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Appendix 11.1 *UoA PARDI Objective 1 Summary Report*

Australian Government
Australian Centre for International Agricultural Research

PARDI Objective 1; Develop value chain analysis as a means to prioritise R&D interventions in agribusiness development

Project

Pacific Agribusiness Research for Development Initiative (PARDI)

project number	PC/2008/044
period of report	Up until June 2012
date due	
date submitted	
prepared by	Mr Craig Johns
co-authors/ contributors/ collaborators	Prof Randy Stringer Assoc/Prof Wendy Umberger Mr Camilo Esparza Mr Theo Simos
approved by	

1 Introduction

The 2009 PARDI proposal stated; Pacific island countries (PICs) face significant challenges in the food and agriculture sector including, distance from markets, small and inconsistent scale of production, high transport costs, eroding tariff preferences, migration of skilled labour, resource depletion and degradation and risks from climate change. As a result of some of these challenges, coordination along PIC value chains has not kept up with the modernisation of the food retail and food service sectors.

PARDI project activities aim to foster the development of these value chains to improve competitiveness and profits of products in both domestic and export markets.

Existing ACIAR activities (e.g. Pearls and canarium) and previous studies have helped direct market orientated analysis in 3 broad sectors (fisheries, forestry and crops) across 6 PIC's: Fiji, Kiribati, Samoa, Solomon Islands, Tonga, and Vanuatu. The project has 5 specific objectives;

1. Develop value chain analysis as a means to prioritise R&D interventions in agribusiness development (led by University of Adelaide (UA)).
2. Strengthen value chains for selected high value fisheries products (led by James Cook University (JCU)).
3. Strengthen value chains for selected high value forestry products (led by Sunshine Coast University (USC)).
4. Strengthen value chains for selected high value horticulture and agriculture products (led by Queensland Department of Employment, Economic Development and Innovation (DEEDI)).
5. Develop and apply appropriate methodologies to evaluate how PARDI activities and interventions have performed (led by UQ-QAAFI).

The work undertaken by the UA team involves collaboration with all PARDI partners and stakeholders to gain a greater understanding of targeted industries in the Pacific.

Research includes assessing how products flow from production to consumption, the key roles and motivations of private and public sector partners and market opportunities and consumer behaviour. The overall aim is to identify the researchable constraints that form the basis of future interventions to increase competitiveness and improve livelihood benefits.

2 Strategic Framework

Figure 1 illustrates how Adelaide University's objective 1 is used to drive sector based and cross sector projects to achieve the livelihood benefits within PARDI. PRA's and the smaller SRA proposal documents are used to document the research based activities and interventions across different sectors. The role the University of Adelaide has played is to not only help direct and develop those projects but to also play an active role within them to ensure value chain and market insights can benefit the interventions throughout the project cycle.

In a similar way to the sector based projects, UA was encouraged by our Pacific partners to investigate cross sector research. An important example is the food retail

transformation project in Fiji which aims to identify research based interventions as well as gain a broader understanding of the wider market for agricultural processing and exporting to better direct future ACIAR involvement in the Pacific.

As a result of the midterm review, UA was also given the responsibility of capacity building so we have ensured capacity building activities have been built into our project activities. These capacity building activities have a strategic focus on enhancing value chain management expertise and occur during project development as well as project delivery. Some smaller projects, like the one in Vanuatu specifically target capacity building, while other larger projects have capacity building activities occurring alongside the main project objectives. In both scenarios, students, academics, government and/or private sector stakeholders are given the opportunity to learn more about value chain techniques that they can then use in their own future projects.

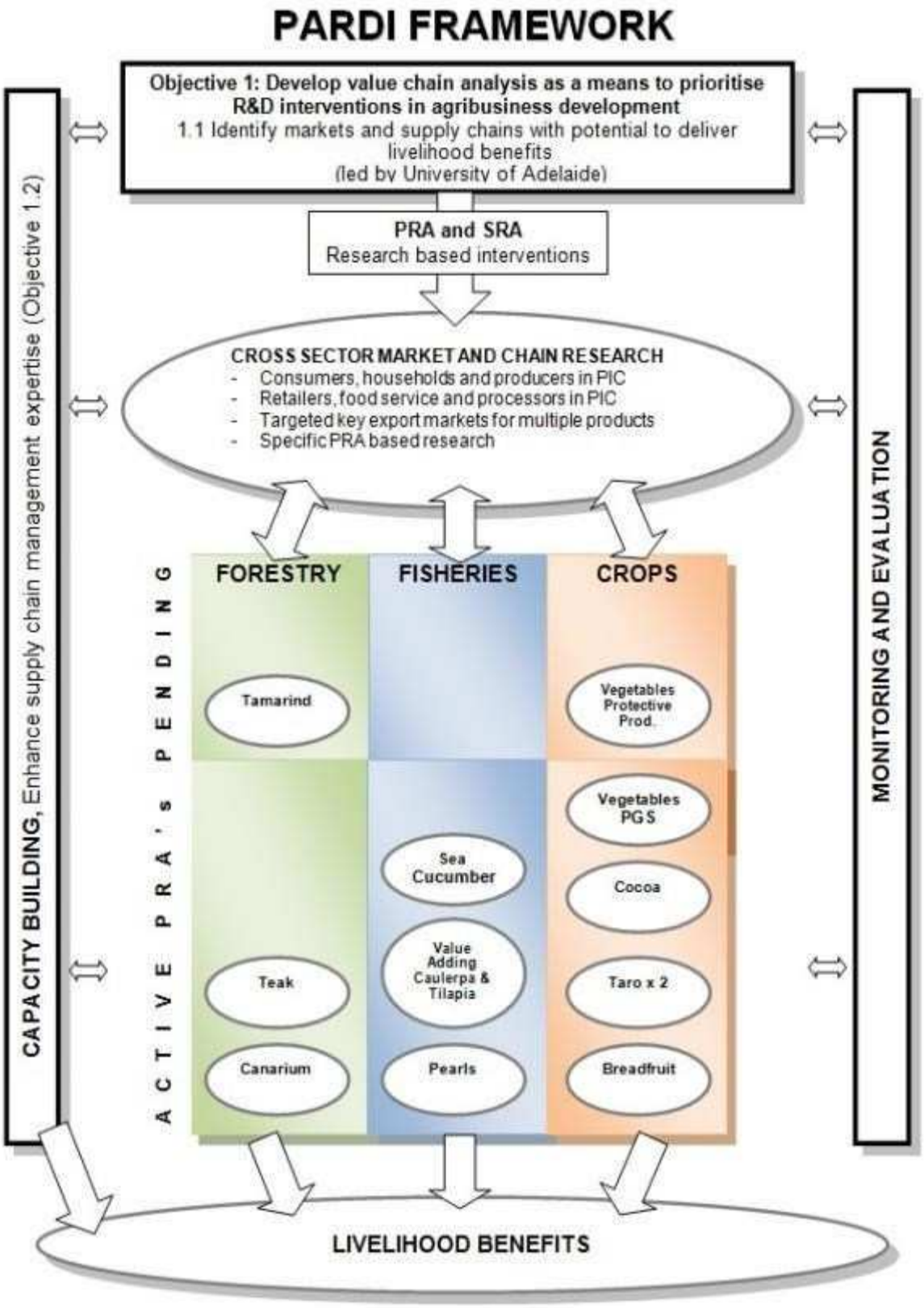

Figure 1. PARDI Framework

Project Stages

Adelaide University is responsible for bringing together our project partners and relevant private sector 'industry champions' to ensure a collaborative market orientated approach is used to deliver practical benefits to local industries. The broad project stages that were used to try and achieve this goal are outlined below;

- Stage 1; Stakeholder engagement / Scoping of current situation / Workshop on where to start
- Stage 2; Rapid Analysis of selected 'Best Bets' / Project development
- Stage 3; Ongoing market and value chain activities within approved projects

Stage 1; Stakeholder engagement / Scoping of current situation / Workshop on where to start

Early activities included;

- Review of relevant project documents including existing body of knowledge at ACIAR
- Interviewed experts and leaders in the Pacific (public and private sectors)
- Collaborated with PARDI project partners (In practice, we actually split our UA team up and did this in the Pacific while we were interviewing key Pacific contacts)

A major workshop was also facilitated by the University of Adelaide in mid June 2010 where all PARDI stakeholders were encouraged to share their Pacific experiences, lessons learnt and priority opportunities going forward (see a list of the key presentations in the appendix).

In addition to providing an opportunity to share information and build connections within the PARDI team, the workshop was also used to discuss and agree on the selection criteria used for picking sectors and the internal PARDI process for project development and approval.

PARDI Industry and Chain Selection Criteria Used:

Generic Criteria

- Potential for commercial success
- Include all the PARDI Islands
- Sector coverage (Crops, Forestry and Marine)
- Within framework of regional and national priorities
- Timeframe for changes and impacts
- Replication mechanisms and scaling up potential
- Previous research and project attention

Livelihood Criteria

- Potential to enhance farm incomes
- Potential to improve food security
- Potential to create jobs and impact real wages (pathways)
- Potential to reduce income risk and vulnerability
- Number of households and small enterprises effected
- Community and distribution impacts
- Opportunities for learning and capacity building
- Environmental and resource management impacts
- Potential to create lasting contacts

The Chain Structure Criteria

- Value for money—expected returns
- Chain Leader and experience
- Extent of value adding potential
- Barriers to entry (knowledge, capital, information, relationships)
- Number of different products produced
- Maturity of industry in the region
- Marketing potential- local and export
- Potential to attract finance

A pivotal activity during the workshop was separating attendees into breakout groups for fisheries, forestry and crops, where ‘best bet’ sectors were discussed, compared and ultimately prioritised for further analysis.

During the small group sessions of the workshop, the criteria were rephrased into questions e.g.

First Tier

- Is there a sustainable/growing market for this supply chain?
- Will the supply chain be able to sustainably supply the market?
- Is this a supply chain that involves both small-holders and larger commercial farmers?
- Will the intervention lead to increased volume of product sales/exports?
- Will the proposed intervention have a positive income effect for small-holders and rural communities?
- Is the private sector involved?
- Is this intervention replicable/potential to be scaled-up? **Second Tier**
- Have there been previous projects/interventions in this area that we can learn from?
- Will the chain impact positively on environmental outcomes?
- Does the chain provide opportunities to address equity and distributional issues?
- Will the chain make a positive contribution to rural livelihoods?

Third Tier

- Does the chain have opportunities for value-adding?
- Will the chain be able to attract independent finance?
- Are there any other partners involved in the proposed chain?

In addition to the ‘sector based’ type projects there were also presentations and agreement on the need for ‘cross sector’ type projects which is what led to the development of the Fiji retail transformation study and the various research activities within the municipal markets.

Stage 2; Rapid Analysis of selected ‘Best Bets’ / Project development

The ‘best bets’ were selected during the six month period of project development. A group of ACIAR RPM and key informants selected the best bets to speed project outcomes. It was important for PARDI to form a quick understanding of who the existing best bet chain members were, which markets are being supplied, the environment they

are operating in (political, environmental, social, economic etc) and some of the broad issues and opportunities facing the sector.

The snapshot provided by the rapid analysis was not only looking at the current situation but also any relevant history of the sector as a way to try and predict future developments and avoid repeating past issues or failures. Various value chain analysis techniques were used including;

- Review of existing data
- Rapid market appraisal and assessment
- Structured and Semi-structured key informant interviews
- Consumer and market research and analysis
- Workshops with chain members and other stakeholders

This work was done in collaboration with the relevant PARDI component leaders and led to the development of project proposal documents (PRA's or SRA's). A separate PARDI Advisory Group (PAG) was formed to independently assess, provide feedback and ultimately decide on whether a submitted project should be approved or not.

Stage 3; Ongoing market and value chain activities within approved projects

During Stage 1 and 2 it was recognised by all of the PARDI partners that there was a need for the University of Adelaide (UA) to play an ongoing role within the PRA projects being developed. Instead of UA's activities and budget being outside of the PRA's an attempt was made to incorporate market and value chain activities into the various projects to ensure those insights were maximised throughout the life of the project.

Some of the activities within these projects have involved;

- Identifying specific chains and stakeholders;
- Identifying target markets;
- Analysing the selected chains, markets and consumers in detail; and
- Identifying priority research activity based interventions in consultation with the wider project team.

The 'cross sector' projects like the Fiji food retail transformation project have used similar techniques to conduct consumer, market, retailer, processor, trader and producer research across various sectors in order to understand interventions across a broader framework and potentially direct new best bet sectors suitable for future analysis.

Further details about individual projects and available reports can be found in the appendix section.

Appendix 11.2 *Case study 1: Macadamia*

Many new industries fail to live up to expectations or deliver their full potential. Only a few new industries survive and go on to developing into major export industries. We can learn from these successful industries and hopefully avoid falling into the same mistakes that the unsuccessful industries made.

Canarium is not a new industry to Melanesia; it has been cultivated and used for food for thousands of years. Taking the step from a subsistence industry to a fully commercialised domestic and export industry is similar to developing any new industry, and as such we can learn from crops that in recent years have grown into successful industries.

Macadamia is one such industry that has grown from a cottage industry in the 1950's and 60's to a multi-million dollar world industry, with production and markets in many countries. The macadamia industry has much in common with canarium nuts and therefore is an ideal case study to help guide the development of the canarium industry.

Macadamias and canarium are both nut crops that grow on evergreen trees grow in the rainforests of the tropics and sub tropics. Both crops have been used by indigenous people for many thousands of years. Australian aborigines used macadamias for feasts and also for trade (McConachie, 2006, Barnidge-McIntyre, 2009) while canarium is consumed as a staple food by islanders in the Solomon's and PNG and is also used in ceremonies in Vanuatu (Esparza, 2011).

Nuts have become more popular with consumers in recent years. They are seen as a healthy snack as well as a versatile ingredient for cooking and bakery products.

The challenge for canarium is to follow the macadamia success, to generate enough processed product to establish international markets that will consume large volumes of Canarium at a price that all in the value chain will benefit.

How did Macadamias become a multi-million dollar industry?

Although macadamias are native to Australia the modern macadamia industry actually began in Hawaii. Macadamias were first introduced to Hawaii in the late 1800's and initially used as a wind break tree for sugar cane (Shigeura and Ooka 1984). In the early 1900's the Hawaiian Department of Agriculture encouraged coffee farmers to plant macadamias as an alternative crop to supplement their farm income. At the same time the Hawaiian Department of Agriculture, supported the new industry through research and development. The earliest research in the 1920's amassed the basic cultural knowledge to grow macadamias. In the 1930's and 40's research focused on cultivar improvement; selecting better varieties, grafting and clonal propagation. In the 1950's and 60's research also included tree nutrition and pest and disease control, and during the 1960's research into processing and quality control became more important (Shigeura and Ooka 1984). Marketing and product development was largely left up to the individual commercial enterprises.

In 1926 the Hawaiian government passed legislation making all lands used solely for macadamia culture free from taxation for five years as an incentive to increase the industry (Pope, 1929). This encouraged a few entrepreneurs to plant larger scale monoculture plantations of several thousands of trees. These early plantations were planted with seedling trees and as a result suffered from variable production and variable quality.

A major breakthrough in the industry occurred in the 1930's when a grafting method was discovered that allowed large numbers of clones to be produced. This opened the way for a

cultivar improvement program and the ability to produce grafted trees of improved varieties for commercial planting.

The Hawaiian Experimental Station began a selection program in 1936 and the first commercial varieties were released in 1948 (Stephenson, 2005). The release of improved grafted cultivars led to many of the seedling orchards being cut down and replaced with grafted varieties. Grafted trees of many preliminary selections were planted throughout the islands in the late 1930's. These plants were given away free to farmers and sugar companies willing to test them under field conditions (Ito 1983).

