



ACIAR PROJECT FST/2019/128

Coconut EWP Value Chain Map

30th May 2022

Coconut and other non-traditional forest resources for the manufacture of Engineered Wood Products

Prepared by
David Young, PHAMA Plus
Sefania Tawake, SPC
Maika Tabukovu, FNU

Coconut EWP Value Chain Map

Executive Summary

Objective: Analysis of the potential value chain for engineered wood products (EWPs) manufactured in Fiji from senile coconut stems is intended to inform decision-making at all stages of the value chain as well as address identified shortcomings in the enabling environment and supporting functions.

Value Chain Overview: The key node in the potential value chain is coconut veneer production. This is the critical activity which the upstream parts of the value chain (harvesting and transport of senile coconut palms) need to supply; and the source of EWPs that supply the downstream secondary processing, distribution and marketing pathways.

Size and Location of the Resource: Planning is constrained by uncertainties about the stock of senile coconut palms available for harvesting. There are uncertainties about the number of hectares of coconuts, the age profile of the plantations, and the number and condition of palms per hectare. However, there is general agreement that around 70% of Fiji's coconuts are grown in the three provinces of the Northern Division, with most of these in Cakaudrove Province. A survey of coconut plantations in Cakaudrove Province was undertaken in 2018 which has been used to derive estimates of the availability of coconut wood for processing, with the "most likely" estimate being around 225,000 m³, but possibly well above or below this figure.

Almost half of the available coconut stems are located in Vuna district which is at the south-western end of Taveuni island, whilst the two existing veneering mills potentially able to process coconut wood are on Vanua Levu, at Savusavu and Labasa respectively. This suggests three options for the establishment of an EWP industry:

- 1) Source only from the mainland areas of Vanua Levu (excluding Taveuni) and reduce scale accordingly.
- 2) Source from both the mainland and Taveuni by shipping logs from Taveuni to Savusavu.
- 3) Establish a second veneering facility on Taveuni.

Logging Operations: There is strong interest in harvesting coconuts among the logging contractors. They have the equipment, staff and expertise needed to provide this service. Experienced contractors consider that logging senile coconuts would be a relatively simple process, provided road access is reasonable. However, in some cases it may be necessary to negotiate access agreements with several *Mataqali* whose land has to be traversed to obtain vehicular access or haul logs to the roadside. Working with the freehold coconut estates is a more attractive option for logging contractors and timber mills.

Regulatory Issues: Logging operations are subject to environmental approvals which require an Environment Management Assessment (EMA), and in some cases an Environment Impact Assessment (EIA). These have to be completed at the expense of the logger and/or landowner and can take some time to complete and approve. It is also likely that a logging licence will be required by the Ministry of Forestry, as well as a number of other approvals to access and harvest plantations on *Mataqali* land.

Harvesting Protocols: Fijis Forest Harvesting Code of Practice does not currently incorporate specific protocols for harvesting coconut stems. A key element of coconut logging practice is site rehabilitation with the objectives of minimising pest and disease risks, retaining nutrients on the site, and facilitating sustainable post-harvest land utilisation.

Transport: Road transport of timber is subject to load limits which are considered by the logging contractors to be particularly onerous and costly. If sea transport of logs is required, this would add considerably to costs due to the sea-freight charges as well as waiting time for trucks to use shipping services. It is important that the logs are graded in the field to ensure that money is not wasted in transporting poor quality or reject material.

Veneer Production: Production of EWPs begins with the process of rotary veneering using the spindleless lathe technology developed under previous ACIAR projects. Trial processing undertaken in 2016 at Valebasoga Tropikboards Ltd (VTB) in Labasa has enabled processing protocols to be defined. The 2016 trials achieved a veneer recovery rate of 45.4% of the gross log volume. Conventional veneer grading systems are unsuitable for grading coconut wood veneer. A systematic grading system needs to be developed based on product and market assessment.

Secondary Processing: There are a number of options for secondary processing and marketing of coconut wood veneer including export veneer sales, domestic veneer sales and plywood manufacture.

Industry Capacity: It is important that the capacity of the different links in the value chain are balanced, in particular the availability of senile palms for processing, and the capacity of the veneer processing facility. The supply capacity of coconut plantations in Cakaudrove Province is estimated to be less than 10% of the forestry sector's current production of logs. It is estimated that that this would be sufficient to supply a single a single veneering lathe for about 20 years or two such units for ten years, with annual production of around 5,400 m³ of veneer per lathe.

Product Range and Marketing Options: The potential product range includes veneers, plywoods and manufactured products using one or both of these. Product specifications need to be developed in conjunction with the customers, but this cannot be done until veneer production begins. Likewise, promoting the product range to potential customers must await production of trial batches.

Initial Conclusions:

- Analysis of the potential value chain provides a picture of how such a value chain might work, the key actors in it, their strengths and weaknesses, and the key elements of the enabling environment. However, any conclusions about the size, structure and feasibility of a coconut-based EWP industry can only be regarded as tentative due to significant uncertainties about the size and nature of the resource stock, and how coconut EWPs are likely to be received in domestic and export markets.
- Potential value chain actors in Fiji generally have a positive view about engagement in the EWP industry. Most importantly, these include the two potential veneer processors, as well as potential logging contractors, coconut estate owners and *Mataqali* landholders.
- The best approach may be to focus logging and processing operations in Fiji's Northern Division involving one or both of the two existing veneer-producers, and sourcing most of the stems from senile plantations in Cakaudrove Province.

- Such an industry is likely to be relatively small, compared with the rest of Fiji's forestry and timber sector, due mainly to the estimated size of the senile palm stock, and complications in the sourcing of senile palms on Taveuni Island.
- The core activity is the production of coconut rotary veneer. A number of secondary/finished products can be derived, but little is known at this stage about the optimal product mix, product specifications, target markets and prices.

Table of Contents

Executive Summary.....	i
1. Introduction.....	5
2. Overview of the Potential Value Chain	5
3. The Resource Base.....	6
4. Logging and Transport.....	9
5. Veneer Production.....	12
6. Secondary Processing	13
7. Scale of the Potential EWP Value Chain	14
8. Marketing of End Products.....	15
9. Initial Conclusions	17
Annex 1: List of Team Members and Persons Consulted	18
Annex 2: Role of Key Value Chain Actors	20
Annex 3: Supporting and Enabling Actors and their Functions	23
Annex 4: SWOT Analysis	25
Annex 5: Plywood Market Information	29
Annex 6: References	32

1. Introduction

This report is intended to contribute to the following two main activities under project FST/2019/128:

- **Activity 4.1:** Map the engineered wood product (EWP) value chain (or potential value chain) to identify all the key actors and their functions and capabilities; and
- **Activity 4.3** Assess the enabling environment and supporting functions required for efficient operation of the EWP value chain.

The outputs of Activities 4.1 and 4.3 are intended to inform decision-making at all stages of the EWP value chain, particularly for private sector partners who are expected to invest in new equipment and processes. Outputs will support key policy decisions necessary to overcome any identified shortcomings in the enabling environment and supporting functions. The output may also provide indications for other Pacific Island countries with large areas of senile coconut plantations, on the investment opportunities related to EWPs.

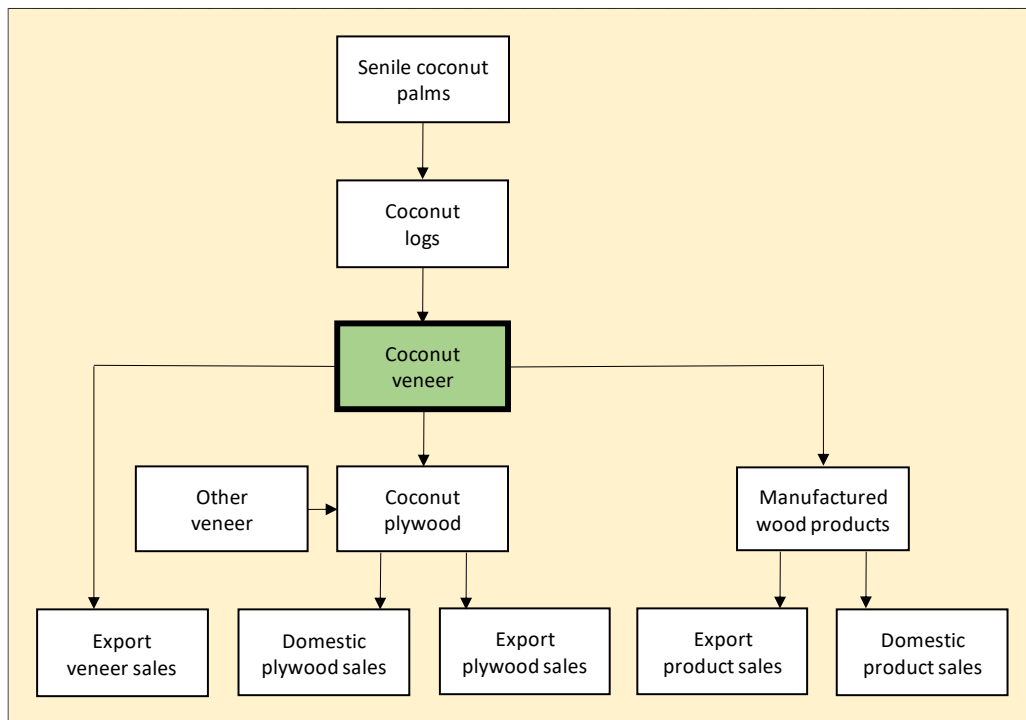
The report is based on work undertaken during the first quarter of 2022 by a team comprising Maika Tabukovu, Sefania Tawake and David Young. It included factfinding and consultations with stakeholders in Suva as well as extensive field work in the Northern Division of Fiji. The team also worked with project AGB/2021/172 “Defining priority commercialisation pathways, and potential private commercialisation partners for viable long-term commercialisation of products emerging from FST/2019/128”. The full list of stakeholders consulted is given in Annex 1.

