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5. PORTABLE SAWMILLS: THE CURRENT AND POTENTIAL FUTURE ROLE IN THE TIMBER SUPPLY CHAIN

David Smorfitt¹, Steve Harrison and John Herbohn

Markets for rainforest cabinet timbers in north Queensland are currently limited. The vast majority of the logs come from private land due to the reduction of the resource with the World Heritage listing of the rainforest in 1988. For a variety of reasons, no market is available for logs for woodchip. Thus for landholders harvesting trees the main market for these species is the sawn-timber market. In north Queensland the single large-scale processor of logs, Ravenshoe Timbers Pty Ltd, only processes plantation grown softwoods. The potential buyers of hardwood logs are limited to a few small 'family' fixed-site mills and portable sawmillers. The markets these sawmillers service in turn are often long distances from north Queensland, which leads to high road or rail haulage costs. Additionally, these sawmillers face stiff competition from rainforest timbers of similar characteristics imported from developing countries where legislative requirements and cost of labour are not as onerous as those in Australia. It is important to ascertain what role the cabinet timber industry can play in the north Queensland economy and what role, if any portable sawmilling can play in a future timber industry. Potential exists for greater use of portable sawmills, to handle the relatively small volume of hardwood timber available, and reduce log transport and milling costs.

INTRODUCTION

There has been much interest in the use of portable sawmills in relation to farm forestry in Australia. Various types and models of chainsaws, circular saws and bandsaws are available, which are readily movable between sites, and can be taken to the forest so as to avoid having to transport logs to a fixed-site timber mill. In north Queensland, relatively low stumpage prices of the order of \$40/m² to \$50/m³ are paid for timber from native forests (Herbohn *et al.* 1997). Potentially, portable sawmills may be a means of increasing returns to landholders by offering a more cost-effective method of milling logs and thus allowing a higher stumpage price to be paid, and allowing landholders to 'value-add' their timber resource on-farm.

FORTECH (1994) noted that portable sawmilling in Australia is a highly informal sector and thus the characteristics are difficult to quantify. The lack of formal sources of statistics on production from this sector, and absence of published work on relative efficiencies and costs of production and quality of output, were also noted. Hunt (2002) encountered a similar lack of information in Papua New Guinea, noting that the overall importance of portable sawmills is difficult to assess, given the lack of data on their production and sales.

The cost of the milling operation is an important element in the overall cost structure of sawmillers. It is useful to differentiate milling costs from other costs such as log acquisition, felling, snigging and haulage, as well as from other value-adding activities such as drying, timber treatment and further processing.

In spite of the apparent advantages of portable sawmills, there has been some resistance to their use. For example, Laidlaw (1997) noted that Forestry Tasmania does not permit

¹ This paper is based on a previously publication by Smorfitt *et al.* (2003).

portable sawmilling of any kind in State Forests in Tasmania. This is because such an activity is a potential source of wildfire and because portable sawmilling is difficult to regulate.

In Queensland, under the *Sawmill Licensing Act (Qld) 1936*, sawmills must be licensed with the Primary Industries Corporation. As at 1996-97, there were 276 fixed-site and 112 portable sawmills licensed in the State, with some licensed portable sawmills operating at fixed locations. The count of portable sawmills excludes most of those for which the blade moves over a stationary log, for which licensing is not mandatory.

Use of portable sawmills by landowners milling their own timber, and entrepreneurs establishing mobile sawmill businesses, has increased in north Queensland in recent years. Anecdotal evidence indicates that mobile sawmillers pay higher stumpage prices to landowners than fixed-site sawmillers, leading to suggestions of profiteering by the latter. However, operators of traditional fixed-site sawmills claim the higher stumpage prices paid by portable sawmillers are only possible because these sawmillers fail to account for costs of workers compensation and industry association costs, and purchase logs on a selective basis.

World Heritage listing resulted in a substantial decrease in the availability of rainforest cabinet timbers. According to Moore (cited in Herbohn 1996), the annual average volume of rainforest cabinet timber removals from Crown and private land in the three years prior to World Heritage listing was 66,000 m³, with lower grade structural timbers accounting for a further 52,000 m³. Following cessation of harvesting in the WH area, there was initially an increase in the cut on private land. However, overall there was a much reduced timber supply, with lower log quality, fragmented sources and less accessible locations, leading to increased harvesting and processing costs. In this situation, portable sawmills have been suggested as an alternative to traditional fixed-site mills, offering lower equipment and operating costs and environmental benefits. Since portable sawmills can be moved between sites within or near forests, much of the biomass can be left on-site and thus transport costs are minimized. However, it has been observed that as larger quantities are milled, operators often revert to a fixed-site setup, allowing more efficient use of ancillary equipment and a more settled base for labour.