The Macadamia industry existed as a small scale cottage industry focused on the Hawaiian domestic market until the 1940s, when World War II saw hundreds of thousands of service men and women stationed or stopping in Hawaii. Once they returned to their homes they took with them a love of macadamia nuts that helped launch the modern industry. However it wasn't until 1953 when Castle and Cooke began exporting from Hawaii that macadamia nuts began to be available in mainland USA (Shigeura and Ooka 1984). Until this time they were largely only available in Hawaii and to a lesser extent in local markets in Australia.

The Hawaiian government continued to support the fledgling industry through research and extension activities. Both the Government Board of Agriculture and Forestry and the Hawaii Agricultural Growing Station were involved in basic research on pests, nutrition, breeding and economics.

The first major attempt at true commercialization of macadamia nuts in Hawaii was made in 1948 by Castle & Cooke, Ltd., with a serious capital investment of 1,000 acres of macadamias (Shigeura and Ooka 1984). With increasing production the market gradually developed. The marketing arm of Castle and Cooke promoted macadamias on the mainland USA. It was their branded product "Royal Hawaiian", released in 1955, which is largely credited with popularizing macadamias in the U.S.

The importance of maintaining high quality standards in the developing Hawaiian industry was realised by the Hawaiian Macadamia Nut Company who developed effective quality assessment procedures for factories. Their simple and convenient flotation test for maturity was widely adopted. Kernels that float on tap water have at least 72% oil and are considered mature. They also developed the concept of kernel recovery (the percentage of kernel within the nut), an important quality feature, particularly in those early days when many orchards were based on variable seedling trees that produced nuts with thick shells.

In the 1960's macadamias were promoted in 3oz packs on the new airline schedule to Hawaii. Through this marketing program macadamias achieved the image of the exotic nut that was part of the Hawaiian experience.

Meanwhile in Australia only small scale plantings were being undertaken. It was not until the early 1960s, after the Hawaiian macadamia industry was already well established, that macadamias began to gain a stronger footing in Australia. The Colonial Sugar Refining Company Ltd decided to invest in the industry in 1963. They established a 220Ha pilot project. With income tax incentives from the federal Government for investment in the industry other large commercial operations were soon established.

Mechanical cracking was the final ingredient that saw macadamias take the leap from cottage industry to a sustainable export industry. It wasn't until the need to dry the nut was understood that a successful cracker was developed.

In 1974 the Australian Macadamia Society Limited (AMS) was established by a small group of enthusiasts eager to share the benefits of their experience and their innovative ideas. This was a major benefit for the development of the Australian industry. The AMS was established to facilitate communication and to act as a representative body for the whole industry, not just the growing sector. It developed very effective and powerful extension

functions that complemented the services provided by State Departments of Agriculture. Perhaps the most significant initiative of AMS was the active encouragement of research into production, processing and promotion of the crop. Initially, research was funded from a voluntary levy paid by growers.

Production in Australia increased rapidly during the 1980's. The US became Australia's largest export market; in fact it was virtually Australia's only export market. The demand from the US was so strong that no other market development was undertaken by the Australian industry.

In 1989/90 an unexpected surge in production in both Australia and Hawaii, coupled with a world financial downturn saw a massive over supply of macadamias on the market. The Gulf war coupled with the world recession further impacted the Hawaiian market. The result was a price crash that left growers and processors struggling. An important lesson that was learnt from this crash is that it is critical to have a strong domestic market. At the time most of the Australian production was committed to one single market, the US bulk kernel export market. Following the crash substantial effort was devoted to strengthening the domestic market and diversifying into value added products. The domestic market is now Australia's largest market, consuming about 30% of the total Australian production.

Following the price crash a marketing levy was introduced to enable generic marketing. Through the AMS the Australian industry took more control over its destiny. They were actively involved in identifying and funding the research program, they were actively involved in developing new markets through the marketing levy and they were lobbying government for greater support through R&D.

There is no doubt that the macadamia industry has been a great success story. In about 60 years it has grown from a cottage industry being grown in only two countries to a world industry being grown in over 15 countries with world production exceeding 120,000mt and with a world value over $360,000million. How it got there can be attributed to just a few important steps that were taken by various industry players at critical times.

In summary the success of the macadamia industry is a result of:

- **Consumer Appeal.** Having a product that had high appeal to consumers
- **Government support.** In the early stages there was strong government support,
- In Hawaii with research and extension from government agencies as well as tax benefits to encourage investment.
- In Australia with tax benefits encouraging investment as well as research and extension from the State departments of Agriculture, and later with matching subsidies for research and development levies that were contributed by growers.
- **Research and Development** (Grafting). A break through with learning how to graft enabled better cultivar improvement and nurseries to produce cultivar clones in a cost efficient manner.
- **Capital investment.** Both the industry in Hawaii and in Australia were operating only on a cottage industry level until a large company (Castle and Cooke in Hawaii 1948) and CSR in Australia (1963) invested extensive capital that took both industries to that threshold level where exports and professional marketing programs could be developed and sustained.
- **Mechanical cracking.** The first mechanical cracker was developed in 1954 which opened the way for industrial sized operations that could process large volumes of nuts.
- **Industry Association**. Both Hawaii and Australia had strong industry associations that conducted strategic planning for the industry, lobbied governments and also acted as a communication point for growers and prospective investors. The Australian Macadamia

Society was also very proactive in defining the industry's research needs and took a "hands on" approach to market development. The introduction of levies for both R&D and marketing were defining moments for the development of the Australian macadamia industry. Without these we would have no Promotions Program and no R&D Program, both of which have been instrumental in the success of our industry.

- **Quality standards.** The development and adoption of quality standards was a key factor in providing a consistent product to consumers. It also allowed farmers to be paid for producing quality at an acceptable standard.
- **Diverse markets**. Do not rely too heavily on one market. Markets can be diversified between different destinations (countries) or different products. A down turn in one market can be supported to some extent by the other markets.

What can the canarium Industry learn from macadamias?

In general the canarium industry is more advanced than the macadamia industry was when it started in 1950. The macadamia industry had a wild undomesticated tree that had no varietal improvement before the Hawaiian research program began in 1936. The canarium nut has been farmed at a subsistence level for thousands of years. There is currently a production base that could support and export industry if efficient supply chains and processing technology existed. The macadamia industry had no production base and only a few thousand trees had been planted and were producing nuts.

- Cultivar improvement has been carried out in remote islands so elite improved cultivars are already in existence.
- Domestic markets already exist in all three countries, with some diversification of product, however this can be improved.
- There is no universal quality standard that can be applied across the whole industry. Some individual processors/marketers have developed a set of standards for buying nuts or kernel from farmers and collectors, but these have no relationship to the retail products. The Canarium industry will require a set of quality standards and product descriptions to ensure that a consistent product reaches the consumers.
- Mechanising the cracking process will reduce the cost of production and make it easier for villagers to harvest and collect larger volumes.
- Supply chains will need to be established that can move larger volumes of nuts in shell and or kernel.
- Industry organisations need to be established in each country to lobby government and to act an information distribution centre. Ideally this could be one international Canarium industry body with branches in each country. A single international organisation will ensure a consistent message, particularly with regard to quality and food safety standards.

The Canarium industry in each of the three countries involved in this project have different characteristics and are at different stages of development. Each country can gain from the experiences of the macadamia industry.

Vanuatu:

Vanuatu probably has the most developed industry, albeit a very small industry. Vanuatu is also in the box seat to capitalise on tourism as did Hawaii in the early days of the macadamia industry.

Vanuatu has a diversified industry with snack products, oil and value added products being produced. In fact the Vanuatu industry is where Hawaiian macadamia industry was in the 1940's. There are two vital ingredients lacking in Vanuatu. The number one missing ingredient is capital investment. This is what is holding the Canarium industry in Vanuatu back and until a substantial commitment is made by a single company the industry is likely to continue at a cottage industry level for many years. There is excess production that is currently not being harvested, and the main reason is a lack of capital from the existing players to buy more product from the farmers, and also a lack of facilities to process and store larger volumes.

There is little doubt that a suitcase export industry can be developed similar to the way the Hawaiian macadamia industry began. Canarium could become "the exotic nut that is part of the Vanuatu experience". To achieve this it needs a high quality flagship product like the "royal Hawaiian" that will appeal to tourists as a souvenir or gift to take home.

An industry association is also required to lobby government for stronger support and more research and development. An industry association could take a lead role in communicating with government as well as growers and prospective investors. The Vanuatu industry also lacks industry wide quality standards.

Solomon Islands:

The Canarium industry in the Solomon Islands is facing the toughest road to becoming a commercial industry. The domestic market in the Solomon's has actually declined since the withdrawal of RAMSI. The supply chains are more difficult, and the market is currently very small and is basically still at the subsistence level. The market in Solomon's is much less developed than Vanuatu, and there is not the opportunity with large numbers of tourists to develop a suitcase export industry.

There is an industry association that would appear to be less active than is needed to advance the industry to any great extent. The industry in Solomon's will need government initiatives in research and extension and other incentives (subsidies) to help drive the planting of commercial orchards as well as investment in processing and marketing.

It was reported at a workshop that in the 1990's there was a forestry worker who could graft canarium trees. Grafting is a critical step for cultivar improvement and to produce large numbers of clones for planting commercial orchards. It is important that this report of a worker who could successfully graft tees be followed up.

The lack of capital is a key missing ingredient in Solomon's, however at this stage it is unlikely that a company would invest heavily. The supply chain is too underdeveloped, too unreliable and too costly to bring product from the outer islands.

Quality standards and food safety issues also need addressing. The traditional processing methods used in the Solomon's leave the product at high risk of contamination.

PNG:

Of the three countries PNG is potentially closest to developing a large commercial canarium industry. While the domestic market is probably less sophisticated than Vanuatu PNG has access to the one key ingredient that is missing in both Vanuatu and Solomon's, and that is capital investment. A number of larger cocoa processing companies have already made substantial investment in planting trees. They are yet to invest in the supply chains,

processing and marketing, but with greater volumes of product coming on line this is probably only a matter of time.

PNG also has strong government support with NARI conducting research and running a commercial nursery for distribution of elite cultivars.

The missing ingredient in PNG is an industry association to facilitate communication, for industry strategic planning and to set quality standards. Market and product development will require further R&D and whether this is done on an industry basis through NARI or done by individual commercial companies will depend on how quickly the commercial companies move. There is an opportunity here for the most aggressive company to steal a march on their competitors.

Supply chains exist in the cocoa industry that could be adapted for Canarium, however handling and quality management systems will need to be defined in order to transport the large volumes that are anticipated.

Conclusion

The big difference between macadamias and Canarium is that, the Melanesians have been farming and actively managing Canarium for thousands of years. This means that there is already a large supply of relatively accessible nuts that can be harvested to fill markets as they become established.

Local people have selected trees for desirable characteristics over the many years of subsistence cultivation, resulting in improved cultivars on some islands. This gives the Canarium industry a huge advantage in that elite varieties already exist in cultivation, and we are not starting from scratch as the macadamia industry did with a totally wild and undomesticated species.

The inability to graft trees will hinder the productivity of commercial orchards and slow cultivar improvement. Further effort should be made to achieve a cost effective method of producing large numbers of clones. This is important to remove the natural variability of seedlings for large scale commercial orchards.

Quality standards need to be developed for buying nut in shell and kernel from growers and product descriptions need to be developed for selling raw and processed kernel to value adders.

Mechanical cracking needs further investigation. The labour intensive nature of hand cracking is a major barrier to making the transition from a cottage industry. Hand cracking may have a place in high end niche markets, but the larger commodity market will require more kernel than can be supplied by existing technology.

There is little doubt that there is a future for the Canarium industry. It does have consumer appeal, at least in the domestic markets where consumers are familiar with the product, it already has a large and growing supply base and tree nuts in general are an expanding market segment around the world.

The single most important ingredient currently missing is capital investment by a company who is serious in taking the industry forward.

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Appendix 11.3 *Case study 2: Nutmeg*

Introduction

The Indonesian Nutmeg has been chosen as a case study, not because it is a 'new industry" like canarium nuts, in fact the nutmeg industry in Indonesia dates back to the middle ages. While nutmeg is a very old industry it still has many similarities and continues to face some of the same challenges as the fledgling Canarium industry.

Similarly to canarium, nutmeg grows on an evergreen tropical rainforest tree, and as with canarium, nutmeg is harvested either from the tree or off the ground. Nutmeg has a fleshy fruit, and a red aril (mace) that surrounds the shell. Both the flesh (pulp) and aril are removed at harvest and in most cases the nut is spread in the sun to dry (EU-Indonesian Trade Support Program II 2012).

Figure 1 Nutmeg has a fleshy fruit and aril (mace) surrounding the NIS. A knife is used to remove the pulp in the field.

Nutmeg production has been a tradition in three island provinces of Indonesia, North Maluku, North Sulawesi and Maluku since the middle ages (wikipedia). The remoteness of many of the production islands in Indonesia leads to similar issues as faced by the Canarium industry in the Solomon Islands and Vanuatu.

Nutmeg farmers are generally small holders with the trees being handed down through the generations from father to son. A typical farmer will have from 20 to 40 trees which yield about 15 to 20 kg nutmeg per tree per year.

Farmers sell their nutmeg to a village trader and the village trader will sell either to a larger provincial trader or to a nutmeg processor.

Traditional farming, harvesting and processing methods have changed very little since the 1800's, which has led to problems regarding food safety and quality. Many of these issues are only now being addressed as import restrictions into the EU become more stringent and routine testing has resulted in consignments of nutmeg being rejected due to food safety concerns (RASFF 2013).

The common practices through the nutmeg value chain are described below and discussed in relation to the Canarium industry. Much of the following information is from personal observations of Mr K Jones gleaned during an EU funded aid project, EU-Indonesian Trade Support program II 2011-22014.

Practices in the Nutmeg Value Chain

Farmers

In many villages and regions farmers are organised into small farmer groups of between 10 and 20 farmers. In some regions they have formalised these groups into cooperatives. However there are still many farmers who operate independently.

Tree management is minimal. Farmers rarely apply fertiliser believing the rich volcanic soil doesn't need additional nutrients. Management mainly consists of clearing around the trees in preparation for harvest.

Harvesting takes place three times per year. The mature fruits are either picked from the tree using long rods or are collected from the ground. Timely harvesting is vital to avoid mould and insect infection. The fleshy pulp is removed in the field and discarded. The aril (mace) is removed and sun dried separately to the NIS.

After harvest and de-pulping the nutmeg is sun dried at the farm on plastic sheets or on simple drying racks that help improve the rate of drying and food safety. In some cases during extended wet periods traditional wood fired driers may be used. These driers have the disadvantage that the kernel may become tainted by the smoke and they lack any form of temperature control. The quality of nutmeg dried at too high temperature will be adversely affected.

Figure 2 Sun drying mace and NIS on plastic sheets/bags

Figure 3 A simple Drying rack to aid the rate of drying and improve food safety.

Figure 4 Traditional nutmeg wood fired drier in Indonesia

The dry or semi-dry nut in shell is delivered to a village collector. Farmers supply their own bags for delivery to the village collector and often deliver very small amounts of only a few kilograms in plastic shopping bags or second-hand sacks.

Figure 5 Farmer selling nutmeg to a village collector. Farmers often deliver very small amounts in plastic shopping bags

Cracking

In some instance farmers will crack the nuts and sell raw kernel to the collector. Cracking is done by hand with a wooden hammer, often in unhygienic conditions on the floor of the farmers hut.

Figure 6 Cracking is done with a wooden hammer, often in poor hygiene conditions.

In general farmers have a lack of knowledge regarding food safety and the risks arising from the formation of aflatoxins and contamination by human pathogens in nutmeg. Traders and middlemen do not set quality parameters for farmers to meet. Nutmeg appears not to be considered as a food crop and therefore farmers do not understand and realise the need to apply good hygiene practices during and after harvesting.

