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Final report

project

A review of the use of portable sawmills in Papua New Guinea and Solomon Islands

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prepared by	Hartmut Holzknecht, Ryde James and Peter Kanowski
co-authors/ contributors/ collaborators	Sairusi Bulai, Ken Groves, Hartmut Holzknecht, Ryde James, Andrew McGregor and Digby Race
approved by	Mr Tony Bartlett, Research Program Manager for Forestry, ACIAR
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Contents

1 Acknowledgments

The material in this report comes from several sources, including from a number of previous reports on the subject. One of the most valuable sources of the information presented here is interviews with mill owners and operators, government officials from the forestry sector in Papua New Guinea and the Solomon Islands, NGO staff, officials from aid projects and community leaders in the field in both countries.

In addition, officials from the PNG Forest Authority and the Solomon Islands Forestry Department gave us generous assistance in collecting relevant information and helping when the teams were travelling in their countries. So many people helped while we gathered information and opinions that we are unable to mention them all; however, we would like in particular to acknowledge the following and the positions they held during the course of the team's visits (in alphabetical order):

Mr. Anda Akivi	PNG Forest Authority (PNGFA) / EU/PNG Eco-Forestry Project
Mr. Leo Angra	EU/PNG Eco-Forestry Project, Lae
Mr. Don Bakat	PNGFA, Hohola headquarters
Mr. Peter Garo	PNGFA, Goroka office
Mr. Martin Golman	PNGFA, Hohola headquarters
Mr. Dike Kare	PNGFA, Director of the Policy Secretariat
Mr. Robin Kimpton	EU/PNG Eco-forestry Project. Lae
Mr. Gordon Konairamo	Commissioner, SI Dept. of Forests
Mr. Tommy Kosi	Village Development Trust, Lae
Mr. Ishmeil Libertino	PNGFA, Hohola headquarters
Mr. Rex Lucas	General Manager, Lucas Mills, Victoria
Mr. Kamung Matrus	Lutheran Church Special Projects Officer, PNG
Mr. Kenn Mondiai	The Ecoforestry Forum (TEFF), Port Moresby
Mrs. Agatha Pokatou	PNGFA, MOMASE regional office, Lae
Mr. Daniel Ranga	Habitat for Humanity, Lae
Mr. Lukis Romaso	Consultant, Lae
Mr. Andrew Tagamasau	Head, Timber Industry Training Centre, PNG UoT
Mr. Terence Titiulu	Forest Officer, SI Forestry Department

Dr. Ryde James was the Team Leader for this project until his retirement in 2007, and participated in the initial drafting of a number of the sections of the Final Report. Dr. Hartmut Holzknecht took over as Acting Team Leader when Dr. James retired and as time allowed also amalgamated, revised and edited the Final Report. An editor, Dr. Susanne Holzknecht, provided final editorial advice. Professor Peter Kanowski provided significant editorial inputs in the compilation of the final report.

The values assigned to the PNG Kina (PNGK), the Solomons Dollar (SBD) and other currencies used in this report are those applicable at the time of the country studies.

2 Executive summary

The aim of this project was to evaluate the effectiveness of portable sawmilling operations in Papua New Guinea, the Solomon Islands, and Australia. Specific objectives were to evaluate the social, economic and environmental outcomes associated with the purchase and operation of portable sawmills, and identify strategies that would result in increased social and economic benefits to all stakeholders, particularly the customary forest resource owners in Papua New Guinea and the Solomon Islands.

The Secretariat of the Pacific Islands Forum prepared a background document describing the history of portable sawmills in the South Pacific and explaining why this method of forest utilisation is more important in some islands than others. This report revealed that sawmills were not always operated on a commercial basis, but also were used to fulfil the social needs of a community through provision of sawn wood for community facilities such as health centres or other buildings for community use. Many of the portable sawmills purchased or delivered in the Pacific Islands are no longer operating, generally as a consequence of their use no longer being a priority for their owners, or their mechanical unserviceability. Technical aspects of mill operation were often reported to be inadequate, the products sometimes of poor quality, and the marketing badly organised.

Project teams travelled to Papua New Guinea and the Solomon Islands, where they observed the operations of portable sawmills and held discussions with a wide range of stakeholders at all levels. Although there are many commonalities between the two countries, the difference in their size and the relative scale of industrial activity meant that the importance of portable sawmills as a source of timber production was quite different in the two countries. Thus portable sawmills are proportionally more important in the Solomon Islands than in Papua New Guinea.

In Papua New Guinea, forest production since the 1970s been focussed on large-scale export-oriented operations run by foreign logging companies. In this context, portable sawmills are regarded as a tool to be used by customary owners to supply timber for their own uses. Operators of portable sawmills are therefore allowed to operate within their own community-owned forests without any requirement to obtain a permit or submit a forest management plan; there is notionally a cutting limit of no more than 500 cubic metres per mill annually. There are virtually no controls on the use and of portable sawmills and no regular reporting is required on the volume of timber felled and processed.

In contrast, in the Solomon Islands, where overall production is at a smaller scale, the portable sawmill has always been seen as an integral part of forest management, and utilisation is subject to official licence and management controls. Portable sawmill operations are also better integrated into forest management planning and operations overseen by government. Customary forest owners wishing to use or hire a portable sawmill are required to follow a process that identifies which clan group owns what area of forest, what proportion of these areas can be felled and processed, and what parts are to be retained and conserved.

This study began based on the assumption that there were major problems with the use of portable sawmills in these two countries with both the technical aspects of running such machinery and their impacts on forests. As the study progressed, the team found that these assumptions were incorrect and that there was much in the use and impacts of this technology that was working well. The study went on to collate a range of data on how portable sawmills were being used, the constraints under which they operated, the infrastructure that absorbed the sawn timber produced and, finally, how individuals and communities were benefiting (or not) by using them and having them operating in their forests. The study concluded that portable sawmills are an appropriate technology for customary landowners in Papua New Guinea and the Solomon Islands, and that past training of landowners in their use has often been effective. The outcomes of the study emphasise that a portable sawmill is simply a tool that can be used wisely, or not.

The project also found that portable sawmills had lower productivity in PNG and SI compared to Australia and that this could be explained by the predominance of social rather than commercial

objectives, the more difficult terrain in which they operate and by the relatively undeveloped markets for sawn timber products. The financial returns of portable sawmills are sensitive to the efficiency and level of utilisation. However, because the initial capital costs are quite low, modelling indicates that the sawmill enterprise remains financially viable even if there is a substantial reduction in use and some reduction in efficiency. A principal conclusion of this project is that the greatest deficiency in the operation of portable sawmills as community or individual enterprises in the Pacific is the lack of knowledge concerning business practices and the capacity to resolve disputes about resource ownership.

This project identified the factors for success of portable sawmills in Papua New Guinea and the Solomon Islands. The key factors are: agreement within the community at all levels (family, clan) about the harvesting of that community's forest and a process for regular community dialogue: a regulatory environment that recognises and supports the wise use of portable sawmills; adequate technical training in portable sawmill operation and maintenance and in implementation of sustainable forest management principles; efficient and competitive markets for sawn timber products; and the development of small business skills for operators and communities involved in portable sawmill enterprises.

The positive use of portable sawmills, consistent with the expectations of sustainable forest management, and the realisation of consequent social and economic benefits, will depend on:

- Stronger forest management planning and regulatory oversight, particularly in Papua New Guinea, to ensure that the use of portable sawmills is consistent with sustainable forest management principles and practices. There are examples in both countries of how this goal can be realised through relatively simple means;
- Continuing investment in training programs to maintain and refresh capacity in portable sawmill operation, to build knowledge of occupational health and safety, and to build capacity in small business management relevant to the operation of portable sawmills and the sale of their products.

INTRODUCTORY COMMENTS

This study was initiated by a small number of individuals at the Australian National University, along with partners in the wider Pacific and in Solomon Islands and Papua New Guinea. The initial project document included objectives that have ultimately proved to be somewhat too ambitious and so unable to be fully met. In addition, there was considerable turnover of Australian project personnel during the project, which has meant that the project staff involved in completing this Final Project Report have faced some significant difficulties in fully addressing the original objectives and reporting on this project. There was dialogue with the ACIAR program manager about these issues during the project. .

In these difficult circumstances, the project team did what it could to fulfil as much as possible the project's objectives. As a result the output for Objective 1 can be seen as reasonably well defined, while those listed for Objectives 2 and 3 can in hindsight be seen as not particularly tangible and so less well defined. Project teams with representatives of all partners …

- visited both Papua New Guinea and the Solomon Islands and a number of operating portable sawmill projects in both countries and spoke in detail with a number of portable sawmill operators in the field and during workshops;
- engaged fully with both project partners and other stakeholders in both countries and provided feedback on the project outcomes to stakeholder representatives in each country.

3 Background

3.1 Forest use and timber harvesting in the Pacific Islands

Forests have always been central to the livelihoods of people in the Pacific region (Kanowski, Holzknecht and Perley, 2005). In the pre-European colonial period, most communities depended largely on forests, for food to supplement subsistence gardening and for timber and non-timber products. During recent decades, people in rural communities across the region have become drawn into the cash economy of their countries and these involvements are gradually changing the ways in which forests are being viewed, used and managed, and how the benefits of forestry are being shared. In most Pacific countries, there is a diminishing prospect for subsistence-based villagers to follow their traditional forest-based practices. Commercialisation of forest resources has reduced access rights to forests due to harvesting by timber (usually foreign) companies. The increasing need for regular inflows of cash, legally binding long-term contracts for timber resources, and the changing aspirations of younger generations are making it difficult to pursue traditional forest-related practices. In addition, customary owners of forests are of the view that their share of the wealth derived from commercial exploitation of their forests has been short-term, transitory and insufficient to their expectations. All of these factors mean that landowners' attitudes to forest harvesting are changing over time.

Policy and commercial incentives have emerged in the region since the early 1990s for landowners[1] and village communities to invest in small-scale forest harvesting as a means of improving their livelihoods. Proponents of portable sawmills also argue that this technology allows low-impact harvesting and processing of trees and so avoid much of the environmental and ecological degradation associated with large-scale industrial harvesting. The use of portable sawmills has been widely advocated by non-governmental organizations as a way for villagers to receive a greater share of the benefits from forestry, and as an expression of local peoples' desire for greater control over the development of their local natural resources. Some aid donors and non-government organisations (NGOs) (particularly the PNG Eco-forestry Forum, the Village Development Trust, and the Solomon Islands Development Trust) have been in active both this advocacy and the practical issues associated with portable sawmill operations. They argue that the concept of sustainable forest management is unlikely to be strongly supported by local people until traditional landowners have more effective participation in the development and ongoing management of their own forests.

Consequently, many individuals and communities in the Pacific Island countries have invested in portable sawmills, and there has been rapid growth in the numbers and use of portable sawmills in the region since the early 1980s. However, only around 20% of the c. 7,000 portable sawmills purchased by people in Pacific countries, or received via NGOs and/or donors, for a total investment of at least $150 million appear still to be operating at any level; perhaps only 5-10 % of the 1500 mills may actually be operating at any given time. There are no reliable data on the production from these portable mills, on their profitability, on their contribution to local or regional economies, on their social benefits, or on their contribution to sustainable forestry.

This study and its findings are set in this context.

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[1] *The language used to describe land held under custom in the Papua New Guinea and the Pacific Islands is often used quite inconsistently. In this report, therefore, the main distinction will be between 'landowners' or 'customary owners' and 'land holders' or 'land users'. The former have what can be called 'permanent and heritable rights', while the latter have no long-term rights, only shorter-term and negotiated 'use rights'.*

3.2 Project aims and objectives

This project focussed on three objectives:

(a) To review the social, economic and environmental outcomes, and relevant policies and regulations, relating to the purchase and use of portable sawmills in Papua New Guinea (PNG), the Solomon Islands (SI) and Australia;

(b) To identify and evaluate the critical factors leading to the optimum performance of portable sawmills in a range of contexts; and

(c) To devise feasible strategies and communicate these to key stakeholders on how to increase the beneficial outcomes of portable sawmills in the region.

These objectives, and the associated outputs, rationale/logic and applications are further discussed in Section 4.

3.3 Portable sawmills in Australia

Many farmers in Australia have used remnant native vegetation on their properties for on-farm use, such as fence posts and building construction. Technological advances in the 1990s (such as cost-efficient portable mills) created opportunities for on-farm processing of forest products, with innovative individuals selling into niche markets (Boutland 1991). However, on-farm processing for commercial products has tended to be regionally unimportant, opportunistic and poorly developed amongst Australian farmers. Success generally requires individuals to invest substantial amounts of time and/or money to develop a viable harvesting program (Kerruish & Reed 1996) and appropriate processing techniques, and to find profitable markets. On-farm processors, forest growers and mill contractors also need to ensure Government safety and environmental standards are met. However, portable sawmills are proving to be a valuable addition to enterprise development opportunities for remote indigenous communities in Australia, such as in Cape York Peninsula (Annandale 2004), and these could perhaps offer lessons for the use and management of portable sawmills in remote village communities in Pacific countries.

Stewart and Hanson (1998) suggested that technological developments, including improved portable sawmills, mobile debarkers and chippers, and portable drying kilns have improved the prospects for on-farm processing of timber. These developments could improve farm forestry viability for small-scale growers by focussing on alternative products and markets, or through adding value to what they are already producing. On-farm processing may also attract commercial opportunities to regions with small discontinuous supplies of timber in remote locations and that currently suffer from low or poor demand. Stewart and Hanson concluded (1998: viii) that there '... appears to be an opportunity for the replacement of Australia's substantial sawn timber imports with domestically produced sawn timber, including that produced by farm foresters utilising small-scale processing equipment'. Table 1, below, gives indicative capital costs and productivity of the four main types of portable sawmills used under Australian conditions.

Although on-farm processing remains small compared to industrial processing, it is likely to grow in importance for individual growers and regions not suited to trading in commodity forest products. There are gaps in the market, which many high volume producers are unwilling to supply, particularly in the plantation softwood sector; this includes high value products such as mouldings, furniture stock and joinery. A recent study by Stewart and Lang (2009) explored the cost structure of processing wood from small-scale growers in Victoria; while it used conventional rather than portable sawmills, its principal conclusions – about the importance of maximising recovery and minimising cost to realising returns – are also likely to apply to farm-based portable sawmills.

The Australian portable sawmill industry, and experience with portable sawmills in Australia, is also relevant to the Pacific because many of the portable sawmills purchased in Pacific Island countries are manufactured in Australia, and local agents in both Papua New Guinea and the Solomon Islands receive technical support of some kind from Australian manufacturers and agents. This study will also review how these major manufacturers support purchasers of mills with follow-up training and a reliable supply of spare parts and selection of reputable local agents.

Table 1: Productivity per man/year under normal Australian working conditions

Type of mill	**Cost (US$ '000)**	**Annual log input (m^3)**	**% recovery**	**Sawn timber output (m^3)**
Chainsaw	2.1	500	30	150
Single circular saw	7 to 11.5	1000	38	380
Bandsaw	> 11.5	660	45	300
Twin circular saw	20 to 32	2500	40	1000

Source: Groves 2001

4 Objectives

Table 2 summarizes in matrix form the objectives, outputs and applications associated with each of the three project objectives.

Table 2: Objective-output matrix

Objective	Output	Rationale/logic	Application
1. To evaluate the social, economic and environmental outcomes, and relevant policies and regulations relating to the purchase and use of portable sawmills.	A report on the broad socio-economic and environmental outcomes and relevant policies and regulations, which will ensure subsequent country analyses are dealing with all the important issues.	An overview of the socio-economic and environmental outcomes was needed to guide subsequent in-country analyses. Also, a review of policies and regulations is needed to clarify the contexts within which portable sawmills were purchased and used.	Preliminary overview report produced under PIFS. This overview informed the detailed review conducted by the project team.
2. To identify and evaluate the critical factors leading to the optimum performance of portable sawmills in a range of contexts.	Country reports analysing a wide range of selected sawmill operations to be synthesised into the project's Final Report.	Analysis of a wide range of successful and unsuccessful experiences was needed to help portable sawmillers to achieve greater success in the future.	Project members worked closely with designated PIFS country partners to conduct detailed case studies of a sample of sawmill operations in each country.
3. To devise feasible strategies and communicate these to key stakeholders on how to increase the beneficial outcomes of portable sawmills in the region.	Country-specific workshops identified and analysed the benefits and limitations for stakeholders; reviewed the extent to which previous review recommendations were adopted (or not). Work to build strategies from 'bottom up' started at country workshops. All strategies will be documented in the Final Report.	Analysis of the benefits and limitations for given stakeholders was needed. Before making further recommenda-tions, the project team had to appreciate the constraints experienced by those expected to make changes. In other words, strategies needed to be practical, feasible and effective if they are to be adopted.	Designated project members conducted a half-day workshop in each country to identify and analyse benefits, limitations and opportunities for improvement. Project members also reviewed the context in which earlier review recommendations were made and whether or not these had been taken up. This also informed any strategies for improve-ments articulated by the project.

Source: FST/2003/049 Project Document

In pursuit of Objective 1, project partners from the Pacific Islands Forum Secretariat prepared a preliminary overview of portable sawmills in the region. This report (Appendix 1) provided a very useful background and guide for the subsequent project work.

For Objective 2, the project undertook separate country field trips, one to the Solomon Islands and one to Papua New Guinea. Some team members participated in both field trips. During these field trips, team members visited a number of selected portable sawmill operations, interviewed operators in the field, senior staff in government departments responsible for the forest sector, NGO staff responsible for facilitating the approval process of many (if not all) of the sawmill operations in the field, and private enterprise representatives with specific interest in the products being generated by these sawmills.

For Objective 3, country-specific workshops were conducted in both Papua New Guinea and the Solomon Islands. Each of these involved portable sawmill owners and operators and representatives of a number of the other stakeholders in the sector, including PNG Forest Authority and Solomon Islands Department of Forests staff, NGO staff and portable sawmill agents, and other promoters of portable sawmills in each country. In addition, at the end of the second field trip, in Papua New Guinea, a further smaller discussion group met to discuss overall impressions and outcomes, and how realisation of the benefits of portable sawmills might best be pursued in the future (see Appendix 3).

Participants in project meetings, workshops and field visits were encouraged to put forward their opinions freely and frankly, and this goal was realised. The project team's aim was to gain good understandings of and insights into the actual operations of portable sawmills and of the wide range of factors likely to impinge on how this sector functioned. Both the material from previous studies and the project activities and visits were important in realising this aim, and the project objectives.

5 Methodology

Project Design and Research Strategy

5.1 Definition of 'portable sawmills'

Portable sawmills are relatively lightweight machines that can be disassembled, carried into the forest to the site of a felled tree, and then reassembled to process the trunk of that tree. The sawn lengths of timber are then transported out of the forest in various ways. This removal may be to the nearest road for transportation to an urban centre for sale, or to a village community for a variety of uses, including for building construction. The sawmill is then disassembled and physically carried to another work site.

A distinction could be made between 'portable' and 'mobile' sawmills; however the terms are often used synonymously and here the term 'portable' remains a generic descriptor. Mobile sawmills tend to be operated on or off trailers using existing roads and forest landings. Their use is therefore much more restricted than that of portable sawmills and in the Pacific they have been used only in Fiji.

Five basic types of portable sawmill are used in the Pacific region. These are:

- Chain-saw mills,
- Single circular-saw mills,
- Horizontal band-saw mills,
- Twin circular-saw mills, and
- One-man bench-type mills usually with a small circular saw.

Currently there are three main brands of portable sawmills being used in PNG and the SI. These are the Peterson, the Lucas and the Alaskan Chainsaw Mill. The Peterson and Lucas mills are single circular-saw mills; the Alaskan mill is chain-saw mill. While other brands of portable sawmill also exist, these three dominate the domestic sales in the two countries surveyed. The Alaskan mill is the type most commonly used in PNG and SI.

The Peterson sawmill is manufactured in New Zealand. It consists of a Stihl 090 motor driving a single 8-inch circular saw blade, on an aluminium frame. The saw is suspended on lightweight guide rails, and advances down the log. This unit can be used on moderate slopes.

The Lucas sawmill is also based on a single circular saw. It is manufactured in Australia, powered by a two-cylinder petrol driven motor. It operates similarly to the Peterson mill, but is less adaptable to sloping ground.

The Alaskan sawmill consists of a chainsaw fitted to light aluminium sizing frames. The most popular power source is the Stihl 090 engine, with the Stihl 076 engine occasionally used. The saw needs to be fitted with a different type of chain to that which would be used for felling and crosscutting, since in the Alaskan frame it is functioning as a ripsaw.

5.2 History of Portable Sawmills in the Pacific Islands

a) Papua New Guinea

Mobile sawmills were first introduced into Papua New Guinea (PNG) in the 1960s and 1970s, but adoption was slow. They became more popular in the 1980s and were taken up particularly by NGOs exploring alternatives to large-scale and high impact commercial logging; such organizations included the Village Development Trust (VDT) and later the PNG Ecoforestry Forum (PNGEFF). These organizations focused on finding and developing more appropriate ways for customary resource owners to manage their own forests, to control the exploitation of their forests, and to achieve better returns for local communities from the harvesting and processing of their trees.

In PNG, this interest by NGOs resulted for a time in the local production of a 'wokabaut somil' (Tok Pisin: 'mobile sawmill') by the precursor of the Village Development Trust (VDT) and then

by VDT itself. In addition to imported portable sawmills, many of the locally built sawmills were sold, always with the requirement of undergoing a training program that taught user groups how to maintain a sawmill, the best ways of sawing felled trees for various purposes, as well as how to raise and plant seedlings to replace the harvested trees. The then national Department of Forests was not interested in the development of this kind of low-level forestry, although some provincial forestry divisions (e.g., in Morobe Province) continued to be closely involved. It is estimated that as many as 3,500 mobile sawmills (or perhaps even more) have been purchased since the 1980s for use in PNG.

Implementation of the PNG-EU Eco-forestry Project in 2001 prompted the PNG Forest Authority planning staff to develop a draft Eco-Forestry Policy (PNG Forest Authority 2004) to assist in guiding this forestry sub-sector. However, this draft policy has not yet been approved nor implemented; the draft was recently withdrawn for review.

b) The Solomon Islands

Both static and portable sawmills are currently used in the Solomon Islands for the production of sawn timber from logs. Prior to the introduction of the portable types, all sawmills in the country were fixed static mills that required logs to be transported from the forests to where sawmills were located. As in PNG, portable sawmills were introduced in the late 1970s and promoted as being a more environmentally friendly and an appropriate tool for the participation of landowner communities in the management of their own forests.

The potential roles that this type of sawmill could perform in the development of rural communities became evident following the devastation caused by Cyclone Namu in May 1986. Prior to this event, portable sawmills in SI had a low profile and were not widely used. To assist with subsequent rehabilitation efforts, several relief agencies promoted portable sawmills so that communities could utilize the timber from trees blown down during the cyclone to produce suitable timbers for the reconstruction of homes and other buildings destroyed by the cyclone.

Even after the worst effects of the cyclone were overcome, the use of portable sawmills continued to be encouraged, mainly by non-government organizations such as the Eco-Forestry division of the Solomon Islands Development Trust (SIDT). Soltrust, a now defunct NGO, imported the first *wokabaut somil* from Papua New Guinea in 1986. A USAID matching grant supported a Foundation of the Peoples of the South Pacific (FSP) portable sawmill program and immediately began to create a cadre of trained operators used to working with customary landowners. This project was followed by another supported by the EU (1997 – 2001) which also involved other Pacific Island countries (see c) below).

There has long been a need for portable sawmills in SI, especially in remote areas where no other sawmills are located. It was recognized that the sawing of logs in the forest was a way to improve the timber yield taken out of the forest. Logs that are of lower quality and that cannot normally be used to produce timber of reasonable quality and value, are not sawn. This reduces costs and also increases the value of the timber produced and taken out of the forest.

Despite this, the operation of portable sawmills in the Solomon Islands was and continues to be seasonal. Typically, owners operate on an ad hoc basis or whenever they need to generate sawn wood for community use or sale, such as when villagers need money to pay school fees or to spend during festive seasons. Consequently, production fluctuates greatly from month to month with November, December, January, April and June tending to have higher production figures than the other months. In some parts of PNG and Solomon Islands the first four months mentioned are rainy season months; in others they are dry season months.

