PARDI2

Santalum yasi (sandalwood) Participatory Value Chain in Fiji: 1984-present

A collaboration between ACIAR FST/2016/158, Fiji Forestry Department and CSIRO & PARDI2- University of the Sunshine Coast.

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Pacific Agribusiness Research in Development Initiative Phase 2

Step 1: Drawing a value chain map

Part 1: List of actors involved in the value chain

Main actors (those who buy and sell the product as it moves along the chain)	Supporting actors (those who provide services to facilitate the movement of the product along the chain
Sandalwood resource owners/harvesters, principally Fijian villagers from Kadavu, Vanua Levu (Bua and Macuata), Viti Levu (Nausori Highlands) and Lau (Ono-I-Lau and Lakeba)	Local transport operators (vehicles and boats)
Buyers/local processors (Victor Zutshi/ Aromatic Oils (Fiji) Ltd based in Lautoka; Jeff Allen (now in Vanuatu); Blue Ocean Marine Ltd, Suva; GoldHold Co Ltd, Labasa; Wee Kong Marine Product & Exporters Co, Suva.	Government of Fiji agencies - Native Lands Trust Board (now iTLTB) and Fiji Forestry Department (approval to cut and sell sandalwood)
International buyers/exporters/processors, including JJ Yu (Taiwan Timber Co (Fiji) Ltd), and Kuo Ping Ku (Taiwan Pine Cedar Wood Enterprise), Jonathon Naupa and associates (Tropical Rainforest Aromatics, Vanuatu)	
Consumers (of sandalwood products from Fiji sourced yasi) – mainly in Asia (PR China & Hong Kong, Taiwan, South Korea, Japan, Singapore and Vietnam), Middle East (Dubai and the Kingdom of Saudi Arabia) and Australia	

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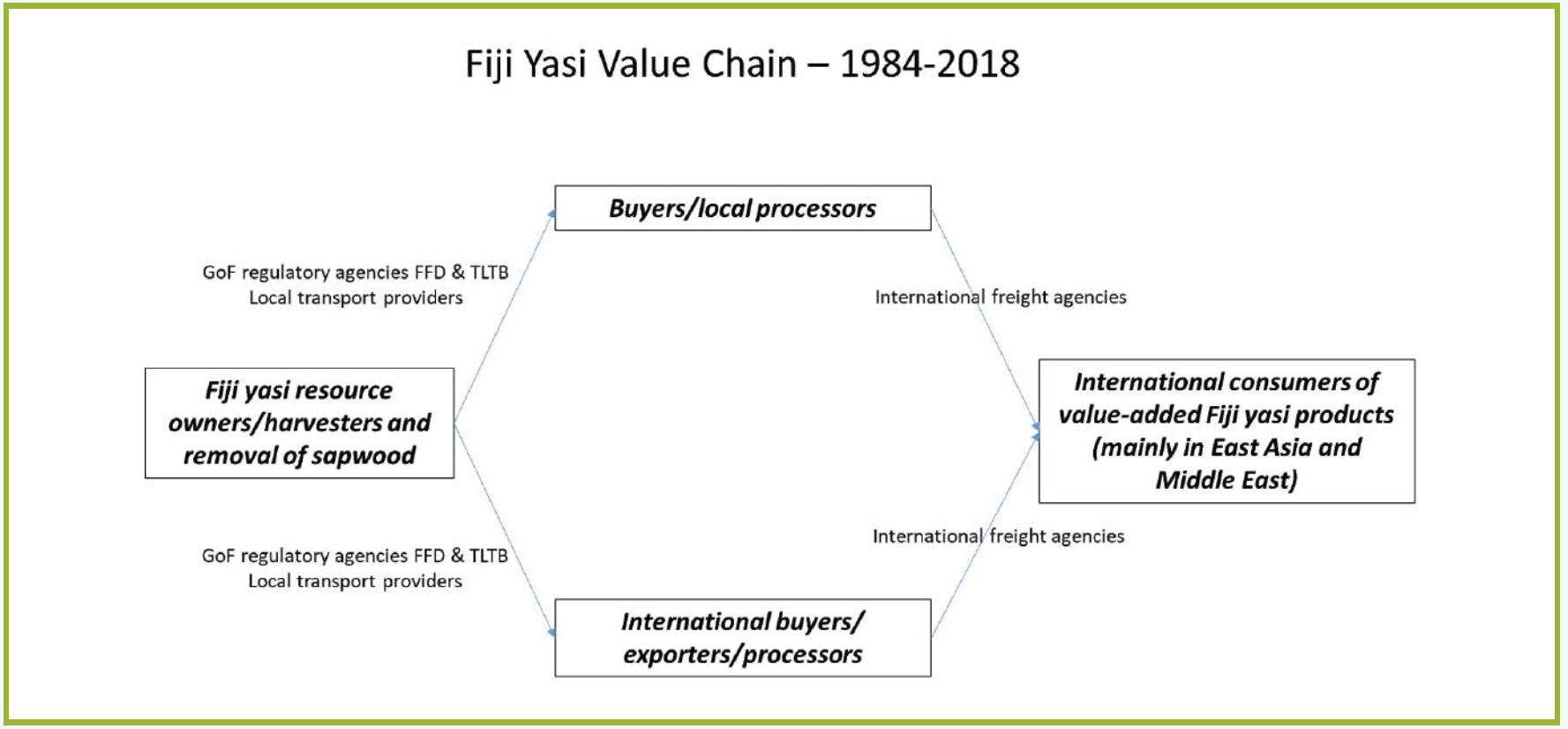
Part 2: Draw a map of how the product flows and placing each actor in their his or her correct place along the chain