Poor drying after harvesting of nutmeg is the primary cause of aflatoxin contamination. There is a lack of drying facilities at farm level and also at village level. In order to ensure a food safe product reaches the market additional drying equipment is required at the farm and/or village level. An alternative is to implement handling systems to ensure the product is passed quickly through the supply chain to facilities where proper drying can take place. The lack of electricity in remote villages is a major factor to consider together with the lack of sunshine during the harvest season.

Many farmers are organised into farmer groups of 10 to 20, and in some cases these groups have combined resources to establish a village or co-operative drying facility.

Among farmers there is generally a lack of knowledge of best practices in post-harvest care and food safety.

Village collectors

Village collectors consolidate the many small deliveries from individual farmers into a larger consignment for shipping to the processor. The village collectors are independent businesses but are often financed by the processor. The provision of finance to the village collector ensures loyalty of that collector to the processor which guarantees supply. Some collectors who are self-financed are free to sell to any processor and will sell to the highest bidder.

The same poor hygiene conditions and lack of knowledge about food safety issues occurs at the village collector level. Village collectors face the same challengers as farmers with regard to post harvest handling. There is a lack of adequate storage and drying facilities in the remote villages and electricity is not reliable or even not available.

The Village collectors use plastic sheets or cement drying pads, or drying racks to dry nutmeg in the sun. In times of wet weather traditional wood fired ovens may be used. The problem with these ovens is that they do not have adequate temperature control and high temperatures can lead to a loss of kernel quality. In periods of sunny dry weather the nuts can be dried to below a water activity of 0.7, which is a safe moisture level at which most fungi and bacteria will not grow, using natural sun drying. In periods of prolonged wet weather or high humidity, above 75%RH, it is not possible to dry the nuts to safe levels without some form of artificial heating.

Village collectors sell their consolidated consignments either to larger provincial traders or directly to processors. Delivery schedules to the trader or processor depend on how long it takes the collector to consolidate a full shipment and also on the availability of shipping, which may be irregular from some of the smaller islands.

Nut in shell held at high moisture content for extended periods are at risk of going mouldy and becoming contaminated with aflatoxin.

Processors

Indonesian nutmeg processors are generally large enterprises focused on the export market Processors receive consignments from village collectors or from provincial traders as nut in shell packed in 50kg polypropylene woven bags. Most processors do not have any drying facilities and expect that the NIS will be delivered at cracking moisture (approx. 13%). Traders who deliver NIS at moistures above 13% receive a financial penalty or in many cases the consignment is rejected. There is no recognition of the time it has taken the NIS to reach the required moisture content, which may be as long as 8-12 weeks from harvest. Nutmeg that has been at high moisture content for extended periods is at a high risk of being contaminated with aflatoxin.

Exporters generally have a better knowledge of food safety issues and use improved hygiene practices when storing, cracking and packing nutmeg compared to those used by the collectors and traders. Indonesian nutmeg processors only crack, sort/grade and pack the nutmeg in bulk 50kg bags ready for export.

The single biggest issue facing the Indonesian nutmeg export industry is food safety. In 2013/13 10% of nutmeg shipments to the EU were rejected by EU customs authorities due to contamination with aflatoxin (RASFF Portal Notifications list 2013). Nutmeg importers in the EU all use a steam sterilization critical control point to kill any human pathogens that are present.

Comparisons with the Canarium Industry

There is basically three different production and processing systems being used for the canarium industry, centralised, decentralised and village cracking (Wallace et al 2014). With the centralised processing system the smallholders sell the whole fruit, including the pulp, to a processing centre. Decentralised processing occurs in Solomon Islands where there is often no electricity and transport is irregular and expensive. Smallholders in remote locations process the nuts to stable dried kernel product using traditional methods then sell the kernel to a centralised processor. In the village cracking system farmers crack the nut-inshell with traditional methods and supply nut-in-testa to a secondary processor within 24 hours of

cracking. The industry in PNG is developing along the lines of centralised processing while in the Solomon Islands and Vanuatu it is mainly decentralised or village cracking processing systems. The Indonesian nutmeg more closely reflects the decentralised and village cracking industries of Vanuatu and Solomon Islands. Therefore the following discussion will focus on these two countries.

Canarium in Vanuatu and Solomon Islands is often grown on remote islands or near remote villages. Electricity can be non-existent or unreliable. Shipping from the islands can be irregular and expensive.

Most farmers only have a few trees. The harvesting system is similar to nutmeg in that the nuts are either picked off the tree or off the ground. Sometimes the nuts in pulp (NIP) are stored in heaps until the pulp starts to ferment or are soaked in salt water to aid the removal of the pulp. The pulp is removed and the NIS is sun dried. In the Solomon Islands some of the nuts will be dried by hanging in bags above the cooking fires. This NIS is used for home consumption and can be stored for up to 12 months.

Figure 7 Canarium NIS and NIP being sun dried in the Solomon Islands

Figure 8 In Vanuatu and Solomon Islands Cracking is done by hand using stones, often with poor hygiene

In the decentralised processing systems the small holders process the product to the kernel stage before selling to the secondary processor. Cracking is done in the traditional way using stones (Fig 8), often under conditions of poor hygiene.

After cracking the kernel may have the testa removed, as in the Solomon Islands, or the nut in testa may be sold to the secondary processor, as in Vanuatu. In the Solomon Islands the kernell is dried or roasted in traditional stone ovens (Fig 9) and sold in recycled 20ltr flour buckets (Fig 10). Each smallholder acts independently in the Solomon islands and ship and sell their own product to secondary processors.

In Vanuatu one secondary processor works closely with villagers who crack and supply nuy in testa to the processsor within 24 hours of cracking. The processors co-ordinates pick up days from remote areas. In this way the processor can control the supply and quality direct from the small holders.

Practices in the nutmeg value chain and lessons for the Canarium industry

As we have seen with the nutmeg export industry, if the canarium industry is to develop into a successful export industry food safety and quality will be paramount. As volumes increase and international markets are established this becomes increasingly important. In recent years standards for importing food into many Western markets has become more stringent. Regular testing for contamination by pathogens, mycotoxins, and agricultural chemicals is a standard procedure in many import markets and the canarium industry will have to meet and exceed these standards.

The post-harvest challenges facing the canarium industry, with remote production, nonexistent or erratic electricity supply, and humid environmental conditions are very similar to those of the Indonesian nutmeg industry. Poor drying facilities, a lack of food hygiene principles and poor storage facilities is likely to lead to the same problems of microbial contamination and development of mycotoxins.

Figure 9 In the Solomon Islands Canarium is often roasted in traditional stone ovens

Figure 10 Roasted kernel is sold in recycled 20l flower buckets.

The approach that the nutmeg industry is taking to overcome these problems is a whole of chain education program. It is expected that the exporter/processors will take a key role in educating and managing their own supply chains. Exporters are being assisted to implement HACCP food safety programs. A generic HACCP plan has been developed (EU TSP II program) and training provided to each of the exporting processors.

A set of training modules and best practice guidelines for the processors, provincial and village collectors and smallholders has been developed and is currently being rolled out to the whole industry. Farmers are being encouraged to build and use simple drying racks that help improve the drying efficiency and food hygiene. Village collectors are being trained in handling and storage practices that reduce the risk of microbial contamination. Where the village has electricity village collectors are being aided to install artificial dryers. A simple box drier has been designed that can dry about 400kgs/week and operates with a 1000W heater and fan. The box drier can be built by the collector for less than $200.

Figure 11 Box drier designed for nutmeg village collectors.

The business model for the nutmeg industry may also fit with the canarium industry in Vanuatu and Indonesia. Farmers or groups of farmers will supply a village collector. The village collector receives the nutmeg, assesses the quality and pays the farmer at the time of receival. The village collector is an independent operator however is usually affiliated to a single exporter. In many cases the exporter will finance the village collector so the collector can pay the farmers at receival. The village collector consolidates the many small deliveries from the farmers into a larger consignment. The village collector is responsible for storing the product and arranging the shipping.

Canarium processors in Solomon Islands have complained of not being able to secure a reliable supply. One processor in Vanuatu has taken a whole of chain approach similar to the nutmeg exporters. This processor has worked closely with the farmers to ensure that they provide a quality product that meets their specifications. They also arrange to collect the nutmeg from the island on specific pre-arranged days. It is ultimately the processors responsibility to ensure that they have a consistent, reliable supply to meet their processing capacity and markets.

1: Nutmeg and canarium farmers have poor knowledge of food hygiene principles.

Poor hygiene conditions and insufficient conditions for storage and drying nuts creates a high risk for contamination with moulds and for the formation of aflatoxin.

In order to safe guard consumers and develop a reputation of producing safe to consume high quality product extensive training needs to occur with the village farmers and primary processors. Forming grower groups based on a village or regional area will help in the dissemination and adoption of best practices. Better drying an storage equipment will also be more effective if utilised by groups of growers.

It is further recommended that user friendly charts are developed to be used as extension aids, specifically for raising awareness of food hygiene and safety practices and improving the practices for cracking, drying, sorting and grading.

Figure 12 A wood fired drier in Vanuatu. Note that the fire is contained within a steel cylinder keeping the product and smoke separated.

2: A training and awareness programme should be designed and implemented that is aimed at providing essential information to farmers and village collectors.

The programme should focus on improving hygiene and food safety practices, use of quality standards and related incentives. The programme should be such as to encourage all operators to establish adequate facilities or alternatively to transfer products immediately to other operators who have such facilities. e.g. farmers should not carry out cracking and drying if they do not have adequate facilities.

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Appendix 11.4

Canarium Nut

Marketing Strategy

| Vanuatu |

Maria M. Raciti

Canarium nut marketing strategy: Vanuatu

University of the Sunshine Coast

January 2015

Table of Contents

Appendicies

1.0 Background

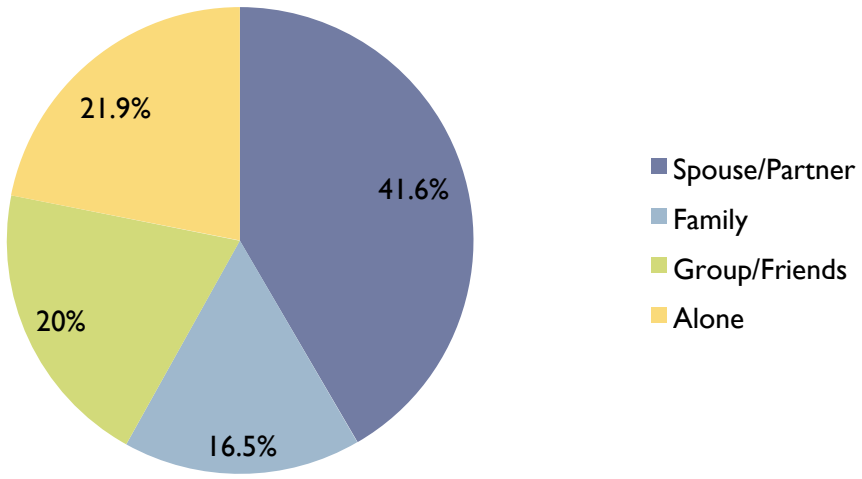
- This canarium Nut Marketing Strategy report is part of the Pacific Agribusiness Research for Developing Initiative (PARDI) (2011-2015) funding of the Developing Sustainability Industry for Pacific Island Communities project. This project is a partnership between the University of the Sunshine Coast and the University of Adelaide. Produced by the indigenous canarium indicum tree, the nuts that are the focus of this project are a culturally important, traditional food of the Ni-Vanuatu people (Melanesian people of Vanuatu) (Thomson and Evans, 2006).
- This canarium Nut Marketing Strategy is concerned principally with the Vanuatu tourist market. Stimulating demand for the local nut among the many tourists that visit is vital to the success of the emerging nut-based agri-industry. Related marketing literature conveys that pro-social food motivations are important with today's consumers concerned about the social and ethical circumstances of the origin of the food they consume (Unnevehr et al., 2010). Such pro-social food motivations have gained momentum since the 1980's, leading to the development of international certified food programs such as Fairtrade, Rainforest Alliance and UTZ (Becchetti and Huybrechts, 2008).
- The priority consumer market for canarium nuts has been identified as the many tourists (n = 237,346) that arrive into Port Vila, the capital of the Vanuatu archipelago, on the main island of Efate. Australians on holidays are the largest cohort of tourists visiting Port Vila, with 59% being one-day cruise ship visitors (Pacific Agribusiness Research and Development Initiative, 2012). A review of the related tourism literature found that the consumption of local food by tourists is an emerging trend (Mac et al., 2013).
- Nuts seldom feature as a local food from the developing world that is part of certified food programs. Brazil nuts in the Amazon (see Lima et al., 2013; Silvertown, 2004); and chestnuts in the Mediterranean (Bounous, 2006) were the only two nuts identified in the extant literature. Additionally, there are no marketing or tourism studies of the South Pacific Islands, of which Vanuatu is part, beyond Garcia Gonzales (2013) study of internet-enabled sustainable tourism and Hutchens (2011) discussion of the success factors that underpin certified food programs. Thus, this project drew from other sources of information including internet audits, a survey and field observations.

1.1 The tourism industry of Vanuatu

- The tourism industry in Vanuatu is significant in size. Firstly, the flow of visitors is large with 237 346 people visiting Vanuatu in 2013. Of these visitors, 110 109 (46%) arrived by air and 127 237 (54%) by cruise ship (The Vanuatu National Statistics Office 2014, p. 5). This composition has been shifting to reflect the growth of the cruise ship sector in the South Pacific; data from September of 2014 now shows that 55.37% of all tourists to Vanuatu arrive by cruise ship. These tourists are typically day-trippers while travellers who arrive by air have an average length of stay of 9 days (VNSO 2014, p. 3). Tourist expenditure is also varied between these two groups. The Millennium Challenge Account (2008, p. 69) found that, in 2008, the average total expenditure of air passengers to Vanuatu was 20 047 Vatu per day. For cruise ship passengers, who only spend one day in port, this figure was 20 160 Vatu. The International Finance Corporation (2013, p. 1) reports that, in 2013, the cruise industry brought $34.6 million AUD to Vanuatu.

- The popularity of Vanuatu as a destination is also evident in the Millennium Challenge Account's (2008, p. 71) report - in 2008, 33.5% of air arrivals were returning visitors. Moreover, tourists indicate a preference to share their experience of Vanuatu: 41.6% travelled with their partner/spouse, 20% with a group of friends and 16.5% with family (MCA 2008, p. 71). This is illustrated below in Figure 1.

Figure 2: Pie Graph of Travel Companions of Vanuatu Tourists, 2008



Source: Millennium Challenge Account 2008, p. 71.

- As afore mentioned, cruise ship tourism is a key element of the industry. A report by the International Finance Corporation (2014, p. 3) states that "Vanuatu is scheduled to host **more than 230 cruise ship calls**" in 2014. 95% of these calls are made by Carnival Australia (operators of Carnival Cruise Lines, P&O and Princess Cruises) and Royal Caribbean (IFC 2014, p. 5). Another key component of the industry is the resort sector. There are currently 46 properties registered with the Vanuatu Hotels and Resorts Association (2014). There are also a number of smaller accommodation sites in operation across the islands, represented by the Vanuatu Island Bungalows and Tourism Association.

1.1.1 Segmentation of Vanuatu's tourists

- A survey of 200 international tourists, conducted by Filep et al. (2014), has created the following socio-demographic profile of Vanuatu's tourists. There are a greater number of female tourists than males, a composition of 66.1% and 33.9% respectively. In terms of age, the 26-35 year-old age bracket is the largest, comprising 34.7% of all tourists (Filep et al. 2014, p. 288), followed by over 55s (22.6%) 36-45 year-olds (21.6%) and 46-55 year-olds (14.7%) – Figure 2 displays this data visually. The Vanuatu National Statistics Office (2014, p. 10) corroborate that the mean age of visitors arriving by air is 38.9. Another notable characteristic of these tourists is their high education level; 74.9% of all respondents were tertiary educated, with 14.4% in total having completed Masters or Ph.D. study (Filep et al. 2014, p. 288).