Given the remoteness of many locations, low production rates, and the sub-standard quality of timber produced, marketing the products of portable sawmills has always been a major challenge (sub-standard quality here refers to not accurately cutting timber to the correct dimensions). The timber is usually shipped to Honiara, the national capital, and is bought there at dockside by timber dealers at prices between Solomon dollars (SBD) 1200 to SBD 1400 per cubic metre for premium species such as *Pterocarpus indicus*, *Vitex cofassus* and *Intsia bijuga*. Lesser-known species such as

Pometia pinnata and *Calophyllum kajewski* are sold at SBD800 to SBD1050 per cubic metre. Over time the market has standardized the freight cost for transporting the timber to Honiara to around SBD 400 to SBD 500 per cubic metre. When the operational costs are added, the financial returns are relatively small.

Because of the rather low profit margins, portable sawmill operators in the Solomon Islands are increasingly opting not to process their own timber for sale but to make their services as machinery operators available for hire. This means that when charitable and similar organizations construct new clinics or school buildings, they hire these operators and their portable sawmills, make arrangements with local forest owners, and thus generate the timber requirements for their projects.

The Solomon Islands national forest policy of the time aimed at promoting and supporting the participation of local people in the sawmilling industry was endorsed and approved by Cabinet in 2003. The long-term goal was to develop sufficient infrastructure to enable the country to undertake domestic processing and to export processed timber rather than round logs, in order to achieve value adding and increase local employment. However, the same policy also stated that the decision to go into sawmilling was best left to the private sector. In the Solomon Islands, the close working relationships between the Department of Forests and the NGOs, and an agreed process of identifying and certifying harvestable volumes of timber at a local level, allow this system to operate quite smoothly.

Section 18 of the Solomon Islands Forest Resources and Timber Utilisation Act (FRTUA) requires all operating sawmills to be licensed. Any person who breaches this requirement is guilty of an offence and is liable to a fine of three thousand dollars or to imprisonment for two years, or both.

All sawmill licenses are granted by the Commissioner of Forests and are valid for one year from the date first issued. In 1985, 24 sawmill licenses were issued and registered. By March 1992, 149 sawmill licenses had been issued (Cameron, 1992). As of mid-May 2005, there were only 29 valid sawmill licenses issued by the Commissioner of Forests. Records indicate that there are currently 391 expired sawmill licenses and, given the present inability of the Forestry Department to enforce the legislation (including the monitoring of the individual licenses), it is not possible to establish whether or not any of these have continued to operate. Nevertheless, the fact that current production of sawn timber is estimated to be much higher than the level that supposedly could be produced by the existing valid licensees suggests that a number of individuals and/or community groups whose licenses have already expired have either been reluctant, or have not bothered to renew their licenses, and have continued to mill timber illegally.

c) Portable Sawmills in other Pacific Island countries

NGOs, in particular the Foundation of the Peoples of the South Pacific (FSP; in PNG now called the Foundation for People and Community Development, FPCD), assisted in the spread of portable sawmills from PNG to the Solomon Islands, and then to other countries in the Pacific, principally Vanuatu and Fiji. A EU-funded South Pacific Community Eco-forestry Project in the Solomon Islands, Vanuatu, Fiji, Tonga and Kiribati for the period 1997 - 2001, focused on the sustainable use of forests, including the use of portable sawmills (Tilling & Holzknecht 2001).

While a small number of portable sawmills operated in Fiji in the early 1970s, village communities at this time were not involved in any of these operations because most or all of these were owned by individual commercial operators. More recently, mobile mills have been restricted by the Government of Fiji to use by communities only, in remote areas and in the outer islands (for example, to produce timber for village housing). However, the government has been under pressure to change its stance on the issue, since current policy is to promote participation of the indigenous community in the forestry sector and associated business activities. Because of costs, the only cheap and quick way for this to happen in the timber industry is for the customary resource owners to be assisted in acquiring and operating portable mills on a commercial basis.

5.3 Findings from Earlier Reviews

Despite long-term interest in this technology in the region, there has been only limited evaluation of whether or not the adoption of portable sawmills has delivered the economic, social and environmental benefits sought by communities and resource owner groups in the Pacific, or by farmers or Indigenous communities in Australia. Assessments of aspects of portable sawmill operation in both the Pacific (Arentz & Holzknecht 1991; Bartlett *et al*. 1998; Tilling & Holzknecht 2001; Groves 2001) and Australia (Stewart & Hanson 1998; Curtis & Race 1998; Feary 2007; McCormack et al. 2000) have focused on particular projects, aspects of operations, or case studies.

Arentz and Holzknecht (1991) assessed a mobile sawmill training program in PNG, carried out by VDT, at a time when sawmill units were still being manufactured in Lae, PNG. This training program depended on the requirement that a sawmill unit could only be purchased when a training program was completed. The training program, conducted by VDT (a NGO), was very thorough and practically focused. However, the extent to which issues such as maintenance of machinery, accuracy of the cutting dimensions, occupational health and safety issues, and reforestation requirements following extraction of timber from a forest were subsequently implemented varied between operators. Since the end of portable sawmill production in PNG, the training program has also ceased, but some NGOs have carried out training programs for those portable sawmill operators who are using their units (see Holzknecht *et al*. 2002).

A more recent review of a South Pacific Community Ecoforestry Program (Tilling & Holzknecht 2001) contrasted that program's activities in three Pacific countries (Solomon Islands, Vanuatu and Fiji) where emphasis was solely on mobile sawmills with a much broader and in many ways more effective implementation of the program's aims in Tonga and Kiribati, where portable sawmills were not used. Unrealistic financial projections by NGO planners and supporters of these community-based projects, and overly optimistic patterns of work cycles with the mobile sawmills, meant that these projects were never able to work at their own pace, particularly in Vanuatu. In the Solomon Islands, issues and conflicts between customary groups interfered with the operations of these units. However, it is of interest that despite this, mobile sawmill-derived processed timber continued to be regularly shipped to New Zealand right through the period of the ethnic tension and national crisis that engulfed the Solomon Islands at the time. In all countries where mobile sawmills were being actively used, the common tasks of monitoring, record keeping and reporting presented major issues for ongoing operations, especially if the sawmill owners were paying off commercial bank loans.

Another finding of the review by Tilling and Holzknecht was that in the three countries where the use of portable sawmills were emphasized a very high proportion number of the units have been abandoned or remain unused; this was a phenomenon that could not be adequately explained from the information available at the time of the review.

Groves (2001) undertook a desktop review of portable sawmills in PNG and found that production varied considerably; on average, productivity was very low by Australia standards using the same kinds of machinery (Table 3). Estimates of the number of *wokabaut* and portable sawmills in PNG varied from 700 to 5,000, with indications that possibly only 1,000 of these operate on a daily or occasional basis (Groves 2001). Table 3 provides Groves' estimates of critical statistics for these sawmills. As Table 3 indicates, on the basis of Groves' (2001) assumptions (1,000 portable sawmills working on a daily commercial basis in PNG), the total annual production of portable sawmill-derived sawn timber in PNG is 50,000 m^3, or 50 m^3 per mill at a rate of only 0.25 m^3/mill/day (assuming 200 working days/year).

More recently Rogers (2010) has investigated the effects of well-planned and controlled logging using portable sawmills on stand structure and regeneration in lowlands forests in West New Britain. He found that impacts were small when compared with conventional logging. He notes that well planned and implemented logging with portable sawmills can be seen as a form of reduced-impact logging. This style of forest management using portable sawmills does not, of itself, guarantee sustainable forestry. Rogers' findings support those of this study.

Table 3: Summary statistics for PNG portable sawmills' performance

Parameter	Estimate	Comments (based on reports; therefore require confirmation by field assessments)
Average log input/mill	500 m^3	Low; should be checked
Recovery range %	10 - 50%	Very wide range; should be checked
Average recovery %	35%	Low; should be checked
Average sawn timber output/mill	175 m^3	Low; should be checked
Average number of employees/ mill	7	Very high; should be checked
Average productivity/man/year* (* assuming 200 working days/ year)	25 m^3	Extremely low; should be checked

Source: Groves 2001

Groves (2001) discusses a number of likely reasons for the low productivity:

- widespread lack of skill and technical expertise;
- lack of backup from equipment suppliers;
- lack of knowledge by portable sawmillers of the widely varying properties of different species as raw material for value-added milling and processing, and the desirability of these species in markets other than local ones;
- lack of physical access to markets, of information about export markets, and of manufacturing and marketing skills;
- poor transport infrastructure; road transport in PNG can often be difficult and expensive and in wet weather, roads and bridges are frequently closed due to landslides and floods. In SI transport to markets from the many smaller far-flung islands has to be by sea; and
- lack of business skills by sawmill operators/owners.

In summary, the results of previous reviews suggest that the operation of portable sawmills in PNG and the SI shares a number of key problems:

- Customary resource owners want greater control over the utilization of their forests and a fairer deal from commercial forestry, yet are uncertain how best to achieve this. Their efforts to do so suffer from a lack of adequate planning and implementation information;
- While portable sawmills have long been promoted as a means for local communities to obtain a better deal from commercial forestry, it remains uncertain how the costs and returns (in the broad as well as the narrow sense) compare to other forestry options. This lack of comparable information handicaps decision-making;
- Most portable sawmills purchased during the last decade are not working to an optimum level - perhaps less than 20% are working at all, let alone to capacity - with uncertainty about why this is the case. Different attitudes among PNG and SI communities to income-generating activities to those which prevail elsewhere, and unserviceability due to lack of maintenance or spare parts, are among the probable reasons;
- Portable sawmills are often promoted as being more 'environmentally friendly' than other forms of timber processing, yet anecdotal evidence indicates that many portable sawmill

operations do not meet accepted environmental standards. With little longitudinal monitoring or reporting data being collected, the basis for forming such judgements is limited;

- Portable sawmills are reputed to be used in small-scale illegal logging activities in some cases; there is more evidence of this in PNG than in SI; and
- There is little national or trans-national coordination of strategies to optimise the use of portable sawmills (e.g., sawmill registration and licensing, training courses, consistent safety standards, marketing alliances), except that provided by equipment manufacturers and their agents. This reflects the low priority given to this sector, particularly in PNG.

In conclusion, while several studies have reviewed the outcomes of portable sawmill operations, none has focused on the full socio-economic and environmental outcomes in a range of settings, limiting the opportunity for these earlier reports to provide decisive recommendations to sawmill operators, program managers and policy makers.

5.4 Implementation of this Project

The original team for this project recognized that portable sawmills needed to be reviewed in terms of three major criteria - economic benefits, social benefits and sustainability - and adopted the project sub-title of 'identifying the factors for success'.

This ACIAR-funded project therefore aimed to build on the work by previous reviews by:

- assessing the extent to which productivity levels, as determined on-site, correspond with the desk-study estimates presented above;
- establishing causes of low productivity by evaluating the perceptions of portable sawmill operators/owners, and experienced forest agency and NGO staff;
- investigating the social settings that might have contributed to the perceived low productivity, and any benefits from portable sawmill operation that might offset productivity performance;
- determining whether or not the current methods of operating portable sawmills were likely to achieve forest resource sustainability;
- identifying where opportunities for synergies exist between PNG, the Solomon Islands and Australia (e.g., coordinated training, operators information network); and
- developing feasible strategies with key stakeholders for overcoming impediments to the optimum use of portable sawmills.

This project brought together a team with complementary expertise to undertake a detailed analysis of the direct and indirect costs and benefits of portable sawmills in Papua New Guinea, the Solomon Islands and Australia, and to make recommendations for improvements. Under bilateral arrangements between the Pacific Islands Forum Secretariat (PIFS, on behalf of several Pacific countries) and the Australian National University (ANU), the project combined the research capabilities and expertise of the PIFS, ANU and other specialists (e.g., the PNG Ecoforestry Forum; Mr Mark Stewart from the University of Melbourne, and Dr Andrew McGregor, economic/marketing analyst based in Fiji). The project also involved experienced people with a range of expertise relevant to portable sawmilling to assist with the project design at the project inception meeting, and with the project planning meeting (including, for example, Mr Martin Golman, PNG Forest Authority - then based at ANU as a PhD scholar; Mr Rex Lucas – General Manager, Lucas Mills, Victoria, a major manufacturer of portable mills; and Mr Mark Annandale, then an industry development officer with Queensland DPI).

At the end of the project, visits have been made to Honiara (Solomon Islands) and to Port Moresby and Lae (Papua New Guinea) to provide feedback on the project and its outcomes to stakeholder representatives in each country (see Appendix 5). Both these visits elicited considerable lively and positive discussions amongst attendees and the presenter.

6 Achievements against activities and outputs/milestones

Objective 1: To evaluate the social, economic and environmental outcomes from the widespread adoption of portable sawmills in selected Pacific Island countries and Australia

No.	Activity	Outputs/ milestones	Comments
1.1	PIFS Background Report, overview of the socio-economic and environmental outcomes, policies and regulations	PI Background report completed (Appendix 2).	PIFS Background Report useful as background and guide for the study, both for assumed socio-economic and environmental outcomes and for the relevant policies and regulations. No Australian report as such was produced; instead, the project drew from published sources (see reference list).

PC = partner country, A = Australia

Objective 2: To identify and evaluate the critical factors leading to the optimum performance of portable sawmills in a range of contexts

No.	Activity	Outputs/ milestones	Comments
2.1	Country reports analysing a range of selected sawmill operations	Specific reports produced	A number of PNG and SI country reports, records of interviews, notes of planning meetings, discussions with stakeholders and knowledgeable persons in this sector
2.2	Field visit to Papua New Guinea	Field trip and site visits completed	Field trip undertaken by project team with PNGFA, EU-PNG Eco-forestry Project and NGO personnel
2.3	Field visit to Solomon Islands	Field trip and site visits completed	Field trip undertaken by project team with Forestry Dept. and NGO personnel
2.4	Assessment of the criteria for portable sawmills	Table 3 in project document	These inform various sections of this report.

PC = partner country, A = Australia

Objective 3: To devise feasible strategies and clearly communicate these to portable sawmill operators, program managers and senior policy makers in government agencies and relevant NGOs on how to increase the beneficial outcomes of portable sawmills in the region

No.	Activity	Outputs/ milestones	Comments
3.1	Country-specific workshops; - assess extent to which previous recommendations have been carried out; - build strategies to help improve capabilities of this sector	Workshops conducted	Successful workshops held in both Papua New Guinea and Solomon Islands.
3.2	Final report	Final report completed and submitted	Initially delayed due to major changes in project personnel and leadership; completed herewith

PC = partner country, A = Australia

7 Key results and discussion

In this section, the key results of the study are identified (7.1); the productivity and use of portable sawmills in the Pacific (7.2) and Australia (7.3) are discussed; the importance of social objectives in the use of portable sawmills is highlighted (7.4); economic aspects of portable sawmills are summarized (7.5); from a subsidiary report by A. McGregor (McGregor, 2008); and the impacts of portable sawmills on forest sustainability are reviewed (7.6).

7.1 Study key results

A fundamental assertion arising from the project's work is that portable sawmills should be seen essentially as just a tool, for meeting a variety of needs such as local timber supplies, community development and an individual's business aspirations. This tool can be used wisely and well, or otherwise. The project team saw and heard much credible evidence of both wise and unwise use of these mills. Consequently, the project's recommendations are focussed on developing the criteria for wise use, i.e. the "the factors for success". The project also found that portable sawmills had lower productivity in PNG and the SI compared to Australia and that this could be explained by the predominance of social rather than commercial objectives, the more difficult terrain in which they operate and by the relatively undeveloped markets for sawn timber products. The financial returns of portable sawmills are sensitive to the efficiency and level of utilisation. However, because the initial capital costs are quite low, modelling indicates that the sawmill enterprise remains financially viable even if there is a substantial reduction in use and some reduction in efficiency. A principal conclusion of this project is that the greatest deficiency in the operation of portable sawmills as community or individual enterprises in the Pacific is the lack of knowledge concerning business practices and the capacity to resolve disputes about resource ownership.

7.2 The productivity and use of portable sawmills in the Pacific

The purchasers of portable sawmills in PNG have been categorised into three groups (Louman, 1996), and these categories also apply to the Solomon Islands:

- Individuals and business groups, who may or may not own the forest they harvest, using a portable sawmill as a money-making enterprise;

- Customary landowners, who purchased a mill outright, or who acquired one at a greatly-diminished (or no) cost through subsidy or donation. Sponsorship is typically provided by overseas aid funds channelled either through NGOs or diplomatic missions, for the purpose of village development activities; current or aspiring Members of Parliament have also donated portable sawmills. These landowners harvest the forests they own, and may be using the product for either or both community purposes or commercial sale; and

- Those who lie somewhere between these two categories. An example of this is when a sawmill unit was originally donated to a community but then eventually taken over by one individual who then attempted to use the equipment to make money.

The productivity of portable sawmills varied greatly by mill type and by mill ownership type, and even within the same basic type, much more so than is usual for fixed sawmills. There are many reasons for this, including:

- The motive for purchasing a portable sawmill, how funding is provided, and the ability to manage a sawmill as a business enterprise. If the motive for owning a mill is purely or principally commercial, then the productivity incentive is much stronger and likely to be more rigorously applied. For example, in these circumstances, it could be expected that the mill would be used on a more or less continuous basis and that sawmilling and marketing skills would be higher than if the mill was purchased simply to meet occasional community needs for sawn timber;
- The species, size, bole shape and quality of logs, and the amount of log and site preparation required at the mill site. In the natural tropical forests of PNG and SI, logs vary enormously in size and bole shape, and in the amount of defect they may contain;
- Access to and from the site, which may be difficult and/or at some distance from a road head. Mill operators commonly described the transport of mills to some sites as 'back-breaking', and the removal of the sawn produce as 'unpopular and tedious hard work';
- The desired product output and the sawing patterns used to achieve it. Where large flitches are cut for re-sawing in a fixed sawmill, productivity can be relatively high. However, given the problems of access and the non-commercial objectives of some mills, when further sawing takes place on-site, and only 'final product' wood, whether for community use or for sale, is removed from the site, the actual log conversion factor is often low;
- Use of a sawing pattern that does not maximise recovery. For example, quarter-sawing may be more desirable than back-sawing from this perspective. Quarter-sawing tends to be more difficult than back-sawing, so productivity may be reduced as a result; and
- The ways in which log and sawn timber volumes are determined. A standard basis for comparison is helpful, but in neither PNG nor the SI were log-to-timber conversion factors commonly determined in actual operations.

7.2.1 Site access

Access to and from the forest site is a major constraint with many implications. The ability to move a portable sawmill to a work site and sawn timber to a road or a beach for loading on to a truck or water transport is a critical productivity issue in both PNG and SI. It is quite common to carry both mill and sawn timber by manpower, sometimes also womanpower, along a roughly cleared track through the forest for distances up to 1km or further. A single piece of *kwila* (Tok Pisin; *Intsia bijuga*; syn.: *merbau*) sawn timber with a 225x50mm nominal size and 4.8m long would weigh about 85kg (or 50 kg if the length is reduced to 3 metres). FAO have promoted the use of a small single axle two-wheeled sulky for pulling pine logs out by manpower (FAO 1997). The use of such a device was observed in one case in PNG, where it had been used to get the sawmill onto a site. The length of the sawn product, and the twisting and undulating nature of the tracks, means that timber is usually hand carried out piece by piece. Potential solutions discussed in the field were the use of the above-mentioned sulkies, small 4WD vehicles and farm tractors powered by 2 stroke motors. In addition, water buffalo were seen being tried at one location in PNG, pulling a small trailer.

7.2.2 Transport infrastructure

Poor transport infrastructure is a major constraint on developing export markets for portable sawmillers. This is particularly true of PNG since it lies off the main sea-lanes. Because of the mountainous terrain and seasonal flooding, road transport is difficult and expensive, and the capital, Port Moresby, is accessible from the rest of the country only by sea or air. The Highlands Highway links the port of Lae to major centres in the Highlands, but little additional reliable road development has taken place, and the poor maintenance of existing roads is a critical limiting factor. In wet weather, roads and bridges frequently close due to landslides and floods. All of these factors limit or make access to markets much more difficult.

Sea transport is an important element of transport infrastructure in some parts of PNG, and critical in the Solomon Islands which comprises many smaller islands than does PNG. In PNG, the need for

shipping of sawn timber is limited, and arrangements are made on an ad hoc basis. In the Solomon Islands, arrangements are made in various sub-regions to regularly charter a landing craft-type vessel to call in at a number of loading points at different islands to pick up portable sawmill timber and deliver these to buyers or a timber yard in the capital, Honiara; this arrangement has enabled a standard price per cubic metre of sawn timber to be set in SI.

7.2.3 Training

The Timber Industry Training College (TITC), a residential college of the Papua New Guinea University of Technology in Lae (PNGUoT), continues to provide training to the timber industry with an emphasis on 'hands on' activity. Training is provided on an 'as needed' basis for people purchasing portable sawmills. The visiting team saw TITC graduates operating portable sawmills with a good degree of competence. In the Solomon Islands, this operational training role was undertaken by one branch of the Solomon Islands Development Trust, with the marketing components more recently the responsibility of a new organization, VETE (Village Eco-Timber Enterprises).

7.2.4 Market infrastructure

In PNG, market infrastructure for small-scale forestry activities is generally poor (Kanowski, Holzknecht and Perley, gen.eds. 2008). This is the case for portable sawmill products, and there is a significant gap between portable sawmillers and the market place. One of the principal manifestations of this is the lack of commercial middlemen who can act as brokers between producers and the market. The lack of such middlemen contributes to PNG's reputation for unreliability in the supply of wood products, which will have to be overcome if the portable sawmilling industry is to develop along more commercial lines. The SI, in contrast, has commercially-minded middlemen operating in this brokering role, and commercial purchasers of sawn timber regularly meet incoming coastal vessels to bid for their loads of sawn timber.

This project sought to establish:

- the extent to which productivity levels determined on-site corresponded with the desk-study estimates;
- the causes of low productivity, by evaluating the perceptions of portable sawmill operators/owners, experienced forest agency and NGO staff.

Our research found that portable sawmills had lower productivity in PNG and the SI compared to Australia and that this could be explained by the predominance of social rather than commercial objectives (as discussed below), by the difficult terrain in which the portable sawmills typically operate in PNG and the SI, and by the relatively undeveloped markets for products of this sector.

The nature (shape and size) of the logs processed by portable sawmills was identified as a contributing factor to productivity levels, but no reliable data exist for precise measures of log conversion efficiency. We noted that while technical difficulties with the sawing process did exist, training had raised the level of expertise to at least satisfactory levels of competence.

7.3 The productivity and use of portable sawmills in Australia[2]

There are essentially three main ways in which portable milling can be undertaken in Australia, for various levels of commercial or financial benefit:

a. The portable mill owner buys logs and sells the sawn timber: There appear to be few mill owners known to be operating full-time in this category, although there are exceptions in the red gum forests along the Murray River system. However, for many operators, returns are not particularly attractive, as the owners are competing against established sawmillers who dominate the market by setting standards and prices, and who are likely to have lower costs due to their economies of scale.

b. The portable mill owner saws other people's logs under contract. This category is more common than the first case. A typical example is where a landowner wishes to remove one or more trees from his property, and wishes to recover the timber from it. The large mills are not interested in such low volume, but this situation is well suited to a portable miller.

c. The portable mill owner uses it for producing timber for his or her own needs. The value to the mill owner in this case is the money saved on timber purchases and the flexibility of producing exactly the sizes and grades to suit the owner. The logs could be either grown on the portable mill owner's land, or may be purchased elsewhere. The timber is then milled solely for his or her own use. A subset of this category is those who might use a portable mill as a hobby, for example, for salvaging timber from trees felled by municipalities, trees felled to make room for other development, or storm-blown trees. In this case, the portable mill owner may target particular specialty timbers opportunistically.

In summary and based on expert experience and observations:

- Option (a) is the least attractive for income generation unless the timber is very high value.
- Options (b) and (c) are the better options for generating returns with a portable mill in Australia.

The most relevant study concerning portable sawmills in Australia was that carried out by Stewart and Hanson (1998). This study compared purchase price, mechanical features and quality, service needs, quality of sawn product, ease of assembly and disassembly, and safety of the different types. Profitability was most sensitive to the selling price obtained for the timber and least sensitive to the distance travelled to the tree.

7.4 The success of social objectives

We have developed from the literature a checklist of criteria that could be used to assess whether communities in Pacific countries are likely to have benefited from the use of portable sawmills (Cernea 1991; Pretty 1995; Arnold & Dewees 1997; Higman 1999; Race et al. 2009). These criteria relate to elements of both social capital and business management.

Elements of Social Capital

- Cohesive community with regular open meetings, in which men and women are actively involved and during which agreed on positions are reached with regard to activities and commitments;
- Leadership and management of community groups and institutions (e.g., village trusts) are and trusted, and there is ongoing renewal of membership;

[2] *Information supplied by Dr. Mark Stewart, Australian portable sawmill owner.*

- Individuals and families feel connected to community decision-making processes, and they can make informed decisions about development/ technology;
- Minority and disadvantaged members of the community (e.g., elderly, ill, poor) are favoured in projects focussed on community development;
- Advice is sought by community leaders from credible outsiders; and
- The community has established relationships with key parts of Government, NGOs and private sector organizations.

