



Australian Government
Australian Centre for
International Agricultural Research

Canarium Nut Value Chain Review





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Why Canarium Nuts?

- World trade in tree nuts is well in excess of US \$1000 million and increasing
- Domestic demand for processed nuts exceeds supply
- For thousands of years the nut has been culturally important and used as a traditional food
- The commercial industry is still in its infancy and is now attracting private sector investment
- There are opportunities to provide assistance in research on markets, processing techniques and factors affecting industry development

Background

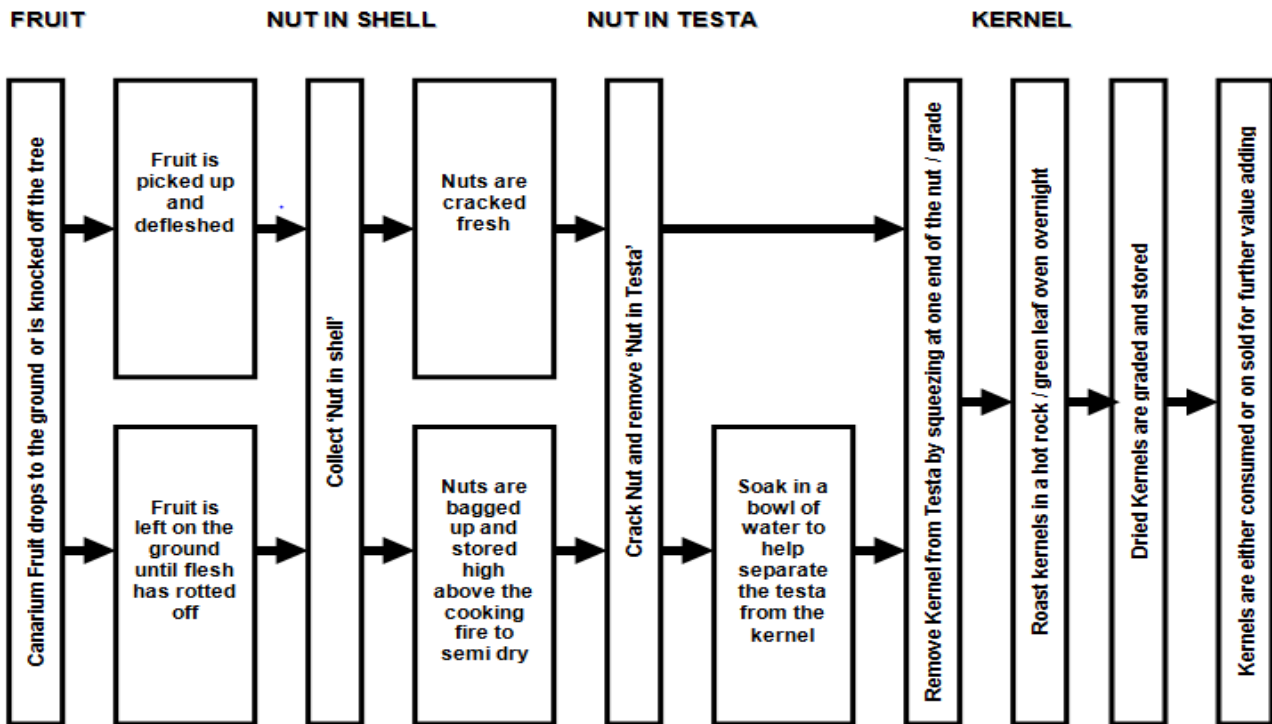
Canarium indicum is a tall indigenous tree that grows throughout the South Pacific and produces edible nuts as well as timber. The nuts are known in Vanuatu as nangai, in the Solomon Islands as ngali and in Papua New Guinea as galip. The genus *Canarium* (Burseraceae) contains approximately 100 species, with eight species having edible kernels and *Canarium indicum* being the most widely utilized species in the Pacific (Nevenimo et al., 2007). In Vanuatu, the main season for the nut is October to January with peak availability around November; in Solomon Islands, fruiting begins in August with a peak in September and October; and in Papua New Guinea, the nuts are available in October to November with a smaller peak in May and June.

