Objective 1.2

Coconut Veneer Value-Chain Proposal

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Coconut Veneer project

Development of advanced veneer and other product from coconut wood to enhance livelihoods in South Pacific communities

Australian Government
Australian Centre for International Agricultural Research
UNIVERSITY of TASMANIA
Queensland Government
SPC Secretariat of the Pacific Community

Contents 3

1.0 INTRODUCTION

Many palms in coconut plantations in the South Pacific Islands are of an older age and are only providing low nut yields. These palms and have been identified as senile and ready for replacement, or the conversion of the plantations to alternative land use. A rotary peeled coconut veneer product industry is being investigated as an option for the use of logs that will be extracted when senile palms are harvested. If this option proves attractive, it will be essential to determine the most efficient way to establish a coconut veneer product industry, so opportunities for providing access to finance, markets and technology can be realised.

A value-chain describes the full range of activities which are required to bring a product or service from conception, through the different phases of production, through to distribution and delivery to the final consumer. The assumption is made that each process step of the chain of activities gives the product more added value so all persons engaged in the chain benefit from their participation. A value-chain for the coconut rotary peeled veneer can be defined as the identified range of activities required to produce, market, trade and deliver this product to the final consumer. These activities include:

- The harvesting of the wood resource to be used in production of the product.
- The transportation of the resource to downstream processors.
- The physical transformation of the wood resource by one or more processors.
- The trades and services required to get the product to the final customer.

It is beyond the scope of this project objective to perform a comprehensive coconut veneer value-chain analysis as many of the characteristics of the chain are yet to be confirmed. Therefore, this document presents a more concise Coconut Veneer Value-Chain Proposal. The proposal identifies opportunities for intervention by investors who have the influence to improve the income generation of those engaged in the coconut veneer chain and would benefit from the establishment of an industry.

1.1 Aims and objectives

This value-chain proposal for coconut veneer focuses on the chain's commercial impacts and examine the value proposition by identifying the economic values at each stage in the chain. More specifically, the study aims to:

- Trace the product flows.
- Determine resource availability.
- Identify products and process flows.
- Identify the cost of production facilities and services that will contribute to product manufacture.
- Establish the required level of community and institutional support.
- Define strategies to improve earning opportunities for all players in the chain.

It is assumed that value is being added to the product as it is being transformed and delivered.

About this report

This report is part of the ACIAR-funded coconut veneer project *FST/2009/062: Development of advanced veneer and other product from coconut wood to enhance livelihoods in South Pacific communities.*

The project team includes researchers and collaborators from the University of Tasmania's Centre for Sustainable Architecture with Wood (CSAW), the Queensland Department of Agriculture and Fisheries (QDAF) Innovative Forest Products Team, the Pacific Community (SPC), the Fiji

Department of Fisheries and Forestry, the Samoan Ministry of Natural Resources and Environment, the Solomon Islands' Ministry of Forestry and Research, and industry in Australia and Pacific Islands. The project supports economic development in Fiji, Samoa and the Solomon Islands and includes activity in market and value-chain assessment, log harvesting, veneer production and product manufacture, and the development of viable uses for coconut residues at the harvest site or the production facility.

More information about the project is available at www.cocowood.net.

2.0 Coconut products

Coconut plantations across the South Pacific Islands provide fresh food in the form of flesh, coconut cream and milk and many other consumable products. The following list (derived from PARDI, 2011) identifies many of the products processed from the coconut or derived as by-products from the coconut palm. See Figure 1.

- Coconut water from the immature nut is a traditional local fresh drink and is now being positioned as a premium priced health drink in international countries.
- Dry coconut flesh is traditionally processed as copra for the oil extraction in local copra mills, or is sold to copra traders for further processing.
- Coconut and palm oil remain important oils for soap-making due to their solidifying characteristics.
- Virgin Coconut Oil (VCO) is used for skincare (moisturisers, lotions, massage oils and soaps), cooking and fuel.
- Fresh and canned coconut milk and cream pressed from copra is used locally, and also sold to export markets.
- Coconut husk yields a fibre (coir) for local woven goods, geotextile mats, and insulation filler for car upholstery and plant mulch.
- The coconut shell is used mostly to fire coconut copra dryers, but is also in demand for bowls, jewellery, ornaments and other handicrafts, and for high-value activated carbon used in filters.
- Copra meal residue from oil production is used for cattle feed and for food grade meal used in bakery goods.
- Coconut palm wood is used in exclusive furniture and in craft and other household items. The palm wood stems are also used in construction and to encourage the clearing of senescent plantations and replanting, the high density wood component of mature trees has been trialled successfully as a flooring material (Bailleres et al. 2010).

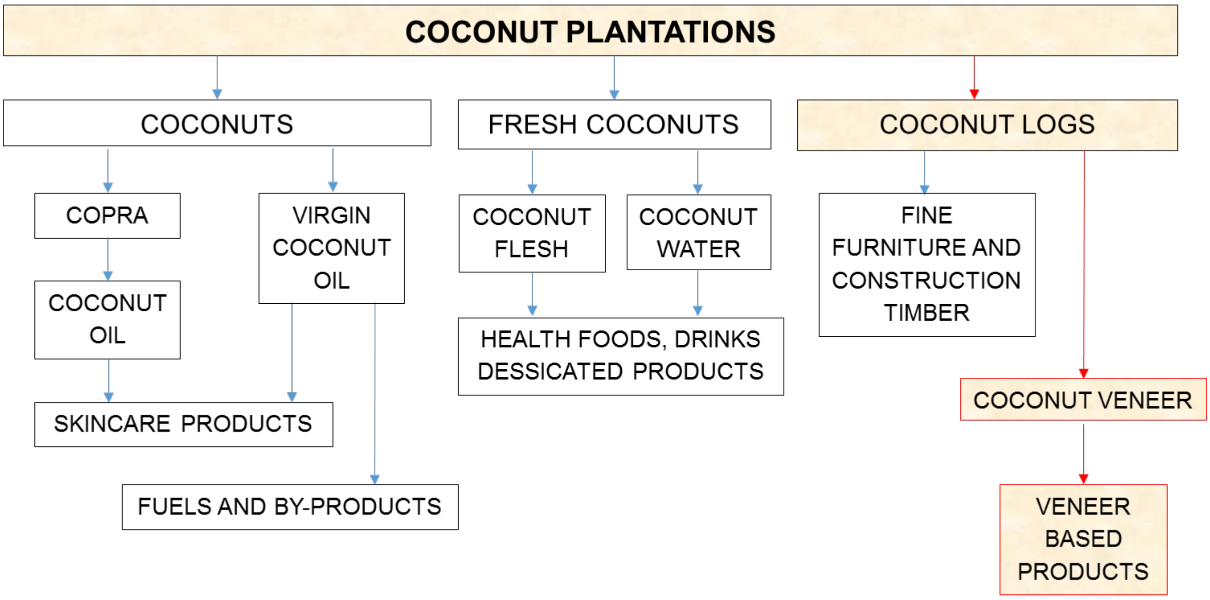
If investors are to be attracted to finance the infrastructure required to establish a coconut veneer value-chain, it is essential to identify which products can be made, what characteristics of those products consumers are seeking and how these products are made. Nolan and McGavin (2016) identified product potential for veneer and veneer-based products in appearance and structural application while McGavin and Bergmaier-Masau (2016) and McGavin et al. (2016) identified material characteristics, and defined product assembly and structural performance. In this process, a number of potential products were developed to demonstrate the feasibility of producing attractive end products from veneers extracted from the coconut log. See Figure 2. CSAW also produced a number of appearance plywood samples which were distributed to Australian veneer based product companies for evaluation and comment.