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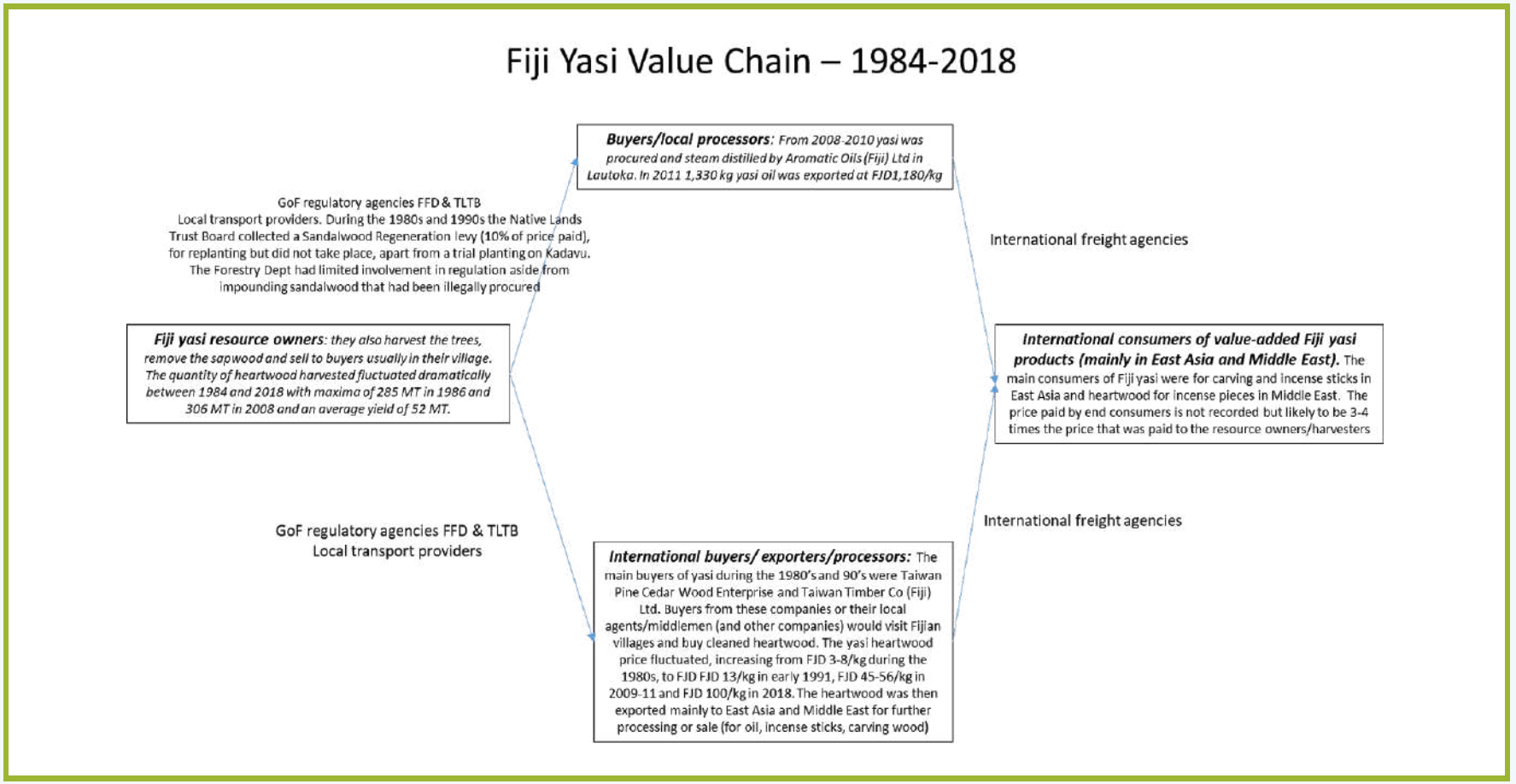
Step 2: Putting facts and figures into the map