2. Overview of the Potential Value Chain

Senile coconut stems are currently harvested in Fiji for production of furniture by Pacific Green at its Sigatoka workshop and showroom facility. There is currently no harvesting of coconut stems for production of rotary veneer-based EWPs, although some trials have been undertaken at semi-commercial scale and produced promising results. Figure 1 therefore presents a picture of how a coconut EWP value chain might work, if it is proven to be commercially feasible, and the required investments are forthcoming.

Figure 1 shows that the key node in the potential value chain is coconut veneer production. This is the critical activity which the upstream parts of the value chain (harvesting and transport of senile coconut palms) need to supply; and the source of EWPs that supply the downstream secondary processing, distribution and marketing pathways. Figure 1 shows that there are a number of potential branches in the downstream parts of the value chain, whilst the upstream activities in the supply or raw material for the veneer mill are more-or-less linear.

Figure 1: Potential value chain for veneer-based EWP production from senile coconut stems



Annex 2 details the role of each of the potential value chain actors including a description of their contribution, the costs incurred, the incentives for participation and their exposure to risks.

Annex 3 provides a list of the supporting and enabling actors in the potential value chain and the functions they perform.

Annex 4 presents a SWOT analysis for each value chain actor and proposes actions needed to build on their strengths and opportunities and address weaknesses and threats.

3. The Resource Base

There are considerable uncertainties about the stock of senile coconut palms in Fiji available for harvesting and manufacture of EWPs. There are uncertainties about the number of hectares of coconuts, the age profile of the plantations, and the number and condition of palms per hectare.

Area of Coconut Plantations: Estimates of the total plantation area in Fiji vary from 17,757 hectares to as much as 65,000 hectares, with estimates dating from the 1990s. None of the estimates are later than 2010. Table 1 provides a summary of various estimates ranked from the highest to the lowest.

Table 1: Estimates of the total area of coconuts in Fiji (hectares)

Year	Hectares	Source
2017	65,000	Coconut Industry Development Programme (July 2017) Pacific Coconut Sector Value Chain Workshop, Section 5.1; Fiji,
2013	65,000	High Level Consultation on Coconut Development in Asia and the Pacific Region, (2013) Bangkok, Thailand. Republic of the Fiji Islands Presentation
2017	62,000	McGregor A and Sheehy M (2017) An Overview of the Market for Pacific Island Coconut Products and the Ability of Industries to Respond
2008	60,000	Coconut Industry Development Authority (2008) Integrated Approach in the Processing of Coconut Products and By-Products and Market Prospects in Fiji.
1991 2007	34,560 28,669	Forestry Department, FAO (2010) Global Forest Resources Assessment: Country Report, Fiji. FRA 2010/068
1991 2009	49,812 17,757	Department of Agriculture, Economic Planning and Statistics Division. Report on the Fiji National Agricultural Census, 2009

The 2020 Fiji agricultural census does not provide an estimate of the area of coconuts or the number of palms. The Ministry of Agriculture Statistics Division is planning to undertake an aerial (drone) survey later in 2022 which should provide updated estimates.

There is general agreement that around 70% of Fiji's coconuts are grown in the three provinces of the Northern Division, with most of these in Cakaudrove Province. The results of a survey of this province undertaken by Fiji Ministry of Agriculture (MOA) in 2018 are shown in Tables 2a and 2b.

Table 2a: Coconut plantation data for Cakaudrove Province, 2018

District	No of Farmers	No of Villages	No of Settlements	No of Estates	Varieties and No of Palms				Total
					Fiji Tall	Hybrid	MGD	MRD/MYD	
Vuna	158	2	5	2	420,575	3,436			424,011
Cakaudrove Wai	335	4	9	1	139,782	1,000			140,782
Navatu	195	6	5	3	79,712	11,835	1,100	1,150	93,797
Wainikeli	301	6	7	6	90,969	2,250			93,219
Savusavu	91	9	5	8	53,684	1,317	2,314	3,277	60,592
Naweni	68	3	3	1	41,580	2,453		200	44,233
Koralau	117	6	1		25,310	1,200		10	26,520
Cakaudrove Vanua	31	3	2	1	22,225	2,050			24,275
Laucala	110	3			23,000				23,000
Rabi Island	270	4	17		9,457	1,442	156	2,466	13,521
Total	1,676	46	54	22	906,294	26,983	3,570	7,103	943,950

Table 2b: Coconut plantation data for Cakaudrove Province, 2018

District	Age and No of Palms					Area (ha)	Palms per ha	Percent >50 yrs
	<10 yrs	10-30 yrs	30-50 yrs	>50 yrs	Total			
Vuna	69,765	38,058	190,580	92,258	390,661	3,043	128	24
Cakaudrove Wai	9,505	32,616	50,900	47,761	140,782	1,224	115	34
Navatu	15,617	33,540	28,610	16,030	93,797	1,091	86	17
Wainikeli	9,326	11,015	29,290	43,315	92,946	799	116	47
Savusavu	5,324	9,457	24,420	21,391	60,592	1,282	47	35
Naweni	4,702	5,863	14,665	19,003	44,233	636	70	43
Koralau	5,260	8,760	7,750	4,750	26,520	301	88	18
Cakaudrove Vanua	2,720	3,040	3,980	14,835	24,575	1,607	15	60
Laucala			3,000	20,000	23,000	200	115	87
Rabi Island	1,591	4,056	4,840	2,987	13,474	136	99	22
Total	123,810	146,405	358,035	282,330	910,580	10,318	88	31
Percent	14	16	39	31	100			

The 2018 survey indicates that there were around 10,300 ha of coconuts in Cakaudrove province. This suggests that the national total is in the vicinity of 17,000 to 20,000 hectares, *i.e.* towards the lower end of the estimates listed in Table 1.

The three provinces of Northern Division, Macuata, Bua and Cakaudrove are proposed as the focus of the EWP initiative because: (i) it has around 70% of the total area of Fiji's coconut plantations, with most of this being in Cakaudrove province; (ii) Cakaudrove is the only part of Fiji where there are recent estimates of the area and age profile of plantations; and (iii) there are three timber mills in the Division potentially capable of producing veneers and veneer-based EWP products from coconut stems.

Age Profile: The 2018 survey found that 31% of Cakaudrove plantations were over 50 years old with a further 39% being between 30 and 50 years. This suggests that over the next decade, around 50% of plantations will be in the senile age range (50 plus years).

Palms per Hectare: In Fiji, coconuts are usually planted at a density of 100-120 per hectare. Plantation density declines with age as palms are lost, mainly due to cyclone damage. Plantation owners estimate that about 10% of palms are lost in each severe (Category 4/5) cyclone. There have been two severe cyclones affecting the Northern Division since 2018, suggesting that the average density is now well below the average of 88 palms/ha found in the survey, and potentially more so in the older plantations. Observations suggest that in most senile plantations, densities are in the range of 50-70 palms/ha. Very old plantations, 80 years plus, are down to densities of 40 palms/ha or less.

Volume of Timber: Senile palms of the Fiji Tall variety are generally 25-30 metres high with a stem diameter of around 30 cm nearer the base, tapering to 20 cm higher up. It is estimated that on average each stem will yield about six 2.5 metre (to suit a typical lathe width) billets, indicating a gross harvested volume of around 0.74 m³ per palm – see calculations in Table 5 below.

Availability of Coconut Wood for Processing: Based on the above data and observations, the following estimates of the availability of senile palms in Cakaudrove Province over a ten-year period can be derived:

Table 3: Estimated availability of coconut wood in Cakaudrove Province over ten years

	Low	Median	High
Hectares of coconuts	8,000	10,000	12,000
Percent potentially available for harvesting	40	50	60
Palms/ha	50	60	70
m ³ of timber per palm	0.70	0.75	0.80
m ³ of timber available for processing	112,000	225,000	403,200

Supply Areas: In considering the above estimates, it is noted that almost half of the available coconut stems are located in Vuna district which is at the south-western end of Taveuni island, whilst the two timber mills potentially able to process coconut wood are on Vanua Levu, at Savusavu and Labasa respectively. If palm logs are to be sourced from Vuna district, they would have to be transported by truck to the wharf (20-30 km) and then by sea to Savusavu, adding considerably to transport costs and logistic complications related to shipping schedules, road conditions etc. The Taveuni-Savusavu service operated by Goundar Shipping currently operates twice a week and can be disrupted by bad weather. It costs FJD 2,000 for a loaded 12-wheel truck representing an estimated cost of over FJD 100 per stem transported.