Most responses were very favourable, with one premium veneer supplier being especially attracted to the darker coloured, higher density veneer. Most companies were understandably reluctant to comment on price, though Mr Soren Holm, the Director of Global Ventures/ Eco-Core®, a plywood board producer specialising in multiply high pressure laminates for appearance products, thought a combination of light and dark coconut veneers arranged in the same board would produce an attractive product. He also commented that he would expect a value of at least $8.00 AUD per m^2 sheet to be realised for dried good quality, dark veneer with a consistent appearance (S Holm 2016, pers. comm., 28 April). The price cited was what the company presently pays for bamboo veneer of 3 mm thickness. EcoCore has subsequently requested the supply of coconut veneer for in-house product development and evaluation.

The $8.00 AUD per m^2 sheet price cited equals a value of approximately $2,640 per m^3. It is possible the coconut veneer could command a higher price for certain grades, given that the veneer has a very even appearance with potentially three distinct colour grades that can be combined to produce a range of attractive plywood or multi-laminar appearance products (McGavin et al. 2015). Senior Managers Ms Juel Briggs and Mr Paul McGovern at Briggs Veneers in NSW Australia, were impressed with the darker coloured veneer and mentioned how different colour groups could be combined to provide a distinctive and appealing end product. They also commented that they would like to see how different processing treatments could darken the veneer (J Briggs, P McGovern 2016, pers. comm., 29 April).

Only one outlet was found to be currently marketing coconut veneer. The company, Global COCO Enterprise has details of product on the Alibaba.com website at www.alibaba.com/product. However, no firm coconut veneer price per unit was offered online and the company did not respond to enquiries about their coconut veneer nor did they offer the product for sale on their home webpage: http://cocofibre.en.ecplaza.net/.

Figure 1: The primary coconut value-chain with coconut logs and veneer as a by-product



3.0 Coconut palm log availability and supply

Without a coconut veneer industry and defined product markets it will be difficult for South Pacific Island communities with coconut plantations to determine the best palm harvesting strategies that simultaneously:

- Meets demand for coconut palm logs.
- Gradually replaces senile coconut palms.
- Maintains an agreed rotation period for a plantation.

If a coconut veneer industry is established, then log harvesting will most occur to match demand. If demand is high, careful harvest planning will be needed to ensure the number of palms extracted from any particular area or community does not adversely affect the supply of resources necessary for other coconut-based products in the long term. Nolan and Blackburn's *Guide to Community Development of Estate Coconut Renewal Plans in South Pacific Island Countries* (2016) discussed community planning to maintain a plantation's productivity for all coconut based products in detail. As it describes, local community land owners with tenure over small coconut plantations (less than 25 hectares) will likely decide if and when to harvest and replace coconut palms. However, if a successful coconut veneer industry is to be established, these community smallholders will have to work cooperatively to meet the coconut palm log supply demanded by a developing industry.

Section 5 below examines coconut veneering enterprise potential cash-flows for different scale-operations. Most of the enterprise options presented require major capital investment, most likely from existing large scale processors established and operating successfully in a related industry. These investors will seek to reduce their log supply risk and secure log suppliers who can offer consistent quality, volume and cost. This process can often exclude or disadvantage smallholder communities, forcing them into smaller markets and potentially increasing poverty (Collins et al. 2016).

To capitalise on the market opportunities, these smallholders should only harvest and supply the quantity of logs they can immediately sell to downstream processors. Thereby each community will benefit by not competing with each other for log supply and by working cooperatively to negotiate the best price for their logs. In contrast, if communities work individually and the market has an oversupply of coconut veneer logs from uncontrolled harvesting, a supply chain mentality may result. Under these circumstances, to increase returns for each community, the chain members will complete with each other, ultimately forcing down the price that the processor has to pay for logs.

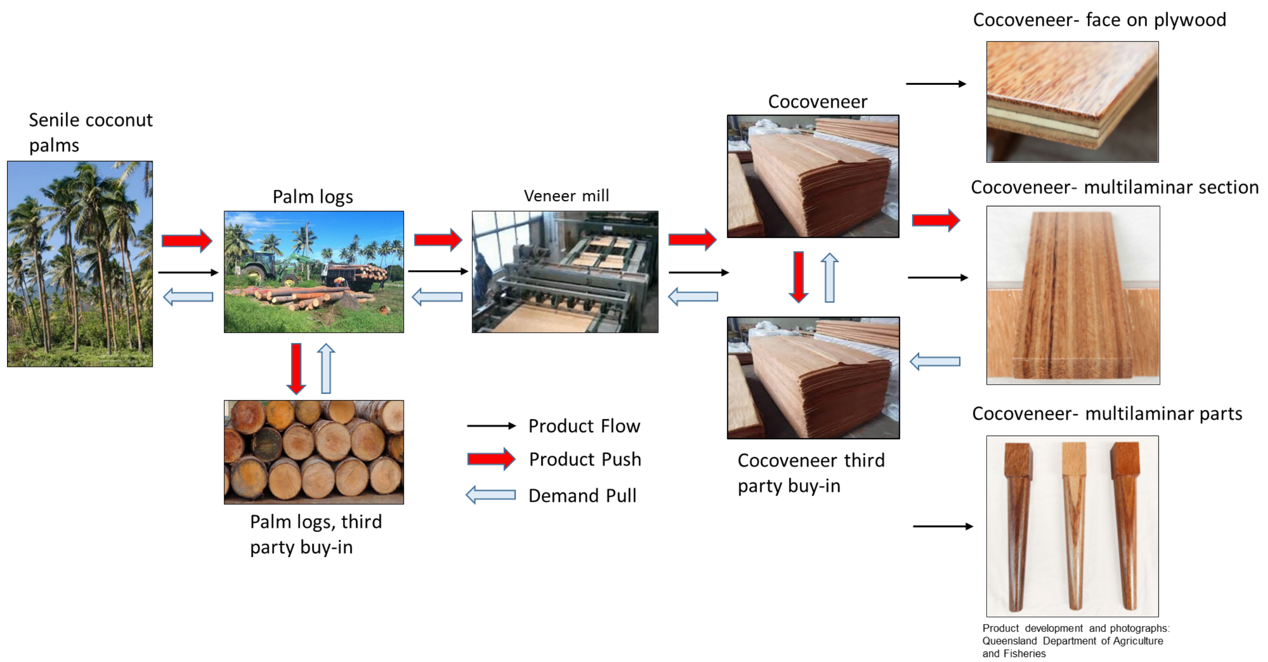
Besides building a cooperative approach to log supply with other plantation holders, the communities must establish good relationships with the log processors and understand their market system and its complexities. This will enable them to respond quickly to feedback from the processor to determine how they can efficiently supply of logs with less wastage, which will also improve revenue returns.