Step 3: Identifying what each actor contributes to the final product and the returns they receive

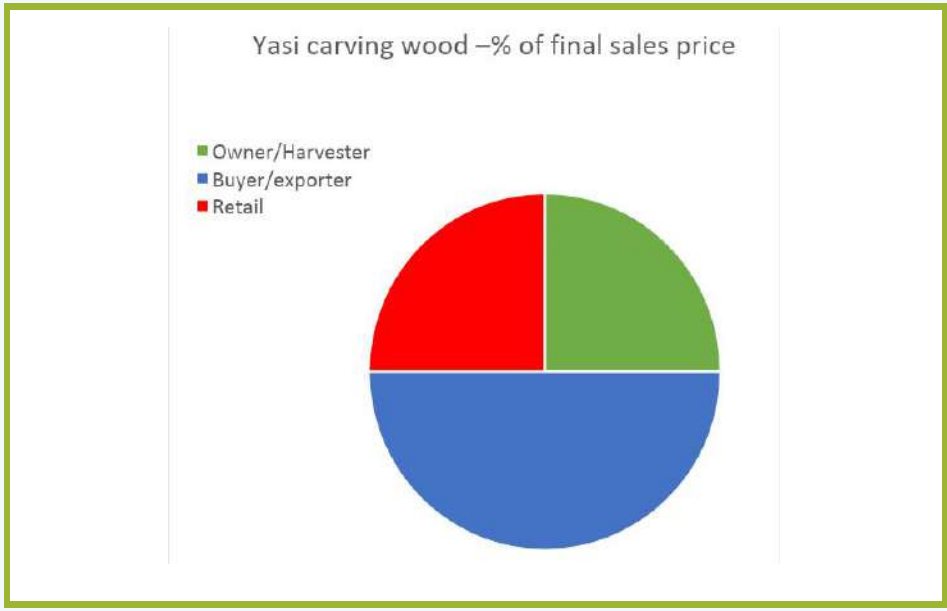
The template below can be used in addition to the example in the value chain guide