While some research on portable sawmilling has been undertaken in other countries (Verissimo *et al.* 1992 and 1995, Barros and Uhl 1995) and in other states (Margules Groome Poyry Pty Ltd *et al.* 1995, Stewart and Hanson 1998), little research has been undertaken in north Queensland, an exception being that of Venn *et al.* (in process). A further aspect is that studies that do mention north Queensland (e.g. FORTECH 1996), do not cover those hardwood sawmills in the region, which process rainforest cabinet timbers, and exclude portable sawmills.

This paper discusses a number of practical and policy issues associated with sawmilling in north Queensland and the role that portable sawmills may play. While this discussion focuses on north Queensland, most of the comments are generally applicable throughout Australia. This paper further examines the operational framework for portable sawmills and reports on their current uses in north Queensland. Finally, the potential use of portable mills in a developing a plantation-based farm forestry industry is discussed.

THE NATURE AND ROLE OF PORTABLE SAWMILLS

The simplest form of portable sawmill is a chainsaw, frequently attached to a lightweight metal frame that is positioned over the log. Due to the wide kerf, these mills are wasteful of timber. They also require considerable manual handling of logs, have low throughput and produce rough sawn surfaces, and are generally only suited to low-value low-volume milling such as sleepers or as a means to break down logs for further sawing (Smorfitt *et al.* 2001a).

A wide variety of bandsaw and circular portable sawmills are available. The relative suitability of circular saws and bandsaws for milling high quality boards for cabinet making and the recovery rates achievable is a continuing debate between proponents of each mill type. Folkema (1992) reported that circular sawmills have long been used by Canadian farmers but sales have dropped since the introduction of mobile bandsaw mills in 1982. Circular saws may use a single, double or multi-blade cutting configuration. A double-blade configuration features vertical and horizontal blades that operate at the same time, cutting two sides of planks with one pass over the log. With a single-blade configuration, orientation may be switched between the vertical and horizontal between passes. A variety of advantages have been identified for each of these two mill types (Smorfitt *et al.* 2001b).

Traditional fixed-site sawmillers argue that portable sawmillers are unable to produce high-quality timber output. Quality of output from portable sawmills is dependent on a number of factors, including species, size of log milled, milling technique and experience and ability of the operator. Smaller and younger logs often have more tension and thus are more difficult to mill without boards twisting. Logs also create problems for portable millers when they are too large to be cut into half or quarters to relieve stress. There are however examples of millers who have been using portable sawmills for 10 years and supplying the Brisbane markets with high-quality timber.

Relative economic performance of portable bandsaw and circular sawmills depends critically on timber recovery rate and log throughput. Bandsaw proponents argue that higher recovery rates are achievable for a number of reasons, and that bandsaws are more suitable for milling logs into a variety of dimensions, and are also highly appropriate for cutting a whole log into a number of slabs. Circular saw proponents point to the higher throughput achievable with circular saws and refer to the wave effect of the wandering bandsaw blade resulting in further costs associated with dressing of sawn boards. Bandsaw proponents claim a well-cut board from a bandsaw should need little dressing, and that the wave effect is due to a lack of operator experience and poor maintenance of the guides on the mill. No doubt, there is a role for both mill types.

RESEARCH METHOD

Selection of the Population Sampling Frame and Sample

As well as the approximately 400 sawmills licensed under the *Sawmill Licensing Act 1936*, anecdotal evidence suggests that there are approximately 300 unlicensed portable sawmills in Queensland of which approximately 100 are accredited with the Australian Portable Sawmill Association Pty Ltd (Goodman 1998). The Queensland Department of Primary Industries (DPI 1998) reported seven fixed-site sawmills operating in north Queensland. In a sawmill survey in north Queensland a sample of size 19 fixed-site and portable sawmills was obtained with one fixed-site sawmill refusing to be surveyed. The survey area was from Ingham to Cairns and on the Atherton Tableland.

Development of Questionnaires for the Sawmill Operator Survey

A questionnaire was developed from discussions with operators during visits to two fixed-site sawmills, information provided by portable sawmill manufacturers and their agents and published material. The questionnaire was tested with a sawmiller from south-east Queensland, which revealed that much of the information being sought was of a commercially sensitive nature. A revised version of the questionnaire was tested with a sawmiller from north Queensland. Two versions of the questionnaire were then developed, one for portable sawmillers and one for fixed-site sawmillers. Both questionnaires were substantively similar but reflected the slight differences in the type of operation and form of information sought from the two groups of sawmillers.