4.0 Coconut veneer product processing flows

Initial rotary veneer peeling studies (McGavin 2015) suggested veneer product recovery from the coconut palm log was too low for a viable coconut veneer product industry to be developed. In later trials, the QDAF group developed processing protocols that resulted in levels of veneer recovery comparable to traditional timber billet peeling (McGavin and Bergmaier-Masau 2016). The results from these studies also showed a significant improvement in many key veneer qualities compared to previous studies, which increases the number of potentially viable coconut veneer end-products.

If a coconut veneer value-chain is to be successfully established based on the potential shown in these studies, it will be important for all participants in the chain to appreciate other participant's different needs and priorities. This will rely on good communication between all members in the chain and will improve the effectiveness of production, money and information flows, thereby improving the overall performance of the chain. In value-chain thinking, the aim is to reduce the product-push, demand-pull competition in transaction-by-transaction relationships that can often impede or distort information flows (Collins et al. 2016). See Figure 2.

Figure 2: Coconut veneer product value-chain flows



For now, the problem that needs to be solved is whether finally assembled coconut veneer products and the veneer, from which these products are made, can be produced in the South Pacific Islands while providing a return attractive enough for potential investors to finance the required processing infrastructure. Firstly, to consider a coconut veneer value proposition, different value-chain operations necessary to produce the product and deliver it to consumers need to be identified. As also shown in Figure 2, these operations should also include potential third parties, who may wish to buy into the product chain at strategic points.

5.0 The value proposition

Before committing funding to finance a larger value-chain analysis, those interested in an enterprise proposal must appreciate the value of any investment considered. If short-term costs are not exceeded by longer-term gains the proposal is not economically feasible and should not proceed. A cost vs. benefit analysis is the most common and easily understood method of evaluating how effective a newly proposed enterprise will be. Costs, savings and benefits must be accurately assessed before further action to implement the system is taken.

In this study, final products are not yet fully defined and markets are not established, only identified as potentials. Therefore, exact costs and revenues for all expenditures and returns are not available. While these are not necessary to examine financial feasibility, any estimates used should be accurate enough to determine if the proposed project would have an acceptable return on investment.

Questions that need to be raised and the estimates required in a cost/benefit analysis of a coconut veneer enterprise in include:

- Is the project possible given resource constraints?
- Are product values and cost recoveries used for modelling acceptable?
- Estimated costs of equipment and infrastructure.
- Estimated cost of future depreciation.
- Estimated costs of installation.
- Costs for maintaining the system.
- Capital equipment/infrastructure replacement costs.
- Labour costs.
- The cost of training employees.
- Legal/establishment costs.
- What is the optimal financing arrangement (rent/lease/purchase)?

5.1 Financial models examining five enterprise options

The five financial models derived during this study examine the cash-flows over a 20 year period for different enterprises as shown in Table 1. They have different equipment configurations that are selected for different scales of operations and are presented as balanced options. The equipment has been selected to meet the capacity of the production output being modelled for and to complement other equipment included in the processing line.

Table 1: Five enterprise options with different production configurations.

Enterprise Options	Production Capacity
Option 1. A single low cost 8-foot (2.4 m) spindleless rotary peeled veneer (RPV) processing line installed at an existing sawmill operating on a single day-shift.	Processing 15,000 m^3 of peeler logs to produce 8,250 m^3 of green coconut veneer product per annum.
Option 2. One 8-foot (2.4 m) and one 4-foot (1.2 m) high-grade spindleless RPV processing line installed at an existing sawmill and operating on two day-shifts.	Processing 50,000 m^3 of peeler logs to produce 27,500 m^3 of green coconut veneer product per annum.
Option 3. Independent veneer drying and grading facility. At an existing peeler mill, with a quality built continuous veneer dryer and upgraded heat plant operating one day shifts.	Processing 35,000 m^3 of delivered green veneer to produce 28,000 m^3 of dried coconut veneer product per annum.
Option 4. An extra shift at an existing peeler mill. Costs have been included for staff night shift loadings and upgrading of the heat plant and buildings for the additional production output.	Processing 35,000 m^3 of delivered green veneer to produce 28,000 m^3 of dried coconut veneer product per annum.
Option 5. A new integrated mill installed at a greenfield site with an 8-foot (2.4 m) and a 4-foot (1.2 m) high-grade spindleless RPV line, a new heat plant and one new quality build continuous dryer operating two shifts for peeling and one for drying. This is included mainly for the Solomon Island and Samoa.	Processing 50,000 m^3 of peeler logs to produce 27,500 m^3 of dried coconut veneer per annum.

Table 2: The staffing levels required for the option shown in Table 1.

STAFFING	Option 1	Option 2	Option 3	Option 4	Option 5
Log docking	0.5	2	0	0	2
Loader operator	0.5	1.5	0	0	1.5
Line operators / Fork-lift driver	6	10	13	13	23
Supervisor / leading hand	1	2	1	1	2
Maintenance /Control room	0.5	1	1	1	2
Sales, Admin & Accounting	0.5	1.5	2	2	2
General Manager	0.5	1	1	1	1
TOTAL	9.5	19	18	18	33.5

5.2 Cash flow analyses

In the cash flow analyses, different enterprise options are presented on five separate cash flow analysis worksheets in excel (Appendices B1–B5). Values shown in the worksheets are derived from base-cost values, which are actively linked to a costs and returns worksheet. A summary of these costs and returns are presented in Appendix A.

These values were based on figures that were directly available from equipment manufacturers and suppliers. The costs and price values for logs, wages, transportation and energy costs presented are current at the time of writing and were obtained during surveys conducted by CSAW staff during visits to the South Pacific Islands. McGavin and Bergmaier-Masau (2016) provided estimated recovery percentages for green and dry veneer from the coconut palm billet. If commercial development of one or more of these options were considered, further work to test the reliability of these figures is recommended, especially for those values known to have widely fluctuating prices such as coconut palm logs and energy costs.

The most popular and easily understood capital budgeting techniques are: Payback Period, the discounted cash flow methods- Net Present Value (NPV) and the Internal Rate of Return (IRR). These have been used in the cash flow analyses of the various models presented (http://www.financeformulas.net).

Payback Period is probably the simplest and easiest to calculate of all the capital budgeting techniques and is the time it takes for an investment to pay for itself or recoup the initial outlay.

Payback Period = Initial Investment / Periodic Cash Flow

Net Present Value is the sum of the present values of all the annual net cash flows minus the initial investment. It is a useful capital budgeting technique because it considers all cash flows, takes into account time-value of money, and for a chosen discount rate has a clear and objective financial decision criteria value. One problem with NPV is that it is difficult to compare the NPVs of investments of different sizes, but does show the amount of wealth that can be created. The formula for the discounted sum of all cash flows can be rewritten as:

$$NPV = -C_o + [C_1/1+r + C_2/(1+r)^2 + \dots + C_T/(1+r)^T]$$

Where;

$-C_0$	is the initial investment (negative cash flow is money going out)
C_T	is the cash flow for that year
T	is the time in years
r	is the discount rate

In any large capital investment venture it is important to consider the opportunity cost of capital necessary to finance an enterprise. The cost of investment in the enterprise has to be compared to the interest that would be received from an alternative investment of a similar or lower risk (M4P 2008). In this study, a decision comparison criterion- *12% IRR at five years* was chosen as a target hurdle, as this was slightly better than an investment in the S&P500 stock index for the last twenty years (10%). The IRR is the percentage rate where the total present value of the sequence of cash inflows, is equal to the present value of the cash amount invested. Usually, final product prices are known and the IRR can be examined, and then the project is either accepted or rejected at a chosen rate and period the investors determine is acceptable for the associated enterprise risk. For example, it could be 15% at 4 years.