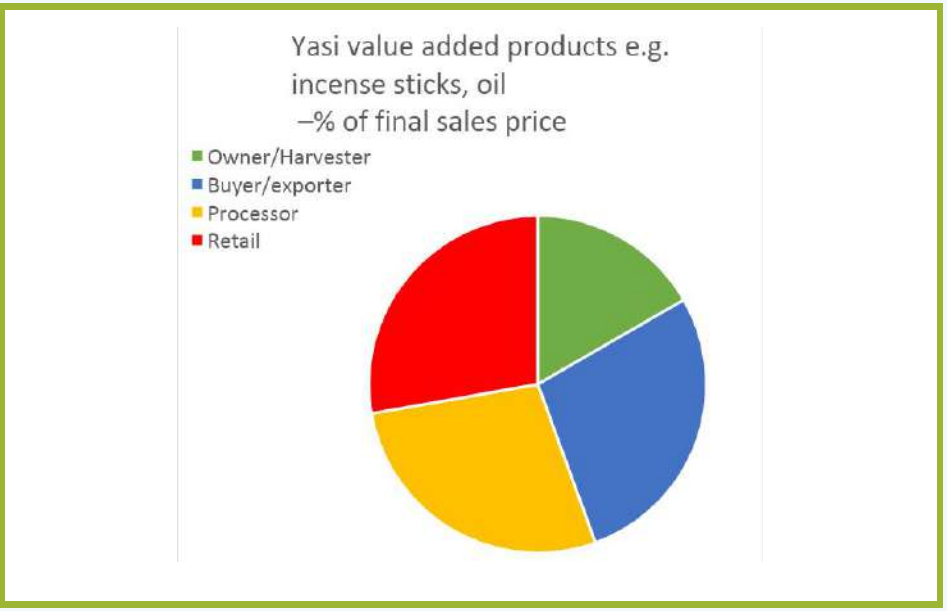
Actor (participant in the value chain)	What the actor contributes to the final product	The cost of the actors contribution	The reward the actor receives (share of the final selling price to the consumer)	Actor risk
Resource owner/ harvesting and desapping	Identify yasi trees containing heartwood and harvest trees including main roots. The lighter-coloured sapwood is then removed using large knifes (usually cane knifes). The de-sapped heartwood is then stored and dried ready for sale.	Not well studied and documented, and the labour inputs will vary greatly from tree to tree with the largest trees providing much better returns for effort (for cutting, digging, local transport – often hand carried or on horse for most of the distance back to the village, and de-sapping). For small - medium sized tree with 20 kg of heartwood, it takes approximately one man day to cut and dig up roots and another 1-2 days to transport back to the village and de-sap.	Approximately 15-30 % of the price paid by the final customer (with increasing proportional reward in later years)	Minimal risks as the market for yasi sandalwood has been strong throughout the period 1984-2018. Main risk if inexperienced and/or poorly informed landowners cut immature yasi, which is a waste of labour and diminishes future returns.
Local buyer/processors	Advance finance for local buyers (middlemen) to scout out yasi in rural areas, later	The costs of the actors contribution are payments to middlemen/buyers,	Approximately 25-50 % of the price paid by the final customer (but can be much	Key risk is that inexperienced buyers or middlemen can procure

	return to procure yasi and then transport heartwood to distilleries in Lautoka and Suva. Verifies that the procured product is yasi, steam distils the oils, ± rectify oil, and markets oil internationally.	including finance to buy yasi; all costs associated with distillation and marketing of yasi oil	higher where individual trees/large logs are auctioned on the internet)	immature yasi and/or wood of other species and/or pay too high a price for inferior wood
International buyers/exporters/ processors/	Buy yasi heartwood in the village, sort different yasi grades and market internationally.	The main costs are associated with product inspection and transport to/from sandalwood producing areas/villages and purchase of yasi heartwood, and then all costs associated with marketing and export (which may be to a parental company based in Taiwan, Vanuatu or elsewhere)	As above	A risk is that travel may be undertaken by buyers to production areas, but insufficient yasi was able to be procured to cover costs. Risk of poor quality and/or false sandalwood products being hidden within consignments
Processors utilizing yasi oil and heartwood powder in their products for sale into overseas markets	Value-adding to Fiji yasi product, through incorporation into perfumes, attars, body-care products and incense sticks.	Yasi oil is likely to have been used as a direct substitute for East Indian sandalwood oil in perfumes and other products. Variable cost depending on end product involved.	Variable, e.g. 20-30%	Production of yasi oil was very limited between 1984 and 2018. Not viable to develop specific products incorporating or largely based on yasi oil due to lack of sustainable supply)