Consideration of the sources of supply and the existing industry capacity suggest three options for the establishment of an EWP industry:

- 1) Source only from the mainland areas of Vanua Levu (excluding Taveuni) and reduce to about half of the scale indicated in Table 3;
- 2) Source from both the mainland and Taveuni by shipping logs from Taveuni to Savusavu; or
- 3) Establish a second veneering facility on Taveuni, probably at the south-western end of the island.

4. Logging and Transport

Some timber mills in Fiji run their own logging operations, others use logging contractors, or a combination of the two. Both the timber mills and the logging contractors currently have excess capacity due to the declining supply of logs from native forest and pine plantations. There is strong interest in harvesting coconuts among the logging contractors in the Northern Division. They have the equipment, staff and expertise needed to provide this service.

A standard logging team consists of 5-6 workers equipped with chainsaws, a tractor (crawler or wheeled) for hauling logs to the loading point, a front-end loader, and a timber lorry for transport to the mill. Contracts are based on a price per cubic metre to cut, haul and load; plus a distance-based trucking cost. Current contract rates to cut, haul and load are around FJD 31/m³ for plantation pine and FJD 85/m³ for native forest.

Experienced contractors consider that logging senile coconuts would be a relatively simple process, provided road access is reasonable. However, in some cases it may be necessary to negotiate access agreements with several *Mataqali* whose land has to be traversed to obtain vehicular access or haul logs to the roadside. For this reason, working with the freehold estates may be a more attractive option for logging contractors and timber mills.

Land Ownership Issues: The MOA 2018 survey of Cakaudrove shows that there are 22 freehold estates growing coconuts, the majority located in the southern coastal strip of Vanua Levu. Discussions with several estate owners indicates that the majority of estate plantations are senile and that the owners are interested in having these felled so that the land can be replanted to coconuts, or more commonly, used for other crops or livestock enterprises. Most of these estates are well serviced by roads east and west of Savusavu also connecting to the cross-island road to Labasa. Contractual arrangement for harvesting senile palms on the freehold estates are likely to be relatively straight forward and provide an opportunity to harvest relatively large volumes in a concentrated area.

Arrangements for harvesting senile palms on *Mataqali* (customary) land are likely to be more complex, requiring consultations and negotiations with the customary owners, and endorsement by statutory bodies responsible for indigenous affairs and customary land administration. At least 60% of adult Mataqali members must vote in favour of any logging agreement. In addition, each negotiated logging contract will only cover a small area of plantation.

Timber processors and logging contractors are therefore likely to focus, initially at least, on sourcing logs from the freehold estates along the south coast of Vanua Levu, east and west of Savusavu.

Regulatory Regime: Logging operations are subject to environmental approvals which require an Environment Management Assessment (EMA), and in some cases an Environment Impact Assessment (EIA). These have to be completed at the expense of the logger and/or landowner and can take some time to complete and approve. It is also likely that a logging licence will be required by the Ministry of Forestry, as well as a number of other approvals to access and harvest plantations on *Mataqali* land.

Logging Code of Practice: All timber harvesting operations in Fiji are required to be compliant with the Fiji Forest Harvesting Code of Practice (Second Edition, 2013) – see Box 1 below.

Box 1: Fiji Forest Harvesting Code of Practice

- The Code applies to all harvesting operations in Fiji in conjunction with any wood-sales agreement between the owner(s) of wood resources, the buyer(s) and the licensing authority (Forestry Department).
- The Code prescribes desirable practices aimed at protecting the forest environment, its assets and its users, while allowing the execution of economically viable operations within acceptable safety standards.
- The provisions of the Code are legally binding on all parties and individuals involved in marking, felling, extracting, loading and hauling wood and wood products from all forests in Fiji.
- The Code must be used in conjunction with the Harvesting Licence Procedures issued by the Forestry Department, which lists the processes involved in acquiring a Forest Harvesting Licence.
- The Code governs the operational phase of the Harvesting Licence Procedures for both plantations and indigenous forests. All harvesting operations must be licensed and therefore must comply with the relevant provisions of the Code. This includes any harvesting by portable sawmills, fuel wood collectors etc within the area covered by the Harvesting Plan.

Box 1: Fiji Forest Harvesting Code of Practice

- The Code aims to optimise the utilisation of forest resources in an ecologically sustainable manner. All harvesting operations must comply with the utilisation standards prescribed in the Harvesting Licence.

The code of practice does not currently incorporate specific protocols for harvesting coconut stems. However, the principles and procedures prescribed in the Code for plantation forests would be applicable to coconut plantations. It would be desirable however, that future revisions of the Code consider the need for specific measures applicable to the harvesting of senile coconut palms. FST/2019/128 Activity 2.5 will develop harvesting protocols including residue management, specifically targeting coconut logging operations.

A key element of coconut logging practice is site rehabilitation with the objectives of minimising pest and disease risks, retaining nutrients on the site, and facilitating sustainable post-harvest land utilisation. Good post-harvest management could consider the following elements:

- Removal of stumps and un-useable parts of stems to be burned or buried. This is important to reduce the risk of pest and disease transmission, particularly coconut rhinoceros beetle (CRB);
- Mulching of palm tops and other biomass to retain nutrients on the site;
- Making good any damage incurred by logging operations, including roads/tracks, waterways and infrastructure (e.g. fencing); and
- Where the landowner(s) opt to replant coconuts, the logging contractor could prepare planting pits using an auger of excavator.

MOA can provide coconut seedlings, currently free of charge, of either hybrid or Fiji tall varieties to facilitate replanting.

Transport: Road transport of timber is subject to load limits which are considered by the logging contractors to be particularly onerous and costly. The current load limits specified by the Land Transport Authority (LTA) are 12 tonnes for a 12-wheel truck and 9 tonnes for a 10-wheeler. According to these limits, a single-lathe veneering unit processing about 48 m³ per shift would require around three 12 tonne loads per day (assumes average log density of 700 kg/m³).

If sea transport is required, e.g., to transport logs from Taveuni to Savusavu this could be done by carrying loaded timber trucks on the roll-on-roll-off ferry which currently runs twice a week in each direction. This would add considerably to costs due to the sea-freight charges as well as waiting time for trucks to use the twice-weekly service.

A further consideration in logging and transport is the need to minimise lengthy delays between harvesting and processing. The palm logs can begin to deteriorate if stored due to microbial decay. This means that logging operations need to be well synchronised with transport and processing at the mill. The scope for stockpiling to allow for bad weather or other disruptions to logging operations is therefore very limited.

Log Grading: Since transporting logs to the mill can be an expensive process, especially if they are to be sourced from Taveuni and processed on Vanua Levu, it is important that the

logs are graded in the field to ensure that money is not wasted in transporting poor quality or reject material. Many coconut producers and loggers have incurred losses supplying coconut stems to Pacific Green that were rejected on delivery. This calls for the development of a grading protocol for coconut logs that avoids expenditure on transporting low grade or reject logs. The basic principles involved in grading peeler logs are summarised in Box 2.

Box 2: Key Principles in Grading Peeler Logs

Log grading systems vary internationally although the principles are essentially the same. The process aims to:

- Identify grade limiting defects.
- Measure and/or assess those defects.
- Determine other important aspects such as size and species requirements.
- Assign a grade to the log.

Grading a log destined for veneer production entails evaluating the log quality and hence the quality of the veneer that can be expected from that log. Log grading is based on a visual assessment of specific log features that are set out for each grade classification. Ideally, the grading rules should be easily understood so they can be applied quickly and accurately. However different interpretation of the rules can lead to small differences of opinion and sometimes written rules are not adequate to describe all scenarios. Then it is for the experienced grader to use their discretion. Factors to consider when grading a peeler log are:

- The dimensions of the log (length and diameter).
- The form of the log (the degree to which the log deviates from a true cylinder) including sweep, taper and ovality.
- The presence of defects in the log (external and internal).

Source: Leggate, McGavin and Bailleres (2017)

Protocols for grading coconut logs will be developed under FST/2019/128 Activity 2.4 – “Develop Log Grading Standard”.

5. Veneer Production

Production of veneer-based EWP from coconut stems begins with the process of rotary veneering using the spindleless lathe technology developed under previous ACIAR projects. Trial processing undertaken in 2016 at Valebasoga Tropikboards Ltd (VTB) in Labasa has enabled processing protocols to be defined. The steps involved include:

- Unload logs in the log yard;
- Merchandise logs into ~2.5 m billets (if not done in the field);
- Pre-condition in a hot-water or steam bath to soften the logs;
- De-bark and round logs on a rounding lathe;
- Peel the billet on the spindleless lathe;
- Dry the veneer to ~6% moisture in jet box drier; and
- Grade and stack veneer.

Yields: The 2016 VTB trials provide an indication of the veneer yield ratios likely to be achieved during commercial processing of coconut stems. The trial results are summarised in

Table 4 below and show that the average yield of veneer is approximately 45% of the gross volume of coconut stems processed.