The questionnaire covered four broad areas. First, information was sought on issues affecting the sawmilling industry and the individual firms. Second, information was also sought about sources of log resources, volume of timber milled and acquisition of logs. Third, specific questions were included relating to the operation of sawmills such as type of equipment used, number of employees, sawn timber recovery rates and factors affecting the level of recovery. Finally, more general questions were framed about the role of portable sawmills in the industry and their relationship with fixed-site sawmills. This final group included open-ended questions requiring general comment on issues pertaining to the industry and their impact on the individual firm, covering the following areas:

- main factors affecting sawmiller's current and future milling activities;
- whether the sawmiller had any plans to acquire new milling or associated equipment in the near future and if so what type of equipment;
- main difficulties faced in sourcing logs;
- whether sawmillers regard portable sawmills as complementary or competitive with fixed site-sawmills;
- whether it would be feasible to replace a fixed-site sawmill with a number of portable sawmills and achieve higher recovery rates and higher profitability while maintaining throughput; and
- how sawmillers view the future of the timber industry in north Queensland.

The questionnaire was administered to sawmillers using personal interviews at the site of the sawmilling operation. This approach was chosen to overcome the reluctance of sawmillers to provide information about their operations. In addition, the visits allowed the interviewer to assess the range and condition of milling equipment.

Classification of Sawmillers

Responses of the structured questions were analysed on the basis of three classifications of mill type, viz. 'Licence type', 'Mode of use' and 'Intensity of use'. Sawmills were allocated to the respective categories on the basis of information obtained from the sawmillers, observation of their milling activities and statistics on sawmill licenses obtained from DPI Forestry. If the sawmill was not licensed, then it was allocated to the 'No licence' (NL) category. Mills that fall into this category are smaller portable mills such as the Lewis and Lucas brand circular saws which fall outside the licensing definition. The remaining mills were categorised according to the license type taken out, viz. fixed- site or portable. Thus it is feasible for a small mobile mill to fall into any one of the three categories. (Mills which fall outside the definition under the Act may still be registered and licensed, should the owner wish.) A licensed mill could be either a fixed-site or mobile mill.

The mode of use classification was made on the basis of observation of the milling activities and through talking to the millers. The three classifications in this category are 'Fixed-site' (FS), 'Portable Sawmill - Mobile' (PSm) and 'Portable Sawmill - Fixed-site' (PSfs). Fixed-site sawmills are those that operate from a permanent site and conduct their activities as if they were a traditional fixed-site sawmill, with covered work areas and associated equipment such as docking saws and bench saws.

The intensity of use category – with sawmillers being classified as either full-time or part-time operators – is designed to differentiate between millers attempting to earn a living from operating the sawmill as opposed to those operating on a hobby (recreational) or semi-commercial basis.

SURVEY FINDINGS

The results of survey data analysis are presented below, and cover aspects including: important issues for the sawmillers; source, species and number of species milled; recovery

rates; and timber milling costs.

Timber Resource Security

Respondents were asked to rank five factors identified as issues that may be affecting the sawmilling industry in north Queensland. Responses are summarised in Table 1 using a Likert scale of 1 to 5 where 1 is least important and 5 is most important. Lack of resource security and the competition from imported timbers were clearly regarded by sawmillers as being the most important of these factors with an average overall ranking of 4.2 and 3.9 respectively.

Table 1. Average ranking of factors affecting sawmillers' current and future sawmilling activities (1= least important, 5 = most important)

Classification	n	Lack of resource security	Old equipment	Low priced imported timbers	Low milling recovery	Restrictions imposed by <i>Sawmill Licensing Act</i>
License type						
Licensed as Fixed-site	8	4.0	2.1	4.5	2.6	1.6
Licensed as Mobile	4	3.5	2.5	3.8	1.0	1.3
No licence	6	4.8	1.8	3.2	1.8	2.3
Mode of use						
Traditional Fixed-site	6	4.0	2.3	4.5	2.3	1.8
Portable mill – mobile	3	5.0	1.7	2.7	1.3	2.3
Portable mill - fixed-site	9	4.0	2.1	3.9	2.0	1.6
Intensity of use						
Full time	14	4.0	2.0	3.9	1.9	1.8
Part time	4	4.8	2.5	3.8	2.3	1.8
Overall	18	4.2	2.1	3.9	2.0	1.8

Some patterns are evident among intra-group categories. For instance, fixed-site and licensed portable millers rated low-priced imports higher than resource security as an issue affecting the sawmilling industry in north Queensland. Those millers who are unlicensed, on the other hand, rate of 'resource security' much higher than 'competition from imported timbers'. Similar rankings occurred for fixed-site as opposed to portable and mobile sawmills in the mode of use classification, and full-time versus part-time in the intensity of use classifications. This higher concern for imported timber may stem from greater awareness of the competition due to selling larger volumes to timber merchants who import timber as well.