Retailers of products incorporating yasi in overseas markets	Provide a retail outlet where consumers can access pieces of yasi heartwood, including carved items, and value-added products containing yasi heartwood powder or oil	Variable depending on location and retailer's overheads - sandalwood and derived/value-added products being sold into different markets (including local markets, department stores, internet etc),	Typically at least 25% of the final value of the yasi incorporated into the product being sold (but will be highly variable depending on product)	Limited risk – sandalwood products are in high demand and non-perishable. Inexperienced retailers may be sold adulterated sandalwood oil.

Illustration of the product indicating the different 'shares' of the final selling price for the various actors





Step 4: Assessing the market

This step is sometimes called market research or market analysis. See instructions and example from value chain guide.

What buyers/ consumers care about	Performance of value chain in meeting demand (score from 1 – 10) and why
Heartwood composition: the oil yield and composition (for most end uses including oil distillation, use in incense sticks etc)	10 – The most important criteria for sandalwood distillers as it determines the percentage yield of oil from < 1% to 8% oil content. The quality is equally important – oils meeting the ISO standard for East Indian Sandalwood oil are preferred. The value of an oil for perfume may be substantially impacted by its minor fragrant constituents (as much as by its α- and β-santalol content) and also negatively impacted by undesirable minor constituents which may give 'off-characteristics' to fragrance or which give rise to allergic responses especially contact dermatitis.
Oil quality (santalol content, absence of irritants (E,E Farnesol), adulteration). Note: While yasi oil will generally qualify for ISO3518:2002 for East Indian Sandalwood Oil, it will be useful to produce an official monograph detailing all the information on yasi oil and make it available for international buyers and end users.	10 – the oil quality/composition is the prime consideration for perfumers and manufacturers of body care products incorporating sandalwood oil. Higher santalols contents are desired, ideally meeting the current ISO standard, viz. 41-55% α-santalol and 16-24% β–santalols, along with the presence of minor fragrant compounds which can impart a unique fragrance (and absence of irritants). The presence of adulterants will considerably downgrade the value of sandalwood oil (or make it unsaleable), as will the presence of E,E Farnesol (a skin allergen recognised by the Scientific Committee on Consumer Safety of the European Commission). Note: some samples of yasi oil appear to have a level of farnesol (1%) that is still too high to allow their use the essential oil in non-allergenic fine fragrances. Sandalwood industry experts are concerned with the hybrid. The F1 S. yasi x S. album produces a high quality oil, but further crossing/inbreeeding may make the hybrid unpredictable, both in terms of performance and its oil yield and composition. Sandalwood traders believe that it will be in Fijian and Tongan growers' interests to