Tree flowering has been reported to commence 5-7 years after planting (Thomson and Evans, 2006). From flowering, it takes the fruit 5-8 months to reach maturity which is characterised with a colour change from green to blackish purple. The fleshy endocarp contains a nut averaging approximately 55 x 20 mm in total size. The inside of the nut is split up into a 3 celled ovary which normally contains only one fully developed kernel (Verheiji and Coronel, 1991). Estimates vary, but a mature tree can yield around 100Kg of nut in shell which converts to around 15Kg of kernel per year (Evans 1996). In the Solomon Islands, the traditional way of cracking Canarium nuts is with stone hammers and then the kernel is dried and roasted by wrapping them up in leaves with hot stones from the fireplace. Nut in shell can also be dried over the fire and stored for up to a year.

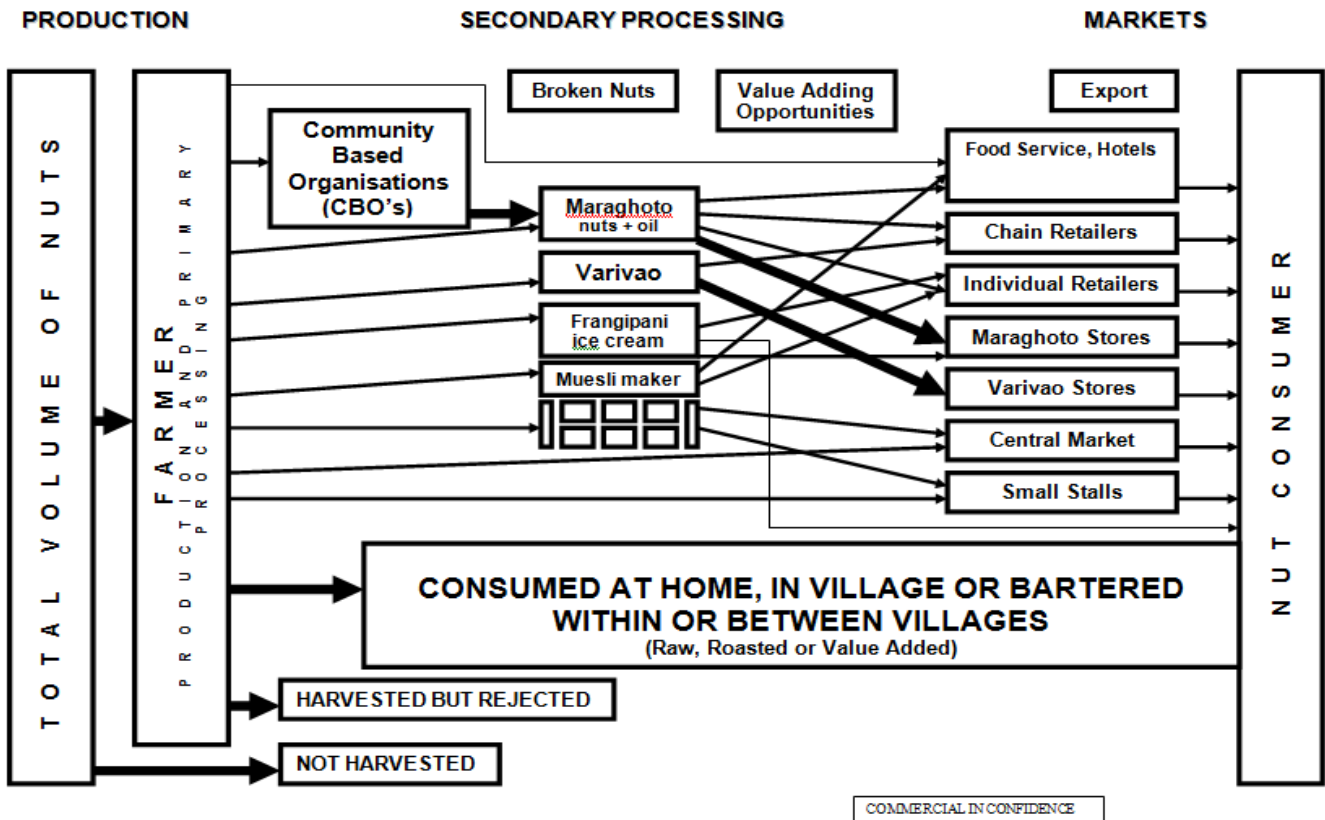
In Melanesian society, trees are selected, tended and cultivated around coastal villages and *Canarium indicum* is a very important food and ceremonial tree (Thomson and Evans, 2006), with estimates the tree and nut have been used in Papua New Guinea for over 6000 years (Matthews and Gosden, 1997). The Canarium nut industry is still in its infancy in the Pacific but the demand for processed Canarium nuts on the domestic market exceeds supply so there is the potential to use this as a platform for expanding both export and domestic markets which in turn could improve the livelihoods of smallholders and business operators across the three countries.