Elements of Business Management

- The community has completed a comprehensive business plan of the financial components of purchasing (through either or both paying cash and using credit) and operating a portable sawmill;
- The community has completed a thorough analysis of market opportunities (including accessibility to different market segments, competitiveness of markets, volatility and risks of markets, short and long term prospects);
- Opportunity costs have been fully analysed (such as investment in a portable sawmill unit has assessed against other forestry options, existing and new agricultural options, other employment options, environmental impacts);
- There is community agreement on how the portable sawmill business will be managed, likely returns and contingencies (if found to be unprofitable);
- There has been an assessment of the direct and indirect impacts on different members of community from a portable sawmill, and strategies developed to minimise or offset negative impacts; and
- There is an ongoing investment to recruit and train operators and foster loyalty.

We were able to test at least some of these criteria with participants at project meetings and so confirmed their relevance. As an example, the importance of the first three criteria (a cohesive community, good leadership and individuals and families connected to their projects) was confirmed by many people in the sector.

7.4.1 Social criteria

Informants at project meetings also suggested other criteria: for example, one experienced forest manager noted that, from his experience of portable mills, those operated by a coherent group such as a family or clan, working on their own clan land, were the most likely to be successful. He also suggested that restricting portable sawmill use to such groups who were sawing in order to produce timber for their own use would minimise adverse outcomes, as in his experience, most problems arose when mills were operated on an entirely commercial basis, to produce timber for sale, and where the sawmill owner was not working in forest he owned, or even had rights to. Another informant agreed with the analysis, but suggested that where the aim was a purely commercial one the mill needed to be registered as a commercial entity to make its basis and intention clear. Such registration is currently required in the SI but not in PNG.

A number of participants at project meetings confirmed that where members of a community perceived that their asset, namely the clan-owned forest, had been depleted for private, i.e., in this case, individual gain, they became aggrieved, an outcome that could weaken the whole concept of unity within the community.

Participants in the study workshops acknowledged that the definition of 'community' could be a problem. In PNG as elsewhere, members [of a community] could hold different opinions and that made the community divisive. One member of a NGO (a church charity) advised that he preferred to deal with a single family group that had a strong authority figure as its leader, presumably for reasons identified above. However, our discussions were not able to illuminate specific issues associated with the role of minority groups within a community, nor those concerned with gender equity. It is possible, nevertheless, to comment in general that minority groups within a community will benefit if they are associated with landowners who hold permanent rights. In-marrying females in patrilineal societies are virtually never accorded the equivalent of permanent rights and so will never have the same range of rights. This restriction also applies to the planting of long-lasting trees or trees with high economic value (such as coffee or cocoa trees). Male children benefit by being born into a clan and eventually on adulthood can exercise those rights. Where value is added, e.g., through a sawmill producing wood for community or household use, the individuals with permanent rights are likely to establish their rights first.

One participant with 25 years relevant experience observed that there had been a shift in objectives of portable sawmill use over that period. Initially, the main objective had been to provide timber for individual or community use only. More recently, commercial operators had become much more prominent, sending their work teams with sawmill units to outlying areas, and even to other provinces, to harvest and saw logs of selected timber species.

Discussions confirmed that members of a community could use a portable sawmill within their own areas of clan-owned forests to meet cash needs or debts (such as school fees, or purchase of 2-way radios) or to provide for celebration expenses (e.g., at Christmas). Because many of these needs arise on a regular basis, the effects can be seen in surges of timber volumes becoming available on the market.

The relationship of communities with Government authorities and NGOs was subject to a wide range of opinions. Some saw the role of government as valuable, in providing training and as an arbitrator between vested interests, particularly when commercial arrangements were being made or disputes arose. Some were uneasy when it was thought that the Government might wish to regulate their activities. NGOs were regarded as a mixed blessing; those that actively worked with local communities and helped deliver results were generally highly regarded. Examples were church trusts that assisted directly by supplying mills, technical support for mill operation, and training in building skills for house construction. Those NGOs whose role was mainly advocacy were not so well regarded, especially when their advice had subsequently proved to be wrong. An example cited was that of a sawmill sited too far from a road (on the advice of a prominent international 'green' organization) and so not able to sell its sawn timber.

In summary, the social benefits from the operation of portable sawmills did not always conform to those expected or hoped for. However, there were enough success stories to confirm that there were many instances when portable sawmills had clearly made a positive contribution to the lives of PNG and SI citizens, particularly those still living in rural districts on their traditional land.

7.4.2 Business management criteria

In terms of business management criteria, the situation is quite different. The team consistently heard that the development of business plans and market analysis were areas in which Pacific Island people have the least skills.

Rural people considered the primary asset, the portable mill itself (valued at about AUD$25,000), to be very expensive for those living a traditional village lifestyle. The villagers, with few cash resources, naturally sought alternative ways of financing such a purchase. These alternatives could include credit or rental deals, or gifts and subsidies, including donor funding. It is easy to understand how dissatisfaction, whether justified or not, can develop.

Even when the objective is to provide timber for local housing or community construction projects, there was always some kind of commercial element in portable sawmill activities. As one mill owner from Bougainville pointed out, operating any sawmill involved commercial transactions of some kind or other because running costs such as fuel, maintenance and spare parts had to be met. The simplest way to cover these costs was to sell part of the production, and so there would usually need to be some commercial return from portable sawmill production.

That the operation of portable sawmills is subject to the same commercial processes as any other enterprise is well understood by some. Mulung (2006) listed factors to be considered in portable sawmill operation as including sales revenue, wages of owner, wages of employees, rent, marketing cost, electricity, telephone, maintenance, depreciation, loan interest and repayments, insurance costs, business licence purchase, raw material log prices, other consumables, and travel. His analysis, based on the actual price of sawn timber in Lae at that time of around PNGK 650 per cubic metre and actual costs of production, suggested a portable sawmill has to work for around 3 months/year to break even, excluding the repayment of any capital costs.

Opportunity costs were not mentioned specifically, but were clearly part of decision processes about portable sawmills. In one well-organised and NGO-supervised operation we visited, the supervisor advised that the villagers never worked at milling more than two-thirds of a formal working week (8-hour day, 5-day week) because they had other important tasks to perform. He regarded that time allocation as quite satisfactory.

Securing the agreement of the whole community about sawmilling operations, and the assessment of benefits for the purposes of distribution of products or income, could clearly be contentious issues. While mills were often owned and operated at clan or family level, the larger community comprising a number of these social units would own the forest as a whole. This distinction could lead to many disagreements concerning the equitable distribution of benefits, and could also affect the ‘resource security’ of the mill. For example, a larger group might withdraw permission for milling if they felt that they had not received adequate benefits. This could be a disaster for a sawmiller who had invested in a unit on the assumption that he could gain access to the whole of the community’s forest. In both PNG and SI there is little (if any) formal demarcation in the legal sense of clan or tribal area boundaries as they apply from place to place, and instances were mentioned where land disputes had upset the existing arrangements for forest access to supply portable sawmills.

The desirability of training, in both sawmill operations and management, was repeatedly mentioned and generally agreed. The necessity for further training to reinforce good practice and expand knowledge into business practice was also widely agreed. It was clear from observations in the field that training had already significantly raised operating standards, so that in general the actual sawing operation was performed well. There was general agreement that it was in business practices such as accounting and management that knowledge was most lacking. The development of a knowledge culture, including the need for continual and additional training above basic levels, was clearly lacking, desired and needed.

Consequently, a principal conclusion of this project is that the greatest deficiency in the operation of these portable sawmills as community or individual enterprises is the lack of knowledge concerning business practices. This includes not just business skills, but also skills in negotiation and dispute resolution which are required to operate a commercial or social enterprise where the ownership of the forest resource and the right to utilise it may not be entirely clear and so subject to the possibility of dispute at any time. This is much less of an issue where the objectives of using portable sawmills to mill traditionally owned community forest resources to provide local ‘social’ assets such as housing, rather than for profit. In this context, where business-related objectives are not prominent, the lack of business management skills is less problematic, and the use of portable sawmills has clearly been and can continue to be successful.

7.5 Portable sawmills and their effects on forest sustainability

One of the most important of the criteria for judging forest operations is that of sustainability. The physical difficulties of operating portable sawmills in tropical rainforest have already been discussed. These were readily confirmed by our inspections and are widely acknowledged, both by those involved in portable sawmills at the community level as well as by outside observers. Because of the physical difficulties of terrain, vegetation and access, the operators tend to fell and mill trees that are in a convenient location for exploitation and of the most saleable species. This has led to localised over-cutting as trees of commercially valuable species close to roads or tracks are felled in preference to trees where access is more difficult. Trees are also felled in areas where it is likely they should have been retained on environmental grounds, such as in riparian zones.

In both PNG and SI, there has been virtually no application of the principles of silviculture, and how these should be applied to ensure the sustainability of the resource, in the choice of trees to be harvested for portable sawmilling operations. While this is understandable under the circumstances of customary forest ownership, it remains a deficiency with serious consequences for both the forests and communities' future livelihood options.

In one case, at least, these issues have been addressed, demonstrating that portable sawmilling can be implemented sustainably. The EU-funded PNG Eco-Forestry Project, though now wound up, took over an 11-step process that had been developed by an earlier EU-funded project, a system for improving forest management that can be used by sawmill operators with very little training (IRECDP 1993). This system involves the inventory of stands of a defined area, locating every tree on a map, demarcation on the tree and on the map of every tree of merchantable size and noting of the desired direction of felling, and determination of the volume of each tree by a simple 2-way volume table based on diameter and height. From this, the "merchantable" volume of the stand is estimated and the trees available for felling are identified. The system allows felling of only 25% of the merchantable volume on any one occasion, and specifies a return time of 20 years between felling. While these rules and procedures represent a simplification of the ideal procedures for selection logging, they should be sufficient to ensure the sustainability of harvesting at the relatively low intensity typical of portable sawmilling operations.

We visited an example of the implementation of this system in the Ramu Valley. Here, the compartment area was 10.5 hectares, containing 160 trees of a diameter greater than the 50 cm cutting limit. Only 28 stems were to be felled in the first cycle. This represented 250 cubic metres of a total merchantable volume of about 1000 cubic metres. The stand assessment complied with FSC requirements and practices were being assessed as part of FSC accreditation when we visited the site.

Thus, another key conclusion reached by the project is that current methods of selecting trees for milling by portable sawmills will not achieve resource sustainability and thus not satisfy forest certification requirements. We recommend that the system of assessment and tree selection for harvesting developed by the PNG Eco-Forestry Project be adopted across both PNG and SI.

There are clearly significant roles for both the PNGFA and the SI Forest Department, as well as for NGOs, in facilitating implementation of this recommendation. Neither the traditional owners of the forest resource, nor the operators of the portable sawmills, have the requisite knowledge necessary for its implementation. Thus, communication and extension activities are necessary if the system is to be implemented more widely (see Section 8.4, below).

7.6 Economic aspects of portable sawmills

A separate report for this project (McGregor 2008, annexed as Attachment 4) assessed the financial viability of portable sawmill operations. Its principal findings are summarised below.

Papua New Guinea: As noted previously, portable sawmilling is a minor part of forest-based industries when compared to large, expatriate-owned logging companies. Groves (2001) estimated that there were, in 2001, between 700 and 5000 portable sawmills with 'only 1,000 of these working on a daily basis', with a total production of sawn timber is 50,000 m3/year, corresponding to an average of 50m3/mill/year' (sic). As harvesting operations producing less than 500m3/year of sawn timber do not require a permit to operate in PNG, this industry is essentially unregulated. In contrast to the industrial logging sector, the portable sawmill industry is 100% nationally owned; it was estimated in 2005 to employ some 2000 people (FSP/PNG 1995).

Solomon Islands: As noted above, NGOs strongly encouraged the use of portable sawmills as an alternative to large-scale logging and as a sustainable income-earning opportunity for rural people. Numbers of portable sawmills increased rapidly to more than 700 in the 1990s, although most of these small-scale enterprises did not last long. Today, there are around 200 Lucas mills, of which half are operating commercially and another 20 semi-commercially (T. Titiulu, pers. comm.). The remainder operate sporadically for village use, or not at all.

The returns from portable sawmills in SI have proved to be significantly higher than logging royalties (Rosomon et al. 1998). At the peak of portable sawmill activity, small sawmills cut about 8000 m3/year, but this was less than 2% of round log timber production at the time (AusAID 2005, Vol. 4: 29). Nevertheless, a study in Choiseul Province notes that in 1999 small-scale sawmills injected more that $3 million into the province's economy (AusAID 2005, Vol. 4: 28).

7.6.1 Determinants of productivity

Many variables impact on the productivity, and therefore on the financial viability, of portable sawmills. There is a variety of reasons for this, including:

- The motivations for purchasing or acquiring a portable sawmill, and the business ethic of the enterprise;
- Species size, bole shape, and quality of logs;
- Whether logs are transported to a mill, or the mill is brought to each log;
- The overall organization and management of the mill site, and efficiency of the operation;
- The ready availability of spare parts;
- The skill of the operator in terms of operating and maintaining the mill, and his ability to determine the most efficient way of sawing each log; and
- The method by which log and sawn timber volumes are estimated.

A key determinant of productivity and viability (financial and economic), and environmental impact, is the recovery rate, i.e., the proportion of the felled tree that is converted to cut lumber after sawing. Recovery rate depends on all of the above factors. The recovery rate for chainsaw mills such as Alaskans is 30-40%, while those for circular- and band- saw mills are generally better at averages of 40-60%. Helden and Schneeman (2000) note that log recovery may be 10-15% higher if one includes off-cuts and pieces used for firewood.

7.6.2 Financial models

The financial model presented below is based on data from the Solomon Islands (data collected by A. McGregor from Mr. J. Houria, AusAID Solomon Islands Forest Management Project). The parameters indicated are for a commercial single-circular sawmill operation, as follows:

Parameters	
recovery(%)	
average	0.35
upper limit	0.40
sawn timber output per day (m3)	
average	3.0
upper limit	5.0
lower limit	2.0
operating days	
per week	5
per year	200
annual throughput (m3)	
logs (average)	1,700
logs (upper limit)	2,500
sawn timber (average)	595
sawn timber (upper limit)	1,000
Prices received ($SI/on beach)	
Kwila and rosewood	2,400
vitex and white beech	1,900
eco-certified timber	5,800
Capital cost (on-site)	
Lucas mill 30 HP	137,000
Skil chainsaw	16,500
Safety equipment	3,800
Equipment life (years)	
mill	3.0
chain saw	1.5
Safety equipment	3.0
boots	1.5

The base case financial viability model presented in Table 1 of Appendix 1 is for a commercial single-circular sawmill operation operating 200 days per year, sawing and converting 1,700 m3 of logs to 595 m3 of sawn timber. It was assumed that the mill is located in reasonable proximity to a beach where the timber is sold for an average of SD2,000/m3, or for ship pick-up to transport to Honiara wharf for sale at a higher price.

The results of the model, as presented and discussed by McGregor (2008), show that a portable sawmill regularly used and operated reasonably efficiently can be highly financially viable. Over a seven year operating period, the enterprise generates a net cash flow of SD 9.7 million (i.e., AUD 1.4 million per year), corresponding to SD 1.5 million or AUD 209,000 per annum. The net present value (NPV) based on an interest rate of 12% is SD 5.3 million (AUD 0.8 million). For an initial capital investment of SD 160,000 (approx AUD 24, 000), the internal rate of return (IRR) on that initial capital investment is an impressive 650%. In addition, portable saw mill operation pays around SD 48,000/year in wages to the community in which it operates.

The financial returns of portable sawmills are sensitive to the efficiency and level of utilisation. However, because the initial capital costs are quite low, the sawmill enterprise remains financially viable even if there is a substantial reduction in use and some reduction in efficiency. If it is assumed instead that the sawmill operates for only 100 days per year, sawing 700 cm of logs per year with a recovery of 30%, and the on-beach price remains the same at SD 2,000/cm, the net cash flow over the 10 years is SD 2.0 million (AUD 0.3 million), with a NPV of SD 1.0 million (Table 2 of Appendix 3). The IRR on the initial investment remains a very healthy 157%.

The financial viability model for a less intensive level of utilisation, as shown in Table 2 (Appendix 1), could be consistent with an operation producing eco-certified timber. and working intermittently throughout the year (refer to that table for further details). Table 3 of Appendix 1 also includes other costs associated with obtaining forest certification. It is assumed that the initial cost of obtaining certification is SD 50, 000, with the additional ongoing cost of compliance being SD 20,000. Due to the much higher price received for eco-timber (reportedly SD 5,800/cm, and

assumed for this analysis), this proves to be a highly financially viable operation, with a net cash flow over the 10 years of SD 9.6 million (AUD 1.5 million), with a NPV of SD 5.2 million. The IRR on the initial investment is nearly 500%.

7.6.3 Economic and financial criteria

In both the Solomon Islands and PNG contexts, those operating outside the cash economy have difficulty accessing loans from financial institutions. In addition, customary land or forests cannot be used as security or collateral to obtain a loan from a commercial bank. The relatively low capital and direct costs of set-up enable groups of people to share the operation in a village context, and to use timber resources for village construction projects. Subject to a number of infrastructure and other constraints, there is also potential for other economic activity to take place as adjuncts to timber milling, such as joinery shops and more general building construction.

In both PNG and SI there are also additional problems in estimating returns and managing operations to optimise returns from portable sawmilling. Firstly, portable sawmillers do not measure log volumes because they own the logs that they mill, and are interested only in the quantity of sawn timber produced for sale. Therefore, it is difficult to estimate the rate of recovery of sawn timber per unit of log volume, and thus productivity (Groves 2007). A second problem is a result of the standardized over-cut allowance adopted across all timbers irrespective of width, thickness and species (Groves 2007). As timber is usually not milled according to the desired final dimensions, the extra allowance adds to a higher proportion of wastage.

In the Solomon Islands it has been very common for the commercial agent selling portable sawmills to, in effect, 'lend out' a sawmill unit to a village group on the basis of virtually no funds paid up front, but with all income derived from sawmilling for the first three months or so and the sale of sawn timber during that time to be paid to the agent until the unit has been paid for. This practice does not occur in Papua New Guinea where sawmill units need to be paid for up-front in cash by a village community, by their Member of Parliament, by a provincial government or by an international aid donor.

7.6.4 Models and reality

The models reported in Appendix 1 are for the Solomon Islands, but also considered to be broadly applicable to Papua New Guinea, show that portable sawmill operations can provide high financial rates of return at relatively modest levels of utilisation and efficiency. It is thus surprising that the attrition rate of commercial portable sawmill operations in the Pacific islands is so high. Few portable sawmill operations approach even the modest levels of utilisation and efficiency assumed in the models presented above. The productivity of portable sawmill operations is exceptionally low for a variety of reasons noted in the various country visits. In particular, these are:

- lack of knowledge by portable sawmill operators of the widely varying properties of different species as raw materials for milling and processing to add value, and their desirability in markets other than local ones. Operations thus typically receive much lower prices than those assumed in the models;
- lack of physical access to markets. The Solomon Island models are based on a beach price for sawn timber and, therefore, assured transport to market. However, the situation in some parts of the SI, and in many parts of PNG, is different, with poor if any physical access;
- lack of skill and technical expertise, coupled with lack of backup from equipment suppliers, resulting in the sawmills being out of operations for extended periods of time, often indefinitely;
- lack of business skills by sawmill operators/owners; and

- other variables that have noted been included in the modelling, such as socio-cultural constraints and the significant impact of not being able to operate these portable sawmill units safely during the rainy/monsoon season.

The financial returns of portable sawmills, as shown in Tables 1, 2 and 3 of Appendix 1, are sensitive to the efficiency and level of utilisation. However, because the initial capital costs are comparatively low, the sawmill enterprise can remain financially viable even if there is a substantial reduction in use and some reduction in efficiency. However, there are additional issues of ongoing operating costs and fluctuating timber prices that also need to be taken into consideration in assessment of returns on investment.

8 Impacts

A number of Pacific Island countries, PNG and SI included, are nearing the end of an extended period in which the industrial harvesting of their native forests has provided a significant proportion of their national incomes. Within a very few years, timber for domestic use and premium timber for export will have to come from managed re-growth forests or from managed forest plantations (Bond 2006; Kanowski *et al*. 2005).

The introduction of portable sawmills into rural communities originally held, and still holds, the promise of providing an appropriate technology whereby landowners' livelihoods will be enhanced, and their most important assets, namely their land, their forests and their traditions, will be sustained.

8.1 Scientific impacts now and in 5 years

As noted in Section 5, portable sawmills are not new technologies in either PNG or SI, and the purpose of this project was to review learning from their use in both countries. Consequently, the project was not oriented to delivering scientific impacts. Nevertheless, it is possible to identify a number of scientific impacts associated with the appropriate adoption of portable sawmills. These intersect to varying degrees with the capacity, community and related impacts outlined below, and are therefore discussed in those contexts below.

8.2 Capacity Impacts now and in 5 years

Pacific Islanders living in rural communities are to a large extent still living largely outside the cash economy and on the fringes of modern technology. Adoption of portable sawmills offers a pathway to the development of skills that are both useful at the community level and portable into the cash economy. These include the elements of sawing technology itself – such as mechanical maintenance and operation – and more generic business skills. Appropriate use of portable sawmills can also, as the PNG Eco-Forestry Project demonstrated, improve communities' capacity for sustainable forest management. However, capacity impacts depend largely on the provision of relevant training, such as that in portable sawmill operation provided by TITC in PNG and NGOs and projects in both countries. Project consultations in both countries emphasised the need to build commercial skills capacity relevant to operating portable sawmills as a business.

The project found that:

- technical capacity for portable sawmill operation was generally adequate, where operators had received training, but training to maintain and enhance these skills into the future, and to foster safe working practices, were required. These could be delivered through current training providers in both PNG and SI, provided these providers were adequately resourced;
- capacity for implementing sustainable forest management principles was generally poor among portable sawmill operators, but the EU-PNG Eco-Forestry Project experience demonstrates that this can be addressed. An obvious strategy would be to emulate the approach adopted by that Project, with a focus at the community level, and on-the-ground interaction between professional or technical foresters and community members and portable sawmill operators;
- skills and capacity relevant to small business and commercial activities are almost universally poor. There is a reasonable level of self-realisation in many communities of this, and a desire to build skills and capacity. Investment in capacity building in this area, through appropriate training providers, is necessary to capture the potential economic and social benefits of portable sawmill operations for both sawmill owners and the forest-owning communities. This could be done through NGOs or small business support units;
- a specific element of business capacity building which will benefit portable sawmill enterprises is better understanding of the local, national and international timber markets available to portable sawmill products. Similar market information needs have been identified for small-

scale timber producers in Australia, and various measures to address them have been initiated (Bhati 2004).

8.3 Community Impacts – now and in 5 years

The benefits to rural communities that could follow from the adoption of portable saw-milling and its successful and sustainable implementation are to enable them to obtain at least some of the benefits available in towns while retaining the aspects of traditional village ways of life that they want to retain. In particular, portable sawmilling of their own forests allows people to derive either or both non-commercial and financial benefits from their customary resources, without losing their customary natural resource rights.

The potential of portable sawmilling to deliver these community benefits is currently realised to a greater extent in the SI than in PNG, because of the greater level of portable sawmill activity, the 'mainstreaming' of that activity in terms of policy, and better-developed markets for portable sawmill products there. Little of this potential has been realised in PNG because of the dominance of large-scale industrial logging and the marginalisation, in both policy and market terms, of portable sawmill production.