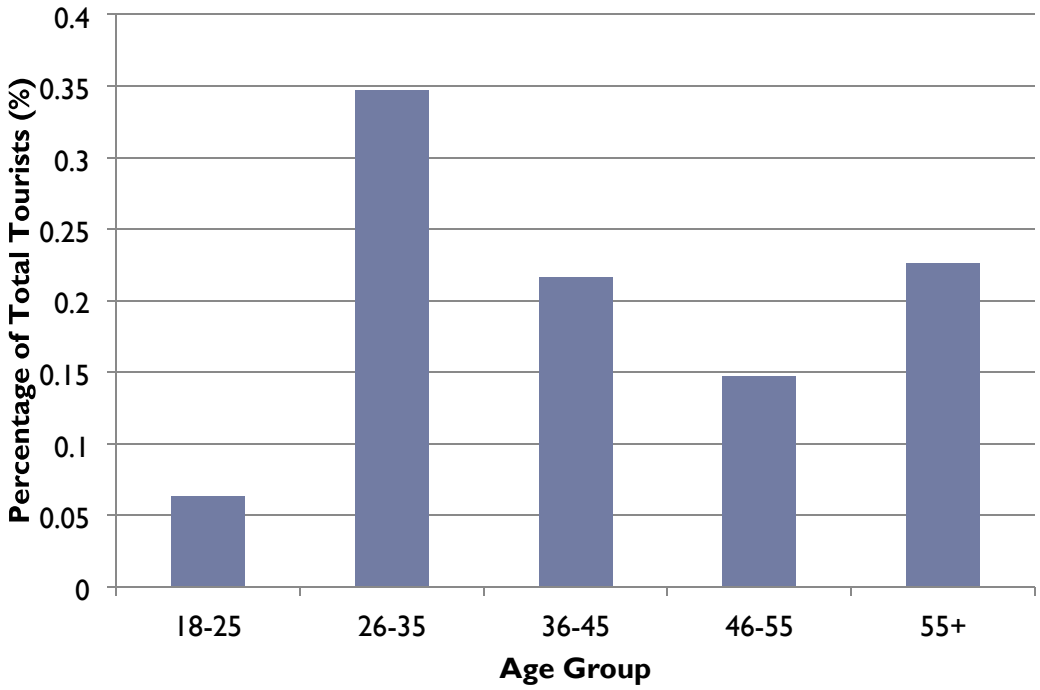


Figure 3: Column Graph of Age Distribution of Tourists to Vanuatu, 2014 Source: Filep et al. 2014, p. 288

- Cruise ship passengers to Vanuatu have a unique demographic profile. With 40% of all Australian cruises travelling to the South Pacific (CLIA 2013, p. 6), The Cruise Line Industry Association's annual source market report illustrates the demographic profile of Vanuatu's cruise ship tourists. In 2013, 45.9% of passengers were under 50 years of age (CLIA 2013, p. 11). Similarly, P&O (2014) state that the average age of passengers on their ships is 42. Although quite old data, a 2004 report by Douglas and Douglas provides a more elaborate portrait of these passengers. Their survey of cruise passengers to Vanuatu revealed that 60% were female and 40% male (Douglas & Douglas 2004, p. 255). Furthermore, they report that 27% of passengers are professionals and that the most frequently observed income bracket was $35 001 - $60 000 per year (Douglas & Douglas 2004, p. 355).
- Vanuatu's tourists can also be segmented geographically. In the first quarter of 2014, 57% of tourists in Vanuatu originated from Australia (South Pacific Tourism Organisation 2014, p. 14). This makes it the largest geographic segment, followed by New Caledonia (16.5%) and New Zealand (8.7%).
- When air travel markets and cruise ship markets are assessed individually, similar patterns are observed. The Vanuatu National Statistics Office (2014, p. 2) reports that 62% of passengers who arrived by air came from Australia, 17% arrived from New Zealand, 7% from New Caledonia and 6% from other Pacific countries. Figure 3 illustrates this composition using VNSO data.

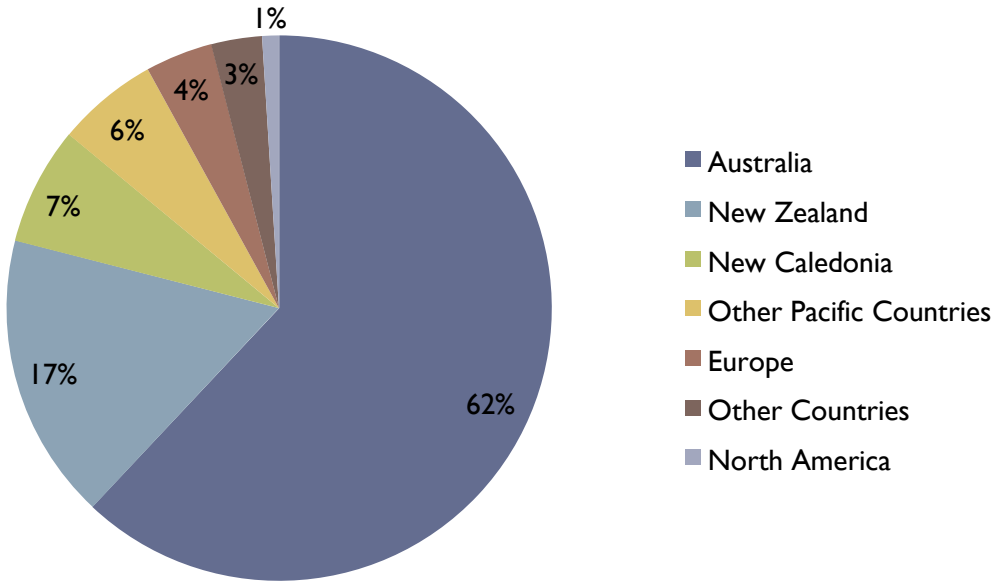


Figure 4: Pie Graph of the Geographic Segmentation of Air Arrivals to Vanuatu, September 2014
Source: VNSO, 2014.

- Australia and New Zealand are also the largest geographic segments of the cruise ship tourist market. 93% of cruise ship passengers in Vanuatu arrived from Australia (40% from Queensland, 32% from New South Wales, 16% from Victoria and 5% from South Australia) and 7% from New Zealand (Charlie 2013a). This is illustrated in Figure 4.

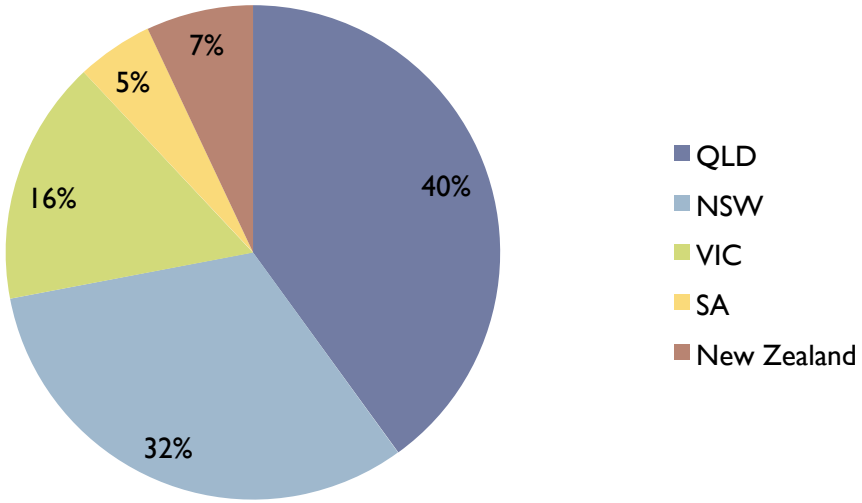


Figure 5: Pie Graph of Geographic Segmentation of Cruise Ship Arrivals to Vanuatu 2013
Source: Charlie, 2013

- Analysis of these cruise ship passengers indicates that most are towards the right of Plog's psychographic continuum, namely, near-psychocentrics. Plog (1991) defines this group as those who favour familiar destinations, structured travel and minimal risk, as opposed to allocentrics, who seek unfamiliar surroundings, unique experiences and adventure. **The preference for familiar destinations, characteristic of near-psychocentrics and psychocentrics, is evident in cruise ship passengers to Vanuatu.** The Vanuatu Cruise Survey 2014 found that 30% of passengers were returning to the country and 88% stated that they would visit again (Charlie 2014). The highly structured nature of cruise ship travel and inclusiveness of cruise packages indicates an appreciation of structure and a passive attitude towards travel, also traits of near-psychocentric and psychocentric tourists. Finally, the psychocentric nature of cruise ship passengers to Vanuatu can be inferred through their preference for low-risk activities; the MCA (2008) report that 41.7% of cruise passengers' expenditure in Vanuatu is on duty-free shopping, followed by 28% on local shopping.
- Comparatively, plane passengers are more readily identified as midcentrics – they display both allocentric and psychocentric traits. As with cruise ship passengers, a high number of plane passengers are returning to Vanuatu – 33.5% in 2008 (MCA 2008, p. 71) – **indicating these tourists value of familiarity which provides an opportunity for repeat purchases.** Additionally, MCA's (2008, p. 68) survey of passengers departing at various Vanuatu airports reveals that 56.2% of plane passengers purchased a package which included their airfare and accommodation. This structured, pre-planned approach to travel is another psychocentric characteristic. Yet, there is also evidence of allocentric attitudes and behaviours in the segment. For example, 29% of arrivals stated that 'adventure' was one of Vanuatu's core attractions (Filep et al. 2014, p. 288). Filep et al. (2014, p. 289) also found that most tourists to Vanuatu were "seeking more meaningful, challenging and authentic experiences." Such attitudes and activities indicate a balance between active and passive approaches to travel, defining the air passenger market as midcentrics.

1.1.2 Tourism trends and projections for growth in Vanuatu

- Vanuatu's tourism industry has experienced rapid growth and development. Across the South Pacific, tourism arrivals have been increasing at an average rate of 3.5% per year and this is projected to continue until 2019 (South Pacific Tourism Organisation 2014, p. 14). Vanuatu itself is also expected to continue to experience growth. The World Travel and Tourism Council (2014, p. 10) estimate that by 2024, approximately 173 000 international air passengers will arrive in Vanuatu per year, a 4.2% increase. This growth is expected to be fuelled by the following trends:
- **Trend 1 Changes to the Short-haul Market** - Australia and New Zealand are expected to maintain their position as the largest geographic tourist segments (SPTO 2014, p. 37). However, the South Pacific Tourism Organisation (2014, p. 17) predict slower growth in Australian tourists as a result of the Australian economy while New Zealand and USA markets are expected to grow due to positive economic circumstances.
- **Trend 2 Emerging Source Markets –** AusAID's report, *Pacific 2020,* identifies India as a potential source market for South Pacific tourism as a result of its flourishing economy (Allcock 2006, p. 7). This is supported by the South Pacific Tourism Organisation (2014, p. 34) who also predict increased flow of tourists from Brazil, Russia, China and South Korea. Vanuatu Tourism Office's Global Marketing Manager, Alan Kalfabun, stated that the country's "fastest growing tourist market is China," (Garae 2014). The VTO has begun pursuing this market by hosting

Chinese industry professionals and creating signage and information booklets in Chinese. As such, the VTO predict that Vanuatu will become less reliant on the Australian market.

- **Trend 3 Growth of Niche Markets –** Vanautu Tourism Office's Market Research Manager, Sebastien Bador, has identified yachting tourists as a potential growth market for Vanuatu (Charlie 2013b). With the aim of capturing this market, Vanuatu Tourism Office has developed a free guide to yachting in the region and an informative website for potential tourists. Amendments have also been made to Vanuatu's Customs Act to make it easier for visitors to travel between ports (Sail-World.com 2014). This would mean a wider geographic dispersal of tourists, tourism exposure for isolated communities and increased economic gain - yachting tourists are identified as having a higher per trip expenditure than other tourists (MCA 2006). Becoming branded as a yachting destination would also contribute to Vanuatu's evolving destination image.
- Other changes to this image include confirmation as a luxury destination. Both Southerden (2009) and Business Advantage International (2011) remark that the number of boutique and luxury accommodation facilities in Vanuatu is increasing.
- **Trend 4 Accessibility by Air –** Vanuatu currently has three international airports: Bauerfield Airport in Port Vila; Pekoa Airport in Luganville; and Whitegrass Airport on Tanna Island (Airports Vanuatu Ltd 2014). Air Vanuatu (2014) currently travels from Australia (Brisbane, Sydney and Melbourne), New Zealand (Auckland), and other Pacific destinations such as Fiji (Nadi and Suva), Solomon Islands (Honiara), and New Caledonia (Noumea). Vanuatu's government has announced that a new international airport will be constructed in Efate (Hill 2013). The contract is held by a Singaporean company Vanuatu Trade Development, which promises to increase the number of air passenger to the region, especially from Asian ports. This would support the forecasted tourism growth and emerging markets.
- **Trend 5 Changes to the Cruise Ship Market –** The cruise industry is currently experiencing significant growth, particularly in Australia (Cesta 2014). The demographic of cruise ship passengers is also changing. The Cruise Line Industry Association (2014) reports increased patronage by Millennials as well as popularity with families. Cesta (2014) also remarks that the cruise industry has spurred an increase in single female travellers. This changing market will continue to affect the tourism profile of Vanuatu.

1.2 Analysis of Australian food trends

- Australian food trends will shape the expectations of Australian tourists visiting the South Pacific. Thus, an analysis of Australian food trends was undertaken to identify food trends and opportunities for the marketing of the canarium nut and canarium nut infused products.

1.2.1 Australian food trends for specific types of food

- Relevant and recent Australian food industry reports were sourced from IBISWorld and examined (Appendix 1). Nuts for human consumption focused upon trends in biscuits, breads, snack food and cereals, pasta and baking mix. Key deductions were:
- Consumer **biscuit** consumption key trends are a desire for:
    - nutrition in that they contain healthy ingredients, are low-fat and low-carb
    - innovative or novel types of ingredients or biscuit forms such as biscuit bars
    - premium products such as gourmet cookies with exotic ingredients
    - portion-controlled packaging that is easily portable and maintains the biscuit form
- Consumer **bread** consumption key trends are a desire for:

- healthy and premium products such as functional breads that have been enriched or fortified; whole grain and fruit- or nut-infused variations of traditional bread and bakery products
- organic, natural foods and artisan-type breads o innovative packaging is portion controlled, convenient and portable ▸ Consumer **snack food** consumption key trends are a desire for:
- nutritious snacks that appeal to time poor consumers who are health conscious o innovative packaging is portion controlled, convenient and portable with packaging conveying health benefits to enhance the credibility of these foods
- pretzels and nuts leading trend and expected to continue to rise over next five years spurred on by increasing levels of health awareness among Australian consumers
- combinations of exotic flavours with premium healthy ingredients o snack foods will shift from quick, filler foods into nutritious meals consumed on their own

▸ Consumer **cereal, pasta and baking mix** consumption key trends are a desire for:

- organic breakfast cereals that boast specific nutritional values o fibre and antioxidant enriched cereals and high-priced premium products o innovative packaging is portion controlled, convenient and portable (e.g. cereal bars)

1.2.2 Short-term, broader Australian food consumption trends

▸ In the short term, Australian consumers are predicted to be influenced by the following emerging food trends. As such, these trends with shape the expectations of Australian tourists travelling to Vanuatu in the next 3 years.

▸ **The Influence of Social Media** - Australian industry report, Food Forward, states that consumers will "increasingly rely on social networks to shape their food choices," (Weber Shandwick 2014, p. 12). 33% of respondents indicated that their food choices were influenced by social media and other online content (Weber Shandwick 2014, p. 12). Langley (2014a) expects this trend to continue with the ownership of internet-enabled devices predicted to continue to grow.