Process Flow & Industry Structure

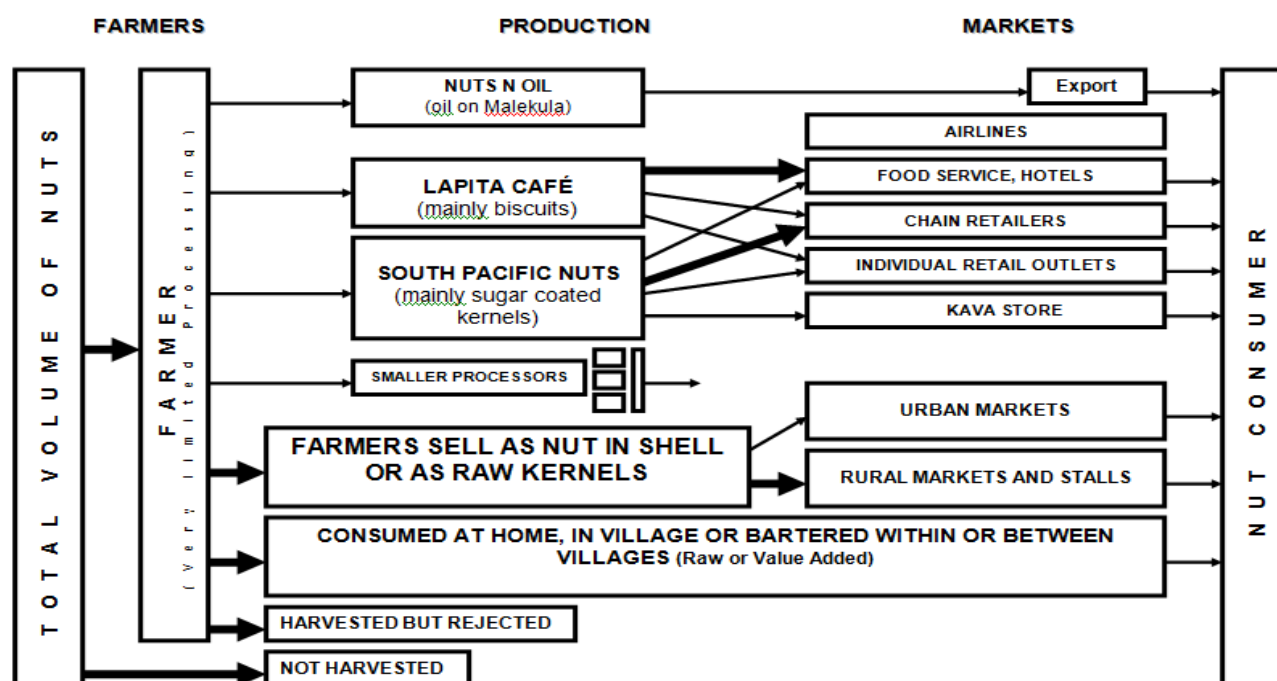
Traditional Process Flow Map



Industry Wide Chain Map for the Solomon Islands



Industry Wide Chain Map for Vanuatu



The trade in Canarium nuts is predominantly based on wild and garden tree populations amounting to around 2.4 million trees across Vanuatu (0.3m), Solomon Islands (0.9m) and Papua New Guinea (1.2m) (Evans, 1996a). In the most recent agricultural census in Vanuatu (2007) the number of planted, permanent canarium trees was 145,317. With Malampa and Penama provinces displaying the largest number of trees, 45,472 and 43,421 respectively.

Traditionally, the nuts are mostly traded fresh in roadside and village markets, either as nut-in-shell or as dried kernels but each country's industry is quite different which is highlighted by the more advanced value adding that has been occurring in Vanuatu in recent years. Processed nuts are an ideal product for Pacific island countries to trade in high value export markets as they can be transported easily, stored for long periods of time, and do not have the cold chain challenges of other produce.