Table 4: Veneer yield estimates derived from 2016 VTB processing trials

No of billets	No	153
Gross billet volume	m ³	25.1
Length of billet	m ³	2.7
Average billet diameter	cm	27.6
Ave gross volume per billet	m ³	0.1641
Rounding volume loss	%	23
Rounding volume loss	m ³	0.0377
Rounded billet volume to lathe	m ³	0.1264
Dried veneer produced	m ³	12.5
Dried veneer produced per billet	m ³	0.0817
Recovery of gross volume (before trimming)	%	49.8
Recovery of rounded volume (before trimming)	%	64.7
Trimmed/dried veneer produced	m ³	11.4
Recovery of gross volume (after trimming)	%	45.4

Source: ACIAR (2016)

Veneer Grading: Fiji does not have a specific veneer grading system. However, the Australia/New Zealand standards are often used for conventional veneers and plywoods produced in Fiji. However, this system is considered unsuitable for grading coconut wood veneer due to its distinctly different characteristics. A tentative coconut veneer grading systems has been developed (McGavin 2015) incorporating three grades: Grade 1, superior quality; Grade 2, high quality; and Grade 3, standard grade. In trials conducted in 2016, 15% attained Grade 1, 50% Grade 2 and 19% Grade 3. Sixteen percent of the veneer sheets failed to meet the minimum grade quality requirements.

It has been recommended that a more systematic grading system needs to be developed based on more detailed product and market assessment. Protocols for grading coconut veneer will be developed under FST/2019/128 Activity 3.6 – “Develop Veneer Grading Standard”.

6. Secondary Processing

Up to the point of veneer production, the coconut wood value chain is strictly linear. As shown in the value chain map in Figure 1, after the veneering stage, the value chain can branch out in a number of different directions, depending on how the veneer is utilised. The options include:

- 1) Export veneer sales:** This would involve stacking veneer on pallets and loading into a shipping container, transporting by inter-island shipping to one of Fiji’s two export ports (Suva or Lautoka), and shipping to an export destination. Global trade in veneer products is valued at around USD 3.5 billion per annum, with the largest importers

being USA, China, Vietnam, Germany and India¹. However, there is no established market for coconut veneer which would be very much a niche product and would require significant investment in market development.

- 2) **Domestic veneer sales:** Again, there is no established domestic market for coconut veneer. However, there are manufacturers producing furniture, cabinets and flooring products that have expressed interest in using coconut veneer in some of their products. Developing the domestic market for coconut veneer among wood product manufacturers would be a much quicker and a cheaper process than export market development. Manufactured products would most likely target the high end of the domestic market such as hotels and resorts where potential customers are already familiar with coconut wood products. Exports could also be considered.
- 3) **Plywood manufacture:** Existing plywood products can be manufactured with coconut veneer on either one, both faces and/or the plywood core. Plywood products could also be made by blending coconut with other timber species (e.g. coconut face veneers and cheaper timbers (e.g. pine) used for the interior (core) layers. Both of the two active plywood manufacturers on Vanua Levu have the capacity to produce a range of plywood products of different thicknesses and grades targeting both domestic and export markets.

7. Scale of the Potential EWP Value Chain

It is important that the capacity of the different links in the value chain are balanced, and in this regard, there are two key considerations: 1) the availability of senile palms for processing, and 2) the capacity of the veneer processing facility.

Raw Material Supply: Table 5 below shows that the supply capacity of coconut plantations in Cakaudrove Province is estimated to be around 228,000 m³ over ten years or about 23,000 m³ per annum. This represents less than 10% of the forestry sector's current production of logs, comprising predominantly plantation pine, plantation mahogany and small and declining production from native forests.

There is considerable uncertainty surrounding the estimates in Table 5 due to the inadequacies of data on the size and density of coconut plantations mentioned earlier. It should also be noted that the estimates include supply from Taveuni where no processing facilities currently exist. If Taveuni is to be included as a source, coconut stems would have to be transported by sea to Savusavu, or a veneering facility would have to be established on the island.

¹ ITC Trademap HS code 4408 - Sheets for veneering, including those obtained by slicing laminated wood, for plywood or for other similar laminated wood and other wood, sawn lengthwise, sliced or peeled, whether or not planed, sanded, spliced or end-jointed, of a thickness of <= 6 mm.

Table 5: Estimated availability of senile coconut stems in Cakaudrove Province

Resource Assessment			Comments
Area of coconuts in Cakadrove Province (2018)	ha	10,300	From MOA survey
Older than 50 years in 2018	%	31	From MOA survey
Available to harvest in next decade	%	50	
Available to harvest in next decade	ha	5,150	
Average harvestable stems per ha	No	60	Range 40-70
Timber per stem:	m ³	0.74	
Length 15 m (6 x 2.5m billets)			Based on 2016 trials
Diameter 0.25 m			Based on 2016 trials
Timber per ha	m ³	44	
Total raw material available over 10 years	m³	227,612	

Processing Capacity: Table 6 provides estimates of the processing capacity of a single lathe veneering facility. It is estimated that such a unit could process around 12,000 m³ per year of coconut stems, based on single shift operation, and would produce around 5,400 m³ of coconut veneer. Provided stems are sourced from both Taveuni and the Vanua Levu part of Cakadrove, possibly supplemented by supplies from the other two Provinces of Vanua Levu, there would be sufficient supply of senile coconut stems to operate the facility for around 20 years. However, if stems are sourced only on either Taveuni or the Vanua Levu mainland, then the size of the resource would become limiting much sooner, and logging/haulage costs would escalate as the more accessible areas are harvested first.

Table 6: Estimated processing capacity for a single lathe veneering facility

Processing Capacity: one 2.5 m spindleless lathe			
Lathe capacity	m ³ /shift	60	McGavin estimate
Capacity utilisation	%	80	
Timber processed	m ³ /shift	48	Gross volume before rounding
Shifts per year	No	250	
Timber processed per year	m ³ /year	12,000	
Area of coconuts harvested per year	ha	272	
Recovery rate (percent of gross volume)	%	45	Based on 2016 trials
Veneer produced	m ³ /year	5,400	

8. Marketing of End Products

The potential product range includes veneers, plywoods and manufactured products using one or both of these. Product specifications need to be developed in conjunction with the customers, but this cannot be done until veneer production begins. Likewise, promoting the product range to potential customers must await production of trial batches. The potential buyers for the various coconut wood products are detailed in Table 7.

Table 7: Potential coconut wood products and buyers

Product Category	Market	Potential Buyers
Coconut veneer	Domestic	<ul style="list-style-type: none"> Timber product manufacturers, joineries, furniture makers and flooring material suppliers
	Export	<ul style="list-style-type: none"> Timber importers, wholesalers and timber product manufacturers
Plywood products	Domestic	<ul style="list-style-type: none"> Builders, manufacturers, joineries, furniture makers flooring material suppliers, building material wholesalers, retailers, DIY stores
	Export	<ul style="list-style-type: none"> Timber importers, wholesalers and timber product manufacturers Large home improvement retailers and trade suppliers
Manufactured wood products	Domestic	<ul style="list-style-type: none"> Builders, hotels, resorts, furniture retailers
	Export	<ul style="list-style-type: none"> Building material wholesalers/retailers, furniture retailers

Plywood Market: The size of the domestic market for plywood products is unclear, but trade statistics (see Annex 5) show that between 2015 and 2020, Fiji's exports of plywoods have fallen whilst imports have risen. Between 2018 and 2020, the value of net imports exceeded USD 2.0 million (FJD 4.2 million).

The domestic market for plywood offers a range of standard plywoods classified as either interior, exterior or marine, but are otherwise un-graded – see Annex 5. There is little difference in retail prices of interior and exterior plywood prices, both of which average around FJD 2,070/m³ (ex. VAT) with a range from FJD 1,800 to FJD 2,700. Marine plywoods retail for FJD 3,200-3,277/m³ (ex. VAT). Fiji retail prices are generally lower than in Australia and New Zealand, with little product differentiation and very limited offer of premium priced plywood products, other than marine ply. Allowing for a 30% retail margin, ex-mill prices for undifferentiated plywood products in Fiji are likely to be around FJD 1,500-1,600/m³.

In Australia, retail prices for plywood average AUD 3,360/m³ (ex. GST), equivalent to FJD 5,230/m³ which is 2.5 times the Fiji average (see Annex 5). The Australian market is much more differentiated with prices ranging between FJD 1,800 and FJD 10,300/m³. The undifferentiated products (mostly CD grade) at the lower end of the product range sell for little more than Fiji retail prices and may not compensate for the costs of transport from Fiji to Australia. However, in the upper half of the range, AA and BC grade products retail for between FJD 5,000 and FJD 10,000/m³ (ex. GST).

New Zealand prices are a little lower than Australia but with a similar price spread between the standard and premium grade products. Given the lower cost of shipping to New Zealand and the less stringent and costly biosecurity protocols, similar returns could be expected in this market.

At this stage, it is not clear how much of the coconut veneer potentially produced in Fiji will be of sufficient quality to produce high grade veneer and plywood products that might attract the price premiums found in the Australian and New Zealand markets. It is also unclear how coconut veneers and plywood products will be received in the market relative to other high-grade products. Initially at least, it can be expected that a significant proportion of the veneer output will be in the lower grades.

9. Initial Conclusions

Analysis of the potential value chain for coconut-base EWPs provides a picture of how such a value chain might work, the key actors in it, their strengths and weaknesses, and the key elements of the enabling environment that need to be in place. However, any conclusions about the size, structure and feasibility of a coconut-based EWP industry can only be regarded as tentative due to significant uncertainties about the size and nature of the resource stock, and how coconut EWPs are likely to be received in domestic and export markets.

