2.5 Financial analysis of small-scale harvesting in Papua New Guinea

RODNEY J. KEENAN, JIM GRIGORIOU and COSSEY YOSI

Introduction

Papua New Guinea (PNG) has about 29 million hectares (ha) of natural forest, mostly closed natural forest (Ambia 2005). The country has a population of 6.6 million, and has great ethnic and cultural diversity, with over 700 language groups. Most people live in traditional rural villages in or near forests and depend on subsistence farming (often based on shifting fallow methods) supplemented by cash crops. Almost all of the forests in PNG are under customary ownership by local communities, tribal groups or individuals and forests play a vital role in sustaining traditional subsistence livelihoods (Filer and Sekhran 1998). Forests also contribute income to government and communities. About 30% of the forest area is considered accessible for timber harvesting. A mix of forest-based industries has developed, including sawmilling, plywood and furniture production, although most timber harvested is exported as raw logs.

Developing a different path for forest management is an important national requirement to sustain the environmental, economic and social benefits for future generations of forest owners. Small-scale chainsaw milling and other types of portable sawmills can be part of that future; they have operated in PNG for nearly 40 years. They have been proposed as a potential alternative to large-scale timber harvesting by many participants in the debate over management of PNG forests. These methods provide a greater share of income to the forest owners from the utilization of forest resources, engage them more in forest production and minimize the impacts of large-scale timber harvesting operations. Mechanisms have been developed to support a combination of small-scale sawmills, certification and timber export to developed countries, particularly to Australia.[1] There has, however, been little detailed investigation of the financial viability of small-scale sawmill operations in PNG.

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Rodney J. Keenan, Jim Grigoriou and **Cossey Yosi** work for the Department of Forest and Ecosystem Science, University of Melbourne, Australia.

In producing timber for markets, portable sawmills usually operate near existing roads, often in areas where industrial logging has taken place and existing logging tracks and roads provide access to resources. The markets where the timber is sold (local or export) will determine the selection of species, log sizes and timber quality produced and the associated equipment needed.

Portable sawmills, with a saw blade driven by a petrol engine, are the most common type of portable sawmill used in PNG. Despite their long history of use, government has generally ignored portable sawmill operations in policy, extension and supervision, except when the operators intend to export products (in which case they require an export licence and timber permit), and there is little data on the number in operation or their production levels. In a nationwide study in 1993, Hunt (2000) estimated that about 1,500 portable sawmills were operating. Surveying 350 of these, Hunt found that operators were harvesting an average of three to four trees per week and employing about seven people each. An estimated 110 of the operations were community-based enterprises engaged in the processing and sale of timber from their forests to supply building materials to their community, to earn wages or to generate profits. A large number of mills still operate around the country producing timber for local use, sale to the domestic market or export. Three types of portable sawmills are in use: the Lucas mill, the Peterson mill and the Lewisaw.

Chainsaw mills are generally more affordable and easier for communities to operate than portable sawmills. An estimated 10,000 chainsaws are sold annually, about 20% of which are used as chainsaw mills. Chainsaw mills generally have a chainsaw head and a rail bracket attachment to produce slabs of timber. Currently, three types of chainsaw mills are being used: the Alaskan mill, the Westford slabber and the Westford ripper.

The production capacity of chainsaw mills is low compared to that of a portable sawmill (0.5 to 1.0 m^3/day of sawn timber, compared to a portable sawmill output of 3 to 5 m^3/day). Chainsaw mills are easier to set up and to move in rugged terrain and inaccessible areas. They can also generate higher recovery by producing round or oval stools and tabletops for furniture from buttresses and bent trees. On the other hand, chainsaw mills consume more fuel and may be more expensive to use.

The aim of this article was to examine the financial viability of small-scale sawmill operations in PNG using a simple financial model. The study is based on the harvest and processing of up to 1000 m^3 of logs annually with a single portable sawmill, the minimum scale at which a community might produce economically viable timber supplies. Costs and other operating issues were researched primarily for portable sawmills. Chainsaw mills are mainly used to produce timber for domestic purposes and generally not for the market. The study also considered the financial viability of adding value through drying and planing of timber for a growing domestic urban housing market or for export.

Production and supply models

The analysis aimed to investigate potentially sustainable production models based on portable sawmills that could provide relatively continuous supplies of sawn timber to different types of markets. Timber (particularly the many dense PNG timber species that are most sought after in the market for furniture, flooring and other higher value uses) is a heavy commodity. The study analyzed the operation of a portable sawmill with supporting equipment (truck and tractor) so that community enterprises could avoid dependence on extensive manual labour to move the mill or transport timber. While many communities and groups currently operate mills, using manual labour to move equipment and transport sawn timber, this is a poor use of community members' time and unsustainable both physically and financially.