In general, the following community impacts can be expected in 5 - 10 years time:

- The majority of large-scale logging projects in PNG and SI, as they are currently being practised, will have ceased. In PNG, the state through the PNGFA will need to negotiate directly with community-level forest resource owners to form partnerships to rehabilitate previously logged-over forests, and so secure future access to timber resources. Plantations will begin to be established on logged-over forests and/or on extensive areas of grasslands. As a result, local communities will be much more involved as genuine partners in the regeneration, management and sustainable extraction of timber from their forests. This will emphasize the role and potential of locally-controlled technologies such as portable sawmills;
- In PNG, provisions of the recently amended and approved Land Groups Incorporation Act (as amended, PNG 2009) will have come fully into force, requiring customary resource-owning groups, such as clans, to demarcate their land ownership boundaries and to have established their business methodologies for working with outside parties (whether other PNG individuals or groups, other business enterprises, government interests, or foreign entities). The application and implementation of this amended law should help reduce the current plethora of land disputes, and establish more enforceable and secure arrangements conducive to longer-term natural resource-based business activities. As a result, the situation will approximate more closely to that which currently applies to portable sawmill operations in the SI;
- If the recommendations of this report are implemented, there is the potential for a much higher proportion of local needs for wood (for housing and community infrastructure) to be sourced from locally-owned portable sawmills operated by a local workforce, and for a greater volume of timber to be marketed domestically and into the international market with this volume to originate from portable sawmills;
- Community income and employment derived in these ways will assist local communities to better manage their natural resource assets, and to fund improvements in each community's infrastructure – schools, roads, water supplies, health centres, community centres, employment opportunities.
- If the recommendations of this report are implemented, portable sawmill owners in both countries will register their sawmill units with the national forestry agency (either centrally or at provincial level), submit written agreements for proposed operations to local forest owners (copy to the national/provincial agency) in order to obtain local and departmental approval, and regularly report their work output statistics. Strengthening these links into policy and management reporting systems should help raise the profile of the portable

sawmill sector, and assist in ensuring the sector receives appropriate public policy attention and resources.

8.3.1 Economic impacts

Most rural dwellers in Pacific Island countries live on the fringes of the modern cash economy. Past attempts to use forestry activities to generate income, and improve infrastructure and wellbeing, for these people have had only very limited success. There is much evidence from both PNG and SI (e.g., Filer & Sekhran 1998; ODI 2006) that where forests have been logged by industrial forestry companies, the financial benefits realised for local communities were significantly less than expected and certainly much less than those promised, the infrastructure improvements have been transitory, and the damage to the residual forest and to the environment more generally (including soils and water) has been severe. Portable sawmilling offers an alternative means of income generation based on technology that is both at a level and of a scale more easily accommodated by rural communities without major disruption to their lifestyle or natural resource assets.

While the capital cost of a portable sawmill is much less than alternatives, it is still a formidable barrier to those largely outside the cash economy. With no tradeable assets to provide security, the owners of customary-owned forests often find the acquisition of even such a low-cost asset as a portable sawmill (approx. AUD 25,000) impossible to achieve. Charitable organizations and NGOs (the donors of a vast majority of PNG's portable sawmill units) that provide all or part of the capital may continue to play a valuable enabling role in these circumstances. Various arrangements are possible for these organizations to provide capital, varying from providing a grant to making a loan which might be repaid by accepting sawn timber as repayment instalments.

Research for this project has highlighted that portable sawmill operators' objectives range from pursuing benefits that are entirely economic to those that are essentially social, or a mix of the two. Financial modelling demonstrates that a portable sawmill run solely for financial goals, under favourable conditions, can be extremely profitable in a Pacific Island context. Even when allowance is made for more common operating conditions, such as part-time use and a low standard of utilisation, profitability may still be quite high. The high profitability is in part a result of the low capital cost of the mill and the low (by Australian standards) labour costs. The financial modelling conducted as part of this project suggests that returns from portable sawmilling are likely to remain favourable even under higher cost structures. Our research also demonstrates clearly that financial return may not be the principal objective for portable sawmill owners in many cases, and that economic impacts should be understood in the wider sense of, for example, avoiding the costs associated with importing non-local building materials.

Our research also demonstrated that capture and appropriate allocation of the full economic benefits of portable sawmills depend on a number of institutional and capacity factors: regulation by the state, informed consent by the community, adequate business and operating skills on the part of mill owners, and appropriate benefit sharing between these three sets of actors.

Our research activities and our more general knowledge of development constraints and opportunities in PNG and the SI, suggest that addressing the following recommendations would optimise future economic returns from portable sawmill ownership and operations:

- Education of landowner groups to be much more aware of both their rights (and responsibilities) and of the multiple ways in which entrepreneurs can operate and access others' resources, so that landowners will be better placed to negotiate with entrepreneurs about portable sawmill operations and timber sales;
- Encouragement of portable sawmill owners and operators to form associations that act on their members' behalf, collect and collate operating statistics from its members to pass on to the relevant authorities, and promote implementation of occupational health and safety requirements and good operating practices;
- The practice of differentiating portable sawmill owners from forest owners, and formulating formal arrangements for access, already prevailing in SI should be replicated

in PNG. Agreements between portable sawmill operators and forest owners for felling and processing should be in written form and approved by monitoring authorities so that resource owners are not exploited. In conjunction with operator associations, as suggested above, government authorities might require the lodging of previous operating statistics before the renewal of annual licenses;

- Both PNG and SI customary resource owner groups would develop and implement their own infrastructure plans with local, provincial and national government agencies. One aspect of such planning will necessarily be transport infrastructure, both terrestrial and water-borne, to allow produce of various kinds to be transported to markets. In PNG in particular, lack of access to transport infrastructure is a significant constraint to market access for many current or prospective portable sawmill operators;
- Financing for the purchase of portable sawmills needs to evolve into much more flexible ways, particularly in PNG, and especially if such a unit is being acquired to serve mainly social goals such as a village housing program.

8.3.2 Social Impacts

Positive social impacts associated with portable sawmill operation can be expected when the products of a sawmill are used to provide amenities not otherwise available to the community. Such benefits could come from the construction of buildings for community use, such as churches, school buildings or a health centre. Houses for individual families can also be classed as community assets when derived from community-owned forests and built in succession so that eventually most or all families in the village benefit.

A sawmill unit itself may be owned by the community as a whole, but used in turn by members to attain particular goals approved by the community, such as provision of wood for individually owned houses. Working to operate the mill may be a way to gain some community credit or repay debts to the community.

The provision of permanent housing in a community may also provide both direct and indirect social and health benefits. It will stabilise the location of the village and make it worthwhile to build or upgrade the road to it. Market places and other shared facilities for a village with a stable location may be needed. Services provided by government are more likely to be delivered to a stable village location than one based on non-permanent housing.

8.3.3 Environmental effects

Past large-scale harvesting of forest resources, in both PNG and SI, has resulted in a greatly changed forest structure, altered species composition and in some cases significant loss of forest areas to grassland. Unwise use of portable sawmills can also lead to these consequences, albeit on a reduced scale. This can occur when undersized logs are sawn, harvest is confined to the most valuable species and cutting is concentrated within a small area. In the past, when portable sawmills have been used to provide timber to merchants for resale, the accumulated effects on the forest of many unregulated harvests have damaged the environment. This has principally been the case in PNG, where portable sawmill operations are currently unregulated. These adverse impacts will be significantly reduced if our recommendations for the regulation of portable sawmills in PNG are adopted, i.e., the volume of unregulated harvests be reduced to 100 cubic metres (log volume) per year, and larger harvests needing to meet a requirement to be subject to formal forest planning, including regular monitoring and reporting.

With any scale of forest harvesting there is a risk of erosion and the steep terrain often found in many Pacific countries and the rates of rainfall that occur during tropical storms and generally during the rain season exacerbate this risk. In part the much smaller scale of tree felling that is adequate to supply portable sawmills by itself reduces risks. However, the use of portable sawmills implies that logs must be sawn on-site where the tree has been felled and that this cannot be altered

in order to reduce the risk of erosion. Sawing several logs from the one tree on adjacent sites and clearing to gain access for machinery and removal of produce means that although the risk may be lower than for conventional logging, it cannot be avoided altogether. Part of the procedures developed by the EU Eco-Forestry Program was to determine the direction of tree felling so as to give the most stable, erosion-free position for sawing with the least disturbance to the residual stand. Such procedures are regarded as essential and, if followed, will almost certainly improve past practices.

On this basis, the following positive environmental outcomes can be expected in 5 to 10 years time (these can also be read as recommendations):

- Harvesting of trees in portable sawmill operations will comply with and be consistent with sustainable forest management principles and practices;
- A broad program of work will have begun in virtually all logged-over forest areas, undertaken either by each resource-owner community itself, or in cooperation with the relevant forestry agency, the PNG Forest Authority or the SI Department of Forests, to rehabilitate and revegetate these environmentally heavily impacted areas. An existing method of doing this in PNG, the Vigus method (KGIDP 1997a; KGIDP 1997b), has been shown to be effective in terms of resource owner groups taking responsibility for the regeneration of their own areas of forest. Training in this method will be needed and associated nursery establishment in each of these communities to provide seedlings for replanting;
- Training (and re-training) programs that focus on the environmental dimensions of forest harvesting and management using portable sawmills in tropical rainforests will continue to be re-emphasized. These will be based on the practical measures developed and implemented by the EU-PNG Eco-Forestry Project, such as the need to source trees from a variety of places for processing (rather than keeping the mill in one location), directional felling, and replanting twice the number of stems that are harvested.
- Oversight and regulation of the annual volume of sawn timber that customary landowners can harvest from their forests using a portable sawmill are needed to ensure that levels of harvesting (by both local communities and external operators to whom communities might allow access) are sustainable.

8.4 Communication and dissemination activities

The skill levels seen during various sawing demonstrations during field visits showed that previous and existing training schemes have been successful. These should be maintained and strengthened. Two main levels of training exist in PNG, and one in SI.

In PNG, of the two main training programs, an excellent course is run through the Timber Industry Training Centre (part of the PNG University of Technology) and the other through a few NGOs, the principal one being Village Development Trust. The former does not have an ongoing field and monitoring component while VDT and a few other NGOs work closely with village-based groups after training and as part of implementation. Existing courses should be strengthened, refresher programs instituted through both avenues; a strong business training component needs to be added to existing programs. The state through the PNG Forest Authority (PNGFA) has in the past not shown much interest in portable sawmills though some provincial administrations do. Since the PNG-EU Ecoforestry Project ended, the PNGFA has drafted a framework law through which to establish tighter controls over this level of forest extraction. To date this draft has not been approved by the National Executive Council and was quite recently withdrawn by the PNGFA for review.

In SI, portables sawmills are much better integrated into the overall forest management process led by the government Dept. of Forests. The Ecoforestry Unit of the Solomon Islands Development Trust (SIDT) has been coordinating the identification and mapping of the areas of customary land and forests in question. Decisions have been made in consultative ways about the proportion of forest to be logged and the remaining area to be conserved. If the forest owners do not own a

portable sawmill then a licensed portable sawmill owner is engaged to do the actual felling and processing. Forest owners and sawmill operators usually agree to divide the sawn timber and each party can then use or sell its portion. Outcomes include that portable sawmill owners and operators are highly experienced; have their own professional association; they travel to areas to be logged; forest owners can have a proportion of their trees harvested without needing to own a sawmill unit; the Forestry Department either directly through its own staff but mostly through specialized staff of SIDT continues to monitor rural logging projects; marketing of sawn timber shipped in and landed in Honiara continues to find a good market from a small group of buyers of sawn timber.

The most important of the other recommendations emerging from this project involve additional training to improve the level of forest management and to acquire fundamental business understanding and application, as noted above in terms of what each involved organization does in terms of portable sawmills.

Other key recommendations involve increasing the level of monitoring of forest operations and yields. While this also implies increased levels of administration by existing or new government forest agencies, there will likely be few revenue opportunities available for governments from this extra work. However, if the benefits are to be captured without adding to the deterioration of forest resources throughout both countries, we regard this step as essential. One recommendation made during the course of a project field visit was that portable sawmill owners should establish their own association. This recommendation emerged because portable sawmill owners expressed considerable reluctance about supplying ongoing information (such as their working information, volumes cut in particular locations, or agreements with landowners) directly to the PNGFA regional and district offices. While some tasks such as field inspections of forest operations will require the authority of an appropriate Government agency, it is possible that other functions may be carried out by other agencies, including NGOs, with or without the requirement for a Government licence.

It is likely that some NGOs or church organizations may be able to carry out some training functions to Government specifications. This may be appropriate where simple business skills need to be acquired. Methods of preparing business plans to forecast feasibility and prepare estimates of costs and returns, recording actual costs and returns and comparing these with those forecast are relatively straightforward skills at this level and could possibly be taught outside the existing educational system (or in conjunction with it).

There will also be a need to take these skills to the villages, but as was the case of sawmilling where the attendance at training was a prerequisite for mill purchase, training in elementary forest management and business skills should also be required before a cutting licence is granted.

In 5 years time, desirable communications and dissemination activities will likely include:

- A network to share implementation practices, experiences and knowledge will be operating between communities in PNG and SI engaged in sustainable management of their own forests in order to adopt best practice and to enable village communities to properly engage in this strategy. Part of this network will focus on information about local, national and international markets for the various tree species found in the two countries; it will also foster higher standards of practice (e.g., Forest Stewardship Council certification standards);
- Access to information and knowledge will be widely available and regularly used so that decisions can be made on the basis of reliable and relevant information;
- Training programs, not only in the technical aspects of portable sawmill use but also in the wider environmental implications of their application, will continue;
- The use of portable sawmills, particularly in PNG, will have improved in standard to the point where portable sawmill owners will have an active and responsible association that ensures that proper record keeping is maintained and regularly reported to the state authorities;

- Information on markets will be clearer and widely accessible (possibly even through mobile telephony), including to the middlemen working out of town centres who are supportive of the work of village communities. Other avenues of resale, such as a partnership timber yard in urban areas, will also have been explored and proven as either feasible or uneconomical; and
- There may be some new NGOs in place that will focus particularly on providing the technical, advisory and institutional back-up for community groups that want to set themselves up to manage their own forests in a sustainable manner. Equally, the PNGFA and the SI Department of Forests will be setting up collaborative partnerships with these aims in mind.

9 Conclusions and recommendations

This final section presents the conclusions arrived at in this study, draws out their implications, and sets out a number of recommendations that emerged from the collected information from many different sources.

9.1 Conclusions

Some significant differences in the ways in which portable sawmills operate in PNG and in SI became evident as this study progressed. In the latter, portable sawmills operated within a state-regulated and licensed system. Their entry into and use within customary forest tenure systems was carefully guided by a facilitation process operated by an NGO; transportation difficulties of bringing wood products into an economic market from a context of many smaller islands separated by ocean were regularized and a competitive market situation had developed between merchants willing to buy sawn timber.

In contrast, in PNG the state-level regulators were not interested in these local-level operations, preferring to focus attention on the foreign-owned large-scale logging operations taking place in a number of mostly remote locations around the country. Thus it was NGOs that promoted portable sawmills; more recently these have been taken up by entrepreneurs to send machinery and operators to community-owned rural forests. These have had more or less significant and negative impacts on these local communities and their forests.

The choice of forest within which to operate and, within the forest, of the trees to fell and process was often made without proper consideration of sustainability. Those carrying out these operations seemed to have little idea of the impact of their actions on the environment or on the sustainability of their forest. Using a portable sawmill in the existing conditions of the Pacific is not easy: much of the terrain is steep making carrying machinery difficult; the weather is often inclement; and extracting the sawn produce by hand is 'back-breaking' (and unpopular) work. There was much evidence of local over-cutting, of setting up the mill where it might cause erosion and of felling mainly 'kwila' trees (*Intsia bijuga*), the most sought-after hardwood species. The choice of which individual tree to fell seemed to be made on the basis of convenience rather than any concept of forest sustainability. This is understandable in view of the arduous task of sawing trees in these remote areas and the lack of training among community forest owners in aspects of forest management other than sawmilling.

An important exception was a small forest where management of its operation had followed directions developed by the EU-sponsored Eco-Forestry Project in PNG. Classic rules for cutting, cycle definition and tree selection had been simplified for application in the PNG situation and the result was a well-managed forest that would likely be sustainable in perpetuity if other factors remained supportive.

Evaluating portable sawmill operations on a strictly commercial basis ignores many factors typical of the Melanesian region of the Pacific. It was clear that many sawmills had not been purchased with the intention of operating them on a commercial basis. In other words, they operate when occasion demands such as when the owners have a need for cash to pay for children's school fees, when cash is needed to pay for celebrations and/or when community facilities or housing are required. When these objectives are satisfied the mills stop operating; this could partially explain the disparity between mills purchased and the numbers operating at any particular time. Adverse weather during the monsoon season and the need to maintain subsistence food crops as well as the relatively short physical life of the mills under bush conditions (three years was frequently quoted) are other explanations for this apparent discrepancy.

It is clear that many isolated communities experience difficulties when attempting to sell their sawn timber on a commercial basis. In particular, the steep dissected terrain of PNG and the many small islands separated by ocean, and the consequent lack of reliable road infrastructure make fully

commercial transactions extremely difficult for most of the population when their markets are in a town or central location some distance away. Many community forest owners sell their produce to middlemen who own the means to transport sawn timber to markets. These can be sawmillers or timber merchants owning fixed mills in a nearby town. Transactions between these parties were often unsatisfactory and it is likely that by purchasing from many forest owners and amalgamating the timber volumes, some owners of larger mills were circumventing the rationale behind exempting owners of portable sawmills from controls.

In the Solomon Islands, although similar difficulties exist, water transport most often replaces roads, and a competitive market for sawn wood does exist in the national capital, Honiara. Owners of portable sawmills therefore tend not to experience the marketing difficulties experienced by their counterparts in PNG.

However, it bears repeating that a portable sawmill is simply a tool that can be used wisely or not. Strategies should be designed to ensure that in future, as well as increasing social and commercial benefits, the environmental values and forest sustainability in general are also strengthened and maintained.

Factors for Success: From the conclusions arrived as summarised above, a number of factors for portable sawmilling success in Papua New Guinea and the Solomon Islands emerged, informed also by lessons that could be learned from portable sawmilling operations in Australia. The key factors are:

- agreement within the community at all levels (family, clan) about the harvesting of that community's forest and as part of a process for regular community dialogue:
- a regulatory environment that recognises and supports the wise use of portable sawmills;
- adequate technical training in portable sawmill operation and maintenance and in implementation of sustainable forest management principles;
- efficient and competitive markets for sawn timber products; and
- the development of small business skills for operators and communities involved in portable sawmill enterprises.

These elements that make for a successful portable sawmilling operation in the Pacific context have been clearly outlined in this report. Project study teams in their country visits were able to test most of these elements with participants at project meetings, confirming their relevance. These elements are discussed below under separate headings:

 # Natural Resources

Access to natural resources, that is, from sustainable managed forest, is a critical element for an intending commercial portable sawmilling operation. For an operation that is aimed at meeting social criteria, such as the building of a church or a rural health centre, access to a forest resource also needs to have been arranged and agreed, but without the commercial aspect.

For a land group (or a family within it) that is setting up a portable sawmilling operation, assuming that all permanent land group members support it, access to the forest resources held by that land group is assured. However, even with an extensive resource base that resource is finite. Access to neighbouring land groups' forest resources is not assured though it may be able to be arranged by including payments for this access or for other land groups selling their timber to the operation. In a sense this indicated that unless access to the resource base is arranged and agreed upon from the beginning of a project that project will eventually fail.

- By registering portable sawmill owners and operators separately from the customary forest resource base, the Solomon Islands Dept. of Forests has broken the previously-assumed link between holding rights to forests and owning a portable sawmill unit. Before a logging or milling operation can get under way the customary land group is required to undertake a land use mapping exercise. This decides what proportion of that land group's forest can be

cut and milled with the remainder requiring to be left standing. A licensed portable sawmill owner then comes in with is crew and cuts the agreed upon number of trees; he usually retains an agreed percentage of the sawn timber as payment for his services. The forest owner can then either keep his percentage of the sawn timber, for example, to build a house, or arrange to deliver that sawn timber to Honiara (or elsewhere) for sale.

- In Papua New Guinea, by contrast, the situation is rather less clearly arranged: the PNG Forest Authority has had no real interest in portable sawmills and only one or two provincial governments have tried to license and control these units in their areas. Other than for projects with social aims, this has allowed entrepreneurs to send their portable sawmill units and work crews into forest areas to make their own arrangements with land groups that own forests. In the past there has been much manipulation of forest owners involved and widespread cutting down, even clearfelling, of large areas of forests (the Ramu Valley, visited by the project team during its PNG trip, was one of the targeted areas for such entrepreneurial activities).
- Other than attempts in the Solomon Islands to maintain a coherent land use mapping approach and linking permission to cut trees to access by licensed portable sawmill units, both countries have not paid much attention to sustainable forest management requirements, nor to the initial prerequisites of bringing in portable sawmills - low impacts, minimal shifting of logs and processing logs where felled, operations by communities themselves of their own forest resources and benefitting financially from such activities, and regular replanting of tree seedlings to replace logged trees.

 # Markets

For a commercial operation having access to markets provides the promise of a steady income stream.

- Virtually no spontaneously set up portable sawmilling operations in Papua New Guinea had set up specific market access before purchasing the equipment and many such operations ended up cutting timber, sometimes high value species, and turning the sawn timber into pallets for sale to urban businesses.
- Some PNG NGOs set up timber yards in urban areas through which to sell sawn wood of various dimensions to urban customers. Every one of these timber yards closed down within a few months due to lack of stock turnover and insufficient profits.
- In the Solomon Islands the linkage between portable sawmill licenses and the required land use mapping exercise ensured that portable sawmill owners, directly or indirectly would be paid for their work and that forest owners who had some of their forest logged and milled could build better houses for themselves and sell the surplus.
- There is a virtual auction system operating at the Honiara waterfront in the Solomon Islands that allows the owners of sawn timber landed there (and not already committed to one or other urban-based purchaser) to achieve good returns for their sawn timber.
- There are currently no timber middlemen operations in neither country that could buy sawn timber of various dimensions at ‘the farm gate’ from portable sawmill operations, transport this sawn timber to urban areas and resell it there.

 # Equipment and Technical Skills

This report sets out descriptions of the most common portable sawmill units being used in Papua New Guinea and in the Solomon Islands with some comments from other contributors in relation to some other South Pacific countries.

- In general, study team visits to both Papua New Guinea and Solomon Islands noted that the technical skills being applied by operators using portable sawmills was of a good standard, with sawn dimensions of wood also being accurate. Refresher courses should, however, be held regularly in each province of both countries to encourage portable sawmill operators to keep up to these standards.

- The operating standards that were deficient in both countries were deficient in terms of occupational health and safety issues and these should receive particular attention during regular refresher courses.
- One major issue that emerged from portable sawmill owners and operators in both countries was the high cost and scarcity of spare parts, particularly the circular saw blades. While these circular saw blades can be re-toothed, most operators purchased new blades rather than undergo the high cost and waiting time involved in re-toothing by the portable sawmill agent.

 # Business Skills

A clear deficiency in both countries has been that having business skills and maintaining a business approach to running the operation have generally not been part of the move into portable sawmilling. Where the aim of a portable sawmilling operation has been to meet particular social needs (the building of a church or a health centre) this lack is not critical to meeting the aims of the operation. However, where the aim has been to work towards self-sufficiency or to generating profits, then this lack manifests itself very quickly when spare parts are needed or the next load of fuel needs to be purchased. This description can be applied in both countries.

Ideally, in communities where such a commercial project is being set up the following descriptors should be able to be applied:

- There is a comprehensive business plan of the financial components of purchasing (through either or both paying cash and using credit) and operating a portable sawmill, put together by the community or by a responsible incorporated land group (ILG);
- Investment is needed to ensure that land group operators are properly trained and continue to operate the equipment safely, are paid properly and are loyal to their tasks;
- There is an understanding and analysis of what market opportunities might be available to such an operation – for example, where are the nearest markets, what will they paid for what products;
- Could a community investment be better used in other forestry options or in existing of new agricultural activities in the same area, what other employment opportunities are there in the area, what environmental impacts are there likely to be if a portable sawmill operation is chosen?
- Does a customary land group have an agreement on how a proposed portable sawmill business will be managed, who will operate it, what are the likely returns, long-term viability (or not)?
- Is there an understanding in the land group of the direct and indirect impacts on various sectors of the community from the operations of a portable sawmill, how can negative impacts be minimised, what longer-term follow-up activities will be needed (to which group members will need to agree and make a commitment of time/labour); and

 # Social Capital

This report shows quite clearly that social capital is an important, a critical background aspects to the success of portable sawmills in the Solomon Islands and in Papua New Guinea. This importance is shown in the need for regular open meetings held by customary land groups to keep everyone informed of developments in relation to the operations of a portable sawmill. Quite often a group-based portable sawmill operation begins in this way but then over time deteriorates into a one-man or one-family operation that effectively shuts out other families within the same land group or clan. However, even the one-man or one-family operations sooner or later will need to fall back on this social capital in order to continue to operate properly.