Priority Consumer Markets

In Vanuatu there is evidence of unfulfilled domestic demand, particularly with the high volume of tourists that arrive by either air or ship into Port Vila. The average number of visitors for the years 2009-2011 in was 237,346 from which 140,075 are one day cruise ships visitors. Australians are the largest nationality of visitors in Vanuatu followed by New Zealand and New Caledonia. By far, holidays is the main purpose of visit for the people going to Vanuatu, followed by business and visiting friends and relatives.

Supply of nuts has been a problem in the past with stringent processing requirement to freeze all raw product within 24 hours, limiting access to market for wild harvested nuts and nuts from remote islands.

In the Solomon Islands there are market opportunities in the domestic food service and retail sectors. The primary processing of the nut through existing village systems seems to work quite well and in

addition to snack nuts, the kernels are also being incorporated into value added products like ice cream and muesli.

Export markets like Australia, New Zealand and potentially even New Caledonia need to be explored as industry capability increases and product quality improves.

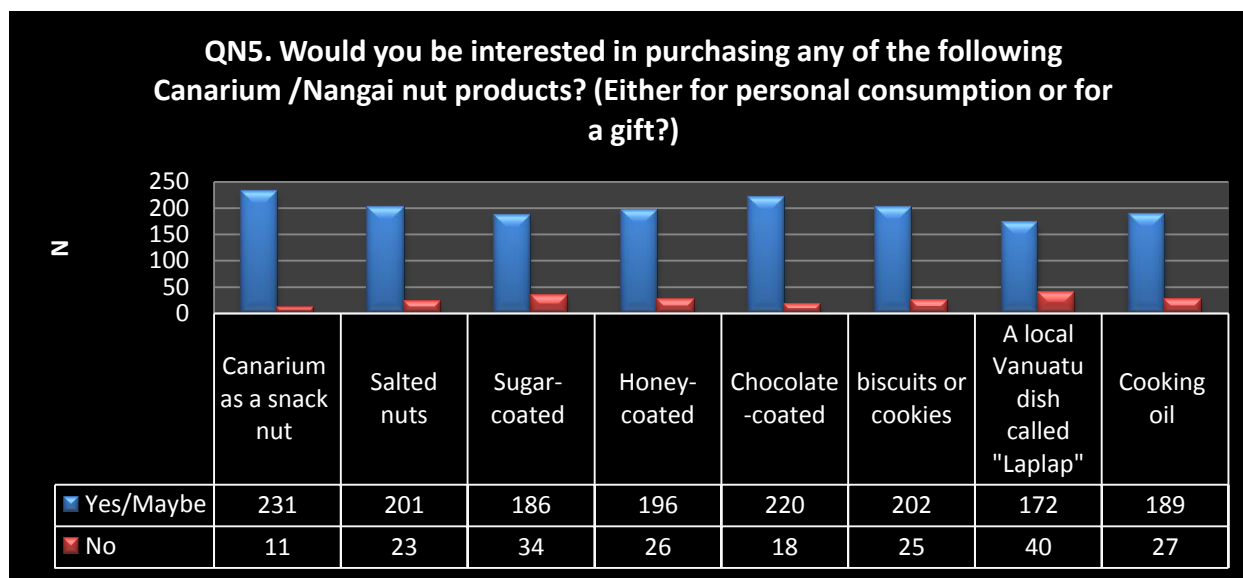
Preliminary Consumer Research

Pilot consumer research was conducted at the airport and the central market in Port Vila, Vanuatu in 2011. Questions were directed to tourists and local residents about Cocoa and Canarium products.

Summary of results:

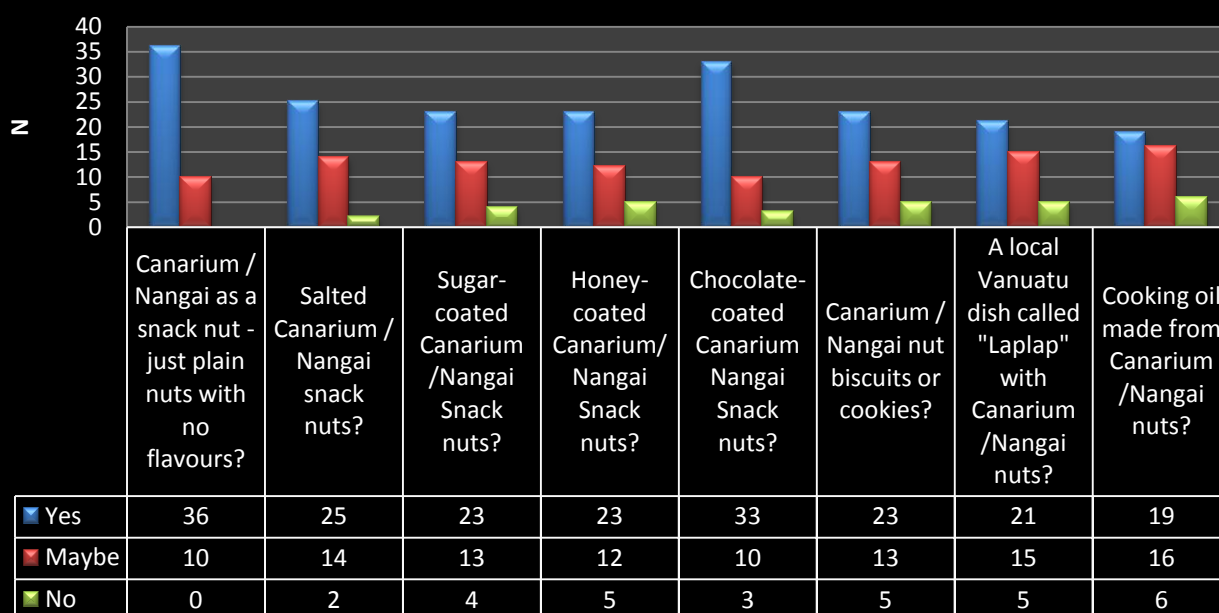
- 355 respondents, 70% local residents, 30% Tourists
- Of the Tourists;
 - 76% arrived by plane, 22% cruise ship, 2% sailed in
 - 70% were on their first trip to Vanuatu
 - 75% were from Australia or New Zealand
 - 70% plan to purchase souvenirs or gifts while in Vanuatu
 - 30% had heard of Nangai or Canarium nut before, and of these 80% had tasted it
- Of all the respondents who hadn't heard of or tasted the nut, 91% said they would be willing to try it. Of the 9% who said they wouldn't taste the nut, 70% said they do not like nuts in general

Questions about purchasing of Canarium products



QN5. Would you be interested in purchasing any of the following Canarium /Nangai nut products? (Either for personal consumption or for a gift?)

TOURIST ONLY

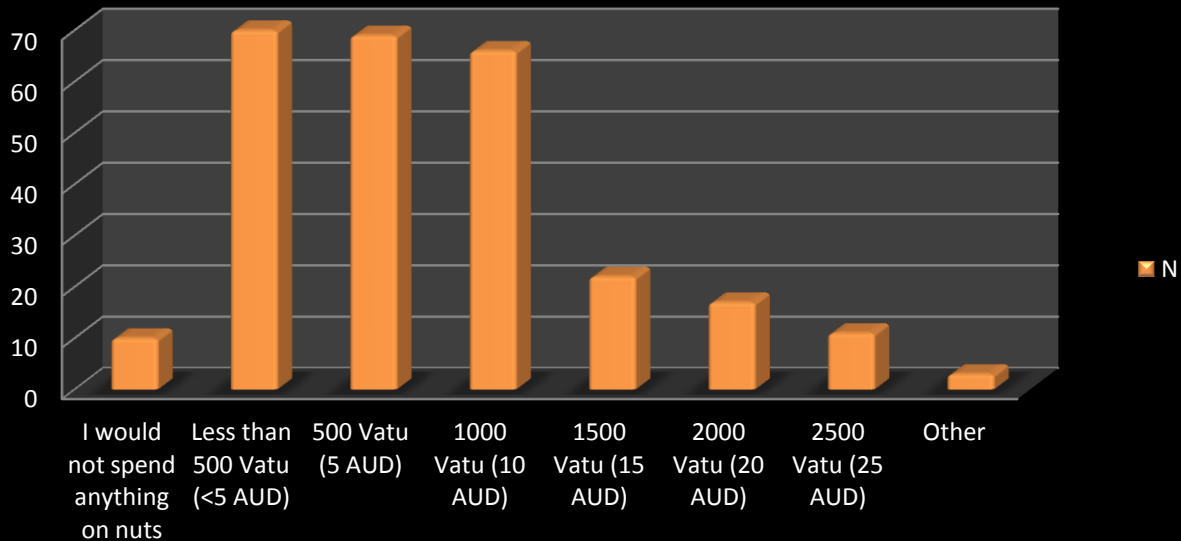


QN6. Which of the following factors would influence your decision to purchase a Canarium /Nangai nut product?