The minimum requirements for this type of operation are a single portable mill, a truck to transport the sawn timber to buyers, and a tractor to relocate the mill to the log site and move boards from the forest to the roadside. Portable mills can generally produce four classes of timber, which are related to tree species and log and board quality. We assume that an equal proportion of each class is produced. We examined the effects of varying the transport distance (from 50 to 400 km) and improving sawn timber recovery (35–50%).

Reduced-impact logging (RIL) practices were assumed to be adopted (cutting lianas, direction felling to avoid damage to retained trees, minimization of ground disturbance and limiting canopy disturbance and gap size). Trees are felled using chainsaws and the portable mill is carried to the felled tree and constructed around it. Four production and supply models were considered in the analysis:

A. green sawn (un-dried) boards sold in the nearest commercial centre (no value adding);
B. green sawn boards of A grade material from Category 1 species sold for export through a central marketing unit — all other timber is sold to local buyers (no value adding);
C. value-adding to Category 1, A and B grade sawn timber through kiln drying and dressing for the timber exported — all other timber (mixed hardwoods) is sold locally as green material; and
D. value-adding to Category 1, A and B grade sawn timber through kiln drying and dressing. All material (including green-sawn, mixed hardwoods) is sold locally (no exports).

Models included costs associated with certification as Community-Based Fair Trade, the first of three stages of full forest certification.

Financial modeling

A financial model was developed to evaluate the performance of these different production models over 20 years. The performance of each production model was assessed using the following criteria:

1. profitability in each of the first three years of operation;
2. average return on sales (or profits as a percentage of sales) over the 20-year period;
3. funds required to purchase the equipment and provide working financing;
4. the payback period (the number of years it takes to repay the start-up investment costs from the free cash flow generated by the operation);
5. accumulated profits during
   a) the first five years of operation, and
   b) over the 20-year period.
6. Net Present Value (NPV) – excess or shortfall of the stream of cash flows expected over the 20-year life of the operation, assuming a discount rate of 20%.

Financial model assumptions and data

The study assumed that the community owned the forest, paying no stumpage cost or log royalties to the government and that all sawn timber was sold. No time was included for replanting with natural regeneration; applying selective harvesting and RIL is assumed to provide for forest regeneration. The time required to start up the business was considered to be free time. Communities bear the full cost of certification. There was no financial value included for other non-timber forest benefits. Production per sawmill varied between 1 and 3 m^3/day (depending on terrain, tree species and level of mechanization). Production was assumed to occur on 173 days per year, which accounts for the wet season and breaks for other community needs. It was assumed that communities used existing roads; road construction costs (generally very high in PNG) were not included in the analysis (Table 1).

Timber prices were established from surveys and interviews with various merchants and companies. These were adjusted over time according to the assumed inflation rate (see below):

- class 1, A grade green sawn timber sold locally, PNGK 1000/m^3, exported PNGK 1300 per m^3, dried and dressed PNGK 2000/m^3 (same price in local or export markets);
- class 1, B grade green sawn timber, PNGK 650/m^3, dried and dressed material PNGK 1300/m^3;
- mixed hardwoods, A grade, PNGK 500/m^3; and
- mixed hardwoods, B grade PNGK 400/m^3.

Table 1. Inputs to financial model

input	cost (PNG Kina)	comment
capital costs		
portable mill, chainsaw, winches and miscellaneous equipment	100,000	miscellaneous equipment includes work gloves, protective clothing, spare cutting blades, air filters, crowbars and tool kit
truck tractor skidder	260,000 162,000 900,000	
labour costs		
wages	1,562 per week	nine staff: feller and assistant, mill operator and assistants, manager-financial controller, truck driver and tractor operator. Basic wage PNGK 101.8 per week, with an incentive factor for staff retention of 1.5 (= K153 per week)
training	27,000	Payment in first year
operating costs		
fuel maintenance	24 per day of operation 12 per day of operation 40 per m^3 40 per m^3	
transport to market	0.40/km	cost of fuel, registration and insurance
marketing and administration	30/m^3 for local; 60/m^3 for export	
other costs		
certification	US$13,500 initially; US$2,800 in years two and three; and US$1,400 in every year thereafter	
export costs	4,000 per container	

Note: All costs are in PNG Kina (US$0.37, except where indicated) for 2009 and subject to inflation over the life of the study (see text).

* This is as per discussions with FPCD, Madang, January 25, 2010.

Other key assumptions

The projected inflation rate was assumed to be 8% over the next four years (Bank of Papua New Guinea 2009) and to decline to 5% annually in years 6–20. Timber prices and the cost of all equipment and consumables increased each year in line with this fore-

cast. A 33% straightline annual depreciation was assumed for portable mills, chainsaws and winches (replaced every three years), with a 20% straightline depreciation for other capital equipment. Miscellaneous costs of 20% of the total of marketing, administration, training and certification were assumed. Returns and bad debts were assumed to be 5%. All purchases were assumed to be paid on receipt of goods and buyers were paid on delivery. Community enterprises do not pay individual or company tax.