Potential value chain actors generally have a positive view about engagement with the EWP industry. Most importantly, these include two existing Fijian veneer processors, as well as potential logging contractors, coconut estate owners and *Mataqali* landholders. Several key actors are already planning to launch new ventures in the sector and are collaborating with both FST/2019/128 and AGB/2021/172 project teams.

The best approach for establishing a coconut-based EWP industry in Fiji may be to focus on logging and processing operations in the Northern Division involving one or both of the two existing veneer-producers, and sourcing most of the stems from senile plantations in Cakaudrove Province.

Such an industry is likely to be relatively small, compared with the rest of Fiji's forestry and timber sector, due mainly to the estimated size of the senile palm stock, and complications in the sourcing of senile palms on Taveuni Island requiring either sea transport of logs, or the establishment of a green-field veneering facility on the Island.

The core activity in the potential value chain is the production of coconut veneer using technologies developed under the two preceding ACIAR projects. A number of secondary/finished products can be derived from coconut veneer, but little is known at this stage about the optimal product mix, product specifications, target markets and prices.

Annex 1: List of Team Members and Persons Consulted

Name		Organisation	Position	Tel	email
Mohammed	Aiyub	Dreketi Contractors	Managing Director	9498009	
Altaf	Ali	VTBL	Factory Manager	9908788	Altaf.Ali@vtbl.co
Muktar	Ali	VTBL	Managing Director	9908780	Mr.ply786@yahoo.com
Senimili	Balecakau	MOWE	Head, Department of Environment	9905176	sainimilbaleicakau@govnet.gov.fj
Peter	Bennett	ACIAR-CEF	Consultant	0422 935383	peter@prbennett.com
Lew	Boddam-Whetham	ACIAR-CEF	Consultant		phpviti@outlook.com
Sera	Bose	MOA	Chief Economist	9905103	serab@agriculture.gov.fj
Tukana	Bovoro	ACIAR-CEF			borovo@yahoo.com
Ian	Buck	Buck Advisory	Managing Director	+61 0428889645	inab@buckadvisory.com.au
Sakiusa	Causavo	ITAB	Assistant Provincial Administrator, Cakandrove	93397039	sakiusanavakoroko@govnet.gov.fj
Ravineel	Chand	MOA	Agricultural Officer, Savusavu	8492996	chandravnil10@hotmail.com
Ravind	Chandra	VTBL	Manager Sales & Marketing	9908755	ManagerSales@vtbl.co
Ilaisa	Dakaica	BAF	Manager Compliance (SPC)		ilaisad@spc.int
John	Deo	FCM	General Manager	7775331	john@cocconut.com.fj
Ashni	Devi	Goundar Shipping	Logistics Manager	7775471	ashni@gosfiji.com
George	Goundar	Goundar Shipping	Managing Director	3301020	goundarshipping@shaw.ca
Howard	Hall	ACIAR-CEF			howard.hall@aciary.gov.au
Josephine	Kalsuak	SPC/HRSD	Technical Assistance (Gender)	3370733	josephine@spc.int
Sainiana	Kirisitiana	MOA/Statistics	Principal Officer (Statistics)	3385234	2020fact@gmail.com
Peter	Kjaer	Pacific Produce Ltd, Taveuni	Owner/Manager	9921358	pkppl@connect.com
Iliesa	Koroi	MOF/TUD	Senior Research Officer	9815376	ilieasakoroi@gmail.com
Vinesh	Kumar	MOA	Permanent Secretary	9904578	vinesh.kumar01@govnet.gov.fj
Ashok	Kumar	FCM	Mill Manager	7775333	ashck@coconut.com.fj
Joanne Lee	Kunatuba	SPC/HRSD	Gender Advisor	3370733	joannek@spc.int
Ravind	Lal	Pacific Green Ltd	General Manager (Fiji)	9922554	info@pacificgreen.net
Rohit	Lal (Dr)	MOA, Taveuni	Senior Research Officer	8681071	rohitalmpie@gmail.com
Alfred	Lepper	Namawa Estate	Estate Owner	9365351	
Rose	Martin	SPC/HRSD	Team Leader	3370733	rosem@spc.int
Jalesi	Matebolo	SPC/LRD	Team Leader (Pillar 2)	8609971	jalesim@spc.int
Rob	McGavin				Robbie.McGavin@daf.qld.gov.au
Maria	Nasila	District Office/Savusavu	District Officer	9750530	maria.nasila@govnet.gov.fj

Name		Organisation	Position	Tel	email
Solomoni	Nata	TLTB	Deputy Operation Manager and Research	9995879	snata@tltb.com.fj
Michael	Parker	PHAMA Plus	Deputy Team Leader		m.parker@phamaplus.com.au
Andrew	Piper	PHAMA Plus	Team Leader	7090800	a.piper@phamaplus.com.au
Lennard	Powell	PHAMA Plus	Biosecurity Advisor		lennard.powell@kalang.com.au
Shalendra	Prasad	MOA	Head, Agricultural Research		shahendra.prasad@govnet.gov.fj
Uraia	Racule	MOF/DFON	Acting DFON	9778640	Uraia.racule@govenet.gov.fj
Maikeli	Sauwaqa	Macuata Provincial Officer, ITAB	Assistant Roko Tui Macuata	8812599	maikeli.sauwaqa@govnet.gov.fj
Sareena	Singh	LIFL	General Manager	9316121	sales@threemax.com.fj
Karl	Smith	Benau Estate	Estate Owner	9996611	krlrebmansmith1@gmail.com
Makia	Tabukovu	FNU	Lecturer	9182695	maika.tabokovu@fnu.ac.fj
Marcus	Tarte	Vatuwiri Estate, Taveuni	Owner/Manager	7777009	
Sefanaia	Tawake	SPC	Project Officer (EWP)	9210633	sefanaiat@spc.int
Visoi	Timote (Dr)	BAF	Scientist (Biosecurity)	3349500	visonit@spc.int
Gary	Torte	Taveuni VCP	Managing Director	7421819	wainiyakuest@connect.com.fj
Navi	Tuivuniwai	PHAMA Plus	National Facilitator	7090808	n.tuivuniwai@phamaplus.com.au
Benson	Yee	LIFL	Manager	9738522	bensonyee@ymail.com

ACIAR	Australian Centre for International Agricultural Research	MOF	Ministry of Forestry
BAF	Biosecurity Authority of Fiji	MOWE	Ministry of Waterways and Environment
CEF	Commercial Engagement Fund	PHAMA	Pacific Horticultural and Agricultural Marketing Programme
FCM	Fiji Coconut Millers	SPC	Secretariate of the Pacific Community
FNU	Fiji National University	TLTB	iTaukei Land Trust Board
HRSD	Human Rights and Social Development	TUD	Timber Utilisation Division
LIFL	Long Investments Fiji Ltd.	VTBL	Valebasoga Tropik Boards Ltd.
MOA	Ministry of Agriculture		

Annex 2: Role of Key Value Chain Actors

Actor	Contribution	Costs Incurred	Incentives	Risk Exposure
<p>Customary (<i>mataqali</i>) landholders</p> <p>Freehold estate owners.</p>	<ul style="list-style-type: none"> Supply of senile coconut palms for processing 	<ul style="list-style-type: none"> Loss of income from felling of palms – generally small since senile palms have low productivity 	<ul style="list-style-type: none"> Stumpage fees received from logging contractors Income from replanted coconuts, other crops or livestock 	<p>Low Risk:</p> <ul style="list-style-type: none"> Payment default Damage to land and infrastructure by logging operations
<p>Logging contractors</p> <p>Some timber mills conduct their own logging operations, others use contractors.</p>	<ul style="list-style-type: none"> Fell coconut palms Haul to roadside Cut into lathe length billets (2.4m) Load onto truck Transport to timber mill Remove debris and clean-up site 	<ul style="list-style-type: none"> Labour hire for logging crews Machinery operating costs (chainsaws, tractors, loaders, chippers etc.) Road haulage and shipping costs Construction or repair of access tracks Stumpage fees paid to landowners Overheads – finance, insurance, permits etc. 	<ul style="list-style-type: none"> Revenue from sale of logs to timber millers 	<p>Moderate Risk:</p> <ul style="list-style-type: none"> Payment default Disruptions due to extreme weather/natural disasters Machinery breakdowns or accidental damage Disruptions due to land disputes Cost of and delays in obtaining regulatory approvals and licences
<p>Veneer producers</p> <p>May also be plywood producers</p>	<ul style="list-style-type: none"> Prepare logs for processing using hot water bath Peel logs using spindleless lathe to produce veneer Dry veneer Trim, grade and stack veneer Transfer waste to furnace 	<ul style="list-style-type: none"> Payments to logging contractors Purchase and operation of machinery and equipment Mill operating costs, labour, electricity, materials etc. Overheads – finance, insurance, permits etc. 	<ul style="list-style-type: none"> Revenue from domestic veneer sales, or supply of veneer to own plywood manufacturing line Revenue from export sales 	<p>High Risk:</p> <ul style="list-style-type: none"> Inability to source adequate/consistent supply of coconut stems of the required specifications Uncertainties about technical aspects of peeling coconut stems Uncertainties about market demand and prices for coconut veneer
<p>Plywood producers</p> <p>May also be veneer producers</p>	<ul style="list-style-type: none"> Utilise coconut veneer to produce plywoods – may include other veneers, e.g. pine, mahogany 	<ul style="list-style-type: none"> Purchase of coconut veneer Materials, adhesives etc. Purchase and operation of machinery and equipment 	<ul style="list-style-type: none"> Revenue from sale of plywood to timber product manufacturers or building material suppliers 	<p>Moderate Risk:</p> <ul style="list-style-type: none"> Inconsistent supply or poor quality of coconut veneer