▸ **Appreciation of Home-Cooking** - This socialisation of food choices has fuelled the growing role of food in popular culture. According to Weber Shandwick (2014, p. 5), 73% of Australians view cooking as a significant part of their social lives and leisure time. This figure is even higher for the 18-34 year-old demographic. The continuing popularity of food-based television programmes is expected to cement the value of home-cooking and in-home entertaining (Ting 2013).

▸ **Continued Preference for Healthy Options** - The movement towards healthy eating and nutrition awareness is also expected to be consolidated in 2015. Langley (2014b) notes that in 2014, 8% of all new products claimed to be "all natural." Furthermore, the popularity of vegan, raw and paleo diets has also seen consumer movement towards nut based milk products in preference to milk and soy. As such, Australian almond production has increased from 10 000 tonnes in 1993 to 78 000 tonnes in 2013(Barnett 2014, p. 10).

▸ **Ethical Awareness** - This value of nutrition among consumers is becoming joined by an appreciation of what Boothroyd (2014) terms "ethical eating." Weber Shandwick (2014, p. 11) report that 71% of Australians value knowing where their food products come from and how they have been produced.

▸ **Food-Focused Travel** - Australians have shown growing interest in travelling for cultural food experiences. This year, Tourism Australia announced that food and wine was the third most

powerful motivation for choosing a destination (Baker cited in Rudra 2014). This is confirmed by Weber Shandwick (2014), who state that 34% of their survey respondents had selected a holiday destination purely based on its cuisine.

1.2.3 Long-term, broader Australian food consumption trends

- Food trends predicted to influence the expectations of Australian tourists travelling to Vanuatu in the next 5+ years include:
- **Demand for Convenience –** Nunzio (2014) describes that a growing number of Australians have "time-poor urban lifestyles," which lead them to seek convenient foods. In the 2011 Census, 89% of Australians lived in urban areas and this is expected to continue to rise (Australian Bureau of Statistics 2013). Such individuals leading busy lives are beginning to place more value on convenience – 53% of those surveyed by Product of the Year said that they, because they do not have time to cook, they purchase products based on their time-saving benefits (Richard 2013). Richard (2013) also notes that consumers are beginning to demand products that are both convenient and healthy.
- **Taste for Foreign Dishes and Ingredients -** The Food Forward survey (Weber Shandwick 2014) also revealed Australians' growing interest in exotic and cultural foods. The Department of Foreign Affairs and Trade (2012) attribute the "growing Australian taste for exotic foods" to the influence of migrants. Australia's population is predicted to become more ethnically diverse, making foreign foods more popular and more accessible in the coming years (Nunzio 2014).

1.3 Internet audits and analysis

1.3.1 Keyword country-of-origin analytics to determine Australian demand

- To gain further insight into demand and interest in the canarium nut, an internet audit of relevant keywords was undertaken. Data from Google Analytics was analysed with the results are presented in Appendix 2.
- The key findings were:
  - 'canarium nut' is searched an average of 50 time per month, with 20% of these searches originating from Australia (2.8% of Google searchers for 'pili nut' emanated from Australia)
  - 'Vanuatu food' is search an average of 320 times per month, with 41.6% of these searches originating from Australia
  - Importantly, it is noteworthy that the following countries (which do not grow the nut) featured in these results and represent *future markets* for canarium nuts: United States, Singapore and Canada; and to a lesser degree the United Arab Emirates, New Zealand and the United Kingdom.

1.3.2 Social media marketing analysis

- With a focus upon social media use and presence, the keywords 'Lapita Café', 'canarium nut' and 'pili nut' were audited on the internet. The intention was to ascertain the potential role of social media as a channel for promoting the benefits and uses of canarium nut products to Australian tourists who have returned from Vanuatu. There are a number of social media platforms and the intention was to ascertain which of these platforms would deliver the greatest impact.

- Appendix 3 provides details of the audit including website addresses, social marketing platforms and any metrics that may have been available (e.g. 'likes'; 'star ratings', 'followers', 'recommendations' or 'site visits'). Key observations for each are also provided.
- The social media marketing analysis revealed the following: o The opportunity for Lapita Café to use of YouTube videos in addition to their Facebook page to convey the nutritional benefits and to demonstrate how to use the nut in cooking. The most popular YouTube videos referred to 'raw foods' and the 'paleo' diet.
    - The keyword 'pili nut' was more popular outside of Australia than 'canarium nut' as such social media strategies might be best to mention both keywords so as to optimise search engine results.
    - A number of the sites found used YouTube videos to describe the pili nut industry in the Philippines (see Chris Beck Investments and Shifting Shades). There may be to opportunity for Lapita Café to produce similar, documentary-type YouTube video that outlines the growth of the business and the supply chain for the nut.

1.3.3 Relevant Australian e-commerce businesses: Potential export partners

- Purchasing food and gifts online is common in Australia. There are a number of existing Australian e-commerce businesses that sell similar products to Australian consumers and these represent additional export partners.
- There is the potential to use these existing Australian e-commence businesses to circumvent tourists concerns over the customs regulations of bringing nuts home with them. Furthermore, this would augment the market as tourists who may have made a one-off canarium nut purchase in Vanuatu can continue to purchase the nut in their home country.
- Appendix 4 provides details of 35 relevant Australian e-commerce businesses, organised by each of the recommended sub-brands for the product hierarchy (see Section 2.4). The website and contact details for potential suppliers are included.

1.3.4 Potential tourist business export partners in the South Pacific Islands

- Following the July 2014 field visit to Vanuatu, the potential for meeting the needs of tourists not only in Vanuatu but the surrounding South Pacific Islands became apparent. With fewer barriers to trade, there is the potential to partner with other food-related and tourism businesses. Appendix 5 provides a detailed list of relevant businesses and their contact details, organised by country and grouped by type.

1.3.5 Transferrable strategies from the Australian macadamia nut industry

- An analysis of the macadamia nut industry's online presence was also examined to identify transferable strategies. Appendix 6 provides details including images, website addresses, internet platforms used by each and any metrics that may have been available (e.g. 'likes'; 'star ratings', 'followers' or 'site visits'). Key observations for each are also provided.
- The audit of the Australian macadamia nut industry revealed the following transferrable strategies:
    - A range of macadamia nut products are successfully sold via the internet on eBay, Facebook, iherb.com and nutworks.com → hence there is potential for export of similar types of canarium nut products via e-commerce.
    - Specific 'tourist' nut products have been developed with different labelling that features national flags and emblems. These appear to be for the bulk, low cost gift market mainly targeted at Asian tourists.

- High cost gift products have been developed including hampers, specialty spiced nuts and jams. These products feature prestige packaging absent any national flags and emblems.
- A social marketing presence, with the celebrity chef promotion drawing the most attention (49 093 'likes'). YouTube videos about the nut and how to use the nut in cooking are apparent.

1.4 Survey of tourists leaving Vanuatu

- A survey of tourists was undertaken in 2012. With little existing research to draw from, the survey of tourists departing Vanuatu was an adaptation of a survey that comprised of existing food marketing scales and which was used in the Australian Seafood Cooperative Seafood Research Centre 2008 funded study for the Repositioning of Australian Farmed Barramundi in the Domestic Market led by Chief Investigator Professor Meredith Lawley (USC). Following adaption of the survey and the inclusion of additional items and scales related to the canarium nut project, two experts with agri-business backgrounds from the University of Adelaide were enlisted to conduct an expert review of the 2012 tourist survey so as to confirm its appropriateness prior to the administration. The final survey is provided in Appendix 7.
- For this study, departing tourists were intercepted by trained Ni-Vanuatu enumerators who administered the paper-based survey. Respondents were intercepted at 11 locations with this purposive, convenience sample approach resulting in a useable sample of 61 respondents (59% response rate). Screening questions ensured that respondents were over 18 years of age, tourists leaving Vanuatu, and were consumers or purchasers of nuts or value-added nut products.
- A summary of the results of the survey is provided in Appendix 8. Respondents were relatively equally split in terms of gender (male = 30; female = 31) with 75.4% under that age of 44 years. Over half of the respondents were tertiary educated (57.4%) and described their household income as high (44.3%) or medium (39.3%). Most were Australian residents (67.2%) all of whom were from the east coast, namely Queensland, Victoria and New South Wales respectively.
- In addition to the valuable demographic, consumption and attitudinal data provided by the survey, statistical analysis revealed four significant relationships among the variables, namely:
  - Age → Food buyer role: Older respondents were more likely to be the primary food buyer
  - Gender → Promotion: Female respondents were more responsive to promotional efforts
  - Income → Food tourism: Wealthier respondents were more likely to be interested in nut-based food tourism
  - Age → Purchases of certified foods: Older respondents were more likely to purchase certified foods

2.0 Recommendations

- A range of recommendations are provided in relation to the marketing of canarium nut products. Three marketing strategy principles are offered to frame the marketing of the products; then specific recommendations on the branding, product hierarchy, sub-brand hierarchy and packaging strategy are detailed.
- These recommendations were formulated based upon the following sources of information:
  - The background information presented in this report that was supplemented with additional literature regarding ethical marketing, ethical trade, green marketing,

agrienterprise, enviro-preneurial marketing, and contemporary country-of-origin consumer behaviour;

- Data collected in the canarium Nut Tourists Departing Vanuatu Survey; o Consideration of the social and cultural context of the South Pacific Islands with a focus on Vanuatu;
- Field observations of the Australian nut market; and o Field observations of the marketing of canarium nuts in Vanuatu.

2.1 Marketing strategy: Three key principles

Key principle 1: Make the unfamiliar, familiar.

- The branding strategy and product hierarchy needs to link an unfamiliar local food to a familiar frame of reference of the mostly first-visit, Australian, cruise ship, daytrip/short-stay tourists that visit Vanuatu.
- Analysis of the 2012 survey of tourists departing Vanuatu found that they have positive perceptions of local food; however form two groups, namely: a) 'active-positive' being those who actively seek out and consume local food; and b) 'passive-positive' being tourists with a positive view of local food but hesitate in purchasing and consuming local food. Perceived risk — namely, functional risk and physical risk — separates the two groups. The branding strategy and product hierarchy strategy are best to focus upon the 'passive-positive' group as the survey data revealed that providing more information about local food and building a trustworthy brand that uses familiar keywords will effectively overcome concerns and lead to purchase and consumption.
- Mac et al., (2013) identified 14 motivational factors of tourist food consumption, and noted the tourist experience is heightened in two instances. First, when the local food is in contrast to the tourists' usual diet (i.e. the food is novel and comes in a variety of forms); second, when the local food has a symbolic aspect in that it is culturally meaningful and consumed in an authentic way.

Key Principle 2: Multiple products for two places of consumption

- As the canarium nut is versatile, many different types of products can be developed. Hence, a comprehensive product hierarchy has been developed in this report to frame immediate, shortterm and long-term endeavours. This product hierarchy is also organised by different uses. This report focuses upon food products for the tourist market that visit Vanuatu as this is of immediate importance.
- Analysis of the survey data found that tourists consume nuts in two places a) while in Vanuatu; and b) as a gift to take back to their home country. As such, canarium nut products are best designed with these two places of consumption in mind.

Key Principle 3: Overarching brand with tiered sub-brands

- Based upon different target markets, the best way forward appears to be the development of an overarching brand with tiered sub-brands based principally upon different psychographic and behavioural-based elements of the consumers. The overarching brand would ensure transferability across the product hierarchy, provide longevity and not stifle opportunity for growth. This ultimately would achieve the goals of the project, in that it would allow for the creation of a sustainable agri-enterprise.

2.2 Branding strategy

- Brands reduce consumers' perceived risks of purchasing a product (Kotler and Keller 2012). There are two types of risk which are most relevant to the marketing of canarium nuts; being functional and physical risk. Specifically:
    - **Functional risk** whereby the product does not perform up to expectations → for example, the canarium nut is not fresh or does not taste the way it has been described.
    - **Physical risk** whereby there is a perception that the product poses a threat to physical well-being → for example, the perception that local foods such as canarium nuts are different to tourists' frame of reference as to the taste and texture of familiar nuts or may make them unwell. Known as food neophobia, it has been researched in the tourism literature (e.g. Cohen and Avieli 2004).
- **Pursuing certified food status via FairTrade, for example, is not recommended**. The literature is limited regarding ethical marketing in the Pacific Islands outside of an article by Hutchens (2011). Hutchens (2011), whilst examining the practices and principles of four 'ethical' enterprises in the region, revealed the unique and complex context of the Pacific Islands which make the likelihood of success in gaining certified food status as low. Hutchens (2011) highlighted that the ways in which the local organisations operate in the South Pacific is at odds with Fairtrade's requirements, standards and assumptions with the key challenges being:
    - The Fair Trade premium is impracticable to pay; o FLO's formula for the Fairtrade minimum wage (cost of living, cost of certification, cost of production) isn't applicable to the South Pacific Islands and needs to be revised;
    - Regarding child labour; in the South Pacific Islands for children not to contribute would be considered disrespectful to elders and the community;
    - The requirement of FLO for producers to form democratically organised cooperatives is economically and socially unviable;
    - Cost of certification is unaffordable; and o Reporting requirements of certification appear inappropriate and overwhelming.

2.1 Brand name

- **Recommended brand name for the Australian tourist market:** Lapita Vanuatu Almond

- A brand consists of many elements. A brand is a "name, term, sign, symbol, or design, or any combination of them, intended to identify goods and services from one seller to differentiate them from those of the competition" (Keller 2012).
- While the survey provided a list of alternative local names for the nut, searches of secondary information revealed that the taste and texture of canarium is often described as almond-like; and in other parts of the South Pacific it is referred to as an almond. Tourists from Australia and beyond would be familiar with the taste and texture of an almond and, thus this brand name would overcome issues of functional and physical risk.
- The recommended brand name meets Kotler and Keller's (2012) desirable qualities in that it:
    - It suggests something about the product's benefits and qualities → 'almond' suggests familiar taste and texture; 'Vanuatu' conveys both origin and exotic element.
    - It is easy to pronounce, recognise and remember → all words are easy to pronounce, Lapita is the brand personality, Vanuatu is recognisable as the place of origin.
    - It is distinctive → Lapita and Vanuatu convey prestige and single-source origin, thus key points of distinction

- It is translatable into foreign languages → all words in the brand are the same in most countries that the core cohort of tourists to Vanuatu come from. o It is capable of registration and legal protection → Lapita is currently the brand name used. Pursuit of registration of Lapita Vanuatu Almond is encouraged.

2.2 Brand points

Three major selling points of the brand

- In Vanuatu there are few competitors aside from low-quality peanuts imported from China; while in Australia there are a plethora of options. As such, it is recommended that following three major selling points will best frame the canarium nut against its competitors in the Vanuatu market to be appealing to tourists from Australia. In order of importance, the recommended major selling points are:
  1. 'Nutritious'
  2. 'Fresh'
  3. 'Delicious'
- While the survey indicated 'organic' was a possible major selling point, until the products are 'certified organic' it would be better to focus upon taste as this is a point of functional risk for the tourist consumer. Seeking organic certification may be part of a longer term strategy.

Three major points of difference of the brand

- Points of difference represent the ways in which the nut is different from others on the market and this offers a compelling reason to buy canarium nut products over competitors. In order of importance, the recommended points of difference are:
  1. Culturally important, traditional food of Ni-Vanuatu people
  2. Exotic food
  3. Social enterprise in that the purchase assists the local community. Note the literature on ethical marketing consistently indicated that there is a gap between what people *say* they will purchase and what they *actually* do purchase with regards to certified foods. Many studies noted that people feel socially compelled to say they will buy a pro-social product because it helps a vulnerable group, however, this does not correlate with actual purchases. Hence, it is recommended that this is not the core point of difference, but rather is best being the third point of difference based upon current industry food trends.

