



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, oil products 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

Figure 1. Traditional Process Flow Map

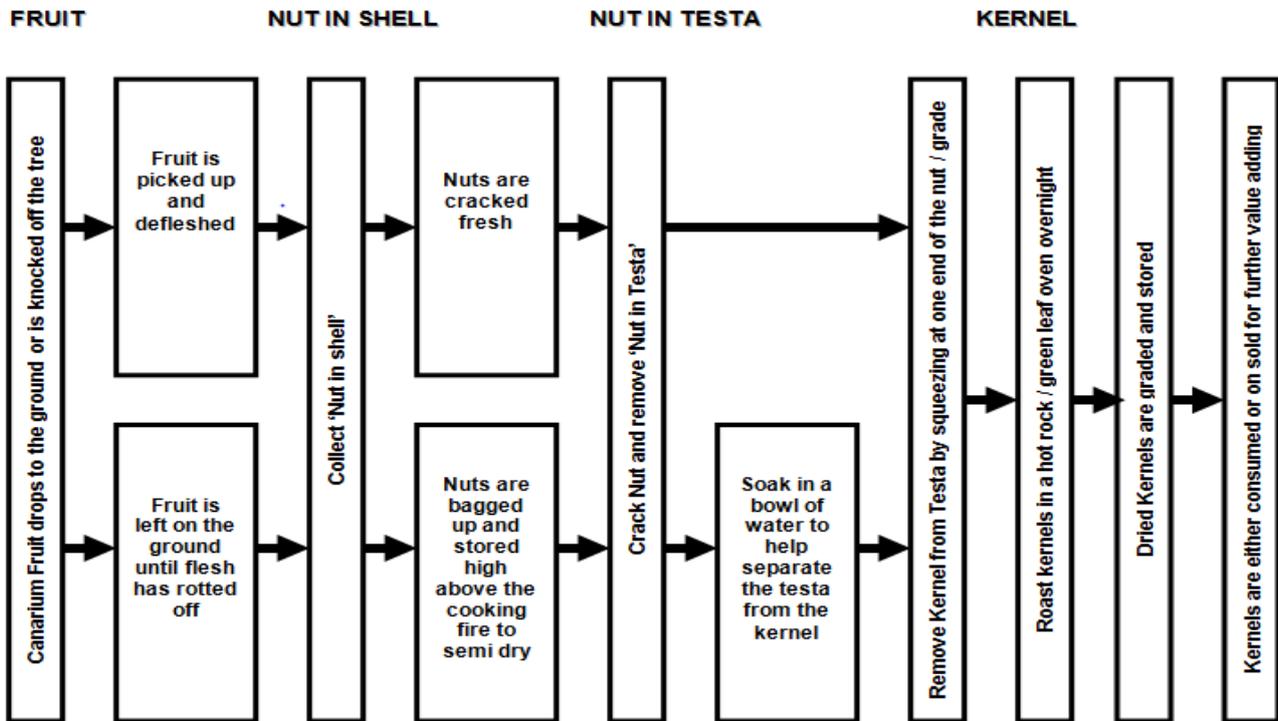
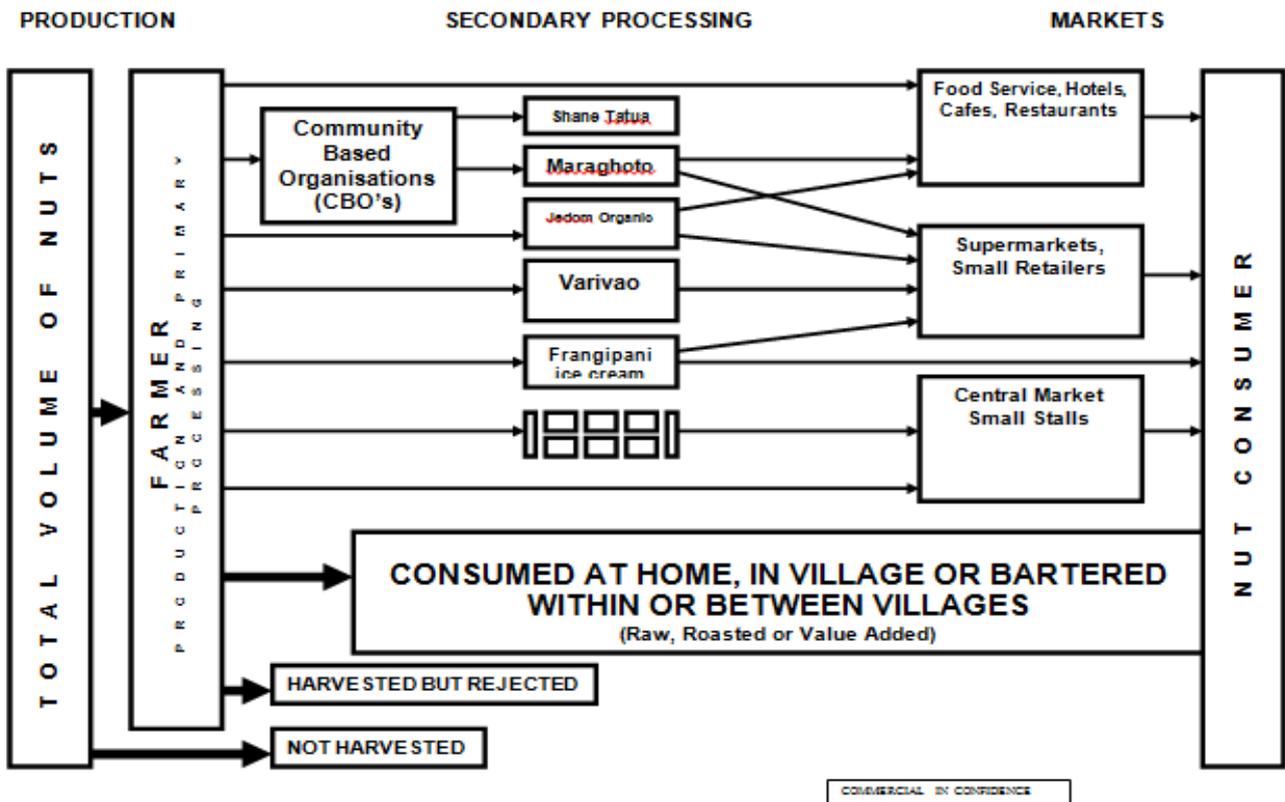
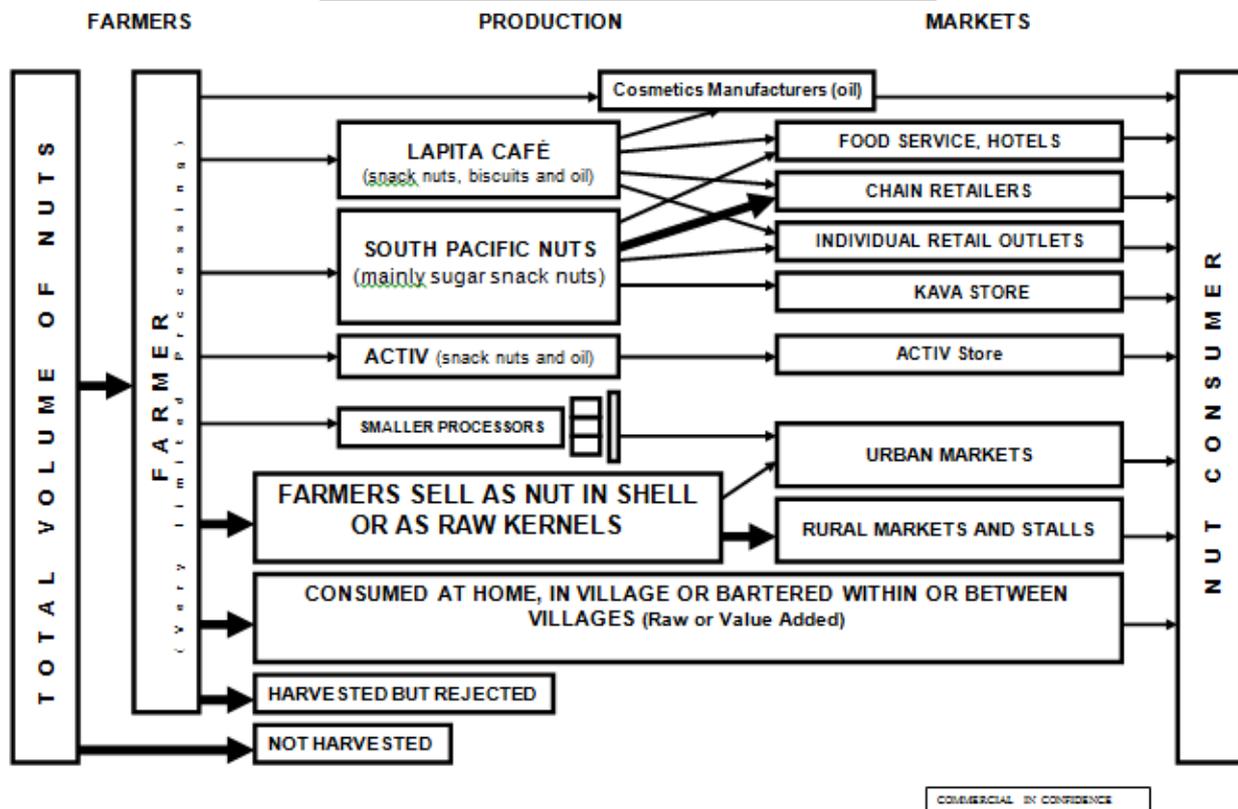