The high average ranking of competition from imported timbers is notable. A number of millers reported that timber merchants land a sawn timber similar to Queensland maple in Brisbane for \$800/m³. The millers considered they were unable to produce sawn timber at this price and had production costs far exceeding those in the developing countries due to:

- reduced resource availability in north Queensland resulting from World Heritage listing;
- increasing restrictions being placed on harvesting from private land (such as those introduced by the Douglas Shire Council); and
- higher labour costs and more strict environmental legislation than in developing countries from which the timber is imported.

A further issue associated with competition is that timber merchants are willing to pay a price premium for imported timbers such as 'Brazilian Oak' due to the continuity of supply and reliable availability (Smorfitt *et al.* 1997, Herbohn *et al.* 1997, Petersen *et al.* 1997).

The findings of the north Queensland survey suggest that not all sawmillers in north Queensland hold opinions similar to those expressed by those surveyed as part of the study undertaken by FORTECH (1996). FORTECH (1996, p. 18) stated that '*All participants wished to make it very clear that the key issue facing the wood and paper industry at present is that of resource security and that all factors relating to enterprise development are subsidiary to this*'. In the survey, sawmill operators of licensed full-time fixed-site mills and particularly mills located on the coastal plain ranked resource security lower than those on the Atherton Tableland as an issue affecting sawmilling in north Queensland. This is perhaps due to land clearing on the coastal belt at the time of the survey, making timber available to millers. Some millers held the opinion that if all timber importation were to cease, local supplies would be insufficient to meet market demand for timber. Millers argued there is a need to redress the inequalities – such as stricter Australian environmental and labour legislation with commensurate costs – by placing them on an equal footing rather than reducing competition by restricting imports.

Restrictions imposed by the *Sawmill Licensing Act (Qld) 1936* do not appear to be a concern with an average rating of 1.8. Likewise 'low recovery rate' and 'old equipment' are not rated highly with average ratings of 2.0 and 2.1 respectively.

Source of Timber Acquired for Milling

Cessation of logging of public rainforests as a result of their World Heritage listing has forced millers to obtain timber from alternative sources, particularly native forest on freehold land. The majority of logs are sourced from millers 'own' land and from other 'private' suppliers (Table 2). Eight of the 14 millers (57%) sourced all their timber from 'private' landholding, and a further six obtained at least 30% from this source. Six of the seven millers who obtained logs from their 'own' land obtained 50% or more from this source. Only two millers obtained logs from Crown forests. One miller obtained all timber (eucalypt) from this source, and the other only 5%. Three millers obtained logs from 'other' sources, one of whom only mills on a contract basis, another for whom contracting accounts for 20% of logs milled, and the third (a hobbyist or recreational miller) obtained logs from subdivisions where land is cleared for road development. Some millers have made provision for long-term resource security by purchasing land carrying rainforest.

Number and Type of Species Milled

Unlike softwood mills which process standard sized logs of a particular species or a limited number of species with similar properties, north Queensland hardwood mills generally handle a wide variety of species. Furthermore, hardwoods from native forests vary considerably in both size and quality, often containing more defects than plantation trees, such as hollow centres. The impact that this has on the milling operations in terms of additional handling time and reduced throughput is difficult to assess. It is unclear whether the higher prices for cabinet timbers compensate for the higher costs associated with these two factors.

All mills reported processing multiple species, with two thirds milling five or more species (Table 3). A claim made by proponents of both portable and traditional fixed-site sawmills is that the opposing group 'pick the eyes out of the timber' on private land and leave the other group to pick up what is left. Based on the number of species milled, it would appear that fixed-site and portable fixed-site licensed mills operating on a full-time basis mill more species than the part-time unlicensed mobile mills (Table 3). This would tend to suggest that the unlicensed mobile portable sawmills take advantage of being more selective in the logs they mill.