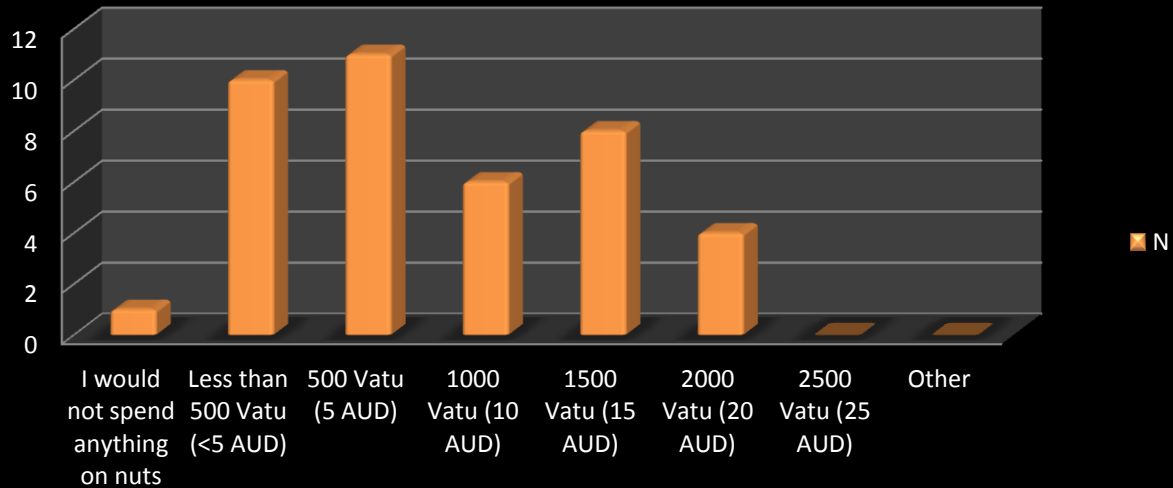
	N
Price	194
Knowing that the product was produced locally (in Vanuatu) from local ingredients	192
Knowing the product was owned locally	171
Quality certification	161
Knowing that the product contributed to the development of local communities	160
Having the ability to sample the product first	155
Knowing that the product was Certified Fair Trade	151
Knowing the product was produced using traditional methods	143
Packaging	133
Getting to meet the producers who produced the product	132
Getting to learn or see first-hand how the product was produced	131
Weight	116
Other *	37

* picture and story on the package, locally produced, manufactured without foreign investment.

QN7. What is the total amount you think you would you be willing to spend on Canarium /Nangai nuts, either for personal consumption or as a gift while in Port Vila?



QN7.1 What is the total amount you think you would you be willing to spend on Canarium /Nangai nuts, either for personal consumption or as a gift while in Port Vila? "Tourist only"



During a consumer research trial in Honiara (Solomon Islands, Oct 2011) 18 respondents and 8 restaurants were asked a series of questions regarding their perceptions about canarium nuts and if they would buy them. Most of the respondents were aware of the canarium nuts and were consuming or using them in their business. At the moment this was only occurring during the season but they were willing to buy it all year round if available.

Plain roasted with no flavours, roasted and salted, and cooking/body oil were the three most popular answers when consumers were asked about their preferences for value added canarium nuts. When they were asked to rate a list of attributes for the nuts, respondents picked: nutritional information, flavour and freshness as the three most important characteristics.