Figure 2. Industry Wide Chain Map for the Solomon Islands



COMMERCIAL IN CONFIDENCE

Figure 3. 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 was 237,346 per year from which 140,075 are one day cruise ship 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 requirements to freeze all raw product within 24 hours, limiting access to market for wild harvested nuts and nuts from remote islands. In more recent times, new raw material requirements and processing techniques have been developed and adopted which has led to an expansion in the number of processors and products, including some processing of canarium oil for the cosmetic uses.

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 muesli and oil.

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

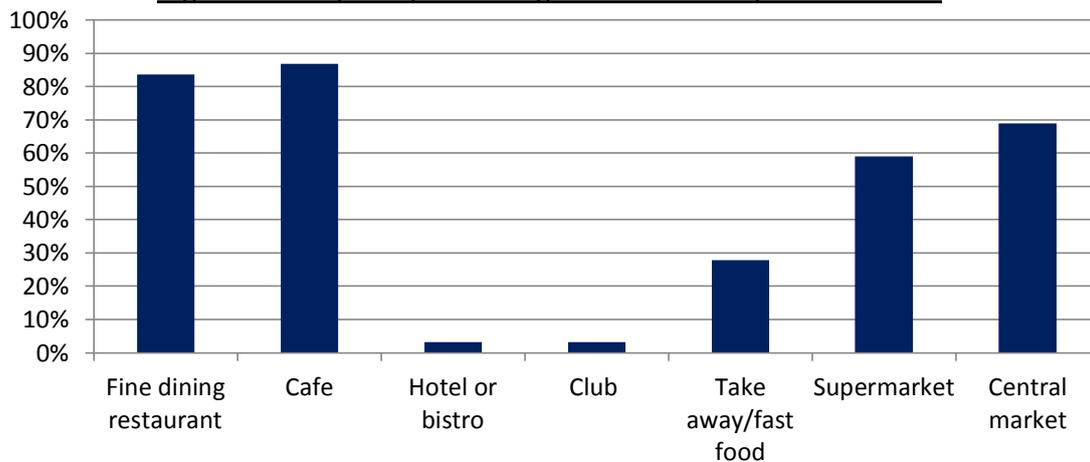
The consumer research for this project has been conducted using a continuous integrated approach where early customer and consumer research was conducted to identify broad market opportunities and help direct the whole of chain research activities. Then as the project has progressed, more targeted consumer research was undertaken to understand consumer perceptions, valued attributes and willingness to pay for a range of value added canarium products.

Detailed reports are available for each of these research activities but for the sake of this summary document we've tried to condense the key insights into note form below.