Table 2. Source of timber acquired for milling

Classification	Sample size	Number of millers obtaining timber from each source (more than one source possible)				Millers obtaining timber from each source as a % of the total in each subcategory			
		Public	Private	Own	Other	Public	Private	Own	Other
License type									
Licensed as Fixed-site	12	1	7	4	0	8.3	58.3	33.4	0.0
Licensed as Mobile	7	1	3	2	1	14.3	42.9	28.6	14.3
No licence	7	0	4	1	2	0.0	57.2	14.3	28.6
Mode of use									
Traditional Fixed-site	10	1	6	3	0	10.0	60.0	30.0	0.0
Portable mill – mobile	3	0	2	0	1	0.0	66.7	0.0	33.3
Portable mill - fixed-site	13	1	6	4	2	7.7	46.1	30.8	15.4
Intensity of use									
Full time	21	2	12	6	1	9.5	57.1	28.6	4.8
Part time	5	0	2	1	2	0.0	40.0	20.0	40.0
Overall	26	2	14	7	3	7.7	53.8	26.9	11.5

Table 3. Number of species milled by sawmills by mill categories

Classification	n	Average number of species milled			Percentage of millers in each group		
		1 species	2 to 5 species	5 or more species	1 species	2 to 5 species	5 or more species
License type							
Licensed as Fixed-site	8	0.0	4.0	35.6	0.0	12.5	87.5
Licensed as Mobile	4	0.0	5.0	21.7	0.0	25.0	75.0
No licence	6	0.0	4.0	14.5	0.0	66.7	33.3
Mode of use							
Traditional Fixed-site	6	0.0	0.0	40.0	0.0	0.0	100.0
Portable mill – mobile	3	0.0	3.5	20.0	0.0	66.7	33.3
Portable mill - fixed-site	9	0.0	4.5	16.6	0.0	44.4	55.6
Intensity of use							
Full time	14	0.0	4.0	28.6	0.0	14.3	84.7
Part time	4	0.0	4.3	0.0	0.0	100	0.0
Overall	18	0.0	4.2	28.6	0.0	33.3	66.7

Sawmillers purchase not only the 'primary' species used in high value products – e.g. red cedar (*Toona ciliata*), Queensland maple (*Flindersia brayleyana*) and northern silky oak (*Cardwellia sublimis*) – but also less sought after species which are used for structural timber which can frequently account for a high proportion of the trees harvested. The major criterion upon which sawmillers base their timber purchases is species, with 12 of 14 respondents indicating they quote to purchase timber on this basis. Quality and diameter are also taken into account by nine and seven sawmillers respectively. Notably, fixed-site sawmillers indicated a willingness to quote on individual species or on a generic price basis depending on the landholders' requirements. Four millers indicated that they would quote for timber on the basis of a generic price for all timber in the area to be logged, i.e. taking all millable logs

irrespective of species or quality (Table 4). In contrast, unlicensed portable sawmillers usually purchased timber on the basis of species and quality. This may in part account for 'portable' sawmillers offering higher stumpage prices.

Table 4. Basis of purchase (number of respondents =14)

License type	Generic price	Species	Diameter	Quality
Licensed as Fixed-site	4	6	3	3
Licensed as Mobile	0	3	3	3
No licence	0	3	1	3

Recovery Rates and Their Impact on Cost Structures

Recovery rate (m³ sawn timber as a percentage of log volume) is one of several factors strongly influencing sawmill profitability. This rate depends on the ability, experience and skill of the miller, the nature of the mill (bandsaws have smaller kerf than circular saws), species of tree cut, dimensions of the sawn timber cut and quality and dimensions of the log input. Recovery rate affects both cost and revenue of the miller. Anecdotal evidence suggests that portable sawmillers are able to achieve higher recovery rates than traditional fixed-site millers. Recovery rates reported in the survey support this view (Table 5). A large number of factors can affect the recovery rate and the relative importance of each may vary between mills. Licensed and unlicensed part-time mobile and fixed-site portable sawmills indicated a recovery rate on average approximately 8% higher than licensed full-time fixed-site sawmills. The average rates indicated by sawmills would appear to be in line with data provided by Queensland Timber Board (1996) for fixed-site sawmills.

Table 5. Milling recovery rate expressed as a percentage of roundlog volume

Classification	n	Mean	Median	Highest	Lowest
Mode of use					
Traditional Fixed-site	6	34.7	34.2	50.0	25.0
Portable mill	15	42.6	42.0	55.0	30.0

The average recovery rate reported for fixed-site mills in Table 5 of 36.4% is close to those previously reported for fixed-site mills in Australia (Bennett 1990, Qld Timber Board 1996). However, new fixed-site mills are for a variety of reasons such as the introduction of modern technology including laser guided saws and computer selected log cutting patterns, the switch from circular to band saws, use of finger jointing after defect removal and milling of plantation grown timbers as opposed to native forest timbers, likely to be achieving a high recovery rate.