Actor	Contribution	Costs Incurred	Incentives	Risk Exposure
		<ul style="list-style-type: none"> • Mill operating costs, labour, electricity, materials etc. • Overheads – finance, insurance, permits etc. 	<ul style="list-style-type: none"> • Revenue from export sales 	<ul style="list-style-type: none"> • Uncertainties about technical aspects of using coconut veneer in plywood manufacture • Uncertainties about market demand and prices for coconut plywood products
Timber manufacturers	<ul style="list-style-type: none"> • Utilise veneer and/or plywood to manufacture end products - furniture, flooring, structural timbers etc. 	<ul style="list-style-type: none"> • Purchase of coconut veneer and/or coconut plywood products • Materials, adhesives etc. • Purchase and operation of machinery and equipment • Mill operating costs, labour, electricity, materials etc. • Overheads – finance, insurance, permits etc. 	<ul style="list-style-type: none"> • Revenue from sale of manufactured items – domestic or export sales 	<p>Low Risk:</p> <ul style="list-style-type: none"> • Uncertainties about technical aspects of using coconut veneer and/or plywood in manufactured products • Uncertainties about market demand and prices for coconut wood products
Domestic building and hardware merchants	<ul style="list-style-type: none"> • Wholesale and retail sales of a range of domestic and imported timber products. • Sell to builders and tradesmen as well as retail (DIY/home improvement) customers. 	<ul style="list-style-type: none"> • Purchase of coconut veneer, plywood and manufactured coconut wood products • Operating costs of wholesale distribution and retailing facilities 	<ul style="list-style-type: none"> • Margins earned on wholesale and retail sales 	<p>Low Risk:</p> <ul style="list-style-type: none"> • Possible need to offer discounts clear slow-moving stock items • Competition from low-cost imported products • Slump in building and home improvements sector
Overseas timber wholesalers	<ul style="list-style-type: none"> • Supply the building industry and hardware retailers with timber products • Handle both imported and domestic product lines 	<ul style="list-style-type: none"> • Purchase of local and imported timber products • Operating costs of wholesale timber distribution facilities 	<ul style="list-style-type: none"> • Margins earned on wholesale sales 	<p>Low Risk:</p> <ul style="list-style-type: none"> • Larger retailers sourcing supplies directly from timber millers and manufacturers • Slump in building and home improvements sector
Overseas building and hardware retailers	<ul style="list-style-type: none"> • Source supplies from wholesalers as well as directly from timber millers and manufacturers 	<ul style="list-style-type: none"> • Purchase of local and imported timber products • Operating costs of retailing outlets 	<ul style="list-style-type: none"> • Margins earned on trade and retail sales 	<p>Low Risk:</p> <ul style="list-style-type: none"> • Smaller retailers struggle to compete with large hardware/home improvement companies (e.g. Bunnings)

Actor	Contribution	Costs Incurred	Incentives	Risk Exposure
	<ul style="list-style-type: none"> • Handle both imported and domestic product lines • Sell to builders and tradesmen as well as retail (DIY/home improvement) customers 			<ul style="list-style-type: none"> • Slump in building and home improvements sector

Actor: the participant in the value chain.

Costs Incurred: the cost of the actor's contribution

Risk Exposure: risks incurred by the actor

Contribution: what the actor contributes to the final product

Incentives: rewards/benefits, financial or other

Annex 3: Supporting and Enabling Actors and their Functions

Actor	Functions and Responsibilities
Ministry of Agriculture (MOA) https://agriculture.gov.fj	<ul style="list-style-type: none"> • Agricultural sector policy. • Research and extension support for coconut growers. • Agricultural census and statistics. Proposing to undertake a coconut survey later in 2022. • Breeding hybrid coconuts – at Mua Research Station on Taveuni. • Raising coconut seedlings (hybrids and Fiji tall varieties) and free distribution to growers for replanting.
Ministry of Forestry (MOF) https://forestry.gov.fj	<ul style="list-style-type: none"> • Forestry sector policy. • Undertakes research on coconut veneer, plywood and related products. • Issues logging licences for coconut stem harvesting – subject also to EIA approval from MOWE. • Inspects timber products for the purpose biosecurity clearance and issuing export licences.
Ministry of Waterways and Environment (MOWE) https://mowe.gov.fj	<ul style="list-style-type: none"> • Environmental policies, legislation and regulations. • Oversight and approval of environmental permits including Environment Management Assessment (EMA) and Environment Impact Assessment (EIA). EMA is a general assessment report and EIA is a full environmental screening process. • EMA and probably EIA will be required for logging of senile coconut plantations. • May require environmental bond to be lodged before approval is given to log.
Fiji Coconut Millers Pte Ltd (FCM) https://www.coconut.com.fj	<ul style="list-style-type: none"> • Parastatal company that operates a coconut oil mill at Savusavu • Buys whole coconuts from growers
Ministry of iTaukei Affairs (MTA) https://www.itaukeiaffairs.gov.fj/	<ul style="list-style-type: none"> • Preservation of Fijian culture and economic and social development of indigenous Fijians. • Oversees Provincial Offices and District and Village Councils. • Provincial Offices need to be consulted on any proposals to harvest coconut stems on mataqali land.
Ministry of Rural and Maritime Development and Disaster Risk Management https://ruraldev.gov.fj	<ul style="list-style-type: none"> • Administers freehold coconut estates. • Able to coordinate meetings with freehold coconut estate owners
iTaukei Land Trust Board (TLTB) https://itlb.com.fj	<ul style="list-style-type: none"> • Statutory trust to control and administer iTaukei land on behalf of its indigenous owners. • Oversees commercial use of iTaukei land through issuing and registering leases of such land. • May require issue of licences for harvesting of senile palms on iTaukei land.
Land Transport Authority (LTA) https://lta.com.fj	<ul style="list-style-type: none"> • Vehicle registration, driving licences and load limits.

Actor	Functions and Responsibilities
Ministry of Infrastructure and Transport (MIT) https://moit.gov.fj	<ul style="list-style-type: none"> • Load limits restrict the number of logs that can be carried on trucks. • Construction and maintenance of roads.
Biosecurity Authority of Fiji (BAF) https://baf.com.fj	<ul style="list-style-type: none"> • Issues phytosanitary certificates for exports where this is required by the importing country. • For timber products this may involve inspection and fumigation.
Ministry of Employment, Productivity and Industrial Relations	<ul style="list-style-type: none"> • Incorporates the National Occupational Health and Safety Service Unit • Administers the 1996 Health and Safety at Work Act (HASAWA)
Energy Fiji Limited (EFL) – formerly Fiji Electricity Authority https://efl.com.fj	<ul style="list-style-type: none"> • Provide efficient and cost-effective power supply to domestic and commercial electricity users • Tariffs are determined by the Fijian Competition and Consumer Commission

Annex 4: SWOT Analysis

Actor	Strengths and Opportunities	Weaknesses and Threats	Action Needed
Customary (<i>mataqali</i>) landholders	<ul style="list-style-type: none"> Interested in removing senile palms and re-planting, especially if they are offered a clear and replant package. Earning little or no income from senile plantations. 	<ul style="list-style-type: none"> Relatively small areas of senile palms per <i>mataqali</i>. Plantations fragmented and often mixed with other crops which could make harvesting operations difficult. Need to undergo consultations and develop a consensus on whether to harvest. Possible disputes within and between <i>mataqali</i> on ownership of plantations. 	<ul style="list-style-type: none"> Identify villages with substantial areas of senile palms. Establish a consultation process for negotiating access arrangements for senile palms on <i>mataqali</i> land. Implement proposed survey to establish with greater certainty the location, area and condition of <i>mataqali</i> coconut plantations.
Freehold estate owners	<ul style="list-style-type: none"> Own large contiguous areas of senile coconut plantations. Earning limited or no revenue from senile plantations and interested in harvesting and replanting or converting to different crop/livestock enterprises. Able to enter into commercial agreements for harvesting. 	<ul style="list-style-type: none"> Many estate owners are not interested in coconut replanting, suggesting a threat to the sustainability of the coconut sector. Around half of the available estate coconuts are located on Taveuni Island which is remote from the two potential EWP processors 	<ul style="list-style-type: none"> Implement proposed survey to establish with greater certainty the location, area and condition of coconut estates. Negotiate offtake agreements with coconut estates in the most accessible areas of Vanua Levu.
Logging contractors	<ul style="list-style-type: none"> Vanua Levu contractors have the equipment, staff and expertise needed to undertake coconut harvesting. Have excess capacity due to declining production from native forests and pine plantations. Strong interest in logging senile coconut plantations. 	<ul style="list-style-type: none"> Limited capacity to navigate regulatory approval pathways such as EIAs. No established code of practice for logging coconuts or for post-harvest land rehabilitation and replanting. Low standards of occupational health and safety in logging operations. 	<ul style="list-style-type: none"> EWP processors to negotiation supply arrangements with logging contractors. Develop coconut logging code of practice and log grading system in conjunction with landowners and logging contractors.
Veneer producers May also be plywood producers	<ul style="list-style-type: none"> Two veneer producers based in the Northern Division with reasonable access to senile coconuts. Have most of the facilities and equipment in place to produce coconut veneers. 	<ul style="list-style-type: none"> Uncertainties about the availability, quality and cost of coconut stems. Both veneer producers need to invest in additional equipment to begin processing coconut stems. 	<ul style="list-style-type: none"> CEF initiative to support veneer producers to develop business plans for coconut veneer production. Facilitate access to finance for investment in equipment and working capital.