Three points of parity of the brand

- Points of parity represent ways in which the nut is similar to others on the market. As tourists have perceived functional and physical risks in purchasing and consuming the nuts and these risks can be minimised by communicating how the nut is similar to other nuts that they are familiar with. The recommended point of parity are:
  1. The Lapita story is currently part of the narrative of the brand. 'Lapita' is best retained as it offers many advantages. First, it confers a sense of history and meaningfulness to the product which conveys modern day prestige. The literature demonstrates that tourists seek prestige in products, particularly gift products. Prestige overcomes any perceived risks that the consumer may have. Analysis of the 2012 survey data indicated similar associations between income and gift buying.
  2. 'Female-sounding brand personality' - Older female tourists were most likely to notice the promotions of local food, as such a female-sounding branded product is more likely to resonate. The literature demonstrates that women are the gift buyers in families and

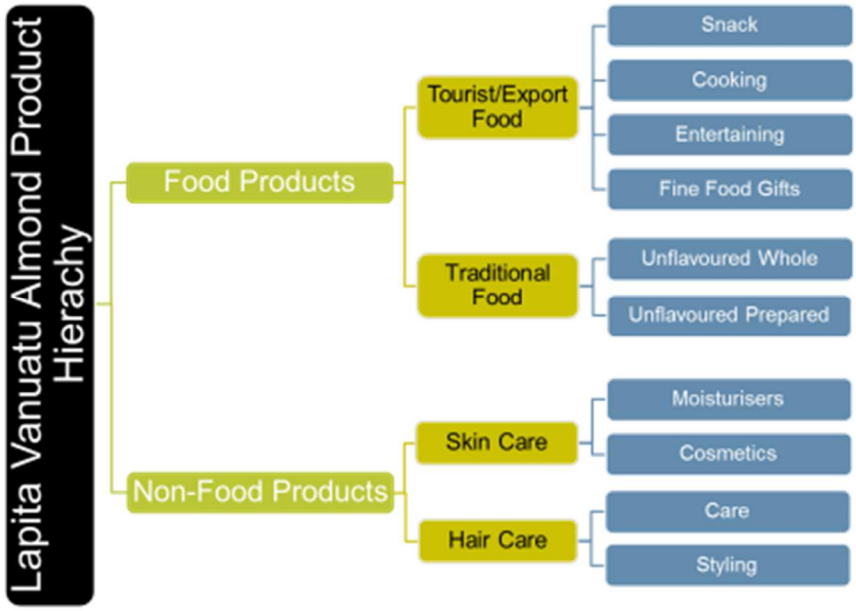
are also the major food buyers. Analysis of the 2012 survey results concurred with the literature. The packaging is discussed later in this report and presents ways to maximise the story and integrate the major selling points, points of difference and points of parity.

3. 'Vanuatu' - Country-of-origin whereby the country name is part of the actual brand name is increasingly popular in food marketing (e.g. Persian Blue Salt) as well as in nonfood marketing (e.g. Moroccan Hair Oil). Consumers today are seeking an 'exotic' element to their purchases (note, an 'exotic' angle is recommended as a point of difference for the brand).

2.3 Product hierarchy

- An overarching brand with tiered sub-brands that present multiple products for multiple uses is recommended (*see* Figure 5). Specifically, a comprehensive product hierarchy has been developed (Appendix 9) that details the full range of recommended food products and nonfood products. The macadamia nut industry was drawn on in developing this hierarchy.

Figure 6: Recommended Product Hierarchy



- Note that food products for the domestic market (Traditional Food) and non-food products (Skin Care and Hair Care) are presented as a frame for expansion of the product line over time. Food products for the Australian tourist market which are of immediate concern and will be elaborated on.

2.4 Sub-brand hierarchy and strategy

- Tables 1 to 5 summarise each of the four sub-brands in terms of their market proposition, products, price, place (distribution), promotion and packaging that aligns with the aforementioned principles, research and branding recommendations is presented. Kotler and Keller (2013) defined four types of consumer product classifications and these are noted in the descriptions in the tables. Specifically:
    - Sub-brand 1 'Island Time' snack food is a convenience product;
    - Sub-brand 2 'Island Chef' and Sub-brand 3 'Island Gourmet' are classified as shopping products; and
    - 'Fine Food' is a premium product.

Table 1: Sub-brand 1

Overarching Brand: Lapita Vanuatu Almond	
Sub-brand 1 is classified as a convenience consumer product: Lapita Vanuatu Almond 'Island Time' Snack Food Range	
Proposition	Convenient, snack sized products for tourists to eat while on day-trips
Products	Consumers of this type of product engage in variety-seeking behaviour. As such a wide range of sweet and savoury flavours that are familiar to tourists will meet this need (see Appendix 9).
Price	Lowest priced sub-brand of the four sub-brands.
Place	Widespread distribution particularly in and outside of retailers close to the cruise ship terminal. Displays at markets, kiosks, cafes, convenience shops and other common purchase points e.g. bars, lobbies, vending machines. Potential retailers are detailed in Appendix 5.
Promotion	Point of purchase displays to be eye-catching and uniform across all distribution points to increase recognisability. Examples can be found at: http://www.megara.com.au/pos-displays/floor-stands/
Packaging size and form	Portable, portion controlled for 1 - 2 people. Resealable foil or plastic packaging that can be carried or placed in handbags, backpacks or pockets (e.g. 150 – 200g size). Primary function of packaging is to retain freshness of the product, but as with other similar products on the market, packaging should have a small clear section (e.g. 10-15% of the front of the package) to enable consumers to see the contents without opening the package. This will address perceived functional and physical risk. Potential packaging types and suppliers are presented in Appendix 10.
Package colour and styling	Update 'Lapita' font and image and via colour introduce a 'fresh modern feel' for this Island Time sub-brand. Adapting modern-takes on the colours of the Vanuatu flag (yellow, black, red and green) and presenting these in a patterned way will appeal to the predominantly older female tourist who makes the majority of food buying decisions. Additional information on packaging attributes is discussed later in this report. Examples of colours and patterns for inspiration:

Table 2: Sub-brand 2

Overarching Brand: Lapita Vanuatu Almond

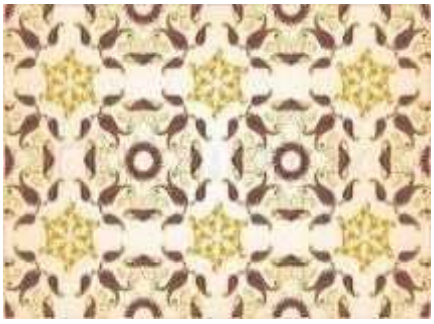
Sub- Brand 2 is classified as a shopping consumer product: Lapita Vanuatu Almond 'Island Chef' Cooking Food Range	
Proposition	'Exotic' cooking ingredients for tourists to take home for personal consumption (i.e. not a gift for others).
Products	Consumers of this type of product are seeking 'exotic' ingredient products that are in a familiar form/texture and can be used in dishes that are familiar to them. Familiar forms/textures are detailed in Appendix 9.
Price	Mid-range priced sub-brand comparable to similar pricing for organic products in Australia and New Zealand.
Place	Limited distribution via bricks-and-mortar stores in Vanuatu (see Appendix 4) such as supermarkets, larger cafes and bakeries (to address perceived functional risk). High visibility in supermarkets (i.e. eye-level shelf position with more facings/rows than other competing products) including end-of-aisle displays and near fast-moving goods such as bread.
Promotion	Point of purchase displays in stores to be eye-catching and uniform across all distribution points to increase recognisability. Examples can be found at: http://www.megara.com.au/pos-displays/floor-stands/
Packaging size and form	Sizing of packaging to be similar to standard industry sizes and container types as per that used in Australia. Packaging size and form will vary depending on each product. Primary function of packaging is to retain freshness of the product; and to ensure portability while travelling (i.e. minimising spilling or splitting). Appendix 10 displays possible packaging types and suppliers.
Package colour and styling	Update 'Lapita' font and image and via colour introduce a 'vintage feel' for this 'Island Chef' sub-brand. Additional information on packaging attributes is described later in this report. Examples of colours and patterns for inspiration:  

Table 3: Sub-brand 3

Overarching Brand: Lapita Vanuatu Almond	
Sub-Brand 3 is classified as a shopping consumer product: Lapita Vanuatu Almond 'Island Gourmet' Entertainment Food Range	
Proposition	Gourmet food product for on-island entertaining for tourists holidaying for longer periods of time in Vanuatu and who are travelling in groups.
Products	Consumers of this type of product are seeking 'exotic' ingredient products that are higher quality. Products as detailed in Appendix 9 are familiar with an 'exotic' or infusion of canarium which meets contemporary consumer demand and food trends.
Price	Upper-middle price range comparable with other gourmet products sold in Vanuatu
Place	Limited distribution via bricks-and-mortar stores in Vanuatu (see Appendix 5) such as supermarkets, larger cafes, bakeries and hotel stores (to address perceived functional risk). High visibility in supermarkets (i.e. eye-level shelf position with more facings/rows than other competing products) including end-of-aisle displays and near fast-moving goods.
Promotion	Point of purchase displays in stores to be eye-catching and uniform across all distribution points to increase recognisability. Examples can be found at: http://www.megara.com.au/pos-displays/floor-stands/
Packaging size and form	Sizing of packaging to be similar to standard industry sizes and container types as per that used in Australia (see Appendix 10). Packaging size and form will vary depending on each product. Primary function of packaging is to retain freshness of the product; and to attract attention on the shelf.
Package colour and styling	Update 'Lapita' font and image and via colour introduce a 'fun, geometric feel' for this 'Island Gourmet' sub-brand. Additional information on packaging attributes is described later in this report. Examples of colours and patterns for inspiration:  

Table 4: Sub-brand 4

Overarching Brand: Lapita Vanuatu Almond	
Sub-brand 4 is classified as a specialty consumer product: Lapita Vanuatu Almond 'Fine Food' Gift Food Range	
Proposition	Premium food products that are purchased by tourists as gifts for family and friends.
Products	Research shows that women are the primary purchasers of gifts and souvenirs. When purchasing gifts, consumers look for premium products and would be interested in those that have a clear link to the holiday or Vanuatu. Thus, Fine Foods would be 'exotic' ingredient products that are of the highest quality in the brand product hierarchy. Products as detailed in Appendix 9 are familiar with an infusion of 'Vanuatu' via canarium nut.
Price	Premium price range. Samples to be provided for rooms in high end hotels.
Place	Exclusive distribution via bricks-and-mortar stores in Vanuatu such as four and five start hotels, high profile gift shops and cruise ship departure area (*see* Appendix 5).
Promotion	Point of purchase displays in stores to be eye-catching and uniform across all distribution points to increase recognisability.
Packaging size and form	Sizing of packaging to be similar to standard industry sizes and container types as per that used in Australia. Packaging size and form will vary depending on each product. Primary function of packaging is to retain freshness of the product; convey prestige of the product and attract attention on the shelf (*see* Appendix 10).
Package colour	Update 'Lapita' font and image and via colour introduce a and styling 'monochrome, prestige feel' for this 'Fine Food' sub-brand (e.g. black, white and gold colours only). Pre-packaged in glossy gift boxes with ribbons or hamper-type baskets with a careful focus upon materials. The following examples are for inspiration:

2.5 Packaging strategy

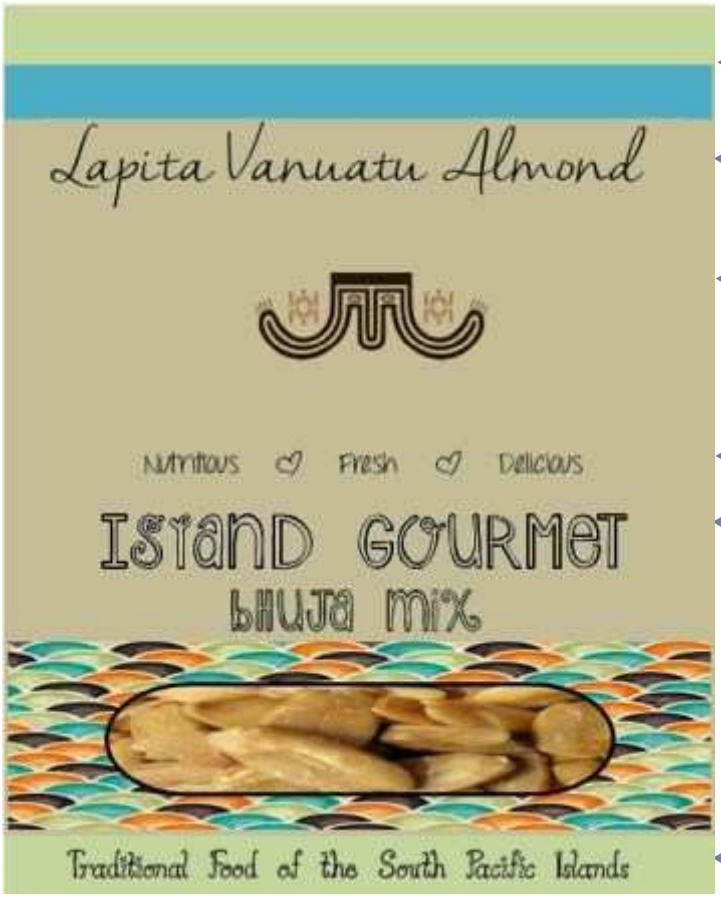
Kotler and Keller (2012) note that packaging serves multiple purposes including to:

- Identify the brand
- Convey descriptive and persuasive information
- Facilitate product transportation and protection
- Assist at-home storage
- Aid product consumption

Furthermore, packaging can consist of the following elements (Kotler and Keller 2012):

- Primary package that holds or contains the product (e.g. breakfast cereal sealed in a plastic bag)
- Secondary packaging that holds the primary package (e.g. breakfast cereal box with cereal sealed in a plastic bag inside)
- Labels on the front, back and sides which serves to identify, describe and promote the product

Applying these notions to the brand strategy for Lapita Vanuatu Almonds, the following mockups in Figure 2 and 3 have been prepared.



Colours for 'Island Gourmet' range

Overarching brand in larger, modern font for recognition and appeal

Artistic effects made to original Lapita image to address resolution issues and to fit with modern look

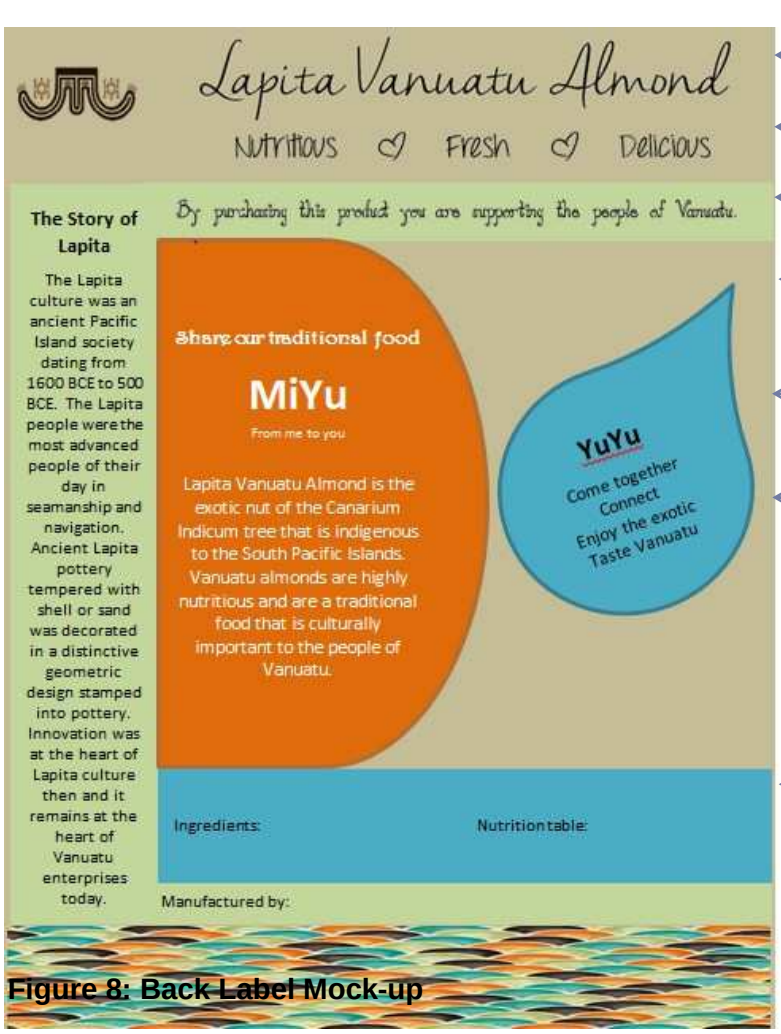
Three major selling points

Sub-brand 3 name and product name - different to overarching brand font, slightly smaller font. Pattern below draws eye down to this point leading to easy identification of product.