When the IRR is used to discount the cash flows expected from an investment it will produce an NPV of zero value. This was the preferred technique for the comparison of the five enterprise models presented in this report, as it allowed for a direct comparison of the different scales of operation and equipment investment options.

In this study, final green and dry veneer product prices are unknown. Therefore, price estimates per cubic metre of product were adjusted in the cash flow models (*Appendices B1-B5*) until *the IRR at a 12% target at five-years* was achieved. Using the IRR to calculate a product price that is feasible for processing, allows potential investors to examine if this is a realistic price for that product and assess the potential for downstream processing, or for making direct sales.

Statements and assumptions relevant to the cash-flow enterprise options presented (Appendices B1-B5) are:

- All costs and prices included are in Australian dollars - $AUD.
- Plant and equipment is straight line depreciated over 10 years.

- Staff on-costs are: 20% for all day shift staff and 40% for night shift.
- EBIT is an acronym for Earnings before Interest and Tax (operating earnings).
- Net Cash Flow = EBIT + Depreciation.
- Working capital for start-up is one-quarter (3 months) of sub-total of expenses in year one.
- Installation and establishment cost is an estimate of costs for planning submissions, legal and accounting fees, site preparation and installation.
- Productivity estimates and labour costs are based on equipment supplier specifications, from industrial users of the equipment proposed and employers in the industry. Annual production volume is based on 7.5 hours of machine operation per 8-hour shift x 340 days per annum.
- Log price shown is a mill gate estimate for 180-360 mm small-end diameter peeler quality coconut palm logs.
- Coconut veneer price returns are set to achieve an IRR 12% hurdle rate at 5 years.
- In an integrated peeling and drying enterprises, residues from peeling will be shredded for boiler furnace fuel.

5.3 Sensitivity analysis

Sensitivity analysis is used to determine the impact the change of a particular base cost will have if it differs from what was previously estimated. A set of both favourable and unfavourable percentage changes to base cost variables (set to achieve the 12% - at 5 years IRR benchmark) were performed for the enterprise models, to gauge the changes in the IRR at 5 and 10 years of operation (See *Appendix C*).

6.0 Discussion and Conclusions

The following paragraphs discuss the financial modelling of the five different scale enterprise options examined in this study. Any conclusions drawn are not intended to present an argument for or against a business case for that enterprises examined, but aim to elucidate the feasibility of each option at established base costs and estimated returns. The different scales of operation are configured to provide alternative options depending on: the developing market for a coconut plywood product, a particular location and the availability of investment finance.

6.1 Option 1

This option is for single low cost spindleless RPV line, installed at an existing sawmill operating on a single day shift, processing 15,000 m^3 of coconut palm logs to produce a green coconut veneer product. See Appendix B1 for details.

This scale of operation was modelled for existing small-scale sawmill operators or timber manufacturers to consider investing in additional processing equipment to complement their operations. Because of the smaller processing scale, initial capital investment costs are much lower, but the lower volume of logs processed means the operation is highly sensitive to any fluctuations in both operation costs and to final product prices, where small changes could dramatically alter all measures used to assess financial returns (Appendix C). These prices and costs for logs may be difficult to negotiate, unless operating under a cooperative arrangement with other small-scale producers who are supplying green coconut veneer to an independent drying operation. Another limitation for this operation is the high-cost of LPG required for the billet preconditioning unit, although this is essential as a high recovery volume of quality veneer is necessary for operation revenues. This scale of operation may be suited to the low demand for coconut veneer, which is likely until products are established and the markets well defined. The green veneer produced could be sold directly to larger scale processors with drying operations, or could be dried for them at cost and returned to be sold on later as a dried coconut veneer product to downstream processors.

6.2 Option 2

This option is for two low cost spindleless RPV lines, installed at an existing sawmill operating on two shifts a day processing 50,000 m^3 of coconut palm logs to produce a green coconut veneer product. See Appendix B2 for details.

This larger-scale of operation is configured to annually process most of the coconut palm logs available in a regional South Pacific Island location. Presently green veneer production is not considered as an option for the Solomon Islands and Samoa, as they have no established veneer drying operations. The model assumes coconut veneer based products have been established and a defined market exists, and that there is a continual demand for the logs. Similar to *Option 1* above, the main limitation is the high cost of liquid petroleum gas (LPG) used for the pre-conditioning tanks to prepare the coconut palm billets for rotary peeling. Although this larger-scale option has not the same degree of sensitivity to operating costs as option one, it remains fairly sensitive to fluctuations in the returns for green coconut veneer. Ideally this operation would be installed at (or within close proximity to) an existing rotary peeling mill with a continuous veneer dryer.

6.3 Option 3

This option is for an independent veneer drying and grading facility installed at an existing saw or peeler mill, with a new continuous dryer and an upgraded heat plant operating on a single day shift to produce dry graded coconut veneer. See Appendix B3 for details.

The high quality jet-box continuous drying line chosen for this option is expensive when compared to veneer drying lines available from Chinese manufacturers. However, managers in two companies that have installed both types of dryer advised that the higher build quality of European built dryers and their reliable technical support, had proved more cost effective to their operations in the longer term. Cheaper drying and grading lines are available, but investigation showed that purchasers of these types of dryers were rarely satisfied with their performance, stating they rarely met the manufacturers claims of production processing volume and were subject to high thermal losses. For an independent drying/grading enterprise without onsite peeling, a relatively high dry veneer product price is required to achieve the target IRR 12% benchmark. The main shortcoming of the stand-alone drying-grading facility under study is that all the fuel required would need to be supplied from external sources. The costs associated with direct gas heated dryers and water-tube boilers heated with wood residues and/or diesel were examined. Establishing the drying and grading facility at either a sawmill or an existing veneer mill with a heat plant with additional capacity to run a jet-box dryer, which could be upgraded for the sum identified in the cost assumptions in Appendix B3, was considered the only possible option that would make this enterprise financially viable at the chosen IRR benchmark. It is highly unlikely a new heat plant of $AUD 8-12 million could be amortised into cash flows if the dry veneer price was market competitive, while at the same time attractive returns ensued for investors.

6.4 Option 4

This option is for coconut veneer drying and grading performed at an existing veneer peeler mill, with moderate upgrading of plant and equipment, operating on a single night shift to produce coconut veneer. See Appendix B4 for details.