	keep the local S. yasi as pure as possible, so that it can continue to be arguably the best sandalwood species performer in the world.
Mislabelling of exported sandalwood – both other genera including cevua (Vavaea spp.), Exocarpus vitiensis and also other Santalum species (notably S. austrocaledonicum from Vanuatu)	10 – the sandalwood market would expect that yasi products from Fiji are derived from the pure species (although yasi hybrids with album will produce a similar and almost indistinguishable heartwood). Other Fijian timbers which produce a fragrant heartwood such as cevua (Vavaea spp.) should never be substituted for yasi as this has the potential to seriously downgrade the future markets and value of all sandalwood supplied from Fiji. Between 2012 and 2018, less than half of the wood exported under the name 'sandalwood' from Fiji was Santalum yasi (or S. yasi hybrids). 20% of sandalwood exports was of another inferior Santalum species (S. austrocaledonicum) which had been imported from Vanuatu for re-export, 21 % was Vavaea species and 13% was Exocarpus vitiensis. Cevua has minor value as a fragrant timber export, but should never be allowed to be exported under the label 'sandalwood'.
Straightness, diameter and proportion of heartwood – for carving wood	9 – the highest value market for sandalwood including yasi is the carving markets in East (and South) Asia. The heartwood oil composition and yield is less important than the piece size, shape and figure and it should have a very high proportion of heartwood.
Sustainability of production	3-5 – The sustainability of production was only of limited importance in earlier times, but has been of increasing importance especially for the sandalwood oil and body-care product market. Here continued availability of raw product is a pre-requisite for new product development and marketing.
Certification (Legally sourced, fair trade, organic)	3 – Segments of the international sandalwood market, especially consumers of high-value perfumes and body-care products, are becoming increasingly conscious of buying only from legally-sourced sandalwood sources, and with a preference for sandalwood products which are able to be certified organic and fair-trade.

Step 5: Assessing strengths and weaknesses along the chain and identifying ways to take advantage of strengths and minimize weaknesses

See instructions and example from value chain guide

Actor (participant in the value chain)	Strengths & opportunities	Weaknesses & threats	Action needed
Resource owner/ harvesting and desapping	Owners of the yasi are typically those involved in its harvest and sale, which provides a greater level of interest in the trees and their protection Wide dispersal of benefits from sandalwood production among owners and their families (who may undertake de-sapping in village)	Sapwood and offcuts with heartwood often go unutilized and left in the village or bush. Some resource owners are not fully aware of quality grades and are potentially underpaid for their sandalwood. Sandalwood owners not fully informed of the economic merits of utilizing high quality genetic stock and of growing trees onto larger sizes with a higher proportion of heartwood. Unaware of techniques to	Better education of yasi growers and owners on growing and managing yasi, especially the need for: 1. Utilizing superior genetic material (i.e. either pure yasi or F1 yasi: album hybrids, which has preferably derived from seed orchards or clones of mother trees of known superior oil composition) and 2. Proper host: yasi ratios and inclusion of several effective hosts, including Calliandra, Acacia, Casuarina, Flueggea, Citrus and others.

		manage sandalwood regeneration to increase survival and growth rates, and imperative of proper hosting regimes to grow sandalwood commercially in both agroforestry plantations and in home gardens. Risk that some mataqali members may prematurely harvest yasi for their own financial gain (with loss of future income to mataqali). Some harvesters are harvesting other genera/species which is erroneously being exported as sandalwood.	Development of local industry to process sandalwood off-cuts into powder for use by incense manufacturers in Asia. Development of standardised grading system for sandalwood products that is accessible to resource owners. Investigate development of separate markets for products like cevua (Aglaia spp.) , which while not sandalwood, does contain potentially valuable aromatics.
Local growers/buyer/processors	Oil extracted from S. yasi meets the ISO standards for S. album While S. yasi trees produce good heartwood at 17-20 years, the best heartwood is produced on trees that are 25 years or older. There is an opportunity for lower value sandalwood to be graded and chipped at a central point for greater utilisation of the tree. It is then desirable to grind the chip into 10mm or 12mm particles for	The local processing industry has limited knowledge of best practices for buying yasi and processing it into oil, and limited knowledge and understanding of sandalwood uses, consumers and markets. Sandalwood trading is a risky business due to sometimes corrupt supply chains. Therefore buyers often don't pay the grower	Differentiate, through effective branding and marketing, Santalum yasi oil and products from plantation S. album oil and body care products. Accent on quality and reliability requires regulation of harvesting, especially of younger material with under-developed heartwood. Substitution of non-sandalwood aromatics for yasi must be stopped