As a result, if the aim of having a viable portable sawmilling operation continues to be the aim, then the maintenance of elements of social capital in both countries should contain the following:

- The focal community should be cohesive, with regular open meetings, in which men and women are actively involved and during which agreed on positions are reached with regard to activities and commitments;
- The leadership and management of community groups and their institutions (e.g., village trusts) are accepted and trusted, and there is ongoing renewal of membership in the activity;
- Individuals and families need to feel connected to community decision-making processes so that they can make informed decisions about such activities as the portable sawmill and gain understanding of the technology and whatever developments may spring from it;
- By having such activities coming under a registered incorporated land group (ILG) system would require meeting minutes to be held and major decisions decided by such meetings (and not just be an individuals or a small elite). Regular reporting to a land group assembly is also required;
- Minority and disadvantaged members of the community (e.g., elderly, ill, poor) are favoured in projects focussed on community development;
- ILG and community leaders should be encouraged to seek advice from credible outsiders (e.g., to do with access to and establishing new markets); and
- The community through such an activity will establish working relationships with key parts of Government, NGOs and private sector organizations and so be able to work better and target its activities better.

 # Implications

Portable sawmill operations in the Solomon Islands and Papua New Guinea share similar cultural operating environments, but very different regulatory operating environments.

- In the Solomon Islands sawmill licensing provisions from the Dept. of Forests require that a landowner group with a forest that it wants to harvest must have it surveyed and an approved and valid land use plan completed before a portable sawmill operator can be requested to harvest the approved number of trees.
- In Papua New Guinea the PNG Forest Authority does not license portable sawmills though some provincial authorities do require approval to be given for operations within that province.
- Recommendations #4, #5, #6, #7, #8, #9 and #10 address various ways in which to improve the regulatory and compliance environment in both countries.

There are a number of implications of the elements for successful portable sawmill operations related to capacity building and the associated training programs that would be needed in both countries. These are addressed in Recommendations #1, #2, #11 and #12, including:

- Ongoing need for training programs to build capacity for the efficient use of portable sawmills and regular refresher courses.
- Training programs to include occupational health and safety standards.
- Both kinds of courses should be held regularly in each country.
- This ‘capacity’ to include adherence to Sustainable Forest Management practices, including elementary forest management and harvest planning, implementation of environmental protection measures and reforestation requirements.
- New training schemes for both countries should concentrate on small business skills such as financial planning and basic accounting.
- Need to focus on having better access to marketing requirements and supply chains.

Recommendations based on the implications from this study for access to markets for sawn timber from portable sawmills are contained in Recommendation #3 in particular. Access to markets in

Solomon Islands appears to be well in hand with standard marine transportation costs applying and a wharf-side auction system in place in Honiara. In Papua New Guinea access to markets is more difficult especially as there is no system of middlemen in place to buy from producers and sell to consumers.

9.2 Recommendations

The following recommendations on how to increase beneficial outcomes from portable sawmills need to be directed at portable sawmill operators, community development program managers and policy makers as well as to entrepreneurs and businessmen in the two countries:

9.2.1 Technical

[1] The technical issues involved and the techniques of operating a portable sawmill are well known in Australia and in both Pacific nations studied, and we consider that this is not an area of major concern in portable sawmill operations. It is also clear that the lower productivity of portable sawmill units frequently observed in all countries is due largely to the predominance of social rather than commercial objectives, and the difficulties caused by rough terrain and adverse weather conditions.

RECOMMENDATION #1: We recommend that the training programs that build capacity for the efficient use of portable sawmills be continued and supplemented by refresher courses, and that courses dealing with occupational health and safety standards be started. Workshops dealing with practical techniques should be held in remote parts of each country on a regular basis.

[2] We observed that established sustainable forest management practices, such as selective harvesting and directional felling, could be followed in operations using portable sawmills.

RECOMMENDATION #2: We recommend that the capacity of portable sawmill operators to follow Sustainable Forest Management practices be enhanced through integration with the training programs proposed above.

[3] We noted that one of the greatest difficulties in producing sawn timber from portable sawmill operations was the “unpopular and backbreaking” task of transporting the product from forest to roadside or village over rough forest pathways (see also Recommendation #12).

RECOMMENDATION #3: We recommend that practical measures (such as the timber ‘sulky’ proposed by FAO) be developed and tested in both Pacific Island nations to assist customary forest or sawmill owners in the manual work necessarily associated with portable sawmill operation, especially to bring sawn timber from a milling site to a road-head for transportation to urban markets.

9.2.2 Institutional

[4] Given the depletion of forest resources in PNG and the SI, the current practice of large-scale industrial logging will likely end in a few years. At that time, the emphasis of forest management will be more focussed on plantations, on rehabilitation of secondary growth areas, and on small-scale management of lands and forests under traditional ownership. Within this context, an important role is seen for community-owned forest and utilisation using portable sawmills.

We therefore recommend that:

RECOMMENDATION #4: All forest industry participants should be required to adhere to existing policies for controlling the environmental impacts of harvest and sustaining forest resources. Regulations for the control of forest harvesting in terms of buffer zones, slope limits and directional felling need to be applied to forests under customary ownership. Both

the volumes felled and the volumes of recovered timber need to be determined, formally documented and regularly reported to a central location for each commercial operation.

RECOMMENDATION #5: Each state forest authority should specifically include the supervision of portable sawmills into the required activities of its field staff. This is already carried out in the Solomon Islands; in Papua New Guinea specific region- or province-based field staff should carry out this supervision.

RECOMMENDATION #6: Industrial practices for sawmilling (sawing procedures including occupational health and safety measures, timber grading and seasoning practices) need to be clearly defined and implemented.

RECOMMENDATION #7: For those mills registered as being in the commercial category, minimum standards of financial practice must be developed, promulgated, reported regularly and enforced.

RECOMMENDATION #8: Compliance with all these regulations will need to be administered, and therefore adequate funds for this purpose need to be allocated to and by the appropriate authorities in both countries.

[5] In PNG, the original decision to exempt all small portable mills from the normal regulation of forestry practices was intended to avoid unnecessary administration for both the forest owners and the Forest Authority. Changes in practice and the increased emphasis on commercial operations by some parts of the sector have changed the situation. It should be noted that a volume of about 10 cubic metres of logs is sufficient to provide enough timber for one house; so an annual harvest volume of 100 cubic metres is likely to meet individuals local needs within their communities in any year.

RECOMMENDATION #9: We recommend that, in PNG, the limit of volume sawn before formal planning and licensing is required be reduced to 100 cubic metres of log volume annually.

RECOMMENDATION #10: We recommend that the current regulatory arrangements for portable sawmills in the Solomon Islands continue.

9.2.3 Capacity building

[6] Lack of knowledge concerning business practices, sustainable forest management and avoiding adverse impacts on the environment is a key deficiency that needs to be remedied by new training schemes and/or more thorough supervision of field practices.

RECOMMENDATION #11: We therefore recommend that new training schemes be developed in both PNG and the SI. These should concentrate on small business skills such financial planning and accounting. They should be supplemented by courses on elementary forest management and harvest planning, and the implementation of environmental protection measures during forest harvesting, including re-establishment in harvested areas.

9.2.4 Marketing

[7] McGregor's economic evaluation of portable sawmill operations (McGregor, 2008) reviews markets for products derived from portable sawmill operations. Local and export markets as well as eco-timber requirements are canvassed.

In general, local markets require a much lower investment and lower associated costs to aiming for export markets. In PNG in particular the domestic sale of timber derived from portable sawmills has been an important factor in peri-urban areas. Aiming for export markets, while requiring much

stricter standards to be met, has the advantage of higher prices for quality timber of certain premium species.

Some market-linked observations are made in this report, both for PNG and for SI. In PNG most sales take place in the urban and peri-urban context. However, a number of attempts by NGOs at setting up timber sales yards have been unsuccessful. In SI a competitive bidding situation at the Honiara waterfront exists for sawn timber not yet committed to a particular buyer when landed, thus benefitting the timber sellers. Currently in SI the buyers competing for 'uncommitted' sawn timber arriving in Honiara are all overseas businessmen.

The marketing of sawn timber products derived from portable sawmill operations in both countries is a specialised technical area. In PNG in particular there appear to be significant gaps in the marketing chain the negatively affects sawmill operators.

RECOMMENDATION #12: We recommend that a further and technically more specific study be undertaken to focus on detailed questions and possibilities for the marketing of sawn timber and other products derived from portable sawmill operations.

Specific areas of focus for such a study should include the following:

- The amalgamation of sawn timber from a range of portable sawmills for marketing within PNG and SI, taking account available infrastructure, the costs of transportation and similar factors;
- The adherence to producing timber products that can meet the required standards for export into particular niche markets;
- The availability or creation in-country of 'middlemen' in the production and supply chain to buy timber products from the 'farm gate' of producers/processors to resell in urban and peri-urban area markets. Middlemen wishing to export will need to create a supply chain of their own with producers through which the required export standards can be predictably produced;
- What should the levels of fair pricing for different products be, given existing costs to amalgamate product from a number of processors/producers and given the state of infrastructure to many rural areas and the costs of transportation to central locations.

10 References

Annandale, M. and S. Feary 2008 Consulting with Aboriginal and Torres Strait Islander Communities – Agroforestry in north Queensland. RIRDC Publication No. 08-168. Agroforestry Joint Venture Program.

Arentz, F. and H. Holzknecht 1991 UKFSP Wokabaut Somil Training Programme Evaluation Papua New Guinea. Conducted during Sept-Oct. 1990, and subsequently published as IIED 1991 Evaluation of the Wokabaut Somil Training Programme: Report for the United Kingdom Foundation for the Peoples of the South Pacific. London: Forestry and Land Use Program, International Institute for Environment and Development.

Arnold, J. and P. Dewees (eds.) 1997 Farms, Trees and Farmers: Responses to agricultural intensification. London: Earthscan.

AusAID 2005 Solomon Islands Smallholder Agriculture Study. Canberra, AusAID.

Bartlett, T., F. Pedro and L. Vutilolo. 1998 Management and use of mobile sawmills in Vanuatu. Pp. 248-258 in: 'Proceedings of Heads of Forestry Meeting, 23-28 September 1996, Port Vila, Vanuatu'. RAS/92/361 Field Document No. 11. Suva. UNDP/FAO South Pacific Forestry Program.

Bhati, U.N. 2004. ANU Forestry Market Report – Overview.

http://fennerschool-associated.anu.edu.au/marketreport/overview.php

Bond, A. 2006. Pacific 2020 Background Paper: Forestry. AusAID, Canberra.

http://www.ausaid.gov.au/hottopics/pacific2020/papers.cfm

Boutland, A. 1991 Minor Products: National summary paper. In: Proc. of The Role of Trees in Sustainable Agriculture. Canberra, ACT: Rural Industries Research and Development Corporation.

Blackwell, P. and M. Stewart 2003 Using portable sawmills to produce high value timber from farm trees in the semi-arid zone. RIRDC Publication No. 03/046. RIRDC Joint Venture Agroforestry Program.

Bulai, S., H. Holzknecht, K. Groves, R. James and D. Race 2006 A Review of Portable Sawmill Operations in Papua New Guinea and the Solomon Islands. Unpublished report prepared for this project.

Cameron, A.1992/1993 Unpublished reports to AusAID.

Cernea, M. (ed.) 1991 Putting People First: Sociological Variables in Rural Development.

Washington: World Bank.

Curtis, A. and D. Race 1998 Links between farm forestry growers and the wood processing industry: Lessons from the Green Triangle, Tasmania and Western Australia. Rural Industries Research and Development Corporation, RIRDC Publication No. 98/41: Canberra, ACT.

FAO 1997 Labor-intensive harvesting of tree plantations in the southern Philippines. Forest Harvesting Case-Study. RAP Publications: 1997/41. Bangkok: FAO.

Feary, S. 2007. Chainsaw dreaming: Indigenous Australians and the forest sector. PhD thesis, Fenner School of Environment & Society, Australian National University.

Filer, C. and N. Sekhran 1998 Loggers, donors and resource owners. Policy that works for forests

and people series, No. 2. London: IIED.

FSP/PNG (FPCD) 1995 The 1993 Wokabaut Somil Survey and Report. Port Moresby. Foundation for the Peoples of the South Pacific (now Foundation for People and Community Development), Hohola.

Groves, K. 2001 Portable Sawmills in the South Pacific. Report prepared for the Centre for International Forestry Research (CIFOR): Bogor, Indonesia.

Groves, K. 2007 Review of the technical, operational, business, marketing and environment aspects of portable sawmilling in Papua New Guinea and the Solomon Islands. Unpublished report prepared for this project.

Higman, S., S. Bass, N. Judd, J. Mayers and R. Nussbaum 1999 The Sustainable Forestry Handbook. London: Earthscan.

Holzknecht, H., M. Makail and G. Gowae 2002 Village Development Trust External Evaluation – Final Report. For the Board of VDT and the funders ICCO (The Netherlands) and HORIZONT 3000 (Austria).

Islands Region Economic Community Development Program 1993 11 Steps to Better Forest Management. Lae: PNG/EU ECP.

Kandrian-Gloucester Integrated Development Project 1997a Reforestation Naturally – the technique (Video). Canberra: ANUTECH Pty. Ltd., and Project Design and Management Pty. Ltd.

Kandrian-Gloucester Integrated Development Project 1997b Lukautim Bus (Video). Canberra: ANUTECH Pty. Ltd., and Project Design and Management Pty. Ltd.

Kanowski, P., H. Holzknecht and C. Perley. 2005. Oceania – Islands of Contrasts. Chapter 13 in:

G. Mery, R. Alfaro, M. Kanninen and M. Lobovikov (eds.). 2005 Forests in the Global Balance – Changing Paradigms. IUFRO World Series Vol. 17. International Union of Forest Research Organizations, Vienna. 281 – 302.

Kanowski, P., H. Holzknecht and A. McGregor. 2008. Value-adding to PNG agroforestry systems through the incorporation of high-value tree species. ACIAR Project FST/2004/050 Scoping Study Report. Canberra: ACIAR.

Kerruish, B. and J. Reed 1996 Small-scale harvesting of trees on farms. Proceedings of the Australian Forest Growers national conference – 'Farm Forestry and Plantations: Investing in future wood supply'. Canberra, ACT: AFG.

Louman, B. 1996 The Use of Small Portable Sawmills in Forest Management in Papua New Guinea. Rural Development Forestry Network. London, Overseas Development Institute (www.odi.org.uk).

McCormack, B., B. Kerruish, J. Reid, E. Antilla, and M. Stewart 2000 Harvesting Trees on Farms. CSIRO and University of Melbourne. Publication No. 00/46. Canberra, ACT: RIRDC.

McGregor, A. 2008 An economic evaluation of portable sawmill operations in the Pacific Islands with particular focus on PNG and Solomon Islands. Report prepared for ACIAR Project FST/2003/049.

Mulung, K. 2006 Business Plan for Upper Ramu District. Agroforestry Development Project – Madang Province. Application for Funding to Agriculture Bank of Papua New Guinea.

ODI. 2006. Papua New Guinea (Papers 1, 2 and 3). http://www.odi.org.uk/fpeg/activities/environmental_governance/S0153/index.html

PNG 2009 Land Group Incorporation Act (as amended). Waigani: Government Printer.

PNG Forest Authority. 2004. Draft National Ecoforestry Policy (June 2004). Hohola: PNG Forest

Authority.

Pretty, J. 1995 Regenerating Agriculture:Policies and Practice for Sustainability and Self-reliance. London: Earthscan.

Race, D., A. Bisjoe, R. Hakim, N. Hayati, Julmansyah, A. Kadir, Kurniawan, P. Kusumedi, A. Nawir, Nurhaedah, D. Perbatasari, R. Purwanti, D. Rohadi, H. Stewart, B. Sumirat and A. Suwarno 2009 Partnerships for involving small-scale growers in commercial forestry: Lessons from Australia and Indonesia. International Forestry Review, 11(1): 87-95.

Rogers, H. 2010 Impacts of portable-sawmill logging on stand structure and regeneration in the lowland forests of West New Britain. Papua New Guinea. Australian Forestry, 73(1): 12-23.

Rosoman, G., F. Narasia, and W. Fetei 1998. The profitability of ecotimber chainsaw milling in Solomon Islands. Solomon Islands Ecoforestry Notes 12/98. Greenpeace Pacific and Solomon Islands Development Trust.

Stewart, M. and I. Hanson 1998 On-site processing for farm forestry. Rural Industries Research and Development Corporation Project UM-22A, Publication 98/79: Canberra, ACT.

Stewart, M. and A. Lang 2009 Improving economics of small-scale farm forestry processing for grower groups. RIRDC Project No. 002671. RIRDC: Joint Venture Agroforestry Program.

Tilling, A. and H. Holzknecht 2001 End-of-Project Review and Evaluation of the South Pacific Community Ecoforestry Project (in Vanuatu, Solomon Islands, Fiji, Kiribati and Tonga); A.J. Tilling and H.A. Holzknecht for the NGO FSPI (Foundation of the Peoples of the South Pacific International), Just World Partners (Edinburgh) and the funder, the European Community (Final Report, January 2001).

URS Sustainable Development 2003. Solomon Islands Forestry Management Project, Phase 6: National Forest Resource Assessment. Canberra, Australia.

van Helden, F. and J. Schneemann. 2000 Cutting Trees to Keep the Forest: An Overview of Lessons Learned from Community-Based Sustainable Forest Programs with emphasis on the production and marketing of Timber. Amsterdam: ICCO (Interchurch Organization for Development Cooperation).

World Bank 2006. Rural growth in Solomon Islands Opportunities, constraints and strategies. Summary report. Prepared for the Solomon Islands Agriculture and Rural Development Strategy

11 Appendixes

11.1 Appendix 1: Financial viability models (Tables 1, 2, 3)

Table 1: The financial viability of a commercial single circular saw mill operation in the Solomon Islands

Parameters: operating for 200 days per year, sawing 1,700 cm of logs per year @ a saw timber recovery of 35% and average beach price of SD 2,000/cm.

Year	1	2	3	4	5	6	7	Total
Revenue								
days operating		200	200	200	200	200	200	1200
log throuput per day (m3)		8.5	8.5	8.5	8.5	8.5	8.5	
annual log throughput (m3)		1700	1700	1700	1700	1700	1700	10,200
sawn timber recovery (%)		0.35	0.35	0.35	0.35	0.35	0.35	
sawn timber (m3)		595	595	595	595	595	595	3,570
beach price ($/m3)		2,000	2,000	2,000	2,000	2,000	2,000	
gross revenue		1,190,000	1,190,000	1,190,000	1,190,000	1,190,000	1,190,000	7,140,000
Cost								
Capital								
mill	137,000			137,000			137,000	411,000
chain saw	16,500	8,250	16,500	8,250	16,500	8,250	16,500	90,750
safety equip	4,400	1200	4,400	1200	4,200	1200	4,200	20,800
Sub-total	157,900	9,450	20,900	146,450	20,700	9,450	157,700	522,550
Operating								
Fuel								
Sawmill 20ltrs/day @ $10/ltre		40,000	40,000	40,000	40,000	40,000	40,000	240,000
Chainsaw 20ltrs/day @ $10/ltre		40,000	40,000	40,000	40,000	40,000	40,000	240,000
Sub-total		80,000	80,000	80,000	80,000	80,000	80,000	480,000
Repair and maintenance								
Saw doctor every 3 weeks @ $600/blade		9,600	9,600	9,600	9,600	9,600	9,600	57,600
Saw mill blade replacement - 1 blade/year @$3000		3,000	3,000	3,000	3,000	3,000	3,000	18,000
Chainsaw blade replacement every 2 months @$1,000 each		6,000	6,000	6,000	6,000	6,000	6,000	36,000
Other spare parts		2,000	2,000	2,000	2,000	2,000	2,000	12,000
Mill and chain saw repairs		2,000	2,000	2,000	2,000	2,000	2,000	12,000
Sub-total		22,600	22,600	22,600	22,600	22,600	22,600	135,600
Labour								-
mill operator @ $800/month		9,600	9,600	9,600	9,600	9,600	9,600	57,600
chainsaw operator @ $700/month		8,400	8,400	8,400	8,400	8,400	8,400	50,400
tally clerk and grader @ $700/month		8,400	8,400	8,400	8,400	8,400	8,400	50,400
3 labourers @ $600/month		21,600	21,600	21,600	21,600	21,600	21,600	129,600
Sub-total		48,000	48,000	48,000	48,000	48,000	48,000	288,000
Total cost	157,900	160,050	171,500	297,050	171,300	160,050	308,300	757,711
Cash flow	(157,900)	1,029,950	1,018,500	892,950	1,018,700	1,029,950	4,832,150	9,664,300
NPV @ r(i) = 12%	$5,258,183							
B/C @ r(i) =0	9.4							
IRR	650%							

Table 2: The financial viability of a commercial single-circular saw mill operation in the Solomon Islands

Parameters: operating for 100 days per year, sawing 700 cm of logs per year @ a saw timber recovery rate of 30% and an average beach price of SD 2,000/cm.

Year	1	2	3	4	5	6	7	Total
Revenue								
days operating		100	100	100	100	100	100	600
log throuput per day (m3)		7	7	7	7	7	7	
annual log throughput (m3)		700	700	700	700	700	700	4,200
sawn timber recovery (%)		0.3	0.3	0.3	0.3	0.3	0.3	
sawn timber (m3)		210	210	210	210	210	210	1,260
beach price ($/m3)		2,000	2,000	2,000	2,000	2,000	2,000	
gross revenue		420,000	420,000	420,000	420,000	420,000	420,000	2,520,000
Cost								
Capital								
mill	137,000			137,000			137,000	411,000
chain saw	16,500	8,250	16,500	8,250	16,500	8,250	16,500	90,750
safety equip	4,400	1200	4,400	1200	4,200	1200	4,200	20,800
Sub-total	157,900	9,450	20,900	146,450	20,700	9,450	157,700	522,550
Operating								
Fuel								
Sawmill 20ltrs/day @ $10/ltre		40,000	40,000	40,000	40,000	40,000	40,000	240,000
Chainsaw 20ltrs/day @ $10/ltre		40,000	40,000	40,000	40,000	40,000	40,000	240,000
Sub-total		80,000	80,000	80,000	80,000	80,000	80,000	480,000
Repair and maintenance								
Saw doctor every 3 weeks @ $600/blade		9,600	9,600	9,600	9,600	9,600	9,600	57,600
Saw mill blade replacement - 1 blade/year @$3000		3,000	3,000	3,000	3,000	3,000	3,000	18,000
Chainsaw blade replacement every 2 months @$1,000 each		6,000	6,000	6,000	6,000	6,000	6,000	36,000
Other spare parts		2,000	2,000	2,000	2,000	2,000	2,000	12,000
Mill and chain saw repairs		2,000	2,000	2,000	2,000	2,000	2,000	12,000
Sub-total		22,600	22,600	22,600	22,600	22,600	22,600	135,600
Labour								-
mill operator @ $800/month		9,600	9,600	9,600	9,600	9,600	9,600	57,600
chainsaw operator @ $700/month		8,400	8,400	8,400	8,400	8,400	8,400	50,400
tally clerk and grader @ $700/month		8,400	8,400	8,400	8,400	8,400	8,400	50,400
3 labourers @ $600/month		21,600	21,600	21,600	21,600	21,600	21,600	129,600
Sub-total		48,000	48,000	48,000	48,000	48,000	48,000	288,000
Total cost	157,900	160,050	171,500	297,050	171,300	160,050	308,300	757,711
Cash flow	(157,900)	259,950	248,500	122,950	248,700	259,950	982,150	1,964,300
NPV @ r(i) = 12%	$1,038,355							280,614.29
B/C @ r(i) =0	3.3							
IRR	157%							

Table 3: The financial viability of a commercial single-circular sawmill operation in the Solomon Islands selling eco-certified timber (an operation working intermittently throughout the year).

Parameters: operating for 100 days per year, sawing 700 cm of logs per year @ sawn timber recovery of 30% and average landed beach price of SD 5,800/cm.