This image of the nuts is **to be a clear window** on the outside of the pack so that consumers can see what is inside to address perceived risks.

Point of difference visible on front

Figure 7: Front Label Mock-up



Overarching brand in larger, modern font for recognition and appeal

Three major selling points

Point of difference

Abridged story of Lapita reinforcing above point of difference

'MiYu' notes points of difference

'YuYu' integrates points of difference, key word 'exotic' is highlighted and encourages consuming in groups which is aligned with the entertaining focus of this 'Island Gourmet' sub-brand

Standard labelling information

Figure 8: Back Label Mock-up

- The fonts used in these labels are available for free at www.dafont.com. Specifically, the fonts used are:
  - 'Nella Sue';
  - 'Throw hands up in the air';
  - Austie Bost 'Somersautlts';
  - Austie Bost 'Cherry Cola'; and
  - Austie Bost 'You wear flowers'.

- Next, examples of the form of the package for each sub-brand are presented in Table 5. Further information about suppliers of these package types is presented in Appendix 10, including the contact details.

Table 5: Package form for each sub-brand

Subbrand	Package Form	Example

Island Time	Similar to other products on the market, this range can retain primary packaging only in resealable packages. Printing the label on the package will increase impact.	
Island Chef	Similar to other products on the market, this range can retain primary packaging only in resealable packages or containers. Printing the label on the package will increase impact.	
Island Gourmet	Similar to other products on the market, this range can retain primary packaging only in resealable packages or containers. Printing the label on the package will increase impact.	
Fine foods	Primary and secondary packaging is recommended (sealed clear bag inside and quality cardboard box outside with ribbon). Consider purchasing via http://designcity.com.au/work/packaging/full/oglivy-and-co-finefood-merchants-gourmet-food-packaging/	

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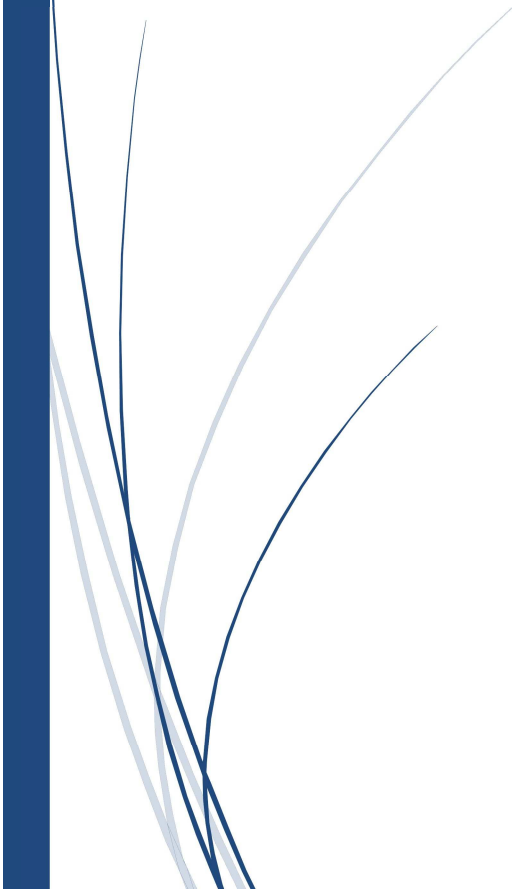
Appendix 11.5 *Developing markets and products for the canarium nut industry: PNG*

June 2015



Developing markets and products for the PNG Canarium nut industry

FST/2010/013

Objective 1:

'*Conduct consumer and customer research to understand the markets and the market segments*'

Activities 1.5 and 1.6

TABLE OF CONTENTS

Chapter 2: Domestic Market Opportunities for a Range of PNG Produced Canarium Products

Chapter 3: PNG Canarium – Becoming Market Ready

Chapter 4: Ranking Canarium Markets and Products

Disclaimer

This Report has been prepared based on primary and secondary sources of information. This Report is intended to provide a concise overview of potential products and markets. Readers should take note that the authors do not guarantee the accuracy of the information contained in this report, not do they necessarily endorse the organisations listed herein. Though every effort has been made to ensure that the information is correct, the authors assume no responsibility for the accuracy, reliability or for any decisions arising from the information contained herein.

Introduction

This Report forms part of the ACIAR Project 'Developing markets and products for the PNG Canarium nut industry'. It pertains to Project Objective 1, that is, to 'conduct consumer and customer research to understand the markets and the market segments', specifically:

Activity 1.5: *Identify and quantify viable export market opportunities for commercially manufactured Canarium products*

Activity 1.6: *Identify specific value-added market chain opportunities in focused export markets for a range of identified products*

Developing an agrifood market in a commercial sense requires that producers, processors and marketers can essentially guarantee customers a reliable supply of products of sufficient quality, quantity and consistency; at an acceptable price (Western Australia - China Agribusiness Conference, 2014). This is not yet the case in the PNG Canarium Industry as the Private Sector has yet to commence commercial processing and marketing, either domestically or in export markets.

In response, this Report focuses on potentially attractive and viable market opportunities for Canarium products within both domestic and selected export markets that fit well with the PNG Canarium Industry at inception. It is envisaged that these potential market opportunities can be tested, quantified and developed as and when the commercial processing industry becomes operational and economic benchmarks are established.

Developing the domestic market is recognised by industry stakeholders in PNG as being a key step in development of Canarium marketing (NARI Canarium Conference and Workshop, September 2014). Starting off and gaining valuable experience in the domestic market can be the foundation of subsequent export market success (Varghese, 2015). Whilst beyond the scope of Activities 1.5 and 1.6, the PNG

market for Canarium appears to have good potential and is likely to be the first market targeted by many entrepreneurs; hence it is covered within this Report.

Presenting and circulating the outcomes of this Report and the upcoming PNG Canarium Strategic Marketing Plan will ideally prove a spur to Private Sector participation in the industry. Consequently information and data has been summarized in a "user-friendly" form so as to *interest, encourage* and *stimulate Private Sector involvement*.

Multiple marketing options are also identified that potentially suit a wide range of enterprises; from rural Community Groups, start up and existing agrifood SMEs, commodity producers and sellers and corporate investors.

As far as is possible the Report focuses on current and projected market trends. This has been done so that the work remains relevant beyond 2015 and can be referenced as industry postharvest and marketing sectors begin to operate.

The Report has been formatted in 4 chapters, plus appendices. Each chapter covers one or more key topic and can be considered as part of the overall Report, or as a stand-alone document in its own right, depending on the specific interests of the reader.

Chapter 1:

International Market Opportunities for a Range of PNG Produced Canarium Products

Maria Raciti University of the Sunshine Coast

1.0 IDENTIFICATION OF POTENTIAL GLOBAL EXPORT MARKETS

1.1 Countries with Medium-to-High Nut Consumption (All Nuts)

Data published by the International Nut and Dried Fruit Council (INC) provides statistics on worldwide nut consumption in 2012. When collated, the data indicates that the top five nut consuming countries in the world are China, India, USA, Vietnam, Brazil and Turkey (see Table 1). However, it is noted that the large consumption of peanuts in some countries without significant consumption of any other nuts skews the data somewhat. When peanut consumption is not included, the highest consumption of nuts occurs in USA, China, Turkey, Germany and Italy respectively (see Table 2). This data is considered more reliable yet still not perfectly indicative of global export markets. It is also noted that the data was collected some time ago which has implications for its relevance. Changing economic, political and environmental situations may make this data unrepresentative of current markets.

Table 1: Top Ten Nut Consuming Countries in 2012 Based on Data from INC

Country	Almonds	Amazonia (Brazil) Nuts	Cashews	Hazelnuts	Macadamias	Pecans	Pine Nuts	Pistachios	Walnuts	Peanuts	All Nuts
China	34,810	339	54,043	-	5,439	393	4,138	69,020	181,625	16,462,347	16,812,154
India	9,543	-	70,322	-	-	-	-	7,362	4,446	3,789,061	3,880,734
USA	269,061	7,571	109,448	15,067	8,534	67,826	3,718	107,548	144,493	2,293,879	3,027,145
Nigeria	-	-	-	-	-	-	-	-	-	1,550,930	1,550,930
Indonesia	-	-	9,622	-	-	-	-	-	-	1,310,932	1,320,554
Vietnam	18,799	-	-	-	261	-	-	43,724	-	809,703	872,487
Brazil	-	-	-	2,801	984	-	-	-	3,113	248,410	255,308
Turkey	23,172	-	-	84,214	-	-	-	83,238	29,857	-	220,481
Germany	71,516	3,202	26,177	28,553	701	214	2,449	-	12,085	74,481	219,378
Mexico	-	-	-	-	-	16,832	41	-	-	182,456	199,329

* Dashes indicate that the country was not among the top 20 consumers of that variety. Source: Adapted from INC (2012).

Table 2: Top Ten Nut Consuming Countries (Excluding Peanuts) in 2012 Based on Data from INC

Country	Almonds	Amazonia (Brazil) Nuts	Cashews	Hazelnuts	Macadamias	Pecans	Pine Nuts	Pistachios	Walnuts	All Nuts (Excluding Peanuts)
USA	269,061	7,571	109,448	15,067	8,534	67,826	3,718	107,548	144,493	733,266

China	34,810	339	54,043	-	5,439	393	4,138	69,020	181,625	349,807
Turkey	23,172	-	-	84,214	-	-	-	83,238	29,857	220,481
Germany	71,516	3,202	26,177	28,553	701	214	2,449	-	12,085	144,897
Italy	37,130	533	5,410	71,884	177	119	1,024	9,820	9,124	135,221
France	30,309	300	8,416	27,880	141	813	246	12,292	16,271	96,668
India	9,543	-	70,322	-	-	-	-	7,362	4,446	91,673
Spain	57,664	415	4,383	10,922	209	44	557	8,748	7,951	90,893
Iran	10,056	-	-	-	-	-	-	76,284	3,398	89,738
Russian Federation	20,248	909	10,094	13,174	-	-	3,734	18,110	9,134	75,403

* Dashes indicate that the country was not among the top 20 consumers of that variety. Source: Adapted from INC (2012).

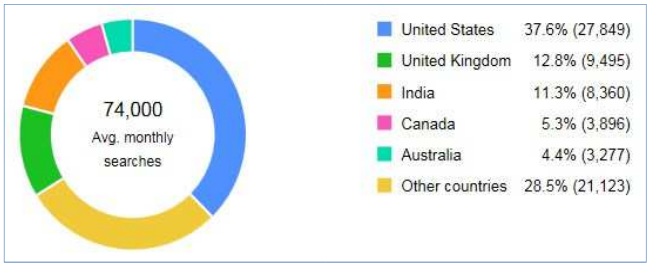
To supplement this data, Google Analytics keyword searches have been performed to assess the geographic distribution of interest in nuts. Using the same nuts as the INC data, data from Google (2015) shows that most searches arose from the USA, the UK, India, Canada and Australia respectively (see Figure 1). This data is also flawed given that it does not include countries in which Google is not used - most significantly, China. However, it creates a more accurate understanding of current market dynamics. Firstly, it affirms the significance of the USA as a market. It also establishes India as a major nut market, which otherwise appeared to be anomalous. Google's (2015) data further indicates that the UK and other Commonwealth nations such as Australia, Canada and New Zealand may be large markets. This should be corroborated by other sources as it may be influenced by Google's target market and the linguistic or cultural context of the search terms.

Finally Japan is investigated as a large market. Domestic production of nuts in Japan has been declining (Ministry of Agriculture, Forestry and Fisheries Japan 2014). Imports of almond have been increasing (Kim 2014) and the Australian Nut Industry Council (2014) writes that Japan is a steady market for chestnuts, macadamia nuts and such premium or highly-valued varieties.

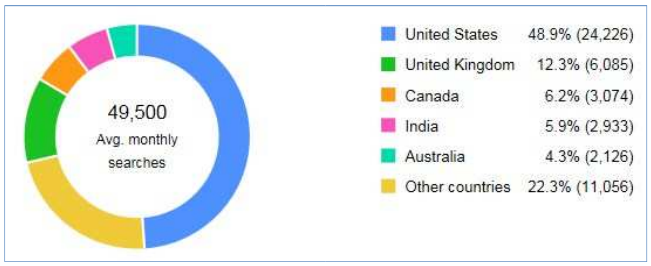
Thus, through collating data and research from a number of sources, it is argued that the world's largest nut markets are: China, Japan, India, the USA, Australia and the UK. China has also been widely noted as a large and growing market (Gale & Yang 2015). Goodwin (2014) affirms that "China is the world's second largest market for tree nuts." Despite much writing on strict import controls, Japan is also noted to be a "major importing nation," (Alasalvar & Shahidi 2008). Research also confirms that India is a large market (Aradhey 2014) which overall is showing growth (Australian Nut Industry Council 2014; Morecraft 2015). Both INC data (2012) and Google Analytics (2015) have confirmed both the USA and Australia's high consumption. The ANIC President, Richard Sampson-Genest, said at the INC Annual Conference in Melbourne in 2014 that "the markets deemed to be mature – such as Europe and the USA" were set to experience growth (Sampson 2014). Historically, Germany, Italy, Spain and Turkey are the largest consumers in Europe (INC 2012; USDA 2015) yet the UK is given focus as a particularly growing

market (Terazono 2013). China, Japan, India, the USA, Australia and the UK are confirmed as high consuming markets by the ANIC (2014, p. 12) stating, in the case of almonds in particular, "While markets in the USA and Europe are growing strongly, most recent expansion has been in India, China and the Middle East."