	marketing into the lucrative agarbatti/incense markets. A greater proportion of the economic and employment benefits from yasi industry stay in Fiji (& Tonga) when there is expanded downstream processing of sandalwood.	a fair price reflecting the value of the product. Marketing and storage should be through a single Government body in Suva and Nuku'alofa. When a parcel of sandalwood is ready then known buyers should be notified and be able to inspect the timber and make offers. It is too expensive to set up powder processing for the lower value parts of the tree (plus fire explosion risk if not done carefully).	
International traders (buyers and exporters)	Knowledge of global sandalwood industry and markets, including how to grade yasi to maximise value	Lack of commitment to the development of a competitive and sustainable yasi industry in Fiji: driven by commercial imperative to make short-term profits through maximizing exploitation of the resource	Better regulate and monitor international buyers of yasi, and make it mandatory to replant sandalwood to replace those harvested (e.g. 5 seedlings planted and maintained for every tree harvested).
International competition: growers/processors of high quality sandalwood especially in northern Australia	Key strengths for northern Australia sandalwood producers are access to large areas of suitable (irrigated) freehold land for sandalwood culture, and established links (including supply contracts) with major	Quintis and other S. album plantations in northern Australia represent a serious threat to the stability of the sandalwood oil pricing and supply in global markets. If the growing companies continue with their	Differentiate, through effective branding and marketing, Santalum yasi oil and products from plantation S. album oil and body care products. Accent on quality and reliability requires regulation of harvesting,

	global users of sandalwood oil (including US-based Young Living, the largest essential oil company in the world, French perfumers, Nestle subsidiary and Lush Cosmetics).	current harvesting schedules, there will likely be an oversupply of S. album oil in the market by 2022. The current price for plantation S. album oil in volume is around US$2,500 per kg. Industry insiders expect this to drop below US$1,800 per kg by 2022. There is a possibility for it to go as low as US$1,200 per kg. The quality of the oil is significantly lower than the wild harvested sandalwood and while Quintis are now harvesting the trees at 15 years old, they would be better off waiting at least another 10-15 years. Due to the cost of maintaining these S. album plantations; they cannot afford to keep them for 30 years and therefore industry insiders expect that sandalwood MIS in northern Australia has peaked and will likely decline (rather than expand) in future. Heartwood formation in young planted S. album is small from	especially of younger material with under-developed heartwood. Substitution of non-sandalwood aromatics for yasi must be stopped

		the butt to up the trunk for about 1 to 2 metres and the sapwood is generally making up to 70 to 80 percent of the log. The growing companies are including secondary heartwood in their reporting, which is not considered valuable or desired for carving logs. Industry insiders believe Quintis (and others) will not be able to produce the desired carving logs for another 15 years.	
Overseas processors and users of yasi as ingredient	Understanding of sandalwood products markets and consumer preferences. Opportunity to substitute in yasi for album (but loss of identity of Fiji product)	As above	End markets for sandalwood timber in Asia and the Middle East cannot differentiate between S. yasi and S. album and therefore they always sell it as S. album at 'album' prices. This is not in the best interests of yasi growers. Wild S. album is continually reducing and will be replaced by S. yasi and plantation timbers. Santalum yasi logs for the next period will be the most sought-after and consistent supply. Therefore it is a good

			opportunity for yasi to be branded and gain recognition in the marketplace. If Fiji could come up with a method to stop this substitution. Maybe burning a "Y" into the end of each log or something similar. There is a need for centralised marketing body that could achieve this. Education and marketing campaign to make overseas sandalwood processors and users more aware of yasi and the attributes of its oil.
Fiji Government – Department of Forestry	Involved in yasi R&D since mid -990s including collaborating in AusAID-SPRIG and ACIAR research projects to conserve, improve and better utilize yasi. Implementation of the sandalwood development project to increase plantings of yasi throughout Fiji.	Weak regulatory function and inadequate legislation to protect and advance the yasi industry in Fiji	New legislation and increased training and funding of Fiji Forestry Dept, including for R&D, policy development, and enhanced regulatory functions.
Retailers of yasi products in overseas markets	Understanding of sandalwood products markets and consumer preferences. Opportunity to substitute yasi for album (but loss of identity of Fiji product)	Major threat from cheaper sources of plantation S. album oil, especially from plantations in north-western Australia	Education and marketing campaign to make overseas sandalwood processors and users more aware of yasi and the attributes of its oil.