Purchasing green coconut veneer at a price viable for green veneer producers and drying the veneer within an existing rotary peeling operation proved to be the most financially attractive option with an IRR 12% benchmark achieved at a relatively low price. However, because of low capital investment and the higher staffing costs accrued by operating a proposed night shift, the operation was moderately sensitive to operating costs and to both green veneer and final dried coconut veneer product prices. This option appears to be suited for initial establishment of a coconut veneer based product industry where small-scale green coconut veneer peeling operations, also working on low capital investment, could supply their dried veneer to a centralised drying operation, which in-turn could scale-up its operations to match any increasing demand from downstream processors. If demand was constant and sufficient, additional capital investment could be sought to increase the mills capacity and to complement existing operations, Options 2 and 3 above could be considered. This option could be attractive for an existing rotary peeling mill with a continuous veneer dryer, such as the mills that operate on the island of Vanua Levu in Fiji. Alternative these mills could, with only minimal capital expenditure on the upgrading of existing manufacturing plant and equipment, integrate dried coconut veneer production into their existing operations.

6.5 Option 5

This option is for integrated Mill with one 8-foot (2.4 m) and three 4-foot (1.2 m) high grade spindleless RPV lines operating three shifts, a new boiler and heat plant and one continuous dryer and scanner/grader operating a single shift over 24 hours to produce dry graded veneer. See Appendix B1 for details.

Both the Solomon Islands and Samoa have no existing veneer peeling operations or large sawmills with heat plants installed for producing kiln dried timber. Therefore, the main impediment to a competitive final dried veneer product price is the required investment capital to install a new fully integrated veneer processing plant. However, both Island countries have access to low cost coconut palm logs and lower labour costs than Fiji, which means substantially lower operating costs and to some degree this can offset the cost of capital investment over a 10-year depreciation. The overall product price estimate of $396 per m^3 (see Appendix B5) for dried coconut veneer could be reduced to a more competitive $328 per m^3 if a refurbished boiler and heat plant were installed at approximately half the new cost estimated (see Appendix C). The mill configuration option proposed would provide utility of the presently available log resources and for the future the dryer and grading line could also potentially process green veneer supplied from smaller-scale local independent veneer peelers. Other advantages of an integrated mill include: the rotary veneer peeling produces a residue that can be processed at minimal cost and used as a heat plant fuel source, that transportation costs between peeling and drying/grading facilities are eliminated, handling equipment can be utilised across the whole facility and that labour can be multi-skilled to operate anywhere across the plant. Even with large capital investment, these advantages reduce the dry veneer product price to achieve the benchmark 12% IRR as shown (Appendix B5). It should be noted that a large capital investment is needed to finance such a facility and a more detailed study would be required to verify the business case for potential investors.

6.6 Concluding remarks

The lower production volume enterprise options models were found to be highly financially sensitive (*Appendix C*), especially where a small decrease in log volume processed or green veneer price, or small increases in operating costs would result in negative IRR values. Conversely, this sensitivity also meant a small favourable change in these variables resulted in large positive increase to the IRR (*Appendix C*). As expected the larger production operations were less sensitive to cost fluctuations, although the low investment option, which had the most attractive return (low product price to meet a target 12% IRR) was highly sensitive to unfavourable cost changes.

The outcomes from the modelling of proposed operations bodes well for the establishment of a coconut by-product industry based on coconut veneer. When considering the least financially attractive option; the entirely new infrastructure and plant required for the Solomon Islands and Samoa, the benchmarked base cost price should be low enough to successfully market the dried veneer to downstream processors, or third party buyers and distributors. The $291-396 per m^3 estimated return for 3.0 mm thickness veneer, equates to $0.87-1.19 AUD per m^2 sheet, which should easily permit downstream participants to add value along a future chain, allowing them to grow with an increasing product demand from the consumers.

Future work should now focus on refining commercial products and market characteristics.

Once commercial products and market opportunities are defined, additional funding should be sought for the collection of additional data and a larger value-chain study. The outcome, a detailed value-chain analysis examining the full range of chain activities is essential, so potential participants can better understand the opportunities and focus on production, chain logistics, distribution and marketing to meet consumer's needs.

7.0 Acknowledgements

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- Ms Elizabeth Kerstin, of NMRE.
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9.0 Appendices

The following appendices are Microsoft Excel spreadsheet outputs that are provided as part of the economic feasibility study of this report. All values shown are in Australian dollars.

9.1 Appendix A. Cost and return estimates

CAPITAL COSTS, LOWER COST OPTION RPV LINE SAUD		
Log docking station	$	50,000
Billet transporter	$	10,000
Log deck/peeler charger	$	38,000
Log LPG heating preconditioning unit	$	50,000
Waste conveyors	$	12,000
RPV spindleless lathe	$	54,000
Veneer conveyor	$	20,000
Clipper	$	10,000
Stacker	$	6,000
Site preparation	$	25,000
Upgrade to Australian Codes	$	9,000
Line installation and establishment	$	25,000

CAPITAL COSTS, HIGH-GRADE PEELING LINE $AUD		
Buildings & site infrastructure	$	45,000
Log docking station	$	100,000
Billet transporter	$	40,000
8' (2.4 m) Peeler. Round-up + RPV	$	858,000
4' (1.2 m) Peeler. Round-up + RPV	$	612,500
Waste conveyors	$	36,000
Site preparation	$	15,000
Installation and establishment	$	125,000
Knife grinder	$	90,000
Installation and establishment	$	75,000

CAPITAL COSTS, DRYER and GRADING OPERATION $AUD		
Delivered waste fuel hopper	$	150,000
Wood Shredder	$	330,000
New biofuel heat plant and boiler	$	8,250,000
Second hand biofuel heat plant and boiler	$	4,100,000
Boiler/Heat Plant refurbishment for a new dryer	$	1,000,000
Boiler/Heat Plant refurbishment -existing plant	$	500,000
4-deck Jet-Box continuous Drying System	$	6,000,000
2-deck Jet-Box continuous Drying System	$	4,500,000
Wood shredder conveyors	$	180,000
Installation and establishment	$	210,000
Wrapping unit	$	20,000
Control room upgrade for new dryer	$	50,000
Racking/Storage	$	150,000
Sales and admin facility upgrade	$	45,000

WEEKLY LEASE COSTS $AUD		
Front end loader - large	$	3,500
Front end loader - small	$	1,800
Forklift	$	250

STAFFING cost p.a. $AUD		
Loader operator	$	5,667
Forklift operator	$	4,133
Shredder operator	$	4,133
Peeler lathe operator	$	5,667
Dryer operator	$	4,133
Log docking	$	5,667
Clipping/stacking, trainee line assistants	$	4,133
Wrapping/Stores/Despatch	$	4,133
Supervisor/leading hands	$	6,333
Maintenance Staff	$	6,333
Sales, Admin & Accounting Staff	$	5,667
General Manager	$	8,800

SALARY LOADING	
Employer on costs	20%
Employer night shift +on costs	40%
Salary adjustment for Solomons and Samoa	-30%

OPERATING COSTS $AUD		
Log resource per m^3	$	60.0
Packaging per m^3 green veneer	$	1.5
Fiji Electricity Tariff KWh p.m.	$	25.7
Solomons and Samoa Electricity KWh p.m.	$	64.3
Av. Rates Premises per m^3 veneer	$	1.0
Consumables per m^3 veneer	$	2.0
Wrapping/Packaging per m^3 dried veneer	$	4.0
LPG Fuel Av. per Ltr	$	1.2
Freight to wharf per m^3 veneer	$	12.0
Wood residual for biofuel delivery /tonne	$	12.5

GENERAL EXPENSES p.a.		
Auditing and Legal per m^3 veneer	$	0.5
Insurance per m^3 veneer	$	3.0
Water Rates per m^3 veneer	$	0.5
Office Equipment per m^3 veneer	$	0.1
Phone/Communications per m^3 veneer	$	0.1
Training start-up per m^3 veneer	$	1.0
Training ongoing per m^3 veneer	$	0.2

9.2 Appendices B1 – B5. Cash flow analyses

9.2.1. B1. Option 1 - A single low cost spindleless RPV line

One low cost 8-foot (2.44 m) spindleless RPV line installed at an existing sawmill and operating on a single day shift processing 15,000 m^3 coconut palm logs to produce a green coconut veneer product.