Year	1	2	3	4	5	6	7	Total
Revenue								
days operating		100	100	100	100	100	100	600
log throuput per day (m3)		7	7	7	7	7	7	
annual log throughput (m3)		700	700	700	700	700	700	4,200
sawn timber recovery (%)		0.3	0.3	0.3	0.3	0.3	0.3	
sawn timber (m3)		210	210	210	210	210	210	1,260
beach price ($/m3)		5,800	5,800	5,800	5,800	5,800	5,800	
gross revenue		1,218,000	1,218,000	1,218,000	1,218,000	1,218,000	1,218,000	7,308,000
Cost								
Capital								
mill	137,000			137,000			137,000	411,000
chain saw	16,500	8,250	16,500	8,250	16,500	8,250	16,500	90,750
safety equip	4,400	1200	4,400	1200	4,200	1200	4,200	20,800
Eco-certification	50,000							
Sub-total	207,900	9,450	20,900	146,450	20,700	9,450	157,700	572,550
Operating								
Eco-certification compliance costs								
Sub-total		20,000	20,000	20,000	20,000	20,000	20,000	120,000
Fuel								
Sawmill 20ltrs/day @ $10/ltre		40,000	40,000	40,000	40,000	40,000	40,000	240,000
Chainsaw 20ltrs/day @ $10/ltre		40,000	40,000	40,000	40,000	40,000	40,000	240,000
Sub-total		80,000	80,000	80,000	80,000	80,000	80,000	480,000
Repair and maintenance								
Saw doctor every 3 weeks @ $600/blade		9,600	9,600	9,600	9,600	9,600	9,600	57,600
Saw mill blade replacement - 1 blade/year @$3000		3,000	3,000	3,000	3,000	3,000	3,000	18,000
Chainsaw blade replacement every 2 months @$1,000 each		6,000	6,000	6,000	6,000	6,000	6,000	36,000
Other spare parts		2,000	2,000	2,000	2,000	2,000	2,000	12,000
Mill and chain saw repairs		2,000	2,000	2,000	2,000	2,000	2,000	12,000
Sub-total		22,600	22,600	22,600	22,600	22,600	22,600	135,600
Labour								-
mill operator @ $800/month		9,600	9,600	9,600	9,600	9,600	9,600	57,600
chainsaw operator @ $700/month		8,400	8,400	8,400	8,400	8,400	8,400	50,400
tally clerk and grader @ $700/month		8,400	8,400	8,400	8,400	8,400	8,400	50,400
3 labourers @ $600/month		21,600	21,600	21,600	21,600	21,600	21,600	129,600
Sub-total		48,000	48,000	48,000	48,000	48,000	48,000	288,000
Total cost	207,900	180,050	191,500	317,050	191,300	180,050	328,300	1,596,150
Cash flow	(207,900)	1,037,950	1,026,500	900,950	1,026,700	1,037,950	4,822,150	9,644,300
NPV @ r(i) = 12%	$5,234,766							1,377,757.14
B/C @ r(i) =0	4.6							
IRR	497%							

11.2 Appendix 2: Overview of portable sawmill use in the Pacific

Pacific islands forum secretariat

1.0 Introduction

Forests and trees play a pivotal role in the livelihoods of Pacific islands rural communities. In the larger Melanesian countries of Fiji Islands, PNG, Solomon Islands and Vanuatu, their forests have provided them with significant economic contributions in terms of government revenue, foreign exchange earnings, employment and infrastructure development. In fact, exploitation of their natural forests has been seen as a vital 'springboard' to these countries' development since gaining their independence.

However, since the early 1970's, the continued exploitation of these forests has caused significant economic, social and environmental problems that have badly affected the livelihoods of the rural communities. Negative environmental impacts included soil erosion with its deleterious impact on freshwater sources and siltation in rivers and coastal areas, the loss of biodiversity, and the loss of valuable genetic resources. The distribution of the financial benefits that accrued from the harvesting of forests was very much to the disadvantage of forest owners. This was mostly at the expense of the total loss of their valuable forest resources with its negative social implications to the mainly rural populations. However, from the 1990's, the improved management and wise use of forests under a system of sustainable forest management with more meaningful participation by the forest owners became a big issue.

It was with the above in mind that the application of low impact forest harvesting techniques using portable sawmills at the rural community level was conceived. They were seen as both environmentally friendly and also as an effective tool for the enhancement of the involvement of forest owners in the management of their own forests. In addition, portable sawmills were much cheaper when compared to static mills and were therefore considered affordable by the forest owning communities. They were also seen to be fairly easy to operate.

At the forefront of the promotion of portable sawmills in the Pacific were non-government organizations keen to support initiatives that target both the protection of the environment and the improved financial benefits that would accrue to the forest owning communities. Although it is difficult to determine the actual number of portable sawmills now existing in the Pacific islands, it would be fairly safe to say that it could run into thousands of different makes, models and sizes, including the 'wokabaut somil' of PNG and the chainsaw-type Alaskan mill.

The perceived benefits of using portable sawmills in the Pacific islands saw the creation of relevant policies and legislations that provide the legal basis for their commercial applications by resource owning communities. This has happened in both Solomon Islands and Vanuatu, and to a smaller extent, Papua New Guinea and Fiji.

Vanuatu and the Solomon Islands, under their existing legislations actively promoted portable sawmills, but putting a cap on the volume of round logs that each sawmill could process in any one year. All portable sawmills in Vanuatu are registered, but only those that operate commercially require a sawmill timber license with a maximum annual log allocation of 500 m3 (Vanuatu, 1999). In the Solomon Islands, each licensed sawmill is given a log quota per year, and the amount varied from one operation to another. However, despite having this policy and legal framework, it would seem that most portable sawmills operating in these countries are not performing as expected. There are other important issues that also impact on the operations of portable sawmills, and these need to be dealt with satisfactorily if the perceived benefits of portable sawmills are to be realized. The operation, like any other project, requires careful planning, a lot of care, adequate training in both the technical and business aspects, and a lot of hard work.

While it is recognized that PNG has the most number and different types of portable sawmills, and also perhaps, the longest history of portable mill use, the country is still working on refining its policy and legislation to try to adequately cater for this kind of forest industry development. There is currently a loophole in their legislation, and this is allowing commercial loggers to operate portable sawmills through forest owner communities, ensuring continuing access to forests. Because each of these operations is processing less than 500m3 of logs per annum they do not require any license.

In Fiji, existing sawmilling policy, while not totally banning the use of portable sawmills, actively discouraged their use for commercial purposes. The commercial application of portable mills is limited to areas where normal static sawmills could not operate economically for various reasons, including remoteness of the resource, accessibility problems, and low forest stocking. Portable sawmills are viewed by authorities as being wasteful, resulting in very low timber recovery, producing timber of sub-standard quality due to inaccurate cutting, low production, and because they operate in rural locations, maintenance is always a problem, resulting in sub-optimal operations. Fiji is very much focusing on expanding its export markets, and the possible export of sub-standard quality timber from portable and mobile mills is considered to be too big a risk for the country. However, times have changed, and better-designed sawmills are now available which can cut accurately, producing higher quality sawn timber. At the same time, more emphasis is now being placed on developing forest owners to establish and manage their own forest-based businesses. Portable sawmills are seen as having a pivotal role to play in this initiative.

But despite the many perceived benefits of portable sawmills, there does not seem to be sufficient documented evidence available on any successful operations in the Pacific. Undoubtedly, there are successful operations on the ground, which have not been reported, and these needed to be identified and documented to provide lessons that could be of assistance to countries and communities who are presently struggling with portable sawmills.

It was with the above in mind that the Secretariat of the Pacific Community (SPC) and the Australian National University (ANU) jointly submitted a project proposal to ACIAR in 2004 to evaluate selected portable sawmill operations in the Pacific with the view to document success stories and report useful lessons learnt. This would be very useful to countries and communities, which are using or planning to promote the use of portable sawmills in response to the need to effectively involve the forest owners in the management of their own forests. The proposal was accepted by ACIAR in early 2005, and this overview is one of the initial outputs of the project. The objective is to document information on the existing situation in PNG and Solomon Islands that would assist in the identification of suitable portable sawmill operations that should be included in the evaluation. PNG and Solomon Islands have been selected because of their relatively longer history of portable and mobile sawmill use, especially by their rural forest owning communities. Portable sawmills, in this overview, also include mobile types.

2. The Solomons Situation

Both static and portable sawmills are currently used in the Solomon Islands for the production of sawn timber from logs. Prior to the introduction of the portable types, all sawmills in the country were fixed static mills, which required logs to be transported from the forests to where sawmills were located. But with the need to have simpler technology and also with the need to move sawmills to the logs, portable sawmills were introduced, and these were promoted as being more environmentally friendly and an appropriate tool for the participation of land owner communities in the management of their own forests.

Although portable sawmills have been operating in the Solomon Islands for some years, the potential roles that this type of sawmill could perform in the development of rural communities became very prominent following the devastation of Cyclone Namu in May 1986. To assist with the rehabilitation efforts at that time, several relief agencies promoted portable sawmills as a means whereby communities could utilize trees blown down during the cyclone to produce suitable timbers for the reconstruction of homes and other buildings destroyed by Cyclone Namu.

Widespread use of portable sawmills continued to be promoted mainly by non-government organizations such as the Solomon Islands Development Trust's (SIDT) Eco-Forestry branch even after the worst effects of the cyclone were over. In fact, Soltrust, a now defunct non-government group imported the first wokabaut sawmill from Papua New Guinea into the country in 1986 (Thorpe, 1992).

The need for portable sawmills has always existed, especially in remote areas where no other sawmills are located. The attraction of sawing the logs in the forest has been recognized from the viewpoint of the improved yield of usable products that are taken out of the forest. The logs that are of lower quality, and which cannot normally be used to produce timber of reasonable quality and value are not sawn. This reduces costs and therefore the value of the timber produced and taken out of the forest.

But despite the above, the operation of portable sawmills in the Solomon Islands tends to be seasonal. This means that the owners operate on an ad hoc basis or whenever they want to operate. They only become functional when they need money to meet things like school fees or to spend during a festive season like Christmas. So, production fluctuates from month to month with November, December, January, April and June tending to have higher production figures than the other months.

With the remoteness of location, low production and sub-standard quality of timber produced, marketing the products of portable sawmills is always a challenge. In fact, on current evidence, it looks as if it may not be a "profitable" business. The timber is normally shipped to Honiara and is then bought by the timber dealers at prices between SBD1200 to SBD1400 per cubic metre for premium species such as *Pterocarpus indicus*, *Vitex cofassus* and *Intsia bijuga*. Lesser-used species such as *Pometia pinnata* and *Calophyllum kajewski* are sold at SBD800 to SBD1050 per cubic metre. The freight cost for transporting the timber to Honiara is about SBD 400 to SBD 500 per cubic metre. When the operational cost is added, the financial returns are very small.

Because of this rather low profit margin, portable sawmill operators, more and more, are opting not to produce their own timber to sell, but to put their services to hire. This means that charitable and similar organizations that are constructing new clinics or school buildings would hire the operators and their portable sawmills for a fee to produce their timber requirements for their projects.

2.1 Policy and Legal Framework

A national forest policy aimed at promoting and supporting the participation of local people in the sawmilling industry was endorsed and approved by Cabinet in 2003. The long-term goal was to develop sufficient infrastructure on the ground that would enable the country to undertake domestic processing, and to export sawn timber rather than logs in order to achieve value adding and increased

local employment. However, the same policy also stated that the decision to go into sawmilling was best left to the private sector to make.

Section 18 of the Forest Resources and Timber Utilisation Act (FRTUA) requires all operating sawmills to be licensed. Any person who breaches this requirement is guilty of an offence and is liable to a fine of three thousand dollars or to imprisonment for two years or both such fine and imprisonment.

All sawmill licenses are granted by the Commissioner of Forests and are valid for one year from the date of issuance. In 1985, 24 sawmill licenses were issued and registered (Thorpe, 1992). In March 1992, 149 sawmill licenses were issued (Cameron, 1992). As of mid-May 2005, there were only 29 valid sawmill licenses issued by the Commissioner of Forests. But current records indicate that there are currently about 391 expired sawmill licenses, and given the present inability of the Forestry Division to enforce the legislation including the monitoring of the individual licenses, it will not be possible to establish whether any of these have continued to operate. Nevertheless, the fact that current production of sawn timber is estimated to be much higher than the level that supposedly could be produced by the existing valid licensees suggests that a number of individuals and community groups whose licenses have already expired are reluctant to renew their licenses or have not bothered to apply for renewal of licenses, and have continued to mill timber illegally.

The following are the valid portable sawmill licenses, by Province, issued by the Commissioner of Forests pursuant to section 18 of the FRTUA:

Province	Licensee	Licence Start Date	Quota (m3)
Central	Eddie Grant Suku	A205015/1/2005	540
	Wilson Mima/ Frank Daoga	A2052223/03/05	1000
Total for Central			1500
Guadalcanal	Kanold Sale	A2050720/1/05	1200
	Kongulai Project Co. Ltd	A2050920/1/05	500
	Maina Milling Project	A2052311/4/05	500
	Natupabi	A205292/5/05	500
	Jamie Lency Vokia	A205315/5/05	120
Total for Guadalcanal			2,820
Honiara	Westwood Enterprises Ltd	A2050820/1/05	1000
	Greenwood (Solomons) Ltd	A2052620/4/05	9600
Total for Honiara			10600

Isabel	Trans Island Timber Mill	A2051211/02/05	1000
	Garanga Sawmill	A2051317/02/05	720
	BT Milling Project	A2051324/02/05	1500
Total for Isabel			3220
Makira	Star Timbers Supplies	A2050420/01/05	1000
	Humphrey Rumu	A205114/02/05	120
	Thomas Waterua	A205104/02/05	120
	Joseph Marisima	A2052802/05/05	200
Total for Makira			1440
Malaita	John Wakiorahu	A2050220/01/05	1200
	Abukwaiara landowning gp.	A205036/01/05	2000
	East Trading & Timber S.	A2050620/01/05	1200
	James Hoilapu & H Rudulf	A2051417/02/05	500
	Eddie Manu	A2051903/03/05	1200
	Henuemola Milling Project	A2052011/03/05	1200
	Purine Lola Timber Milling	A2052412/04/05	1000
	A'ahoa Chainsaw Milling	A2052721/04/05	2400
	Fafo Milling Project	A2053002/05/05	200
Total for Malaita			10,700
Temotu	Vanikoro Lumbers Ltd	A2051821/02/05	36000
Total for Temotu			36000
Western	Solwood Mill	A2051824/02/05	150
	Kalena Found'tn R. Dev	A2052118/03/05	1500
	Dora Island Sawmilling	A2052514/04/05	1000
Total for Western			2650
Grand Total			68970

2.2 Types of mill

The 'wokabaut somil' was the first to be introduced in the country in 1986. It was originally imported from Papua New Guinea before it began to be produced locally by Soltrust. No wokabaut somil has been produced since 1992 (pers. comm., Rauhana). As the name wokabaut implies, it is designed to move from one site to another in the forest. However, the main issue with the wokabaut somil is that it has no back up system. Hence when there is a problem with any part of the machine, the whole machine has to be transported to Honiara for fixing.

Currently, there are three main brands of portable sawmills in the country. These are the Peterson Sawmill; the Lucas Sawmill and the Alaskan Sawmill. Of these three, the Alaskan Sawmill is the type that is most commonly used. While other brands also exist, these three dominate domestic sales of portable sawmills in the Solomon Islands.

The Peterson Sawmill is manufactured in New Zealand. It consists of a Stihl 090 powerhead driving a single 8" circular saw blade, on an aluminium frame. The sawmill is capable of being used on moderate slopes.

The Lucas Sawmill is the most recently introduced portable sawmill in Solomon Islands. It was first brought into the country in 1995. Timol Enterprises, a buyer of rough sawn timber in Honiara, is the local distributor. The mill is sold at SBD100,000.

The Alaskan Sawmill consists of a chainsaw powerhead fitted to a light aluminium frame. The most popular powerhead is the Stihl 090, with the 076 occasionally used. The cost of a Stihl 090 with the frame is SBD21,000.

2.3 Positive Aspects of Portable Sawing

With the current forest industry more or less a logging one, the use of portable sawmills provides the opportunity for additional employment for people who otherwise cannot be employed by the logging companies. The workers involved contribute to the local economy and frequently other opportunities become available as further development takes place (in the form of joinery shops, for example), utilizing the sawn timber from the sawmill.

In forests of restricted access, portable sawmills may be the only convenient method to use for the harvesting of trees in these types of areas. The amount of commercially extractable species of timbers in some forests may be too low to justify a larger sawmill, but could be just enough for a portable sawmill to survive on.

Another benefit is their relatively low capital cost of purchase and direct costs of setup which assists in the expansion of the sawmilling industry, and also in the involvement in this expansion of local communities. They enable groups of people to share the operation and to commence business or to produce timber for their own village housing schemes.

The other advantages of portable sawmills are as follows:

a. Portable – in that they could be taken to the log rather than vice versa

b. Environmentally sensitive – especially when compared with commercial logging operations

c. An alternative to full commercial operations

d. Cheap and easy to operate and run

e. Appropriate for village level development.

2.4 Negative Aspects of Portable Sawmills

It is often thought that portable sawmills, because they are small, are easier to operate. This belief is not always true. To effectively operate a portable sawmill requires exactly the same commercial understanding, technical considerations and sound business management acumen as does a fixed sawmill.

It must be kept in mind that portable sawmills have an obvious design limitation. Their weights must not be above a certain limit or they no longer become portable. This means that every part of the machine needs to be purposely designed to minimize weight. In the end the robustness of the machine that is so important when considering the locations where these are going to be used, has to be sacrificed. Therefore the maintenance part of it becomes very critical.

Proper maintenance of the machine is so vital to its continued operation. However, because of the remoteness of areas where most of these are located, maintenance is not always carried out as required, which results in lost production and timber of sub-standard quality.

Portable sawmills have, in general, low sawn timber recoveries. In addition to the maintenance factor mentioned above, the use of thicker gauge circular saws and the mill's inability to fully convert a log, are also contributing factors. A reasonable size slab, which could not be further converted, is usually left behind after a log has been sawn. In the absence of any re-sawing facility, this slab will actually go to waste reducing the recovery of sawn timber.

2.5 Issues Faced By Sawmillers

Discussed below are some of the constraints and difficulties encountered by those who wish to venture into sawmilling in the Solomon Islands:

2.5.1 Poor policy

The government encourages indigenous Solomon Islanders to participate in sawmilling, but offers very little or no incentives at all to those intending to venture into milling. Moreover, there is no legislation to limit this activity to the indigenous communities only.

It appears that the only thing that government has done to support sawmill operators is to impose a low export duty on timber exports. Currently, 2.5% duty is charged on timber exports.

The government needs to put in place better targeted financial incentives that will enable potential sawmill operators to acquire good quality portable sawmills at more affordable prices. In the absence of this type of support, people often go for cheaper machines such as chainsaws, and engage in chainsaw slabbing, which is very wasteful and produces low quality timber.

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2.5.2 No Credit Facility

In the Solomon Islands, using customary land or forests as security to obtain a loan from any of the commercial banks is not possible. The banks do not recognize customary lands and the forests as assets. This is despite the fact that the land contains trees, which may be worth millions of dollars. In this situation, and because land owners are desperate to own a portable mill, they usually end up entertaining unfavourable deals with distributors

of portable mills, who are often also buyers of sawn timber. The land owning group signs a contract with the distributor to acquire the portable sawmill on credit and in return the group sells their timber to the distributor. The distributor buys the timber and deducts an amount, which would go towards recovering the initial cost of the mill. The landowning group would only be able to fully own the machine after the initial costs have been paid. This arrangement disadvantages the resource owners as they are obligated to sell all their timber to the supplier of their mill. In some cases, machines are re-possessed by the mill supplier, and the landowners ended up with virtually nothing despite having exhausted their forest resources.

2.5.3 Ineffective Forestry Division

The Forestry Division is currently concentrating its efforts on the monitoring of commercial logging operations in the country and is providing very little support to the portable sawmill operators. A possible reason is perhaps because of the high duty being charged on log exports, which is 25% of determined price compared to the 2.5% charged on sawn timber exports. Another reason too would be the inadequate resources, in terms of both human and financial resources, provided to the Forestry Division for the implementation of its activities.

The lack of support by the Forestry Division is resulting in:

- The absence of any support to help the sawmill operators to better access overseas markets
- Lack of training

2.6 Possible Operations to Visit

From the license information provided earlier it would be apparent that the number issued for Guadalcanal is very small, and the implication of this is that any assessment in the Solomon Islands will have to target other provinces, which have more operations.

With the exception of one project in Isabel Province, all the portable sawmills that could be visited and assessed are located in Western Province. They are as follows. :

i. Lobi Project in Marovo, Western Province – A project associated with SIDT's Eco – Forestry Branch.
ii. Leona Project on Vela la Vella, Western Province – a project started by a now defunct non-government group known as SWIFT and reactivated after a short closure by SIDT's Eco- Forestry Branch.
iii. Sigana Project in Isabel Provice
iv. Nama Development Company Limited (holder of a felling license which involves in log export), Marovo Lagoon, Western Province.
v. Voge (a felling licensee)
vi. Ridol, in the Marovo Lagoon, Western Province

3.0 The PNG Situation

Portable sawmills were introduced in PNG in the early 1960's with the arrival of missionaries who ventured into timber milling to build community services such as churches, schools and health centres. They were issued with some form of milling permits, which required them to declare that their annual allowable cut was below 500m3 of round logs, and that the timber produced was solely for community purposes.

However in 1983, the "wokabout somil" was introduced into PNG. It was designed and developed by a local engineering company sponsored by South Pacific Appropriate Technology Foundation (SPAFT) – a non- government organization. The machine was manufactured at the cheapest possible cost and sold at an initial affordable price of K9,500.00, and as a result, more than 500 were built and sold to communities.

Operating under the legal window of harvesting less than 500m3 per year where there is no requirement for a sawmill license, competitors such as the Patterson, Alaskan and lately the Lucas sawmill entered the market. The significance of these small-scale sawmills was not apparent at that stage because PNG was in the early stage of exploiting its virgin forests bringing large sums of income to the rural communities which people had never experienced before.

Twenty years down the line, large foreign logging companies have logged out three quarters of PNG forests. The erosion of the forest resource resulted in logging companies and well to do entrepreneurs going underground, and acquiring portable sawmills for the communities to cut timber under what they call a sales and purchase agreement between them and the landowners, exploiting the existing loophole in the forest legislation to gain access into PNG's remaining forest areas. The application of

proper forest management practice (silvicultural operations) is of no concern to them because their prime concern is the amount of timber they produce to meet their orders.

The other group is the customary organizations, which purchased or received the mill for the objective of community development activities. Trees are mainly harvested for local use, the mill operation is often heavily subsidized by NGO's, aid donors or missions, and cost effectiveness is of no concern.

3. 1 Portable Mill types

1. Chainsaw – Chainsaw are used "free-hand", cutting long the grain of the log to produce timber products in the form of fitches. It is capable of producing sawn timber volume of not more then 1m3 per day. The fitches are very low quality and value but can improve quality and value through further processing, however with further loss of timber. One major problem with the use of these mills is the inability of many operators to make very straight cuts to produce straight lengths timber. This style of mill is very common in parts of Milne Bay province.
2. Alaskan Mill – the mill involves the combine use of chainsaw and a special frame. Cuts are made along the grain of the log to produces fitches. These fitches are then clamped and further cut, again along the grain into required sizes. It is capable of producing sawn timber volume of about 1 to 1.5m3 per day. The quality of sawn timbers is a lot better than that cut free-hand using only a chainsaw, but can still be improved through further processing. One major problem with the use of this mill is the inability of many operators to cut very straight lengths of timber. Some experienced operators can make very straights cuts to produce straight length timber. This type of sawmill is commonly used by many producers in Milne Bay, Morobe, Madang and the Highlands provinces. It is also cheap, hence affordable by many producers.
3. Portable sawmill (Lewis/Lucas/Patterson) – first termed a "wokabout somil" for the first models, and with the currently three different models: Lewis, Lucas mill and Patterson mill. Each mill is compromised of an engine with one/ two circular blades, mounted on its carriage, which slides freely on two parallel rails/frames. The mills are capable of cutting logs to a maximum size of about 6m long and 1.5m in width. Horizontal and vertical cuts range from 0 mm to 200mm. Each mill is capable of producing about 1m3/hour of sawn timber. The quality of sawn timber is much better than those produced by chainsaw (free hand) and Alaskan sawmills. Quality can be further improved through further processing. This type of sawmill is owned and operated by many producers through out the country.

3.2 Policy and Legislative Framework

Legislative changes in the Forestry Administration saw changes in the method of acquisition of timber rights from customary owners. Under the repealed Forests Act Chapter 216, the acquisition of timber rights from customary owners was by way of a Timber Rights Purchase. The Forestry Private Dealing Act chapter 217 which saw landowners selling their timber rights directly to interested developers has also been repealed. The old method of acquiring timber rights has now been replaced by the Forests Management Agreement (FMA) method of acquiring timber rights from customary owners pursuant to Division 4 of the Forestry Act 1991 (as amended).This constitutes the current method of acquiring timber rights that were formerly under the two repealed legislations; with more emphasis on sound management of the nation's forests resources.

Forestry is an activity recognized as being in good standing under the organic Law on Provincial and Local Level Governments. Activities in relations to the acquisition and the allocation of the forests resources are therefore carried out in conjunction with the respective Provincial Governments through the Provincial Forest Management Committees.

The National Forests Plan that was approved by the National Executive Council (NEC) in 1996 provides a detailed statement of how the National Government and Provincial Governments intend

the forests to be managed and utilized. The PNG Forest Authority ensures that the forest resource is strictly developed in accordance with the Plan.