The average recovery rate for portable sawmills is 42.6%, with a maximum reported recovery rate of 55% (Table 5). These recovery rates contrast with claims of promoters of portable sawmills of 60% to 70%. In a study of recovery rates achievable by portable sawmills, Hasek and Ponce (1973) stated that the loss was negligible and the yield high, approximately 64%, resulting from the high quality and excellent condition of the log. However, a log of lower quality would not necessarily produce a similar recovery rate. In another example of high recovery rates, Mamum and Knoabe (1992) cited a successful portable sawmill operated by a family group in Papua New Guinea consistently achieving a rate of recovery of more than 55%. Gan *et al.* (1985) quoted recovery rates for portable sawmills ranging from 22% to 47% depending on the cultivars of Heveawood (rubberwood) being milled. Low recovery rates can be expected from tree species where the quality and condition of boles is not high or uniform. Hunt (2001) noted that the uniform logs of plantation timber have a higher recovery rate than native forest trees.

Fixed-site sawmillers claim that recovery rates in the 60% to 70% range are generally not feasible under the conditions in which fixed-site mills operate, where highly selective harvesting is not possible and all millable timber is harvested. Circumstances are further complicated in north Queensland by the large number of native timber species available for harvest. There are approximately 800 rainforest tree species² of which about 600 reach sawlog size, but only about 150 of these are harvested for timber (Poore 1988). The lack of standardisation of inputs associated with high species diversity reduces the recovery rates achieved by fixed-site mills. It is also likely that the larger fixed-site mills aim for higher throughput so they spend less time in assessing and arranging each log for optimal cutting patterns, although large mills can afford high technology which could also increase recovery rate.

An interesting point made by one sawmiller who operated a number of portable mills on a fixed-site basis was that whilst there is much talk about negative impact on recovery rates of the wide kerf of blades used in fixed-site sawmills, this impact is limited to the 'breakdown saw', the use of which is restricted to cutting logs in half (one cut) or in quarters (three cuts) for large logs. Subsequent milling is carried out on a bench saw, the kerf of which does not differ greatly from that of a Lucas or Ecosaw portable circular saw.

Sawmillers were asked to rate a number of factors in terms of their importance in reducing recovery rates (Table 6). The higher overall average rating of 4.1 for small logs and 4.4 for low log quality is not surprising. The low rating of the negative impact of old technology on recovery rates by portable sawmills is contrasted by the higher rating by traditional fixed-site sawmillers. This would support the assertions that the old technology used by traditional fixed-site sawmills is a major contributor to low recovery rates. Some traditional fixed-site sawmillers expressed the view that newly available technology would make little difference to recovery rate due to the dominance of other negative factors such as log size variation, log quality and the species they mill. Furthermore, sawmillers suggested that much of the new technology is designed for softwood sawmills which receive plantation logs of uniform size, species and quality, and is not suitable for their operations. The high rating for milling 'multiple species' by fixed-site sawmillers corresponds with the large number of species they mill (Table 3). In contrast, the high rating of the effect of small logs and low quality and small boards cut by the portable sawmillers may be a reflection that these sawmillers generally cut higher quality timber and struggle for high recovery rates when they have to cut timber that the fixed-site sawmills usually cut.

Table 6. Average rating of factors negatively affecting recovery rate (1 for extremely unimportant through to 5 for extremely important)

Mode of use	n	Multiple species	Small log	Poor quality	Lack of experience	Old technology	Small boards cut	Wide kerf of blade
Traditional Fixed-site	6	4.2	2.7	3.7	4.3	3.7	2.7	3.5
Portable mill	12	3.1	4.8	4.8	3.1	2.2	3.7	3.4

The sawmillers interviewed were unable to provide a definitive figure as to the cost of milling timber, due to the variety of species milled, varying recovery rates depending on species and log quality, lack of detailed cost recording, and commercial sensitivity of the information. However, some estimates were provided, as reported in Table 7.

² Hyland and Whiffin (1993) identified 1056 taxa present as trees in Australian tropical rainforests.