				YEAR	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
EXPENSES																									
CAPITAL COSTS					309000																				
WORKING CAPITAL FOR START-UP					318368																				
OPERATING COSTS						1098753	1098753	1098753	1098753	1098753	1098753	1098753	1098753	1098753	1098753	1098753	1098753	1098753	1098753	1098753	1098753	1098753	1098753	1098753	1098753
VEHICLE LEASES						104000	104000	104000	104000	104000	104000	104000	104000	104000	104000	104000	104000	104000	104000	104000	104000	104000	104000	104000	104000
GENERAL EXPENSES						9400	9400	9400	9400	9400	9400	9400	9400	9400	9400	9400	9400	9400	9400	9400	9400	9400	9400	9400	9400
STAFFING						60320	60320	60320	60320	60320	60320	60320	60320	60320	60320	60320	60320	60320	60320	60320	60320	60320	60320	60320	60320
TRAINING AND DEVELOPMENT					3000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
SUB-TOTAL EXPENSES (Incs. Inflation p.a. @ 2.5%)				1.025	630368	1273473	1305310	1337943	1371391	1405676	1440818	1476838	1513759	1551603	1590394	1630153	1670907	1712680	1755497	1799384	1844369	1890478	1937740	1986184	2035838
DEPRECIATION 10 years @ 10%)					0	30900	30900	30900	30900	30900	30900	30900	30900	30900	30900	0	0	0	0	0	0	0	0	0	0
			TOTAL EXPENSES		630368	1304373	1336210	1368843	1402291	1436576	1471718	1507738	1544659	1582503	1621294	1630153	1670907	1712680	1755497	1799384	1844369	1890478	1937740	1986184	2035838
GREEN VENEER REVENUE																									
	$/m3	m3 p.a.																							
SUB-TOTAL REVENUE $	**174.5**	**8250**			0	1439625	1475616	1512506	1550319	1589077	1628804	1669524	1711262	1754043	1797894	1842842	1888913	1936136	1984539	2034152	2085006	2137131	2190560	2245324	2301457
(Incs. Price Increase p.a. @ 2.5%)				1.025																					
			EBIT		-630368	135252	139406	143663	148027	152500	157086	161785	166602	171540	176601	212688	218006	223456	229042	234768	240637	246653	252820	259140	265619
			NET CASH FLOW		-630368	166152	170306	174563	178927	183400	187986	192685	197502	202440	207501	212688	218006	223456	229042	234768	240637	246653	252820	259140	265619
			CUMULATIVE CASH FLOW		-630368	-464217	-293911	-119348	59580	242980	430966	623651	821153	1023593	1231094	1443782	1661788	1885243	2114285	2349054	2589691	2836344	3089164	3348304	3613923
DISCOUNT RATE	5%		**NPV 5%**							**$124,041**					**$792,816**					**$1,385,677**					**$1,911,240**
DISCOUNT RATE	10%		**NPV 10%**							**$28,666**					**$491,648**					**$816,900**					**$1,045,395**
			IRR							**12%**					**25%**					**28%**					**29%**
			PAYBACK YEAR	**6.0**																					

9.2.2. B2. Option 2 - Two high-grade spindleless RPV lines

One 8-foot (2.44 m) and one 4-foot (1.22 m) spindleless RPV lines, installed at an existing sawmill operating on two day shifts processing 50,000 m^3 coconut palm logs to produce a green coconut veneer product.

				YEAR	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
EXPENSES																									
CAPITAL COSTS					1932500																				
WORKING CAPITAL FOR START-UP					1063666																				
OPERATING COSTS						3693473	3693473	3693473	3693473	3693473	3693473	3693473	3693473	3693473	3693473	3693473	3693473	3693473	3693473	3693473	3693473	3693473	3693473	3693473	3693473
VEHICLE LEASES						208000	208000	208000	208000	208000	208000	208000	208000	208000	208000	208000	208000	208000	208000	208000	208000	208000	208000	208000	208000
GENERAL EXPENSES						19900	19900	19900	19900	19900	19900	19900	19900	19900	19900	19900	19900	19900	19900	19900	19900	19900	19900	19900	19900
STAFFING						138040	138040	138040	138040	138040	138040	138040	138040	138040	138040	138040	138040	138040	138040	138040	138040	138040	138040	138040	138040
TRAINING AND DEVELOPMENT					6000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
SUB-TOTAL EXPENSES (Incs. Inflation p.a. @ 2.5%)				1.025	3002166	4061413	4162948	4267022	4373698	4483040	4595116	4709994	4827744	4948437	5072148	5198952	5328926	5462149	5598703	5738670	5882137	6029190	6179920	6334418	6492779
DEPRECIATION 10 years @ 10%)					0	193250	193250	193250	193250	193250	193250	193250	193250	193250	193250	0	0	0	0	0	0	0	0	0	0
			TOTAL EXPENSES		3002166	4254663	4356198	4460272	4566948	4676290	4788366	4903244	5020994	5141687	5265398	5198952	5328926	5462149	5598703	5738670	5882137	6029190	6179920	6334418	6492779
GREEN VENEER REVENUE																									
	$/m3	m3 p.a.																							
SUB-TOTAL REVENUE $	**176.5**	**27500**			0	4853750	4975094	5099471	5226958	5357632	5491573	5628862	5769583	5913823	6061669	6213210	6368541	6527754	6690948	6858222	7029677	7205419	7385555	7570194	7759448
(Incs. Price Increase p.a. @ 2.5%)				1.025																					
			EBIT		-3002166	599087	618895	639199	660010	681342	703207	725618	748590	772136	796270	1014258	1039615	1065605	1092245	1119551	1147540	1176229	1205634	1235775	1266670
			NET CASH FLOW		-3002166	792337	812145	832449	853260	874592	896457	918868	941840	965386	989520	1014258	1039615	1065605	1092245	1119551	1147540	1176229	1205634	1235775	1266670
			CUMULATIVE CASH FLOW		-3002166	-2209829	-1397683	-565234	288026	1162618	2059074	2977942	3919782	4885168	5874688	6888946	7928561	8994166	10086412	11205963	12353503	13529732	14735367	15971142	17237812
DISCOUNT RATE	5%		**NPV 5%**							**$595,426**					**$3,784,649**					**$6,611,856**					**$9,118,140**
DISCOUNT RATE	10%		**NPV 10%**							**$140,607**					**$2,348,454**					**$3,899,501**					**$4,989,135**
			IRR							**12%**					**25%**					**28%**					**29%**
			PAYBACK YEAR	**6.0**																					

9.2.3. B3. Option 3 – Independent veneer drying and grading facility

Installed at an existing saw- or peeler mill. A new European built automated continuous dryer, with upgraded heat plant and processing facilities operating on a single day shift to process 35,000 m^3 of green coconut veneer to a dried veneer product.