Step 6: Developing a plan to improve the value chain

Actor	Short term plan	Longer term plan
Sandalwood resource owners /i-Taukei	Locate and map sandalwood regeneration – undertake measures to protect sandalwood especially from fire and theft. Undertake thinning and reduce canopy cover of neighbouring trees to allow more sunlight to reach yasi. Protect (tabu) scattered mature yasi seed trees from harvest to ensure future natural regeneration.	Plant more yasi throughout the natural stands, including to increase seed sources. GPS, measure and tag (preferably microchip) sandalwood that is > 10 cm diameter at ground level. Better plan yasi utilization together with iTLTB, Dept of Forestry and sandalwood buyers.
Sandalwood smallholder growers	Locate and map sandalwood regeneration – undertake measures to protect sandalwood especially from fire and theft. Undertake thinning and reduce canopy cover of neighbouring trees to allow more sunlight to reach yasi. Protect (tabu) scattered mature yasi seed trees from harvest to ensure future natural regeneration. Thin overstocked yasi plantings and infill plant with recommended short, intermediate and longer-term hosts to improve quality and productivity of their yasi. Undertake inventory of their planted stock either by age or size (diameter at ground level). Provide information to Forestry Dept to assist with planning of the future utilization and value-adding/processing of yasi resource.	Plant more yasi throughout the natural stands, including to increase seed sources. GPS, measure and tag (preferably microchip) sandalwood that is > 10 cm diameter at ground level. Better plan yasi utilization together with iTLTB, Dept of Forestry and sandalwood buyers. Establish better-designed agroforestry plantings using high quality pure yasi germplasm (produced by Forestry Dept through ACIAR FST/2016/158) and yasi x album hybrids in wetter areas (where yasi does not naturally occur).

Fiji Government - Department of Forestry	Implement yasi sandalwood harvesting regulations. Ensure that immature sandalwood is not harvested or that young wild trees 'checked' with cane knife, and that other species are not substituted as yasi or sandalwood. Produce and distribute high quality yasi and yasi hybrid germplasm. Produce and distribute yasi extension materials. Focus yasi extension activities on outer islands (including Lau Group, Rotuma, Lomaiviti Group and islands off north coast of Vanua Levu) where villagers have few other viable commercial cash-generating crops.	Develop yasi industry plan in collaboration with all stakeholders (esp. resource owners and private sector) Publish accurate reports on the yasi resources in Fiji to facilitate private sector investment in processing/value adding. Contribute to orderly development of the industry to ensure that excess processing equipment is not established (which will be unviable and put unsustainable harvesting pressure on both native and planted yasi resources)
Sandalwood Buyers	Better communicate their needs to resource owners, sandalwood growers and harvesters to ensure that immature sandalwood is not harvested. Encourage resources owners to replant and protect some seed trees from harvest to ensure future viability of the industry.	Feedback information to resource owners and growers on the size and quality of sandalwood that is needed (and taking into account changing market conditions and buyer preferences).
Sandalwood Processors	Make sure only mature sandalwood is harvested and brought to their factory. Develop laboratory facilities (or link with OS laboratories) to test their sandalwood and make sure that it meets relevant standards, e.g. low E,E-Farnesol, high α- and β-santalols etc.	Develop and promote Fiji yasi sandalwood products as a unique and distinctive brand (this objective may be pursued with Tongan sandalwood growers and processors). Install processing facilities that match the projected availability/supply of sandalwood resources.

Sandalwood Exporters	Ensure that only genuine mature yasi heartwood is being exported. Undertake market research to ensure that they are obtaining the highest price for different types and grades of products.	Feedback information to growers and processors on the products being demanded in the international market (and changing demands and prices).