Opportunities in Research for Development

In both countries the key opportunities in research for development are:

1. Conduct consumer and customer research in priority domestic and export markets
2. Develop processing techniques tailored to each countries market requirements and whole of chain capabilities
3. Analyse the drivers and barriers to stakeholder engagement, industry developments and capacity building
4. Work with chain and industry 'champions' to identify specific market opportunities, develop new products and link these opportunities back to the smallholder farmers

Appendix

- Associated ACIAR projects:
 - FST/2002/010 'Domestication and commercialisation of galip nut: feasibility study'
 - FST/2006/048 'Processing of *Canarium indicum* nuts: adapting and refining techniques to benefit farmers in the South Pacific'
 - FST/2004/055 'Domestication and commercialisation of *Canarium indicum* in Papua new Guinea'

References

#	Title	Author	Year	Publication	Comments
1	Pili nut, <i>Canarium ovatum</i> Engl. Promoting the conservation and use of Underutilized and neglected crops.	Coronel R.E	1996	Institute of Plant Genetics and Crop Plant Research, Gatersleben/International ; Plant Genetic Resources Institute	This monograph (1) identifies constraints in and possible solutions to the use of the <i>Canarium</i> nuts, (2) identifies possible untapped genetic diversity for breeding and crop improvement programmes and (3) detects existing gaps in available conservation and use approaches.
2	Overview of resource potential for indigenous nut production in the South Pacific	Evans BR	1996	ACIAR Proceedings No.69	This paper provides background information on the status, potential and current production of indigenous nuts in the South Pacific region.
3	What we don't know about indigenous nut production in Melanesia	Evans BR	1996	ACIAR Proceedings No.69	This paper highlights the most important and fundamental gaps in the scientific knowledge of indigenous nuts in Melanesia, also showing how this lack of information is affecting their commercial development.
4	The role of Galip nut (<i>Canarium indicum</i>) in forest conservation in East New Britain,	Henderson, M	1996	ACIAR Proceedings No.69	A more detailed description of the forestry situation in PNG is explained here and the role of a foundation that protects the heritage of the forest

	Papua New Guinea,				(PHF). Also, the use of the Canarium nut as an alternative for a non destructive method of earning income.
5	Business Associations Can Help to Increase Your Profits	Kreag, J	1996	ACIAR Proceedings No.69	This review describes the benefits of associations and cooperatives and how they can gain a lot more out of these agreements; leading to a positive competitive environment where there is genuine price competition that encourages production of high quality nuts.
6	Domestication potential and marketing of <i>Canarium indicum</i> nuts in the Pacific: 1. A literature review	Leakey RRB	2006	Agroforestry Systems	This review evaluates the biophysical and socio-economic literature and suggests how the domestication and commercialization processes could be taken forwards to improve the livelihoods of rural households in Melanesia.
7	Characterization of tree-to-tree variation in morphological, nutritional and medical properties of <i>Canarium indicum</i> nuts	Leakey R	2008	Agroforest Syst	This study examined, compared and made some conclusions on the tree-to-tree variation in morphological traits (nut and kernel mass and kernel:nut ratio), as well as nutritional (carbohydrate, fat, protein, sodium, vitamin E) and medicinal traits (anti-oxidant activity, anti-inflammatory activity and phenolic content) of kernels from 18 to 72 trees in a small number of different villages of Papua New Guinea
8	Processing of Galip (<i>Canarium indicum</i>) in Papua new Guinea	Maima M.	1996	ACIAR Proceedings No.69	Detailed description of the known processing of the nut and the different paths that can be followed in order to obtain a high quality product out of the raw nut. A typical process line is described as well as a large scale one.
9	Plant remains from waterlogged sites in the Arawe Islands, West New Britain Province, Papua New Guinea: implications for the history of plant use and domestication.	Matthews, P.J	1997	Econ. Bot	This article talks about the general history of human plant use in the Western Pacific. Using archaeology and fossils analysis to determine plant domestication and agriculture.
10	Domestication potential and marketing of <i>Canarium indicum</i> nuts in the Pacific- A literature review.	Nevenimo T	2007	Agroforest Syst	This review evaluates the biophysical and socio-economic literature and suggests how the domestication and commercialization processes could be taken forward to improve the livelihoods of rural households in Melanesia.