The customary landowners own the forest resources of Papua New Guinea and therefore the current forestry legislation provides for the exploitation of this resource under two arrangements:

a) The Forests Management Area (FMA) or what was known before as the Timber Rights Purchase Area (TRP). Annual Allowable cut above 5000m3 per annum.
b) Timber Authority (TA) – Annual allowable cut above > 500m3 < 5000m3.

There are guidelines and procedures and regulatory mechanisms in place to ensure that permits are issued accordingly under the existing forests laws. As a developing country more emphasis is placed on large to medium scale operations that are involved in log export, and large static sawmills generating the internal revenue required to bring social and economical development.

From the legislative point of view there is no control mechanism in place to monitor and control small sawmill operations. In the earlier 70's and 80's all small to medium scale sawmill operations used to be monitored through the forestry extension services. However this service was discontinued in the 1990's. The NGOs and the civil society have been the driving force behind the push for recognition by the PNG Government of community based portable sawmill operations because they offer the following perceived benefits, which include

- Sustainable use of forests resources.
- Minimal environmental damage.
- Long term local income
- Local employment, skills training and education.
- Sustainable rural community development and local empowerment.

The Eco-forestry Forum of PNG, with the EU-funded PNG Eco-Forestry Programme, and in consultations with all civil societies, has drawn up Guidelines Small–Scale Saw Milling. These operational guidelines set out steps that should be followed if a small-scale saw milling operation is to provide social, economical and ecological benefits. They were developed in accordance with the Forests Management Standards for Papua New Guinea, which have been developed under the Forests Stewardship Council Certification System.

Acknowledging the need to address small-scale milling operations the National Forests Board approved the Eco- Forestry Policy and is now with NEC for final approval. This policy accommodates the Eco-Forestry Forum's agenda by way of creating the regulatory and monitoring mechanism whereby the government is proceeding towards acknowledging forests certification. This concept has been developed and promoted under the EU funded IREDCP (1995-2001) with DEC as the implementation agency for the first phase and then the Eco-Forestry Program for the second phase (2001-2006) with PNG Forests Authority as the implementing agent.

Some 35 mills were distributed in the New Guinea Islands, Morobe and Madang provinces under the fist phase. In its first 5 years IREP has developed the technical part of saw milling and has established very good, widely acknowledged training courses for chainsaw and small mill operators. However none of these 35 Mills have succeeded as a commercial timber business operation. With this knowledge as its foundation the second phase, entitled Eco-Forestry Program has taken on to a holistic, systematic and process- oriented approach for the further development of eco-forestry in Papua New Guinea.

As such, the second phase has established the eco-forestry policy, the timber marketing information centre and the identification for development of seven community based forests enterprises, and given all of them the basic training to run as timber business enterprises.

The PNG Eco-Forestry Program is being prepared to exit into PNGFA by December 2006. An Eco-Forestry Division will be created and its major functions would be to:

- Continue to co-ordinate and promote community based SFMU as promoted under the Forests Management standards for Papua New Guinea developed under the auspices of the Forests Stewardship Council Certification System.

- Centralize networking of portable mill data between all stakeholders maintaining collaboration and dialogue between the NGO and environmental groups, to ensure there is control and standards maintained according to PNG laws.
- Ensure the establishment of Central Marketing Units (CMU) for small producers for both the local and overseas markets to promote timber from a SFMU.
- Develop a procurement policy to promote certified timber from community forests management units and medium to large-scale operations.
- Establishment an Independent Forests Certification Scheme according to the Forests Managements standards of PNG under the auspices of the Forests Stewardship Council's Certification Scheme.

3.3 Current status

The Papua New Guinea Forests Service has its Head Office in Port Moresby with regional offices in the four regions of PNG (Mamose, NGI, Southern and Highlands regions). The regional offices manage the respective Provincial Offices that are overseen by Provincial Forests Management Committees.

Each Provincial Office should have some statistics on the number of portable sawmills operating in each Province. Some of these are operating legally with FIP registration while so many others are operating illegally without an FIP registration (refer list of IPA registration). There is no control mechanism in place to follow up on this FIP registration to determine the type of operation and where they are operating or how viable they are running. For instance in the year 2000 the former regional member for Eastern Highlands Province bought 12 Lucas Mills using the electoral development funds and gave them away to the people of Eastern Highlands. The question is whether these communities have been FIP registered and what their status is now.

Conclusion

Portable sawmills are being promoted throughout the Pacific, especially in the Melanesian countries. These countries have significant forest resources, which have contributed to their economic developments. However, because of the ways in which forest exploitation were carried out, significant economic, social and environmental problems have arisen that have badly impacted on the livelihoods of the rural forest owning communities. The use of portable sawmills is seen to be very beneficial to the rural forest owning communities because they are more environmentally friendly and also enable the forest owners to manage their own forests.

In recognition of these perceived benefits, countries like Vanuatu and Solomon Islands have put in place policies and legislation that support the commercial applications of portable sawmills. PNG and Fiji are still working towards creating similar framework conditions. However, other issues are also important and need to be dealt with effectively if the perceived benefits of portable sawmills are to be realized.

Despite the reported thousands of portable sawmills in the Pacific, there is a dearth of information on any successful operations that can provide lessons for other communities and countries struggling with this type of small-scale sawmill. There is a need to identify selected operations, document success stories and to report lessons learnt. The ACIAR funded project on portable sawmills in the Pacific has been approved with this in mind.

This overview of portable sawmills in the Pacific with a focus on PNG and the Solomon Islands is one of the first outputs of the project. It provides information on the present situation in the two selected countries to facilitate in the better identification of suitable operations to be included in the evaluation. A list of possible mills to evaluate has been included for the Solomon Islands.

References

Cameron, A.L. 1992. Primary Processing of Logs and Timber Handling in Solomon Islands, AIDAB, Timber Control Unit Project – Solomon Islands, Project Report No. 3, Volume 1, Forestry Technical Services Pty Ltd, Canberra.

PNG. 2002. Small-Scale Sawmilling Operational Guidelines, The Papua New Guinea Eco-Forestry Forum. 1st Edition.

PNG. 2002. Small-Scale Sawmilling Information Pack. The Papua New Guinea Eco-Forestry Forum. 2nd Edition.

Thorpe, T. 1992. Experience with Portable mills in Solomon Islands, Paper prepared for 1992 Heads of Forestry Meeting, Western Samoa.

Vanuatu. 1997. National Forest Policy of Vanuatu. Department of Forests.

11.3 Appendix 3: Notes on Papua New Guinea project trip 2006

Dr. Ryde James (The Australian National University), Project Leader

PNG project team:
Mr. Ryde James, Leader (The Australian National University)
Mr. Sairusi Bulai (Pacific Islands Forum Secretariat, Suva)
Mr. Gordon Konairamo (Commissioner for Forests, Solomon Islands)
Mr. Terence Titiulu (Dept. of Forests, Solomon Islands)
Mr. Anda Akivi (PNG Forest Authority, EU/PNG Ecoforestry Project)
Dr. Hartmut Holzknecht (The Australian National University)

1. Purpose:
* The purpose of the project trip was to hold the inception Meeting in Port Moresby with the PNG Forest Authority and then proceed to Lae, hold a technical Seminar and then go to the field to collect data.

2. PNG Forest Authority meeting, April 2006

* Principal officer present was Mr Dike Kari, PNGFA's Director of the Policy Secretariat. Others included Ishmeil Libertino, PNGFA's divisional head of marketing and Don Bakat, PNGFA's divisional head, plantation development.

* Discussion focus: 'Defining the Criteria for Success'.

* Gordon Konairamo spoke of the situation in the Solomon Islands [SI]. He identified a number of factors that could contribute to success or failure of portable sawmills. For example, the sense of 'community' in which people worked together for a common goal. He noted that in the SI, only family units could be expected to work consistently as a cohesive "unit" or community; Portable Sawmills (PSMs) provided employment, a positive social climate when people cooperated but most importantly cash for vital items outside the provision of subsistence food and shelter. He gave the example of two-way radios for improved communication, but most important was the provision of school fees. Education was both important to the people of the SI but also very expensive in their terms.

* Another factor for success was the concept of sustainability. This was a big consideration. The practices of the past could not continue, as they were clearly not sustainable. What was the role of PSMs? Their role in determining sustainable forest management was not yet established and required further technical evaluation. He regarded this as an extremely important point in the general consideration when determining the proper role of PSMs within the forest sector.

* Other speakers pointed out some of the problems experienced when operating PSMs: the work was said to be 'back-breaking'; the output was, by definition, semi-finished and therefore of low value in the market. This was a problem because expenses for items such as fuel, spare parts and repairs required that at least some part of the production needed to be sold to pay for the running costs. Conversion rates from log to sawn timber were lower than for conventional mills and this meant that the logs were used less efficiently or, if sawing was being carried out to provide a set amount of timber (a house lot for example), more trees were needed than if they had been sawn in a conventional mill.

* Don Bakat remarked that consideration of the role of the PSMs was timely. In PNG, the focus of forest harvesting was shifting, of necessity, from large-scale industrial operations to smaller-scale operations and the place of PSMs needed proper evaluation of their place and positive contribution to the forest sector.

* His experience of these mills suggested that it was important to success to have the mill operated by a coherent group such as a family or clan who were preferably working their own domain of land and forest. He suggested that use of portable sawmills be restricted to such groups who were sawing in order

to produce timber for their own use. He suggested that most problems arose when mills were operated on an entirely commercial basis, i.e., to produce timber for sale and where the sawmill owner was not working in forest he owned or had major rights to.

* Another speaker agreed but suggested that in that case, mills must be licensed as commercial ventures and not exempt from all controls as they were at present. He also suggested that owners should be required to attend proper training courses and that the mills must be registered and of a design that was at the standard of the Lucas mill or similar.

* Sairusi Bulai then asked about the problems of policing the licence conditions and making sure that the licence was current and held in good standing.

* Another speaker stated that in PNG there was no Government control or even guidelines over how PSMs should be operated. He looked to the EU Ecoforestry Project to develop guidelines for "best practice". In terms of selling timber to pay running costs, this was said to be difficult as many mills were remote from markets. Without cash sales there was no readily available source of funds to pay for the running costs of the mills.

* It should not be assumed that use of PSMs would automatically lead to sustainability. If all the mills in PNG were to operate on a full time basis, then the forest would certainly be over-cut. A large increase in the number of mills had occurred in 1990 when many politicians had bought PSMs for their constituents. There had been no follow-up to check how many of these mills were still operating and there were no standards for the operations to be checked against.

* Don Bakat agreed with the localised over-cutting that operators of portable mills caused, particularly when working close to the boundaries of their forest. He felt that there was a need for the Policy Division of the PNG Forest Authority to develop rules and that this required information about working practices to be collected and evaluated, in order to develop these rules. It was important because such small-scale operations 'were the future' now that an end could be foreseen to the current big-scale commercial operations. He also agreed with Gordon Konairamo's doubts about whether or not the PSM operations were really sustainable. He also agreed that the definition of 'community' was a problem in terms of its coherence. In PNG a community is composed of many families but such a group was not always cohesive.

* Ishmeil Libertino queried what aspect of the definition was a problem. Was it the size of permissible cut? How were PSMs to be defined? Were mills 'portable if they were shifted from place to place but had logs bought to the mill'? Or was a mill 'portable' only if it was shifted to the log? He also questioned the 'detachment' of advice from NGOs. He noted that one (VDT) was in fact a sales agent for portable mills [this information was incorrect] and suggested that in such a case the advice might not be disinterested.

* He said that five centres had been established as timber buyers for produce from portable mills and that this was necessary if the mills were to be a commercial success. However, he did not think commercial sales were necessary before a mill could be successful in community terms. He saw one of the problems to the success of PSMs as being lack of infrastructure. This was needed to get the produce from mill to market for a commercial sale. This was mainly a requirement for serviceable roads but not all roads in PNG were linked to markets. In some cases the requirement was for a road to a proper jetty so that produce could be removed by sea transport. He thought that some level of commercial activity was a requirement for success.

* There was some discussion about the role and competence of NGOs. It was said that Greenpeace had organised a sawmill too far from a beach, which was the only access to the market, for the project to be viable. There was a warning that NGOs had their own agenda and could be 'dangerous' to those they offered to help.

* Hartmut Holzknecht drew attention to the concept of the 'forest as a community asset' and that the effects which might follow from the loss of such a community asset is something that many

communities have no experience of and so do not comprehend. Ishmeil Libertino disagreed and advocated 'freedom' of action by communities.

* Dike Kari counselled that NGOs were a 'law unto themselves' in that they could not be made responsible if there were bad consequences from the actions they advocated. People should understand this is the situation and treat the advice with caution. He said that the aim of the current exercise should be to show us all how to "Get it right"! He said that this implied that what we advocated should be sustainable above all.

3. Project Seminar, PNG FRI, Lae.

3.1 Morning Session -

* This was a large gathering and those present were: officers of the PNG Forest Authority (both Head Office and field officers), researchers from FRI, portable sawmill owners, customary landowners and owners of larger sawmills. Some people belonged to more than one category.

* One of the speakers was Mrs Agatha Pokatou, a PFO (provincial forest officer) in the PNGFA. She spoke of a high concentration of PSMs in her area (Morobe). She had observed the use of PSMs over 25 years. The original use of these mills was as a community asset (in 1983). Success was defined as achieving community goals such as the building of a house or church. Today success is more likely to be defined in commercial terms based on the sale of the timber. Owners of PSMs might own or not own the resource they milled. There were many brands and types of PSMs used today. Critical factors included good access to a road and resource ownership. Most cutting was in fact carried out close to the roadside. Cuts tended to be 6x1, 8x1, up to 10x1. Thicker or wider sizes were not sawn as they were too heavy to carry out of the forest. Sometimes mill owners also owned a truck. Otherwise they tended to hire a truck when they had cut a truckload. Loads were transported to Lae for sale. If hired, the cost would usually be PNG K200 per load. The load, however, could vary from 2 to 6 cubic metres. It was said that buyers in town would pay PNG K1000 for six cubic metres but that often a load, believed to be around 6 cu m, would be downgraded by the buyer, on grounds of poor quality, to about 4 cubic metres.

* There was usually no record of where the timber was cut and although the size limit for cutting was 50 cm DBH, the actual tree size could not be verified. At the point of sale in town, only the sawmiller knew how to assess the timber volume; so the possibility of cheating was always high. There was no check on environmental requirements and often the timber was cut too close (< 50m) to the river. The limit for a PSM of 500 cubic metres per year was originally designed for the protection of the local forest owner. It was now being abused.

* Does the current system benefit the traditional forest owner? This is simply not known. There is no documentation for any current sales and complaints are hard to verify or judge. It is at least possible, even likely, that resource-owners are sometimes being swindled and that some sawmill operators are wasting the resource through poor knowledge and technique.

* Where PSMs operate far from the road then the produce may be extracted using a skidder hired from the Timber Industry Training Centre in Lae. In the hands of an untrained driver this can result in a great deal of damage to the forest.

* A sawmiller's view was put to the meeting. It was claimed that local sawmillers found it very hard to get access to forest resources and that for legitimate operators, the lack of infrastructure was a huge problem.

* A firm in Madang was named and it was claimed that they would buy sawn timber, without question, from any source. They never asked about the 500 cubic metres limit. It was also claimed that some owners of fixed mills also owned more than one portable sawmill. This was seen as a device to get around the 500 cubic metre limit and also to gain access to customary-owned forests. The sawmill owner would then re-saw the timber and present it for sale.

* This system was said to work because of the pressure to pay school fees. Parents wished to have their children educated but villagers living in the traditional way often did not have access to a source of money. Although the PNGFA received many complaints about this process they found them very

difficult to resolve and could not really determine who was at fault. Genuine commercial operators were hampered by the lack of roading infrastructure and organised markets.

* An NGO, Habitat for Humanity [HfH], (a Christian non-denominational charity with the aim of providing affordable housing for the people in PNG villages) made a presentation. The spokesman was Daniel Ranga. He claimed that for a village person who could get access to customary-owned forest resources and was willing to mill the timber himself with the aid of other villagers, then the cost of a basic home could be as low as PNG K4,000 - 6,000. HfH would supply the PSM.

* This was much less than the cost of PNG K50,000 for a comparable house that was fully purchased. If fully purchased, then there may be conflict over land title and access to the forest. There would also be no new skills learned unless the community participated in the milling and house construction.

* Disadvantages of PSMs were seen as expensive by the standards of a PNG villager at PNG K60,000. The mills were expensive to maintain, spare parts were difficult to obtain and the milling could do environmental damage.

* It was claimed that trees were inspected before felling and that timber must be extracted by hand by the potential owners. This was acknowledged to be hard work. HFH was said to have built 1500 houses for which 15,000 trees had been felled. This had saved 12 million Kina and to date (after 20 years) 9,000 families had been housed.

* Andrew Tagamasau, Timber and Forestry Training College (now part of the PNG University of Technology) in Lae (about 2 kilometres from the FRI building), spoke about the activities of his College. He agreed that inexpert use of a skidder could result in environmental damage and stated that the use of skidders from his college had now ceased. He said that sawmill techniques were taught at his College and this training program had provided about half of the trained operators in PNG, about 15 people.

* Mark Ann from a local company that sold PSMs spoke of the current situation. His firm had sold more than 200 mills. They did provide training or referred customers to the Timber Industry Training Centre (TITC). He thought that the PNGFA should be involved in the monitoring of operational standards. From his point of view, the major problem was the shortage of financial resources amongst his customers leading to slow payment for the PSMs that were purchased from his firm.

* Lukis Romaso drew attention to a potential supply of logs for PSMs amongst the rejected logs left on industrial logging skids. He said that on Manus Island they had a project to do this because good timber was being burnt.

* Hartmut Holzknecht made a plea for access to information about prices and measures of timber quality to be made available to PSM operators. He said the there should be some supervision of operations but said that he was not sure how best to do this in PNG.

* Agatha Pokatou said that she thought that a “sales and purchase agreement” was necessary between purchasers and sellers of timber sawn using PSMs. She thought that these agreements should be overseen and witnessed by officers of the PNG-FA. She also said that although this idea was widely agreed, no one had actually done anything about it. To make this approach work would require the active cooperation between sawmillers and purchasers of their wood. In practice, sawmillers had rejected any attempt to help them; regarding such help as a restraint of their ability to trade.

* Snow Kimpton said that operators should be licensed but that instead of looking to punish people for doing wrong we should be looking to help people to get it right. This would mean providing guidelines about how to select the correct trees.

* Another speaker said that originally, the limit of 500 cubic metres was meant to apply to landowners so that they would not be hampered in the use of their resource by restrictive requirements to meet regulations. This limit was now used by timber merchants and entrepreneurs to ‘rip-off’ resource owners. Many merchants were owners of a number of mills they let resource owners use so they (the merchants) could get access to timber.

* Another speaker who identified himself as a large sawmill owner said that many resource owners came to him first to ask him to help utilise their resource. The main aim should be to help landowners to do this even at a rate of 2-5 trees at a time.

* Another speaker (from the Southern Region) said that the problem was how to take control of the situation. He said that PNG lacked the legislative base. Like in Morobe Province, sawmillers would buy a few logs at a time. This way of trading was not the original intention of the law; which was meant to help families who wanted to take some logs for purely domestic use. He was of the opinion that as soon as timber was sold or traded, then the person must be registered. He thought that even a deal involving HfH should be registered because it was a commercial deal, however well intentioned.

* Mr Dike Kari said that this could be the job of Provincial Forest Management Committees who have responsibility for forest management within a particular province.

* Lukis Romaso pointed out, however, that operating any sawmill involved commercial transactions of some kind or other. Somehow running costs had to be provided for. There was fuel, maintenance and spare parts to purchase and the simplest way to cover these costs was to sell part of the production; therefore there would be some commercial returns.

* The policy is to export logs but in some parts this has created a resource that could be used by portable sawmills. In New Britain the lack of transport infrastructure is the major problem and this must be improved before PSMs can operate efficiently. He suggested that the Land Act and the Petroleum Act could be used to circumvent the Forests Act.

* It was said that spare part stocks were low in PNG because GST was paid on stock as soon as it was imported. This increased the amount of capital tied up in stock.

* Another speaker said that the definition of success needed to be examined. It was stated that we should be concerned with the landowners who were trying to obtain timber for their own use from their own forests and not commercial millers with vested interests.

* Other speakers discussed markets. It was said that the PNGFA should develop markets for the minor species. The speaker queried the concept of forest sustainability versus commercial sustainability and wondered what ways there were of measuring this.

* Agatha Pokatou made a plea for more information about what was logged from the forest and how the trees were selected. There was strong possibility that some trees were undersize when felled.

3.2 After this free-ranging discussion, the afternoon program was more structured:

* Mr Anda Akivi gave a presentation concerning the EU financed Eco-Forestry Program. This was community-based and aimed to provide sustainable forest management to community owned forests. There were Policy, Marketing and People components of the program. The program was consistent with the objects of the PNGFA policy on sustainable management. Currently utilisation was based largely on the two most marketable species, rosewood and kwila. But the aim of the Eco-Forestry program was to deal with the full range of forest products. They had assembled and made available information on a full range of PNG timber species. He said that it was good that the Eco-Forestry methods would be included into the practices of the PNGFA.

* Leo Angra also spoke about the Eco-Forestry program. There had been about 7 projects that had each produced their 500 cubic metres (per year?) from 2002 to 2006 (but mainly 2004-05). Total worth was said to be about Kina 400 000. This had been done with equipment worth Kina 50,000 per mill and donated by the EU. The cost of the mills was to have been repaid, based on an assumed rate of production of 15 metres cubed per month and an assumed sale price of Kinas 500 per metre cubed.

* Problems and constraints:
    - mills were slow to get to satisfactory operating levels

- the framing of the Enterprise Overseeing Committee needs review; this was meant to involve all groups in the community
- extraction of the timber was very difficult since some forests were over 7 kilometres from the road. The usual maximum carrying distance was 100 metres.
- Individual families or sub-clans in the communities had become possessive about the PSM.
- Practical trainers needed to be placed in the community for a longer period as interim managers.
- A detailed review of the 11-stage process was required.
- One group was training and using buffaloes to cart timber to the road (instead of the village women).

* Tommy Kosi (Village Development Trust [VDT]) spoke of his organisation's work. The objective was to find a mechanism to provide villagers with cheap housing, using their own timber resources as the main asset as well as their own labour. Under this scheme the house purchaser allows timber to be milled using a PSM. He also pays the VDT an amount, said to be Kina 6,000, for the costs associated with milling, building the house, materials other than timber and overheads, including the VDT fees. VDT also sells some of the timber to obtain some of the cost using a Central Marketing Unit that exports the timber. At face value, this seems to be a method of solving many of the problems associated with mill ownership, running costs and marketing of enough timber to acquire cash resources for operating expenses.

* A lecturer from Unitech, Lae pointed out that so many PSMs had been purchased in PNG that we were beyond the point where they could be stopped because of problems with their operation. They were here to stay, therefore we must concentrate on improving the skills of the resource owners so that they can use their mills and forest to the best advantage of all. The price of sawn timber in Lae is Kina 650 per cubic metre. Based on this and the costs of production, a miller has to work for around 3 months to break even. Factors considered were: sales revenue, wages of owner, wages of employees, rent, marketing cost, electricity, telephone, maintenance, depreciation, loan interest and repayment, insurance, business licence, raw material log price, other consumables, travel.

* Robin (Snow) Kimpton spoke: Factors for success were in his opinion mostly related to people and the skills they possessed. The Eco-Forestry program had proved this by being slow to start. Somewhere between 4-5000 sawmills have been bought in PNG. There are about 8-500 still running. They produce between 0.5 and 20 cubic metres per day; largely depending on the size of the tree.

* Regarding infrastructure problems: in areas remote from roads the mill operators may be able to provide enough timber to build a house with the help of a NGO, especially with operating (running) costs. In that case the project has been a success. In the case of a community project, it may be necessary to sell some timber in order to cover operational costs. However, where the infrastructure is good then the mill can be operated on a commercial basis generating its own cash flow and profit. Money might be invested back into the community. Timber houses will raise the living standards of the community as will first aid posts or the ability to deposit money at the local hospital to provide for free health care for the members of the community that owns the mill. Such results are good ones whether or not the mill is still running.

* If export is the aim then the species need to be known in the market place. The market for "white woods" is saturated on world markets. Species producing this wood might have a domestic market though. Kwila and rosewood fetch Kina 1,500 FOB out of Lae.