				YEAR	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
EXPENSES																									
CAPITAL COSTS					6525000																				
WORKING CAPITAL FOR START-UP					1783179																				
OPERATING COSTS						6957916	6957916	6957916	6957916	6957916	6957916	6957916	6957916	6957916	6957916	6957916	6957916	6957916	6957916	6957916	6957916	6957916	6957916	6957916	6957916
VEHICLE LEASES						39000	39000	39000	39000	39000	39000	39000	39000	39000	39000	39000	39000	39000	39000	39000	39000	39000	39000	39000	39000
GENERAL EXPENSES						21800	21800	21800	21800	21800	21800	21800	21800	21800	21800	21800	21800	21800	21800	21800	21800	21800	21800	21800	21800
STAFFING						112000	112000	112000	112000	112000	112000	112000	112000	112000	112000	112000	112000	112000	112000	112000	112000	112000	112000	112000	112000
TRAINING AND DEVELOPMENT					4000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
SUB-TOTAL EXPENSES (Incs. Inflation p.a. @ 2.5%)				1.025	8312179	7132716	7311033	7493809	7681155	7873183	8070013	8271763	8478557	8690521	8907784	9130479	9358741	9592709	9832527	10078340	10330299	10588556	10853270	11124602	11402717
DEPRECIATION					0	652500	652500	652500	652500	652500	652500	652500	652500	652500	652500	0	0	0	0	0	0	0	0	0	0
			TOTAL EXPENSES		8312179	7785216	7963533	8146309	8333655	8525683	8722513	8924263	9131057	9343021	9560284	9130479	9358741	9592709	9832527	10078340	10330299	10588556	10853270	11124602	11402717
DRY VENEER REVENUE																									
	$/m3	m3 p.a.																							
SUB-TOTAL REVENUE $	**355**	**28000**			0	9940000	10188500	10443213	10704293	10971900	11246198	11527353	11815536	12110925	12413698	12724040	13042141	13368195	13702400	14044960	14396084	14755986	15124886	15503008	15890583
(Incs. Price Increase p.a. @ 2.5%)				1.025																					
			EBIT		-8312179	2154784	2224967	2296903	2370638	2446217	2523685	2603089	2684479	2767903	2853414	3593561	3683400	3775485	3869873	3966619	4065785	4167429	4271615	4378406	4487866
			NET CASH FLOW		-8312179	2807284	2877467	2949403	3023138	3098717	3176185	3255589	3336979	3420403	3505914	3593561	3683400	3775485	3869873	3966619	4065785	4167429	4271615	4378406	4487866
			CUMULATIVE CASH FLOW		-8312179	-5504895	-2627428	321975	3345113	6443830	9620015	12875604	16212583	19632986	23138900	26732461	30415862	34191347	38061220	42027839	46093624	50261053	54532669	58911074	63398940
DISCOUNT RATE	5%		**NPV 5%**							**$1,609,263**					**$10,695,367**					**$20,712,284**					**$29,592,160**
DISCOUNT RATE	10%		**NPV 10%**							**$349,315**					**$6,635,970**					**$12,131,395**					**$15,992,017**
			IRR							**12%**					**25%**					**29%**					**29%**
			PAYBACK YEAR	**6.0**																					

9.2.4. B4. Option 4 – Operating an additional shift at an existing rotary peeling mill.

An additional (night) shift operating in an existing rotary veneer peeler mill to process 35,000 m^3 of green coconut veneer to a dried veneer product. Costs for new or upgraded building and equipment are included.

				YEAR	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
EXPENSES																									
CAPITAL COSTS					1475000																				
WORKING CAPITAL FOR START-UP					1787221																				
OPERATING COSTS						6957916	6957916	6957916	6957916	6957916	6957916	6957916	6957916	6957916	6957916	6957916	6957916	6957916	6957916	6957916	6957916	6957916	6957916	6957916	6957916
VEHICLE LEASES						39000	39000	39000	39000	39000	39000	39000	39000	39000	39000	39000	39000	39000	39000	39000	39000	39000	39000	39000	39000
GENERAL EXPENSES						20300	20300	20300	20300	20300	20300	20300	20300	20300	20300	20300	20300	20300	20300	20300	20300	20300	20300	20300	20300
STAFFING						130667	130667	130667	130667	130667	130667	130667	130667	130667	130667	130667	130667	130667	130667	130667	130667	130667	130667	130667	130667
TRAINING AND DEVELOPMENT					2500	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
SUB-TOTAL EXPENSES (Incs. Inflation p.a. @ 2.5%)				1.025	3264721	7148882	7327604	7510794	7698564	7891028	8088304	8290512	8497775	8710219	8927974	9151174	9379953	9614452	9854813	10101183	10353713	10612556	10877870	11149817	11428562
DEPRECIATION					0	147500	147500	147500	147500	147500	147500	147500	147500	147500	147500	0	0	0	0	0	0	0	0	0	0
			TOTAL EXPENSES		3264721	7296382	7475104	7658294	7846064	8038528	8235804	8438012	8645275	8857719	9075474	9151174	9379953	9614452	9854813	10101183	10353713	10612556	10877870	11149817	11428562
DRY VENEER REVENUE																									
	$/m3	m3 p.a.																							
SUB-TOTAL REVENUE $	**291**	**28000**			0	8148000	8351700	8560493	8774505	8993867	9218714	9449182	9685412	9927547	10175735	10430129	10690882	10958154	11232108	11512911	11800733	12095752	12398146	12708099	13025802
(Incs. Price Increase p.a. @ 2.5%)				1.025																					
			EBIT		-3264721	851618	876596	902198	928441	955339	982910	1011170	1040137	1069828	1100261	1278955	1310929	1343702	1377295	1411727	1447020	1483196	1520276	1558283	1597240
			NET CASH FLOW		-3264721	999118	1024096	1049698	1075941	1102839	1130410	1158670	1187637	1217328	1247761	1278955	1310929	1343702	1377295	1411727	1447020	1483196	1520276	1558283	1597240
			CUMULATIVE CASH FLOW		-3264721	-2265603	-1241507	-191809	884131	1986970	3117380	4276051	5463688	6681016	7928777	9207732	10518661	11862363	13239658	14651385	16098406	17581602	19101877	20660160	22257400
DISCOUNT RATE	5%		**NPV 5%**							**$633,158**					**$4,154,332**					**$7,719,371**					**$10,879,735**
DISCOUNT RATE	10%		**NPV 10%**							**$139,099**					**$2,575,958**					**$4,531,790**					**$5,905,792**
			IRR							**12%**					**25%**					**28%**					**29%**
			PAYBACK YEAR	**5.0**																					

9.2.5. B5. Option 5 - New integrated mill for the Solomon Islands or Samoa

A new mill with new heat plant and continuous veneer dryer installed at a greenfield site with One 8-foot (2.44 m) and one 4-foot (1.22 m) spindleless RPV lines, operating three peeling shifts and one drying shift to process 50,000 m^3 coconut palm logs to a dried veneer product.