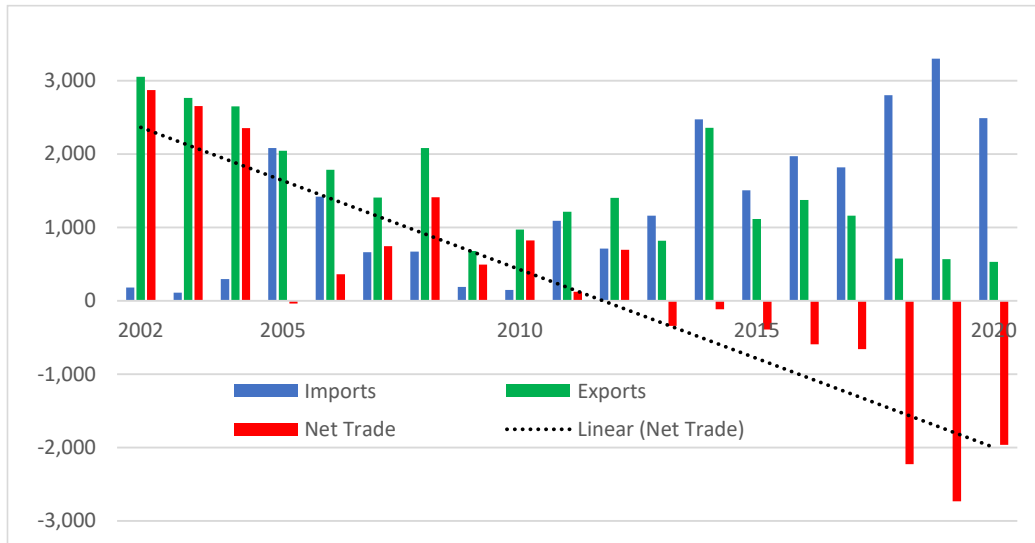
Actor	Strengths and Opportunities	Weaknesses and Threats	Action Needed
	<ul style="list-style-type: none"> • Also able to undertake secondary processing to produce plywood and other EWPs. • One producer (VBT) participated in commercial coconut veneering trials in 2016. The other is aware of the 2016 trial results. • Both producers have an interest in processing coconut wood to compensate for declining availability of logs from other sources. 	<ul style="list-style-type: none"> • Difficulties and delays in obtaining regulatory approvals (such as EIAs) to source timber. • Low standards of occupational health and safety in mill operations. • Lack of technical expertise/experience in processing coconut wood. • Limited understanding of potential markets for coconut veneer products. • Conventional grading system not appropriate for coconut veneers. 	<ul style="list-style-type: none"> • Provide technical support to veneer producers to refine processing protocols. • Support veneer producers in product development and marketing trials for EWPs. • Develop a coconut veneer grading system in conjunction with potential customers.
<p>Plywood producers May also be veneer producers</p>	<ul style="list-style-type: none"> • Two plywood producers based in the Northern Division, who also have veneering capacity. • Capacity to develop plywood products utilising coconut veneers. • Connected to product distribution and marketing pathways for plywood products. • Fiji is becoming increasingly dependent on imported plywood products. This trend will continue as domestic timber supplies wane. 	<ul style="list-style-type: none"> • Limited or no experience in commercial-scale production of plywoods using coconut veneer. • Low standards of occupational health and safety in plywood operations. • Limited understanding of potential markets for coconut plywood products. • Australia/NZ plywood grading system not appropriate for plywoods using coconut veneers. 	<ul style="list-style-type: none"> • CEF initiative to support plywood producers to develop business plans for coconut plywood production. • Provide technical support to plywood producers to refine processing protocols. • Support veneer producers in product development and marketing trials for EWPs. • Develop a coconut plywood grading system in conjunction with potential customers.
<p>Timber manufacturers</p>	<ul style="list-style-type: none"> • Fiji has a number of manufacturers of furniture, cabinets, flooring and structural timber products that are interested in the utilisation of coconut veneers and/or plywoods. • The domestic market is familiar with coconut-based furniture and manufactured timber products. • Potential market for high-quality manufactured products for hotel and 	<ul style="list-style-type: none"> • Manufacturers have strict requirements for veneer/plywood quality and consistency. • Some manufacturers have experience in using coconut wood but not coconut veneers or plywood. • Major coconut wood furniture manufacturer (Pacific Green) not 	<ul style="list-style-type: none"> • CEF initiative to support timber manufacturers to develop business plans for coconut veneer and plywood utilisation. • Provide technical support to timber manufacturers interested in using coconut veneers and plywoods. • Support manufacturers in product development and marketing trials.

Actor	Strengths and Opportunities	Weaknesses and Threats	Action Needed
	<p>resort refurbishment in post-COVID recovery period.</p>	<p>interested in using coconut veneers or plywood.</p> <ul style="list-style-type: none"> Limited understanding of potential markets for products including coconut veneers or plywoods. 	
<p>Domestic building and hardware merchants</p>	<ul style="list-style-type: none"> Well established network of timber wholesale and retail outlets. Offer a range of timber products to builders, tradesmen and retail customers – potential to expand product range by including coconut-based EWPs. Procure timber merchandise from both domestic suppliers and overseas sources. Can provide customer support in the selection and utilisation of building and home improvement materials. 	<ul style="list-style-type: none"> Do not stock coconut wood products and have limited awareness about these. Limited technical knowledge about the characteristics and potential uses of coconut-based EWPs. Limited understanding of how coconut-based EWPs would fit into product range, or who would buy them. 	<ul style="list-style-type: none"> Prepare trial batches of various EWPs (veneers, plywoods, building materials etc.) to enable merchants to offer these to wholesale and retail customers.
<p>Overseas timber wholesalers</p>	<ul style="list-style-type: none"> Source timber merchandise from a wide range of domestic and international sources. Well-connected to the building industry as well as timber product retailers, DIY stores etc. 	<ul style="list-style-type: none"> Deal in large volume lines and unlikely to be interested in low volume/niche market products such as coconut EWPs. Able to source products from low-cost Asian suppliers. 	<ul style="list-style-type: none"> No action identified at this stage.
<p>Overseas building and hardware retailers</p>	<ul style="list-style-type: none"> Offer a wide range of timber products to builders, tradesmen and DIY customers, including high quality veneer and plywood products. Large retail chains provide national market coverage. Offer high quality plywood products at prices up to five times those of standard plywoods. 	<ul style="list-style-type: none"> Strong buying power and ability to source globally from the cheapest suppliers. Limited technical knowledge about the characteristics and potential uses of coconut-based EWPs. Limited understanding of how coconut-based EWPs would fit into product range, or who would buy them. 	<ul style="list-style-type: none"> Consult with retailers in the development of coconut-based EWP products. Prepare trial batches of various EWPs (veneers, plywoods, building materials etc.) to enable retailers to test the market.

Actor	Strengths and Opportunities	Weaknesses and Threats	Action Needed
	<ul style="list-style-type: none"><li data-bbox="474 229 990 320">• Some retailers offer technical support to customers on selection and utilisation of timber products.		

Annex 5: Plywood Market Information

Figure 1: Value of Fiji's Imports and Exports of Plywood Products (USD'000)



Source: ITC Trademap

Table 1: Retail Plywood Prices in Fiji, April 2022

Dimensions (mm)			m ³	FJD	FJD/m ³		Description	
					Inc VAT	Ex VAT		
2,400	1,200	6.5	0.0187	75.00	4,006	3,676	Marine	
2,400	1,200	19.5	0.0562	195.00	3,472	3,186	Marine	
2,440	1,220	4.0	0.0119	35.00	2,939	2,697	Interior, imported	
2,440	1,220	6.0	0.0179	48.00	2,687	2,466	Interior, imported	
2,400	1,200	9.0	0.0259	62.50	2,411	2,212	Exterior	
2,400	1,200	16.0	0.0461	110.00	2,387	2,190	Exterior	
2,400	1,200	17.5	0.0504	120.00	2,381	2,184	Exterior	
2,400	1,200	6.0	0.0173	40.00	2,315	2,124	Exterior	
2,400	1,200	17.5	0.0504	115.00	2,282	2,093	Interior	
2,400	1,200	16.0	0.0461	105.00	2,279	2,091	Interior, veneer	
2,440	1,220	5.2	0.0155	34.05	2,200	2,018	Interior, imported	
2,400	1,200	6.0	0.0173	38.00	2,199	2,017	Interior	
2,400	1,200	12.0	0.0346	76.00	2,199	2,017	Interior, imported	
2,400	1,200	19.0	0.0547	120.00	2,193	2,012	Interior, veneer	
2,440	1,220	18.0	0.0536	117.00	2,184	2,003	Exterior	
2,440	1,200	12.0	0.0351	76.20	2,169	1,990	Exterior	
2,400	1,200	12.0	0.0346	74.00	2,141	1,964	Exterior	
2,440	1,220	15.0	0.0447	94.00	2,105	1,931	Interior, imported	
2,400	1,200	4.0	0.0115	23.60	2,049	1,879	Interior	
2,400	900	4.0	0.0086	17.65	2,043	1,874	Interior	
2,400	1,200	12.0	0.0346	70.50	2,040	1,871	Interior, veneer	
2,440	1,220	18.0	0.0536	108.00	2,016	1,849	Interior, imported	
2,400	1,200	9.0	0.0259	51.50	1,987	1,823	Interior	
						Average	2,181	