Results

Exporting green sawn timber of higher value species and selling other species locally (Model B) was the most profitable option, earning PNGK 1.9 million over 20 years and with almost 15% return on sales (Table 2). It also had the shortest capital payback time (three years). Model A (no value adding and sale of all products locally) was moderately profitable (PNGK 0.6 million of accumulated profits over 20 years). Start-up capital costs were the same as in (Model B) but it took a year longer to pay them back.

Table 2. Comparison of four models for a portable sawmill (PNGK)

financial criteria	Model A	Model B	Model C	Model D
total profits, years 1–5	14,700	56,500	–507,000	69,600
total profits, years 1–20	608,000	1,914,000	-3,183,000	429,000
average return on sales	4.84%	14.86%	–19%	2.4%
start-up costs	780,000	780,000	1,800,000	1,800,000
payback time of initial investment	year 4	year 3	not possible	year 5
NPV	20%	20%	20%	20%

Note: Based on harvesting and processing of 1,000 m^3 of log input per year and 50% sawn timber recovery from forests located 100 km from the point of sale in Papua New Guinea. 1 PNG Kina = US$0.37

Investing in adding value to the output from a single sawmill was not justified given the current prices for timber. Model D — involving adding value and selling locally — was less profitable than options A and B (PNGK 0.43 million over 20 years), with a lower return on sales (2.4%).

Model C (adding value through kiln drying, dressing and export of high-quality timber, with all other timber sold locally as green material) was unprofitable (a loss of PNGK 3.2 million over 20 years, and a 16.4% average loss on sales). It was not possible to pay back the starting capital in this option.

To make value adding profitable, a significantly higher scale of production is required to cover the high fixed and variable costs associated with operating a timber yard.

Certification is a significant up-front cost that is currently not demanded by the local market. If communities choose not to pay for certification, the profitability of model A, where all timber is sold locally, would increase by 10% over the 20-year period.

None of the models returned a profit in the first year of operation. Model A and B were unprofitable in the first year, but were profitable in nearly all subsequent years. The financial outcomes are obviously highly sensitive to timber prices and costs (such as labour, equipment and costs of servicing capital).

Two other important determinants of profitability are transport distance and rate of log recovery:

- Transport distance is a key factor; the most profitable operations are situated close to markets. Assuming 50% timber recovery from each log, production model A remains profitable (net positive average return on sales) when it is located within 170 km of the point of sale. Higher prices received for export materials allow producers of green, rough-sawn boards for export (model B) to be located up to 340 km from local buyers. By adding value and selling timber locally (model D) producers can be profitable within 140 km from the point of sale.
- Recovery from each log helps determine the viability of small-scale processing operations. For example, in the simplest production option (Model A) for an operation close (within 50 km) to the buyer, reducing the recovery rate from 50% to 45% decreased total profitability over the 20 years from PNG 0.97 million to PNG 0.25 million (Table 3).

Table 3. Variation in financial indicators

	rate of recovery (%), green boards						
	44	45	46	47	48	49	50
accumulated profitability, years 1–5 (PNGK)	–1,200	3,400	8,000	12,600	17,200	21,800	26,500
average return on sales, years 1–5 (%)	–1.58	–0.10	1.30	2.70	3.97	5.21	6.41
accumulated profitability, years 1–20 (PNGK)	109,000	253,000	397,000	542,000	686,000	830,000	974,000
average return on sales, years 1–20 (%)	0.39	1.83	3.20	4.53	5.78	7.00	8.15

Note: Sawn timber recovery from processing 1,000 m^3 of logs in a portable sawmill (Model A green sawn boards, sold locally)

Conclusions

This article shows that a single portable sawmill can be operated profitably in a community-based enterprise when it is worked to maximum capacity with high recovery and if the resource is relatively close to the point of sale and the operation does not have to cover road construction costs. Market prices, productivity, recovery and distance to market are the main determinants of profitability. Value adding by drying and dressing timber can double the sale price but is not justified for single small-scale operations.

Timber processing, even for small-scale portable sawmill operations, is capital-intensive. Few community-based operations in PNG currently achieve the required mill production, recovery and transport arrangements for long-term financial viability of their portable sawmill operations. Aggregating production and producing at a larger-scale can increase viability, but this presents political challenges for communities. High transaction costs are associated with being a part owner of a processing facility and significant continuing effort is required to ensure that the community receives an equitable return from its resource and labour inputs.

Access to capital to commence a portable sawmill operation is also critical to its success; harvesting a larger area can overcome problems of scale. With increased volume from a larger area, a skidder can be used to move logs to stationary mills, but this could lead to impacts such as damage to the forest floor, soil erosion and water quality problems.

Effective leadership, business skills, motivated and trained staff, attractive salaries and equitable distributions of surpluses are critical to the success of any community enterprise.

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Endnote

1. See, for example, FORCERT (www.forcert.org.pg).

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