* The question of sustainability is not really considered by the small owners "and who can blame them". One house can be built from between 5 to 10 cubic metres of logs; therefore the annual limit of 500 cubic metres is sufficient to build at least 50 houses. This is well in excess of the needs of community owners and the limit could be reduced to 50 cubic metres without affecting their objectives. Mobile sawmills can be "profitable"; we just need to define the term "profitable" and state how it is to be applied.

* Lukis Romaso agreed that we should accept that PSMs are "here to stay" and that future discussion should be aimed at defining successful practice; we cannot turn the clock back and abolish them now.

* The conference then divided into groups and discussed what changes they thought were necessary. One opinion was that: the amount of volume cut below which there did not need to be formalities needed to be reduced. There needed to be an accepted code of practice for the operation of the mills, operators needed to furnish an estimate of annual production for statistical purposes, sales agreements made on a commercial scale, need to be registered, including the price paid.

* When discussing the effect on the environment of using PSMs, one spokesman said:
Milling occurred without formal planning or even any recognisable plan, there was no way of telling whether trees were being cut when undersize or volumes were exceeded, whether trees were felled too close to watercourses or extracted through streams. It was claimed that the legislation often conflicted. Where damage to the forest occurs, who pays for the rehabilitation? For example if high value species were eliminated by preferential selection for logging. Who would demarcate the areas to be logged, so that there would be no claims of conflicting land ownership. What resource security did mill owners have when the wider community might reallocate the forest they were cutting; even if they belonged to the community that owned the forest?

* Other speakers also advocated registration for all mill owners and all sales covered by a "purchase and sales" agreement. There should be a logging code of practice which would cover how close to water catchments logging could take place and what width the buffer zones should be around sensitive areas. Mill owners should be required to report production and penalties should be available for those who broke the rules. Not all speakers thought that penalties should be used and thought that education and incentives would work better.

* When discussing marketing the main comments were about the need for market information, particularly for millers to be able to estimate the worth of their production. Grade and size specifications were also not widely appreciated, leading to sub-standard production.

* Hartmut Holzknecht attempted to summarise the discussions.
<> He said that PSMs were now recognised as a legitimate component of the industry. There was a need therefore to develop strategies to use the mills correctly and to make sure that these strategies were followed. He pointed out that with the winding down of the large-scale projects, the small mills would become more important. He said that we know that forests can be maintained when felling is at a small scale. Therefore utilisation of PSMs will be a suitable system for the future and a source of wealth for resource owners and others involved in the chain of production and sale.

<> He noted that compared to Australians, the people of PNG had two types of identity - as individuals but also as members of a community. By contrast they were poor at forming associations across those groups. However an association of PSM owners would be useful if it lead to self-monitoring and to development of standards with internal self-discipline.

<> When marketing the produce, more information is required. Information lies at the heart of making good, informed choices in a market economy and PSM owners may be entering this for the first time.

<> Resource-owner security is a pre-requisite for the operation of a PSM; especially on a commercial basis. If ownership is disputed then the sawmill operator cannot enter into any agreement to supply timber.

<> Monitoring of activity is essential for sector planning. How do we know that all is well if we have no information on production, price, internal consumption and exports?

<> Forest management is necessary for continuity of the resource (sustainability). The correct trees must be selected for harvest in the correct amount, the remaining forest must be left in a condition that will allow the recruitment of smaller trees to the merchantable classes and the desirable species mixture must be maintained. As with any powered machinery, there are occupational health and safety issues with the operation of a portable sawmill, just as with an industrial sized mill.

4. Inspection of Operations in the field

4.1 Village Development Trust

* We inspected the field operations of the VDT under the guidance of Tommy Kosi. The forest had been logged four times since 1951. Operations were based on one family. Sawn timber was extracted from the site by hand (man-carried), then after about 20 minutes walk, by truck or 4WD to a main road. Timber was taken from the area by boat.

* The operation was certified by ForCert, under a group certification scheme. Produce was sold via a Central Marketing unit after being graded for domestic use or for export. To obtain full FSC certification trees cut must be greater than 70 cm. In this case the trees harvested are greater than 50 centimetres in diameter. The "allowable cut" has not been calculated. The most valuable species is Vitex. Short lengths were used for pallets set at 1.2 metres. A comment was made that the Lucas Mill was best in flat or near level ground. However, the Lewis mill was better for sloping ground. Purchase price for both mills was of the order of 49,000 Kina (AUD 25,000). The sales agent in Lae kept adequate spare parts. The engine being used had a two-cylinder petrol motor with an electric start. In the broken terrain of PNG, it took 4 people to carry in and set up the mill, the engine being the heaviest and most awkward part. It should be noted that in the situation we saw, the track into the mill from the road was quite easy to walk without load, being more or less level. However a shallow creek had to be forded a couple of times and the track twisted and turned around trees and other obstacles. It could easily be seen that getting the engine onto the site was a difficult job. Tommy said that the people operating the saw did not do it continuously because they had other tasks as well. He guessed that the sawmill operated about two thirds of "normal" 8 hour-five day a week time. He said that the operation of this particular mill was regarded as good and gave the opinion that this was because one family operated it and this family was a cohesive unit under the direction of the head of the family. On other occasions they had had to dismiss managers and leave the operation for 1.5 years before it could be restarted. The problem on that occasion was non-transparency of the operation and dissatisfaction with accounting for the money and hence the share of the money that each party was getting. In the area where we were shown, each family had been allocated a distinct area as their own. Family boundaries were convoluted in shape and reflected past allocations and re-allocations, disputes and trades; rather than recognisable terrain features. We were told that D-GPS mapping could be used to map these convoluted boundaries.

* From my observation of this operation it was clear that not every log from felled trees had been sawn. Those with awkward shapes, large defects (e.g., gross limbs on one side) or those logs which had fallen or rolled to give an awkward lie on the ground were the logs most likely to be left un-sawn. While this was rational enough in itself, it did mean that extra trees would need to felled to produce the same volume of timber. We were told that about 10 cubic metres (sawn measure) were needed to build a standard house, including cladding. This would represent about one week's production from a sawmill working full time.

* A second mill was seen. This was operated by another NGO, Habitat for Humanity. The all-up costs of a house produced by the HfH was about Kina 5,000 including administration costs. Timber was supplied from a forest resource owned or used by the potential house-owner. The HfH was ultimately owned by protestant churches in Michigan, a State of the USA. House costs were subsidised by the church to the extent of about 50%. HfH had operated in PNG for about 20 years and in the local parish of Urong (?) for about two years. For a person to benefit from this, they had to demonstrate a commitment to saving over a 6-month period. The expected rate of saving was Kina 60 per month and if that was achieved, then house building could start. In this community the repayments were 100%; but in other communities this was not so.

* If the timber was purchased it would cost about Kina 1,295 for 8 m cu (a house lot). (I note that this is different from the figure previously quoted. I think both are approximate figures and that the speaker genuinely did not know the exact figure.)

* Average sawn recovery was said to be 32%, but I noticed that many smaller pieces were left at the site, including those sawn to small lengths and board thickness (2 cm). I asked about taking out for fuel the very smallest pieces and those unsuitable because of excessive wane. The answer was that it was not worthwhile. There was no market for odd sizes and fuel was much easier to gather close to the houses rather than carry it out from such a relatively remote site. The situation of many of the working mills that we saw was that the mill was on steep sloping ground and that the soil was fine loam that became slippery when wet. I could easily understand why wood was being left behind.

* This was not the only work done by the group. HfH worked with other church groups to provide a clean water source for communities by drilling shallow wells. The speaker (Daniel Ranga) admitted that selection of trees for felling was not perfect and that HfH would like to work more under the guidance of the PNG-Forest Authority in this respect. The speaker was not able to give any information about the consumption of fuel and oil nor the current rate of repairs. This was common omission and indicated a general lack of awareness in these groups of the additional costs of doing business or simply operating a PSM. He confirmed that setting up a sawmill took about 4/5 people. HfH recommends the Lewis mill especially for its convenience on sloping ground. (We gathered that the Lewis mill does not have to saw on the level and that this kind of mill can produce timber when the mill travels up and down a slight slope.) There was confirmation that the timber for a house could be produced in one week if “all was ready”. Timber is air-dried in three weeks to three days depending on the weather.

* Observation was that in all the mills that we saw, care of the timber after sawing was often rudimentary. It was surprising to observe that this did not seem to matter. The timber species were ones that produced very high quality wood and the sawn pieces did not seems to deteriorate during drying; even if stacked badly.

4.2 Brahmin Catholic Mission, Ramu Valley

* Operation of PSMs were discussed with Luke, long-time Administration Manager for the local Catholic Mission (church and Schools). He said that about 100 Alaskan PSM’s operated in the forests around the Mission. The Church operates a large stationary sawmill itself in the area so he was familiar with mill operation. Many families paid for their school fees by selling timber to the Church; (fees were Kina 1,200 for a boarder and half that for a day pupil, per year). The main species, kwila, was bought at K750/cubic metre (log ?) and costs of about K 150 deducted for logging and extraction, depending on the difficulty and distance.

* There is a firm called Lae Builders in Lae that buys rough sawn timber from many mills in the area for re-saw and subsequent use or sale. The PSMs that supplied Lae Builders were said to be located close to the road where extraction distances would be short. This means that the forest in these locations is depleted and that erosion is common.

* Observation in summary (so far) is that trees are selected for felling based mainly on the convenience of their location, that not all logs from felled trees are sawn and not all sawn wood is extracted from the site. This is all understandable given the heavy physical nature of the work and the limited knowledge of sustainable forest management amongst indigenous forest owners. Some of the conversion factors quoted were extremely high and could only have been obtained if all wood was counted, including unsaleable small wood, wood with wane and wood with shakes. The effort of extracting all this wood is “back-breaking” and is simply not done. Conversion factors are meaningless in this sense of estimating the quantity of usable timber.

4.3 Goroka; Regional Office of the PNG Forest Authority

* Peter Garin, Provincial Forester, said that it was hard to monitor the production by PSMs as the area over which they operated was not fixed. If they wished to get some idea they had to make arrangements with individual owners. The number of Alaskan mills in the district is unknown but the number of Lucas/Lewis mills near Goroka is about 15-20. Mills are only registered when they wish to be eligible for aid (TA’s?).

* There is a constant low-level series of complaints about payment processes for timber sales. These are hopeless to resolve as the process of milling destroys the evidence that would settle the complaint. The operation cannot be reconstructed and as soon as the tree is cut up and the logs moved, the trail ends. Sawn wood is sold on a local market in Goroka. There are about 4 grades of timber sold there and demand is said to be high.

* The PSM is not usually owned by the actual operator who is entitled to do the milling. A common example is that the owner of a fixed sawmill will own 2 to 3 PSMs to supply him with wood for recutting into market sizes and resale.

* Mills are not required to be registered if the owners mill timber for their own use. If the timber is for resale then they should register as a 'Forest Industries Participant'. This enables the PNG-FA to inspect their timberyard and mill. The designation FIP means that you can enter a forest legally. It has no other meaning and the Forest Management Committee plays no part in directing the activities of the FIPs.

* Part of the deal when you purchase a Lucas Mill is that you receive training in the use of the mill and an issue of safety gear. There is little evidence that safety gear is actually being worn during bush operations. In the PNG climate it is generally too hot.

* In terms of plantations, the PNGFA has a list of the woodlots by owners; this is held in the extension branch. Some communities have substantial holdings (e.g., about 50 ha). There was a big interest in workshops on seedling and nursery management.

* Peter Garo talked of the budget constraints under which he worked and how he could not take on more projects without dropping the quality of those he did. The frequent reorganisations in the PNGFA hampered the development of consistent research and extension programs. Prior to the 1990's, when there was a National Forest Service, there was inspection of logged areas and rehabilitation after logging or mills sawing logs in the forest. This is not done now because the PNGFA is not an active manager of the forest. It was claimed that formal standards to judge the condition of the forest did not exist now. There is a Provincial Forest Management committee but this was not active at the small operator level; although at District level the staff might inspect their activities. There was no control or even information given about choice of species for exterior use, treatment or seasoning. Information on all these matters is known in PNG, mainly at the FRI, but is not communicated to users. There is no control on the choice of tree to fell.

* There is some information about prices and some eucalypt plantations are realising good prices for timber. For example, trees of 60 cm dbh, 30 m tall straight with no branches in the lower trunk get K 1,000 per tree.

* The team then went to see a sawmill in town this had a Peterson mill set up under cover to saw eucalypt logs. This was used as a breakdown saw and flitches were moved to a horizontal band saw, a docking saw and a breast bench saw for outside pieces.

4.4 Location, the Eco-Forestry project, demonstration area.

* This mill was located at Usino in the Ramu Valley and produced sawed wood from a forest that was carefully managed. They were in the process of training buffaloes to pull a small cart of wood out of the forest. Wood was sold through a Central Marketing Unit but this was not entirely satisfactory as the millers only received payment when their timber was finally sold. In this operation, we saw wood stacked very competently in a covered shelter; but also some wood that had been spoiled (externally at least) by lying in the bush when the sawmill was cut off by floods. Some of the wood will be down graded from export to local use.

* Our visit coincided with a visit by the ForCert the certification agency. We were shown and inventory of 10.5 ha of forest. There were 160 trees but only 28 could be felled. This represents 25% of the assessed available volume. This includes trees 2 cm below the felling limit to all trees above. The area was mapped and all trees of DBH greater than 50 cm were located on the map. All trees of merchantable or near merchantable size were identified and their direction of felling

determined. Volume was determined using a two-way volume table and the species identified. Not all species are selected because not all are accepted in the market.

* Under the FSC system the stand must be monitored every six months. There is a formal system of features to be checked. This amounts to a formal vetting of procedures followed. This demonstration was outstanding and was the only time we saw something as competently done in PNG. While not perfect (eg the one volume table was used for all species) it represented a great advance in forest management (my personal opinion). The procedures were simple, objective and if followed would result in harvesting of a defined proportion of the merchantable trees. The monitoring process included a chain-of-custody accounting.

* The return cycle was said to be 20 years. If followed this is most likely to lead to sustainable management. Total volume for the area was said to be about 1,000 cubic metres. This means that 250 cubic metres can now be cut every five years; after which the stand will be reassessed.

* We saw the sawmill attached to this stand. It was confirmed that four people were required to work the mill; more will be needed to transport out the sawn produce. Two or three were needed to fell the trees using chainsaws. Thus about 7 people are needed in total to produce the timber. These are all men, but if transport out is included the total is about 15 people and this total would include women. The mill is worked about 15 days a month or about half the possible time. The loggers need two areas to be felled, one for wet and one for dry weather. Current production was 5 to 10 cubic metres per month when the target was 15 cubic metres. We saw some problems with the Lucas mill that was being used. The feet of the guide rails kept sinking in the damp muddy soil and this put the guide rails out of alignment.

4.5 Location: Lae International Hotel

* These notes record the discussion between the project team and invited discussants at Lae International Hotel. A number of forest and PSM owners returned for a day of discussions. Attendance at this meeting included Daniel Ranga (HfH), Sairusi Bulai, Hartmut Holzknecht, Lukis Romaso, Albert, Harry Sakulas, Gordon Konairamo, Terence Titiulu, Tommy Kosi (VDT), Ryde James.

* Lukis Romaso said that there was usually no written agreement about payment when sawmillers operate on land owned by another person or group. This can lead to disputes over payment. In Bougainville (where he comes from) the arrangement is frequently one of barter or agreed share. For example, often the landowner will choose and fell and prepare the trees for sawing. The sawmiller mills the logs and the produce is shared, usually on a 50:50 basis. Some times the ratio is 1 for the Land Owner and 2 for the sawmiller. In either case the arrangement seems to work because of its transparent nature, the division is done openly and each side can see what the other has received. Common rate of production is 5 logs a day. On Bougainville both sides are well informed. The landowners might specify the dimensions to be sawn, and/or the species they will accept. Another arrangement is for the Land Owners to lease the mill for a few days and produce the timber that they want themselves. There have been problems with mills owned by the Eco-Forestry Program because the ownership of the mill is not clear; the deal becomes unstable over time.

* Tommy said that mill ownership could be complex. Strictly speaking Farmset owned the mill that he had shown us, but had lent it to the VDT to use, as long as they used it to train villagers. They regarded the mill as theirs for practical purposes.

* Lukis Romaso spoke of a program run by the Lutheran Church in Finschhafen where congregations used a mill to cut timber to build their own houses. In the end there were problems because the ownership and responsibility for the mill itself was not clear; for example who was entitled to use the mill. The Church regarded itself as the legal owners of the mill but did this on behalf of its congregation; which didn't always coincide with the owners of the resource. In this case part of the problem was that the scheme was designed in Germany and the assumption was made that the congregation and the resource owners were exactly identical.

* Tommy agreed that this was a potential problem but said that this had not occurred with the VDT because the ownership of the mill and forest was clearer.

* Sairusi Bulai asked why VDT had concentrated on running the PSMs through family groups. There was some discussion about the definition of a clan/family. Many families make up a clan, but to make the enterprise work in a stable manner the clan area is best divided into family groups. Tommy thinks that it is best to deal with single-family groups. Their problems come when repayments are not made on time. (The HfH group puts great reliance on the savings plan because of this.)

* There was a comment made that community groups were the right scale when the objective was a community project, such as a church, health centre or school.

* There was some consensus that the smaller the group you could deal with, the better; and the more closely the rights to the resource were established, the better. Also the less reliance on credit arrangements the better. Lukis commented that essentially the features that made the barter arrangements work were their simplicity, their transparency and the way that the wood was divided openly at one time to settle the deal.

* Tommy agreed saying that there was less tension if a tangible output could clearly be seen for the effort. An example could be a house per year for a community.

* Lukis said that a house per year was fine because it was visible and tangible. In this sense it was better than cash that could be lost or spent. Likewise timber as a tangible good for exchange was also a good method of payment. Lukis said that in Bougainville, one forest officer was required to supervise 5-10 sawmills.

* Tommy said that when people are given the option of cash or some tangible product such as timber, they mostly go for the timber. This was not to say that more complex arrangements could not work. An example where one house was built each year for each of four clans was quoted.

* It was said that training should be carried out within the community so that all members could learn the techniques. When only one went away to learn, they were often reluctant to share their knowledge.

* There was confirmation by all, however, that technical difficulties with sawing the timber are not a major source of problems; the major problems are organisational.

* Helping mill owners or operators better understand the business side of the operation was controversial. One view was that the operators should stick to the sawing. Others thought that help was needed with estimating and coping with running costs such as fuel and repairs and maintenance. While there was some agreement that operators needed some help with the business aspects some speakers pointed out that this was hard to do when operators were often semi-literate at best. This kind of person was often poor at planning ahead and needed help to do this.

* Harry reported that some progress was being made. The Eco-Forestry Program had been monitoring the operation of 7 mills and knew of others where after 9 years of operating they were now exporting timber that they had sawn, in their own right. He stressed that this kind of improvement takes a lot of time. The people need coaching over this time so that they can gain experience in solving the problems as they occur.

* Some of the discussants said that they had noted conflict between different NGO groups and that in fact they often competed with other foreign donors in the way that they helped the people. Where cooperation existed, it was often on an individual basis working together on the ground; not at organisational level or higher up the command chain.

* Other speakers indicated that this did work and was a positive force. Tommy talked about cooperation at two levels. He talked of a deal with an international donor that had then been broken down to local deals with a number of agencies.

* Hartmut asked about local rules for harvesting – were there compliance codes or standards?

* Harry answered that there were local rules in some cases which covered: buffer zones, size limits for trees, slope limits for harvesting, avoidance of sacred sites, directional felling and protection for succession crops (i.e., regeneration).

* Lukis said that although these guidelines exist, it was an open question who would monitor the performance.

* Hartmut noted that the PNGFA was already exploring ways in which it should work in the forests after the end of the big logging projects. He asked whether there was an incentive to form a logging association to help market the produce and to set standards of operations (technical standards).

* Albert said that the question of the 500 cubic metres limit should be re-considered. The imposition of operating standards was another question that should be explored.

* Lukis said that cruder methods such as slabbing were not wrong when combined with precision re-sawing. Hartmut added that the Alaskan sawmills were perhaps used best when the intention was to resaw the wood; this provided a genuine example of 'value-adding' at the village level.

* Another important aspect of this work was to evaluate the lessons of the Eco-Forestry Project, before it ended and the people dispersed.

* Gordon Konairamo described the conditions in the Solomon Islands, especially with regards to the application of forest regulations. They have a longer experience of working with portable sawmills. As with PNG, the emphasis has been on logging because that is the principal source of revenue. PSMs are encouraged because they prevent millers from buying wood from illegal sources. Millers must buy from licensed loggers and must report the sale.

* Terence Titiulu added that each application for milling must include a map of the source of the wood and this was checked with other claims for supply.

* Sairusi Bulai said that the situation was much the same in Vanuatu. Production without formal planning was capped at 500 cubic metres and production must be reported.

* Hartmut suggested that while PSMs could be seen to be successful, the communities did not always receive the majority of the benefits. How do we ensure a more equitable distribute of the benefits?

* Lukis suggested that this could only come from the monitoring of operations and a comparison of claims made before the logging began and the benefits obtained afterwards. An analysis of benefits in retrospect would show who got most out of the project. He noted that all of the buildings in his town (Buka) originally came from the product of PSMs. He asked about the rehabilitation of logged areas; whose responsibility was it to do it, who should pay for it?

* This raised a question about ownership of the forest. If you replant it do you then own it? The traditional view of a crop is that if you planted it, it was yours. Crops on traditionally owned land are therefore the property of the planter. Ownership is regulated by the community because you can only plant if you have permission to do so. It might be a good idea to ask the loggers to replant areas they have logged; but viewed in a traditional light, the subsequent ownership would not be clear.

* Daniel Ranga (HfH) said that his people did do replanting. The locals were good at growing seedlings because their lives depended on these skills so to grow tree seedlings was relatively easy. When the forest is mapped after logging, they also put on the map the families/ clans so that they know who did the work and who was involved.

* Hartmut asked the question: 'Who benefits from PSMs that are used to log traditionally owned forest?'

* Lukis said that this needed to be assessed carefully, particularly how much money stayed in the village. This is an economic benefit and so needs to quantified.

5. Port Moresby Discussions

5.1 Discussion with Kenn Mondiai (kmondiai@pwmpng.org.pg)

* Kenn works both for The Ecoforestry Forum (an umbrella organization for NGOs) and for another NGO, Partners with Melanesia (the latter had some funding from the Rainforest Foundation of Norway). He works mainly on the Managalasi Plateau (Oro Province). His experience with PSMs was bad and he now forbade them in his area. His focus was now on non-timber forest products. He did not see the development of PSMs as a good project for PNG except as a method of obtaining wood for a specific purpose. After that he thought that the mill should be dismantled and stored away until there was another legitimate use.

* Kenn said that because if the mill was still able to operate the people used this as a means to extend the boundaries of their gardens and thus destroyed the forest. Poor training means that all trees were felled and that the methods were dangerous to both the people and their forest. Kenn blamed poor training and the way in which PSMs could be used to get easy money. The result was a desire for more money and the continued destruction of the forest. The reasons and details of how this was so are given in the final report of the TRED. Main points: need more emphasis on training including safety and small engine mechanics; business training required; logistics of supplies in and timber out were two severe problems. The difficulty lies in getting fuel to the saw and carrying the timber out by hand. Community cohesion is important and this could upset it. The boundaries of different ownerships were often fragmented when viewed on the land. He thought that PSM owners needed an organization that was recognised by business; i.e., an association or cooperative. Incorporations and companies were not so good as the reporting requirements were too formal and onerous.

* Using reject logs was not straightforward. Many logging companies worked across clan boundaries and therefore the ownership of reject logs was often contentious, (where did they come from, whose land).

* Kenn said that he had learned that local landowners would squabble over money and were not interested in deferring returns for some intangible benefit in the distant future. This acts against the need to re-establish logged forest.

5.2 Port Moresby – PNG Sustainable Development Program

* 'The regulation which set 500 cubic metres as the limit for production without a formal plan has been repealed'. This was done by altering a definition in the section dealing with the application of the Act. The effect is that it is now legal for the wood from any sawmill to be traded commercially. If you claim that your cut is less than 500 cubic metres per year, then there will be no check on this or how the timber is used or traded.

* There was discussion of a development project in the Western Province close to the West Papuan border (Wipim-Tapila project area). The development would be away from the coast to keep any effects clear of wetlands and waterways and coast. The developers were trying to work with WWF and the local people.

5.3 PNGFA Dike Kari

Dike pointed out that while small groups might be more cohesive, you really needed a large forest area to practice proper sustainable forest management. He saw this as a counter-argument against forestry at the family and micro level.

[Original Ryde James notes edited by Hartmut Holzknecht