Table 7. Sawmillers' cost of milling timber (\$/m³ roundlog)

Classification	n	No. who do not know	No. who contract	Lowest (\$)	Highest (\$)	Average (\$)	Median (\$)
License type							
Licensed as Fixed-site	8	8	7	112.00	200.00	148.86	140.00
Licensed as Mobile	5	5	4	140.00	250.00	170.00	145.00
No licence	7	7	6	80.00	150.00	128.33	135.00
Mode of use							
Traditional Fixed-site	6	6	6	112.00	200.00	150.33	147.50
Portable mill – mobile	4	4	4	120.00	150.00	135.00	135.00
Portable mill - fixed-site	10	10	7	80.00	250.00	150.00	140.00
Intensity of use							
Full time	16	16	15	112.00	250.00	150.80	140.00
Part time	4	4	2	80.00	150.00	115.00	115.00
Overall	20	20	17	80.00	250.00	146.59	140.00

Anecdotal evidence suggests that portable sawmillers are able to mill timber at lower cost than traditional fixed-site sawmills for a variety of reasons. However, if the overall median contract price is compared with their average for each sub-category, there appears to be little difference except for the 'part-time' operated sawmills in the 'Intensity of usage' category (Table 8). The lower costs estimated by this group may arise because they underestimate some of the fixed or sunk costs associated with their operations.

In an attempt to gain a better understanding of industry views on factors that enable portable sawmillers to operate at lower cost, respondents were asked to rate nine factors on a scale of 1 to 5 as to their importance in reducing overall costs for portable sawmillers. The two most important cost advantages identified by portable over fixed-site sawmillers are lower capital requirement and absence of workers compensation payments (Table 8). The reduced capital requirement received a high rating by sawmillers in all categories. Fixed-site sawmillers consistently gave Workers Compensation and Health and Safety legislation a higher rating than other respondents. Part-time mobile portable sawmillers also rated this factor highly. This is not necessarily an admission of non-compliance with the requirements of the Workers Compensation and Workplace Health and Safety legislation but rather may be due to many of the portable sawmills being one- or two-man owner-operators, without any employees.

Based on the data collected from these sawmillers and other sources, a financial model was developed which was used to assess the cost of milling timber using a small bandsaw. The cost to mill a cubic metre of sawn timber was \$406. Appropriate sensitivity analysis for the parameters was also undertaken (reported in Smorfitz 2000).

Higher recovery rates may also contribute to lower costs for portable mills. Operators of unlicensed part-time mobile sawmills expressed the opinion that the higher recovery rates achieved are significant in reducing their overall costs. Based on figures provided on recovery rates in Table 5, the high recovery by portable sawmills of about 8% would improve the sawmill's revenue. Fixed-site sawmills did not rate this factor highly, which is surprising because recovery rate improvements should reduce unit costs of all sawmillers. The lower rating may however stem from the belief that portable sawmills do not achieve higher recovery rates than other mills.

Table 8. Average rating of reasons why portable sawmills can mill timber at a lower cost

Classification	n	Don't pay towards industry costs	Less capital outlay and thus lower break-even point	Don't meet cost costs associated with the Sawmill licensing	Owner operators are more motivated and thus more productive	Don't comply with Workers Comp. and Workplace Health and Safety Acts	Do not comply with the Environ. Protection Act	Do not comply with the Timber Utilisation and Marketing Act	Nature of the operations make portables more efficient in terms of labour usage	Higher recovery rates achieved
License type										
Licensed as Fixed-site	8	2.6	4.0	2.9	2.9	4.0	3.3	4.0	2.0	2.3
Licensed as Mobile	4	2.3	4.0	2.8	3.5	4.8	4.0	2.3	3.3	2.5
No licence	6	2.7	4.0	3.0	4.0	3.5	3.3	3.5	3.7	4.8
Mode of use										
Traditional Fixed-site	6	3.0	4.0	3.4	2.3	4.7	3.7	4.5	1.8	1.5
Portable mill – mobile	3	3.7	4.7	4.0	5.0	4.0	3.3	4.0	3.3	5.0
Portable mill – fixed-site	9	1.9	3.8	2.2	3.6	3.6	3.3	2.6	3.4	3.7
Intensity of use										
Full time	14	2.8	4.0	3.2	3.2	4.4	3.6	3.6	2.6	2.7
Part time	4	2.0	4.0	1.8	4.0	2.8	2.7	3.0	3.5	4.8
Overall	18	2.6	4.0	2.9	3.4	4.0	3.4	3.4	2.8	3.2

Of the sample of 18 sawmillers, 11 (61%) reported they had no plans to make further investment in equipment (Table 9). The lack of resource security combined with the increasing competition from softwoods, imported timbers and substitute products such as plastic and steel does not provide a positive climate for investment on new milling technology. For some millers there was some indication of interest in investing in value-adding equipment such as kilns and moulding machines rather than milling equipment.

