>
<td>6705</td>
</tr>
<tr>
<td>Forklift for loading packets onto truck</td>
<td>7500</td>
</tr>
<tr>
<td>Peterol Waterblaster</td>
<td>1200</td>
</tr>
<tr>
<td>Green chain and conveyor belt</td>
<td>20000</td>
</tr>
<tr>
<td>Fire wood and sawdust truck</td>
<td>10000</td>
</tr>
<tr>
<td>Total capital</td>
<td>168405</td>
</tr>
</tbody>
</table>
“The Goal” (book by Goldrat)

**IRR for Different Contract Cutting Rates**

<table>
<thead>
<tr>
<th>Contract cutting rate ($/m³)</th>
<th>IRR (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>0%</td>
</tr>
<tr>
<td>105</td>
<td>20%</td>
</tr>
<tr>
<td>110</td>
<td>40%</td>
</tr>
<tr>
<td>115</td>
<td>60%</td>
</tr>
<tr>
<td>120</td>
<td>80%</td>
</tr>
<tr>
<td>125</td>
<td>100%</td>
</tr>
</tbody>
</table>

**Production of North Otago Sawmilling**

- **Production per month**: 248 m³/month
- **Contract cutting rate**: $113/m³
- **Revenue**: $27,997/month
- **slab wood production**: 120 m³/month
- **Fire wood price**: $25/m³
- **Fire wood sales**: $2,993/month
- **Total Revenue**: $30,989/month
- **Total monthly cost**: $25,155/month
- **Net Revenue**: $5,834/month
How can this type of operation be applied to New Zealand in Value recovery

- P1 logs Cost about NZ$170/m³
- Conversion ratio of logs to sawn timber for mill was 62%
- Results in log cost for sawn timber of $274/m³
- A conversion ratio of 50% results in log cost of $340/m³
- This type operation only suitable for pruned logs
- Must be in fixed location or have large volumes of pruned logs to the mill for number of years
How can this type of operation be applied to New Zealand

- A large mill spent $60 million to increase production by 250,000 m³
- The cost capital over one year over production $240/m³
- North Otago Sawmilling Capital costs $170,000 to produce 2,725 m³
- The cost capital over one year over production $62/m³
- Operational cost was $93/m³ for sawn timber and fire wood $16/m³

Things to work on:
- How does production and conversion ratio effect IRR?
- What effects will much larger run volume have on productivity of the mill?
- Can the mill be ran continually?
Conclusion

- North Otago sawmilling is an established business with 20 years of operation.
- It has low inventory including capital investment and no stocks held due to having contract cutting.
- Meets required rate of return of 20%.
- Average productivity of 2.6 m³/h.
- Produces 11.8 m³/day of sawn timber.
- Has a recovery ratio of 62%.
- Mills pruned radiata pine.