[Ply — Vinod Patel | Home & Living](#)

Table 2: Retail Plywood Prices in Australia, April 2022

Dimensions (mm)			m ³	AUD	AUD/m ³		FJD/m ³	Description
					Inc GST	Ex GST		
1,220	810	4.0	0.0040	28.85	7,299	6,635	10,334	Hardwood marine AA grade
1,200	810	3.0	0.0029	20.95	7,184	6,531	10,173	Pine premium BC grade
1,200	396	7.0	0.0033	19.4	5,832	5,302	8,258	Pine premium BC grade
1,200	600	18.0	0.0130	70.50	5,440	4,945	7,702	Red oak
897	600	7.0	0.0038	19.40	5,149	4,681	7,291	Pine BC grade
2,440	1,200	3.0	0.0088	42.55	4,844	4,404	6,859	Pine premium BC grade
1,200	596	7.0	0.0050	23.55	4,704	4,276	6,660	Pine BC grade
1,200	897	7.0	0.0075	35.35	4,692	4,265	6,643	Pine premium BC grade
2,440	1,220	6.0	0.0179	83.35	4,667	4,242	6,608	Hardwood marine AA grade
1,200	596	18.0	0.0129	49.00	3,806	3,460	5,389	Pine BC grade
2,440	1,220	18.0	0.0536	202.00	3,770	3,427	5,338	Hardwood marine AA grade
2,440	1,220	12.0	0.0357	117.00	3,275	2,978	4,638	Hardwood marine AA grade
1,200	1,198	12.0	0.0173	42.70	2,475	2,250	3,505	Pine premium BC grade
2,400	1,200	9.0	0.0259	54.90	2,118	1,926	2,999	Ecoply pine structural CD grade
2,400	1,200	21.0	0.0605	123.00	2,034	1,849	2,880	Ecoply flooring F11 pine T&G
2,400	1,200	19.0	0.0547	111.00	2,029	1,844	2,872	Ecoply pine structural CD grade
2,400	1,200	15.0	0.0432	86.20	1,995	1,814	2,825	Ecoply pine structural CD grade
1,200	1,200	7.0	0.0101	19.00	1,885	1,714	2,669	Specrite pine CD grade
2,400	1,200	15.0	0.0432	78.10	1,808	1,644	2,560	Ecoply flooring F11 pine
2,550	600	30.0	0.0459	62.00	1,351	1,228	1,913	Pine BC grade
2,400	1,200	12.0	0.0346	43.70	1,264	1,150	1,790	Non structural plywood
					Average	3,360	5,234	

<https://www.bunnings.com.au/>

Table 3: Retail Plywood Prices in New Zealand, April 2022

Dimensions (mm)			m ³	NZD	NZD/m ³		FJD/m ³	Description
					Inc GST	Ex GST		
2,400	1,200	19.0	0.0547	213.00	3,893	3,385	4,844	IBS ply floor H3.2
2,400	1,200	25.0	0.0720	235.00	3,264	2,838	4,062	I Built CD structural untreated
2,400	1,200	7.0	0.0202	62.09	3,080	2,678	3,833	I Built DD H3.2 Structural
1,200	600	18.0	0.0130	34.70	2,677	2,328	3,332	Untreated CD
2,400	1,200	15.0	0.0432	115.50	2,674	2,325	3,327	I Built CD structural untreated
1,200	600	7.0	0.0050	12.90	2,560	2,226	3,185	Untreated CD
1,200	600	12.0	0.0086	20.80	2,407	2,093	2,996	Untreated CD
2,400	1,200	9.0	0.0259	59.30	2,288	1,989	2,847	I Built DD H3.2 Structural
2,400	1,200	12.0	0.0346	73.58	2,129	1,851	2,649	Untreated CD
1,200	1,200	18.0	0.0259	54.00	2,083	1,812	2,593	Untreated CD
					Average	2,353	3,367	

[New Zealand DIY, Garden & Hardware Store - Bunnings New Zealand](https://www.bunnings.com.au/)

Table 3 (continued): Retail Plywood Prices in New Zealand, April 2022

Dimensions (mm)			m ³	NZD	NZD/m ³		FJD/m ³	Description
					Inc GST	Ex GST		
2,745	1,200	12.0	0.0395	279.48	7,070	6,148	8,799	Texture plywood untreated
2,700	1,200	12.0	0.0389	227.69	5,856	5,092	7,288	Classic plywood untreated
2,700	1,200	7.0	0.0227	118.48	5,224	4,543	6,501	Structural plywood H3.2 treated
2,400	1,200	9.0	0.0259	132.28	5,103	4,438	6,351	Structural plywood untreated BD
2,400	1,200	25.0	0.0720	271.49	3,771	3,279	4,692	Structural plywood H3.2 treated CD
2,700	1,200	12.0	0.0389	138.99	3,575	3,109	4,449	Structural plywood untreated CD
2,700	1,200	7.0	0.0227	76.59	3,377	2,937	4,202	Structural plywood H3.2 treated
2,400	1,200	9.0	0.0259	74.49	2,874	2,499	3,576	Birch poplar core lining plywood
2,400	1,200	21.0	0.0605	156.99	2,596	2,257	3,230	Structural plywood untreated
2,400	1,200	17.0	0.0490	118.48	2,420	2,104	3,011	Structural plywood H3.2 treated
2,400	1,200	12.0	0.0346	82.69	2,393	2,081	2,977	Structural plywood H3.2 treated
2,400	1,200	17.0	0.0490	95.29	1,946	1,692	2,422	Non structural plywood H3.2 CCA treated
2,700	1,200	17.0	0.0551	90.19	1,637	1,424	2,038	Non structural plywood untreated
					Average	3,200	4,580	

[Plywood | Lining Plywood Interior | Structural Plywood Treated/Untreated \(placemakers.co.nz\)](https://www.placemakers.co.nz/)

Annex 6: References

Coconut Industry Development Authority (2008) Integrated Approach in the Processing of Coconut Products and By-Products and Market Prospects in Fiji

Department of Agriculture, Economic Planning and Statistics Division. Report on the Fiji National Agricultural Census, 2009

Forestry Department, FAO (2010) Global Forest Resources Assessment: Country Report, Fiji. FRA 2010/068

High Level Consultation on Coconut Development in Asia and the Pacific Region, 2013, Bangkok, Thailand. Republic of the Fiji Islands Presentation

Ministry of Fisheries and Forests (2013) Fiji Forest Harvesting Code of Practice, Second Edition

McGavin, R.L. (2015). "DAF Report – Coconut palm stem veneer processing – Trial 3." Queensland Department of Agriculture and Fisheries, Brisbane.

ACIAR (March 2016) Development of advanced veneer and other products from coconut wood to enhance livelihoods in South Pacific communities DAF Report - Coconut palm stem veneer processing Trial 4 March 2016

Leggate W., McGavin R.L., and Bailleres H. (Eds) 2017. A guide to manufacturing rotary veneer and products from small logs. ACIAR Monograph No MN182. Chapter 3: Log Specifications, Grading and Pre-Processing.

McGregor A and Sheehy M (2017) An Overview of the Market for Pacific Island Coconut Products and the Ability of Industries to Respond.

Coconut Industry Development Programme (July 2017) Pacific Coconut Sector Value Chain Workshop, Section 5.1; Fiji, Dr Bosco Augustine Jerad – ITEC Coconut Specialist

McGavin R.L., Leggate W., Bailleres H., Hopewell G. and Fitzgerald C. 2019. A guide to the rotary veneer processing of coconut palms. Australian Centre for International Agricultural Research: Canberra. ACIAR Monograph No 206

Fiji Agriculture and Rural Statistics Unit, EP&S Division, Ministry of Agriculture. 2020 Key Statistics on Fiji Agriculture Sector

Ministry of Agriculture and FAO. 2020 Fiji Agriculture Census

ACIAR (October 2021) Defining priority commercialisation pathways, and potential private commercialisation partners for viable long-term commercialisation of products emerging from FST/2019/128. AGB/2021/172

Tawake S. (Nov-Dec 2021) Field technical report for Northern Division Visit to Veneer Mills and Coconut Plantations, unpublished report

Tawake S. (February 2022) Field Trip Technical Report – EWP Value Chain Mapping (with David Young and Maika Tabukovu)

Tabukovu M. (March 2022) Identifying potential value chain actors in cocoveneer manufactured from senile coconut palm stem in Fiji, unpublished report