Vanuatu Consumer Research

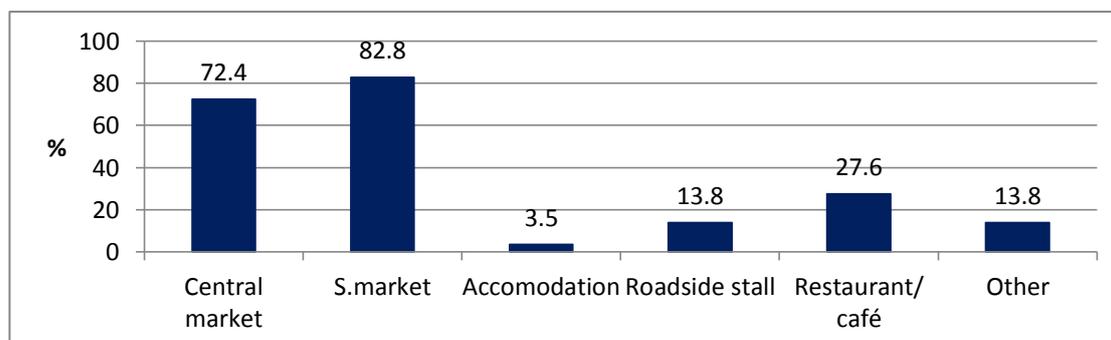
- In 2011, 355 surveys were conducted in Port Vila
 - Respondents were made up of 70% tourists and 30% locals
 - 75% of tourists were from Australia or New Zealand
 - 70% were on their first trip to Vanuatu
 - 70% planned to purchase souvenirs while in Vanuatu
 - 30% had heard of Nangai or Canadian and of these 80% had tasted it
 - Most appealing products to respondents were plain nuts, chocolate coated or salted
 - Key factors influencing purchasing were 1) price 2) Being locally produced with local ingredients 3) local ownership
 - Majority of respondents were willing to spend between 500 Vatu (~\$5AUD) and 1000Vatu (~\$10AUD) on Canarium nuts
- In 2012, 105 surveys were conducted in Port Vila
 - These were specifically targeting tourists leaving Vanuatu, over 17 years old, who consume nuts
 - A total of 61 surveys were analysed after the screening questions
 - 50% were purchasing local food at least once per day. 80% purchased local food at some time during their visit which suggests tourists are willing to engage with local food
 - Fine dining restaurants and cafés are the venues visited most by tourists but supermarkets and the central market also play a role (see Figure 4)