Table 9. Sawmillers' intention to purchase new milling equipment or associated equipment

Classification	Number			Percentage			
	Total	Yes	No	Maybe	Yes	No	Maybe
Licence type							
Licensed as Fixed-site	8	2	4	2	25.0	50.0	25.0
Licensed as Mobile	4	1	3	0	25.0	75.0	0.0
No licence	6	2	4	0	33.3	66.7	0.0
Mode of use							
Traditional Fixed-site	6	1	3	2	16.7	50.0	33.3
Portable mill – mobile	3	1	2	0	33.3	66.7	0.0
Portable mill - fixed-site	9	3	6	0	33.3	66.7	0.0
Intensity of use							
Fulltime	14	5	7	2	35.7	50.0	14.3
Part-time	4	0	4	0	0.0	100.0	0.0
Overall	18	5	11	2	27.8	61.1	11.1

CONCLUDING COMMENTS

The survey clearly identified a number of aspects affecting the sawmilling industry in north Queensland. Major concerns relate to resource security and competition from lower priced imports. There is, however, also belief that a lack of resource means that domestic demand for rainforest cabinet timbers cannot be met by north Queensland sawmillers. This may suggest a long-term future for these sawmillers if the timber on private land is well managed on a sustainable basis and a low-volume high-value industry is built on this resource.

Most sawmillers obtain the majority of their logs for processing from private landholders. Most fixed-site sawmillers purchase and mill logs of multiple species. Portable sawmillers on the other hand often purchase logs on the basis of a single species or single logs of high quality and this creates the misleading impression that portable sawmillers pay higher log prices.

Sawmillers, as is the case with many small business operators, do not keep appropriate records to allow estimation of milling costs. Any attempt to calculate milling cost is further complicated by the multiple species milled and high variation in recovery rate due to a number of factors. However, sawmillers are willing to quote contract-milling costs for milling logs and some respondents quoted a figure of \$700 to \$900 to purchase, mill and package a cubic metre of green sawn rainforest timber.

Potential exists for greater use of portable sawmills as complementary to fixed-site mills to reduce transport and other milling costs. This arrangement may also allow for greater utilisation of large branches which full-time portable sawmillers are currently reluctant to mill due to low recovery rates. The increased use of on-site milling may also hold environmental benefits with reduced volume of timber being milled and larger volumes of biomass being

retained in the forest. The potential also exists for tourist visits to view portable sawmills in operation, together with other value-adding activities.

It would appear that many portable sawmillers operate financially on a cashflow basis and do not bring all costs into account, possibly due to the lack of information on costs and adoption of a cash flow approach to costing without provision for equipment replacement and all labour costs. Alternatively, mills may be covering costs and thus idle capacity is being utilised and costed at variable cost only. Their ability to mill at these prices may also stem from the fact that many operate on a part-time basis or alternatively have another income source and thus operate on the basis of covering operating costs only. Even if higher recovery rates were to be adopted, the per cubic metre milling cost is still in excess of the \$140/m³ median price charged by sawmillers.

The lack of accurate record keeping by both fixed-site and portable sawmillers did not allow for accurate recovery rate calculation. The recovery rates indicated by portable sawmills are higher than those of fixed-site mills and this would tend to be supported by anecdotal evidence and previous studies. However, it is relevant to also indicate that in the north Queensland situation, portable sawmills purchase logs selectively based on log quality and species. The result is that fixed-site sawmillers are not milling logs of comparable quality and thus a lower recovery rate is to be expected, i.e. the difference is not due to cost-effectiveness.

Portable sawmills may have a role to play in the north Queensland timber industry. This may be limited to those areas where there is a shortage of log resource and in particular to niche markets such as 'bark to bark slabs' of natural feature timber. In some instances, portable mills may even prove a viable alternative to fixed-site mills, though not in situations where large volumes of standardised plantation timbers are to be processed.

The sawmilling industry would not be regarded as a thriving growth industry by any standards, but it has reflected some fortitude and resilience even in the face of stiff competition. Sawmillers currently indicate they are unable to meet domestic demand, but this needs to be seen in the light of a lack of cabinet timber resource and the competition faced from imported rainforest timbers.

It has been suggested that portable sawmills really come to the fore in a declining or emerging timber market. The north Queensland timber industry appears to be in a state of limbo, a combination of both of these. On the one hand, the market is declining in that the major portion of the resource is no longer accessible and the remaining accessible resource on private land is becoming more scattered, less physically accessible due to rougher terrain, and of lower quality. Also, a replacement resource from the CRRP and other private landholder plantings will not become available for a few decades yet.

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