11	Sensory analysis of galip nuts: consumer acceptance study on selected nuts including raw and roasted galip nuts.	Nottingham S	2005	James Cook University	This analysis is part of a project that sought to determine the feasibility of developing a strategy and methodology for the parallel improvement of the food/nutritional security, and income-generating opportunities of smallholder farmers through the domestication and commercialisation of indigenous fruit and nut species in PNG (East New Britain), SI and Australia.
12	Okari Ecoenterprises: A Snapshot of Participatory Rural Development	Olsson, M	1996	ACIAR Proceedings No.69	This article is about a project focusing on the commercial marketing of the valued okari nut involving community participation in both design and implementation. Challenges and background are described and some recommendations for future projects and lessons learned.
13	Canarium nut and oil marketing in Solomon Islands.	Pelomo PM	1996	ACIAR Proceedings No.69	This paper briefly highlights aspects of ngali nut as a cash crop, the current marketing structure, the role of government, non-government organisations (NGOs) and international marketers in the ngali nut project, the project's achievements and the difficulties encountered.
14	Research and development on edible nut tree crops in Solomon Islands.	Roposi N	1996	ACIAR Proceedings No.69	Some background related to the previous research in Solomon Islands is provided in this brief review. Aspects like processing for market, propagation and further work are described here.
15	Tree domestication in tropical agroforestry	Simons AJ	2004	Agroforest Syst	The authors propose that the products of domesticated trees are called Agroforestry Tree Products (AFTPs) to distinguish them from the extractive tree resources commonly referred to as non-timber forest products (NTFPs). Two case studies are presented to highlight the approaches used for medicinal and fruit-producing species.
16	<i>Canarium indicum</i> var <i>indicum</i> and <i>C. harveyi</i> (<i>Canarium</i> nut) <i>Burseraceae</i> (torchwood family), Species profiles for Pacific Island agroforestry.	Thomson L	2006	Permanent Agriculture Resources: Holualoa, Hawaii,	Comprehensive description of the <i>Canarium</i> nut, botanical description characteristics, distribution, genetics, growth and development, environment characteristics, propagation, common practices and disadvantages, among others.

17	Plant Resources of South-East Asia	Verheiji EWM	1991	PROSEA	This is a handbook which aims to summarize knowledge about useful plants for workers in education, research, extension and industry. It comprises monographs on 120 species providing information (where known) on vernacular names, origin and geographical distribution, uses, production and international trade, properties, botany (with line drawings), pests and diseases, harvesting, yield, handling after harvest, genetic resources and breeding, prospects and literature sources.
18	Marketing indigenous nuts in Vanuatu— a private enterprise perspective	Wah CL	1996	ACIAR Proceedings No.69	Short comments from one of the vendors in Port Vila, Vanuatu. Process techniques are mentioned here and the volumes sold over the past years.
19	Post harvest cracking and testa removal methods for <i>Canarium indicum</i> nuts in the Pacific	Wallace H	2010	International Society for Horticultural Science ACTA	This article investigates postharvest processing methods for <i>C. indicum</i> that are appropriate to Pacific Island countries. Also, it examines depulping, drying, cracking, testa removal, roasting and packaging methods.
20	Indigenous nut trees in Vanuatu: Ethnobotany and variability	Walter A	1996	ACIAR Proceedings No.69	This paper focuses on seven species of nut trees in Vanuatu because they are commonly cultivated around villages or gardens, or are protected and tended. They also represent potential economic resources for Vanuatu. For each one of the species, there is a taxonomy and description paragraph, intra-species variability, growth and development, propagation and planting, uses, and conclusion.
21	Galip (<i>Canarium indicum</i>) as a cash crop in West New Britain, Papua New Guinea: Experiences of the Kandrian Gloucester Integrated Development Project	Wissink D	1996	ACIAR Proceedings No.69	This paper details the experiences of the KGIDP, the Kandrian Gloucester Integrated Development Project, a five-year rural development project funded by AusAID. It examines the potential for creating a galip nut industry in West New Britain Province (WNB) PNG.
22	Melanesian arboriculture: Historical persp. with emphasis in the genus <i>Canarium</i>	Yen D	1996	ACIAR Proceedings No.69	This paper takes a historical perspective towards <i>Canarium</i> , factors such as use, species, antiquity, variability among others, are discussed.

23	Quarterly Statistical Indicators Republic of Vanuatu April-June 2012	VNSO	2012	Vanuatu National Statistics Office	General indicators related to the main exports products and visitors to Vanuatu.
24	Census of Agriculture Vanuatu	VNSO	2012	Vanuatu National Statistics Office	General information about the state of the agriculture, main crops, trees numbers and areas reserved for agriculture by province. Sources of income and different agricultural activities including livestock and commercial farms.