Figure 4. Frequency of visiting food outlets to purchase food



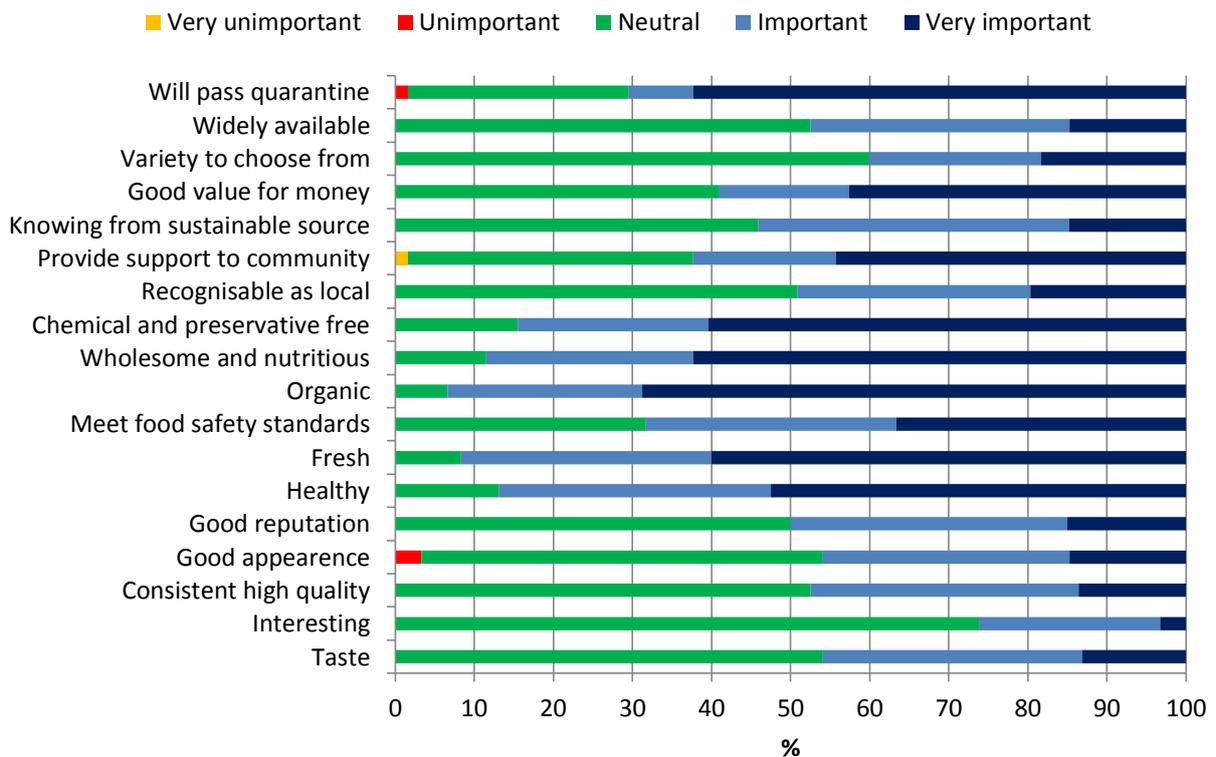
- 92% of tourist respondents purchased gifts and souvenirs while in Vanuatu and 65% of these purchases were for food products. This is encouraging because bringing these products back home would result in further product exposure with friends and family.
- For the respondents that purchased nuts during their stay, 35% of these did so daily.
- The consumption of nuts by tourists was predominantly done as a snack (79%) or as a gift to take back home (69%)
- Most nuts were purchased from the central market or supermarket which probably says more about the availability of the nuts than the preference of tourists. From a producer and processor point of view it may indicate an opportunity to develop their products across all market channels including fine dining and cafes which are frequented more often by tourists (see Figure 5.)

Figure 5. Frequency of location use by Canarium nut purchases



- The nut attributes consumers valued the most were based on being healthy, fresh, organic, nutritious, local and an ability to pass through quarantine (see Figure 6.)

Figure 6. Tourists' value of attributes



- The survey also showed that the majority of respondents would be willing to pay 10-30 % more for nuts that were clearly branded as being local to Vanuatu which is encouraging for all links of the chain including retailers, processors and farmers.
- These results demonstrate that tourists see value in canarium nuts and there is room to expand the local market. This only reinforces the existing plans to focus on the value adding, packaging and branding opportunities for the industry in different market segments.

Australian Nut Processing Companies

- In 2012, the CEO's of 50 Australian nut processing companies were approached and invited to take part in research on the potential for canarium nuts in the Australian marketplace.
- Fresh samples of new season dried canarium nuts were supplied to the companies along with background information on the nuts, nutritional analysis (see Figure 7) and four questionnaires to capture the thoughts of the key decision makers in the company
- Of the 50 companies, 16 companies returned a total of 25 surveys which were completed by the CEO's, Purchasing Managers and Research and Development Managers.

- The most significant nut attributes stated by the companies were flavour, price and freshness
- It was encouraging to note that 67% of respondents believed canarium nut would have commercial appeal in the Australian Market and 58% stated they would consider using canarium nuts as part of their product mix
- The market segments suggested as the best opportunity included health stores, gourmet food and boutique stores, bakery and confectionary products and as a cooking ingredient
- We also asked the processors how they would prefer to buy the nuts. Most respondents replied raw so they could control the value adding step themselves but other companies that specialise more in packaging and distribution were more interested in obtaining the nuts already value added which offers an interesting differentiation in the types of Australian companies that could be targeted by Pacific exporters.

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 Canarium 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, Papua New Guinea,	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 (PHF). Also, the use of the <i>Canarium</i> 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	<p><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.</p>	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 (WNBPN) 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	2007	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