				YEAR	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
EXPENSES																									
CAPITAL COSTS					15891500																				
WORKING CAPITAL FOR START-UP					709255																				
OPERATING COSTS						2448204	2448204	2448204	2448204	2448204	2448204	2448204	2448204	2448204	2448204	2448204	2448204	2448204	2448204	2448204	2448204	2448204	2448204	2448204	2448204
VEHICLE LEASES						221000	221000	221000	221000	221000	221000	221000	221000	221000	221000	221000	221000	221000	221000	221000	221000	221000	221000	221000	221000
GENERAL EXPENSES						42000	42000	42000	42000	42000	42000	42000	42000	42000	42000	42000	42000	42000	42000	42000	42000	42000	42000	42000	42000
STAFFING						123816	123816	123816	123816	123816	123816	123816	123816	123816	123816	123816	123816	123816	123816	123816	123816	123816	123816	123816	123816
TRAINING AND DEVELOPMENT					6000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
SUB-TOTAL EXPENSES (Incs. Inflation p.a. @ 2.5%)				1.025	16606755	2837020	2907946	2980644	3055160	3131539	3209828	3290073	3372325	3456633	3543049	3631625	3722416	3815476	3910863	4008635	4108851	4211572	4316861	4424783	4535403
DEPRECIATION					0	1589150	1589150	1589150	1589150	1589150	1589150	1589150	1589150	1589150	1589150	0	0	0	0	0	0	0	0	0	0
			TOTAL EXPENSES		16606755	4426170	4497096	4569794	4644310	4720689	4798978	4879223	4961475	5045783	5132199	3631625	3722416	3815476	3910863	4008635	4108851	4211572	4316861	4424783	4535403
DRY VENEER REVENUE																									
	$/m3	m3 p.a.																							
SUB-TOTAL REVENUE $	**396**	**22000**			0	8712000	8929800	9153045	9381871	9616418	9856828	10103249	10355830	10614726	10880094	11152097	11430899	11716671	12009588	12309828	12617574	12933013	13256338	13587747	13927440
(Incs. Price Increase p.a. @ 2.5%)				1.025																					
			EBIT		-16606755	4285830	4432705	4583251	4737561	4895729	5057851	5224026	5394355	5568943	5747895	7520471	7708483	7901195	8098725	8301193	8508723	8721441	8939477	9162964	9392038
			NET CASH FLOW		-16606755	5874980	6021855	6172401	6326711	6484879	6647001	6813176	6983505	7158093	7337045	7520471	7708483	7901195	8098725	8301193	8508723	8721441	8939477	9162964	9392038
			CUMULATIVE CASH FLOW		-16606755	-10731775	-4709921	1462480	7789191	14274070	20921071	27734246	34717751	41875844	49212889	56733360	64441843	72343038	80441763	88742955	97251678	105973119	114912596	124075560	133467598
DISCOUNT RATE	5%		**NPV 5%**							**$3,188,300**					**$21,444,775**					**$42,407,805**					**$60,991,278**
DISCOUNT RATE	10%		**NPV 10%**							**$671,991**					**$13,302,111**					**$24,802,732**					**$32,882,096**
			IRR							**12%**					**25%**					**29%**					**29%**
			PAYBACK YEAR	**6.0**																					

9.3 Appendix C. Sensitivity analysis for the five options modelled

Model Option	Variable	Base Cost Year-5 IRR 12%, Year-10 IRR 25%	Negative Cost change	New 5-Year IRR	New 10-Year IRR	Positive Cost change	New 5-Year IRR	New 10-Year IRR
Option 1. A single low cost spindleless	Log volume processed /m^3	15,000	-10%	3%	18%	+10%	20%	32%
RPV line installed at an existing sawmill	Log cost $/$m^3$	$60.00	+5%	0%	16%	-5%	23%	34%
operating a single day shift. Processing	Operating cost p.a.	$1,098,753	+5%	-3%	15%	-5%	25%	36%
15,000 m^3 logs p.a. for green veneer.	Staffing labour cost p.a.	$60,320	+5%	11%	25%	+3%	11%	25%
	Green veneer product price $/$m^3$	$174.50	-5%	-7%	10%	+5%	28%	38%
Option 2. One 8' and one 4' spindleless high-	Log volume processed /m^3	50,000	-10%	5%	20%	+10%	18%	30%
grade RPV lines installed at an existing sawmill	Log cost $/$m^3$	$60.00	+5%	5%	20%	-5%	18%	30%
operating two shifts. Processing	Operating cost p.a.	$3,693,473	+5%	2%	17%	-5%	21%	33%
50,000 m^3 logs p.a. for green veneer.	Staffing labour cost p.a.	$138,040	+5%	11%	25%	+3%	11%	25%
	Green veneer product price $/$m^3$	$176.50	-5%	-1%	15%	+5%	23%	35%
Option 3. Upgraded Boiler/ Heat plant	Green veneer volume processed /m^3	35,000	-10%	7%	21%	+10%	16%	29%
and a new veneer drying and grading facility	Green veneer cost $/$m^3$	$180.00	+5%	5%	21%	-5%	18%	30%
operating on one day shift. Processing	Operating cost p.a.	$6,957,916	+5%	5%	20%	-5%	24%	36%
35,000 m^3 of green- to graded dry coconut veneer.	Staffing labour cost p.a.	$112,000	+5%	11%	25%	+3%	12%	25%
	Dry veneer product price $/$m^3$	$355.00	-5%	2%	18%	+5%	20%	32%
Option 4. Upgrade and use of existing boiler,	Green veneer volume processed /m^3	35,000	-10%	7%	22%	+10%	15%	28%
heat plant and veneer drying and grading	Green veneer cost $/$m^3$	$180.00	+5%	-5%	12%	-5%	26%	37%
facilities at an existing peeler mill operating	Operating cost p.a.	$6,957,916	+5%	-7%	11%	-5%	28%	39%
one shift (i.e. night shift) Processing	Staffing labour cost p.a.	$137,200	+5%	11%	25%	+3%	11%	25%
35,000 m^3 of green- to graded dry coconut veneer.	Dry veneer product price $/$m^3$	$291.00	-5%	-10%	8%	+5%	29%	39%
Option 5. A new processing plant with an 8 and 4'	Log volume processed /m^3	50,000	-10%	6%	21%	+10%	17%	30%
peeling lines installed at a greenfield site	Log cost $/$m^3$	$38.00	+5%	11%	24%	-5%	13%	26%
with new heat plant and drying facilities.	Operating cost p.a.	$3,596,204	+5%	10%	24%	-5%	13%	27%
operating on three shifts for peeling and one	Staffing labour cost p.a.	$158,336	+5%	12%	25%	+3%	11%	25%
day shift fro drying. Processing 75,000 m^3	Dry veneer product price $/$m^3$	$396.00	-5%	8%	22%	+5%	16%	29%
of logs p.a. for graded dry coconut veneer.								

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