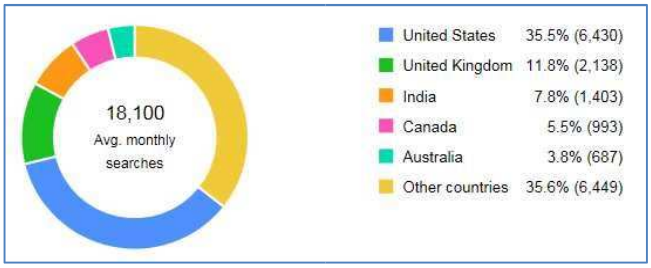
Figure 1: Geographical Distribution of the Search Terms Related to Nut Consumption



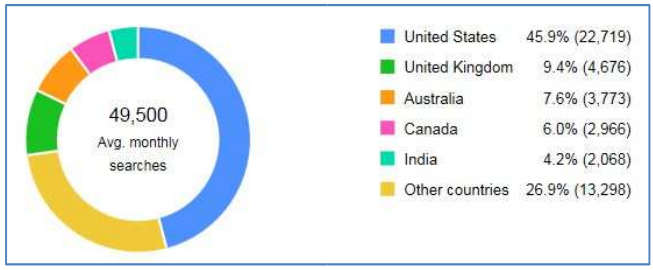
Geographical Distribution of the Search Term "Almonds"



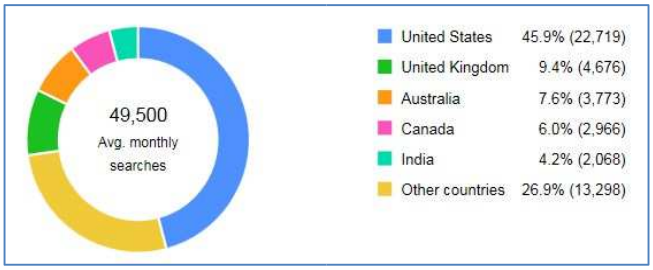
Geographical Distribution of the Search Term "Brazil Nuts"



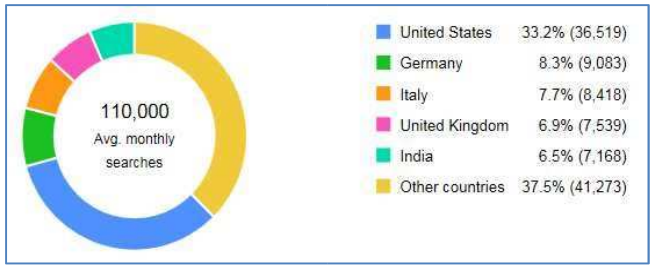
Geographical Distribution of the Search Term "Cashew Nuts"



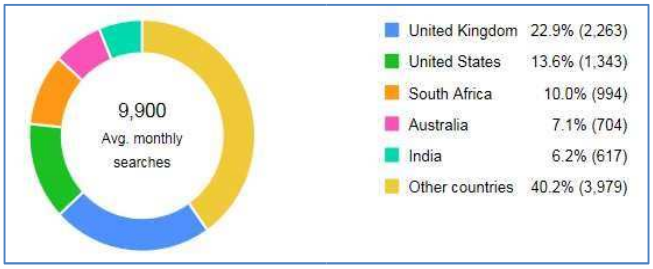
Geographical Distribution of the Search Term "Hazelnuts"



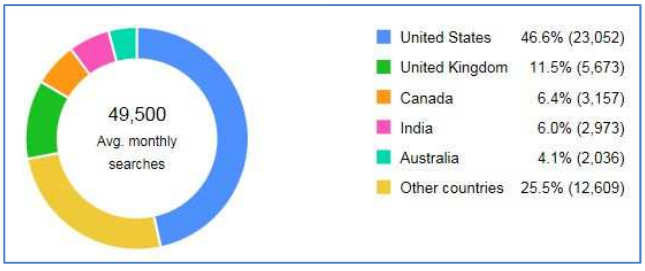
Geographical Distribution of the Search Term "Macadamia Nuts"



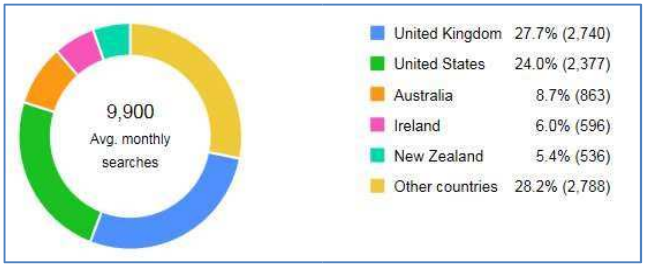
Geographical Distribution of the Search Term "Peanuts"



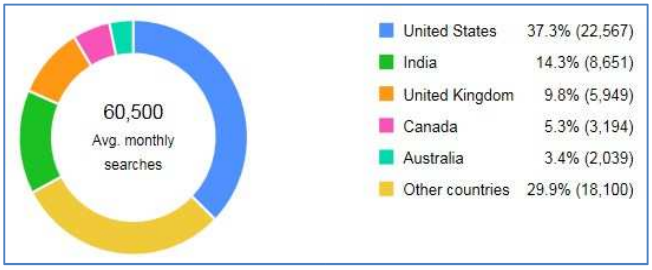
Geographical Distribution of the Search Term "Pecan Nuts"



Geographical Distribution of the Search Term "Pine Nuts"



Geographical Distribution of the Search Term "Pistachio Nuts"



Geographical Distribution of the Search Term "Walnuts"

Source: Google (2015).

1.2 Markets that have medium-to-high nuts consumption

1.2.1 China

In China, tree nuts are valued for their nutritional properties by the urban middle class (Tang 2012). The USDA (2014) reports that nut consumption is highest in first tier cities such as Beijing, Tianjin, Shanghai and Guangzhou. Nut consumers are mostly young and well educated (Tang 2012). They are attributed a rising income but display price-sensitivity in their choices (USDA 2014). Another prominent segment of consumers are those who purchased nuts as gifts. Tang (2012, p. 2) comments that, “the Mid-Autumn Festival and Lunar New Year are the best seasons for imported tree-nut sales and consumption.” However, later reports note that institutional reforms have caused decline in the purchase of giftpackaged nuts by organisations (USDA 2014).

1.2.2 Japan

Data collected at a promotional event by USDA in Japan indicates that tree nuts are of most interest to women, given that 60% of attendees were female (Noguchi 2012). 30-39 year-olds were the largest age demographic in attendance (27.8%) followed by 40-49 year olds (26.7%). This is confirmed by the Japanese External Trade Organisation (2011, p. 14) which has observed many television programs promoting the health benefits of nuts to “young women.” However, Euromonitor International (2015e) notes that snacks, particularly healthy varieties such as nuts are most highly valued by young people and the elderly.

1.2.3 India

Similarly, Indian nut consumption peaks during the festival season, between September and January. The report also affirms that most nut-consumers are a part of the middle class (Aradhey 2013). As this group continues to grow, in line with India's population as a whole, nut consumption is expected to increase. In another similarity to the Chinese market, most Indian consumers appreciate the nutritional value of tree nuts. They are particularly marketed as source of energy for the young, active or recovering (Aradhey 2013). In an early report, Aradhey (2012) also remarks that Indian consumers are often willing to try new

nut varieties and nuts from various producers rather than displaying loyalty to any particular type. Borris and Brunke (2012) write that India is a large market for unshelled nuts. They are then shelled and produced into other nut-products, a process enabled by India's secondary industrial sector and large workforce.

1.2.4 United States of America

A study by the USA's National Centre for Health Statisics (NCHS) found that nut consumption was higher among older markets; that is 35% of 20-39 year olds consumed nuts, as compared with 38.6% of 40-59 year olds and 42.3% of those aged 60 and over (Kit, Nielson & Ogden 2014).

Segmenting the market by gender, women were more likely to consume nuts than men (39.5% and 36.7% respectively). Higher consumption was also found among people of Caucasian ethnicity as opposed to African American or Hispanic descent. Kit, Nielson and Ogden (2014) also state that the US market prefer nuts as a single-item food as opposed to an ingredient in cereals, cookies and cakes etc.

Another high consuming market is individuals on a vegetarian or vegan diet. The North American Vegetarian Society (Aronson & Kimmel 2015) claims that this market eats nuts as meal components rather than snack foods, as a source of protein (Aronson & Kimmel 2015).

1.2.5 Australia

In 2012, 2% of Australians consumed 30g of nuts per day 14% consumed nuts weekly, 11% fornightly and 58% monthly (Horticulture Australia 2012). Roy Morgan Research (Nagaratnam 2014) states that nuts are more frequently consumed by women (39%) than men (35%). They have also identified that nuts are most popular among Australians aged between 50 and 64 years old (Nagaratnam 2014). The

Australian Macadamia Society have released a detailed assessment of their market, reporting that Australian macadamia nut consumers are intensely health conscious, value a balanced diet, homecooked meals and premium products (Ziehlke 2015).

1.2.6 United Kingdom

Research by Mintel reveals that consumption of nuts in the UK is highest amongst older generations (Stones 2010). Mintel (2010) also report that nuts are more frequently consumed by those with higher discretionary income. This aligns with a report from LACORS (2009) which suggests that consumers consider most nut varieties to be luxury food. They are also viewed to festive products with consumption of brazil nuts, walnuts and hazelnuts peaking during the Christmas period (LACORS 2009).

1.3 Reasons for this Medium-to-High Nut Consumption

1.3.1 China

Luna (2014) writes that Chinese demand for nuts is "driven by a shift to a more health-conscious diet and the rise of the Chinese middle class." Nutritional foods have become increasingly valuable (Lai 2013). This

is especially the case amongst youth (Harashima 2015). The ANIC (2014 p. 12) confirms that "increased consumer awareness of the health benefits of nuts is increasing global demand." The growth of the Chinese middle class has been widely noted as a market opportunity. Wildeboer (2015) notes that increased income among this group has led to changes in their consumption: namely a demand for more exotic, higher quality products. Qui (2011) writes that young consumers are spending more on snack foods, especially imported snacks. Both Qui (2011) and Wildeboer (2015) note that imported snacks are considered safer due to a number of "food and product safety scares" in Chinese factories.

China does grow a significant amount of nuts for domestic consumption. However, the ANIC (2014) has observed increased exports, particularly of pecans, to China in the last quarter of the year, meeting demand while domestic crops are out of season. The trend of importing nuts in-shell, particularly prominent in Hong Kong has continued (ANIC 2014; Lai 2013). Lai (2013, p. 3) writes that "Hong Kong re-exports over half of its imported tree nuts to other markets with Vietnam, China and Taiwan being top of the three export markets in 2012. Finally, consumer preferences in each area drive high demand. Salted products are favoured in Northern China whereas those in the East (around the Shanghai region) display a preference for sweet products (USDA 2014). Southern China consumers are more likely to purchase natural products (USDA 2014).

1.3.2 Japan

Canada's International Markets Bureau (2013a) have reported that "Japanese consumers are among the most health conscious in the world," which is predicted to continue increasing. The health benefits of nuts "in relation to heart disease, diabetes and weight management," (Epplett 2014) have become more widely known, driving increased nut consumption (International Markets Bureau Canada 2013a; Japan External Trade Organisation 2011; Noguchi 2012). Increased consumption is also attributed to the promotion of nuts as beauty enhancing by television programs (Japan External Trade Organisation 2011; Noguchi 2012). In fact, nuts and meat are the only food items expected to experience increased consumption by 2017 as Japan faces a decline in demand for fresh food (Ministry of Agriculture British Columbia 2014).

The shift towards ethical production is also observed to drive nut consumption in Japan (Epplett 2014). Japanese consumers have traditionally placed a higher value on domestically produced foods preferring to support their local economy (International Markets Bureau Canada 2013a). Concerns over radiation and decreased production have caused increased demand for imported foods which are of premium quality and produced in a sustainable fashion (International Markets Bureau Candada 2013b). In fact, the Australian Macadamia Society attributes the growth in macadamia nut demand to this trend (Epplett

2014). Finally, the Australian Trade Commission (2015) reports that Japan has a rising number of single households which has resulted in a high demand for convenient food products such as nuts.

1.3.3 India

One of the main reasons for high nut consumption in India is the traditional diet of its people. Pohl (cited in Angle 2009, p. 10) writes, "India has the second largest population in the world, and has the largest vegetarian percentage, so non-meat products high in protein are, naturally, in great demand."
Angle (2009) goes on to confirm that nutritional value is important to Indian consumers. This increased health awareness, noted in other markets, is expected to become more widespread in India as the population grows and incomes rise (Joshi 2014).

Current trends impacting Indian consumption include continued gift buying associated with festivals and seasons, expansion of the middle class, increased disposable income and continued urbanisation (Netscribes 2013). Nerenberg (2011) writes that festivals encourage increased consumption of nuts across South East Asia. Nuts are a traditional component of gift hampers for the Diwali Festival (Kaul 2014). Infact, Kant Kumar and Mehta (2014) write that 40% of India's annual nut consumption occurs during Diwali. Additionally, consumption in India has been changing due to the growing middle class. Mukherjee and Satija (2012) estimate that by 2025, this group will be comprised of 538 million people; that is 41% of India's total population, up from 5% in 2005. This rising disposable income is spent mostly on food (Mukherjee & Satija 2012), an area where continued growth is anticipated (Joshi 2014). Finally, Netscribes (2013) reports that urbanisation in India is creating busier lifestyles and increased demand for convenient snack products. Agarwal (cited in Kurian 2014) identifies that many consumers are now choosing snacks as meal replacements, with nuts seen as a healthy alternative to sweet products.

1.3.4 United States of America

The main drivers of high nut consumption in the USA are health consciousness and convenience. Firstly, US consumers continue to display increased value of nutritional products; the International Food Information Council revealed that for 71% of survey respondents, "healthfulness was a major factor in how they bought food," (Videojet 2014). This is particularly true for Generation Y and Z (Watson 2015), a market said to be driving healthy snack consumption (Wildeboer 2015). US consumers have also displayed more interest in the ingredients of their food purchases (Videojet 2014). Additionally, purchase of organic products has experienced growth as individuals examine products more carefully (Videojet 2014).

This increased health awareness has been coupled with increased understanding of nuts and their nutritional value. In 1992, the Adventist Health Study connected walnut consumption to reduced risk of

coronary heart disease (CHD) (Beeson et al. 1992). Since then, new research and "wide media coverage of recent evidence connecting nut consumption to a wide range of health benefits," (Ros 2010) has driven increased demand for nuts. Some of the most influential research includes Hu and Willet's (2002) confirmation that nuts reduce the risk of CHD. This was endorsed nationally by the US Food and Drug Administration (FDA 2003), which released the claim: "scientific evidence suggests, but does not prove, that eating 1.5 ounces per day of most nuts as part of a diet low in saturated fat and cholesterol may reduce the risk of heart disease."

Further, demand for nuts have increased as they have been proven to lower blood cholesterol (FDA 2003), reduce the risk of Type Two Diabetes (Fulgoni et al 2004) and contribute to weight loss in the form of reduced Body Mass Index and waist-circumference (Fulgoni et al 2004). Ros (2010) also writes of a shift in the US public's view of nuts. A study by the University of Michigan asserts that Americans traditionally avoided nuts due to their high fat content (Tan 2011); however, consumption has increased with changes in perception toward fats. Public acceptance of 'healthy fats' has increased the perceived value of nuts (Tan 2011).

Finally, the popularity of new diet trends has influenced nut consumption. The Mediterranean Diet – high in vegetables, olive oil, nuts and fruits while low in red meat, salt and dairy – has remained popular in Western nations (Baer-Sinnot 2013). It is ranked as the most effective diet in America alongside similar diets: the DASH Diet, the TLC Diet and the Mayo Clinic Diet, which recommend nuts as a protein source (US News 2015). Narula (2015) notes that nuts are also valued in the Nordic Diet, which is gaining popularity. The popularity of Paleo and Raw food diets (Sachs 2014) have also created increased demand for nut products.

1.3.5 Australia

Horticulture Australia (2012) report that nut consumption in Australia has been significantly hindered by the perception that nuts are fattening. However, the Australian Nut Industry Council's Nuts for Life program has been credited with raising awareness of the health benefits of nuts and significantly increasing domestic consumption (ANIC 2009). This aligns with Settineri's (2014) report that Australia's growing health awareness is driving healthy snacking trends.

In addition to a general health awareness, diet trends have strongly influenced demand for nuts in Australia. Paleo, vegan and raw food diets have grown in popularity, causing a spike in demand for nutbased milk products (Langely 2014). Demand for gluten-free and organic products is also increasing the market for nuts (Boothroyd 2014). Euromonitor International (2014g) predict a 12% growth in sales of organic nuts in 2015.

Demand for nuts has also been driven by Australian's growing focus on foods which are "locally and seasonally sourced," (Langely 2014), particularly macadamia nuts. Euromonitor International (2014g, p. 4) report that Australians purchase organic nuts in particular for "health, ethical, sustainability and environmental regions." Convenience is also a significant growth driver in Australia (Settineri 2014). This is corroborated by Langely (2014) and Euromonitor International (2014g).

Finally, Australians still consider nuts to be somewhat of a luxury or occasional food. Horticulture Australia (2012) reports that 37% of consumers ate nuts during air travel. The same report suggests that demand for nuts is socially influenced with 58% of people consuming nuts at parties and 31% as a complement to alcoholic beverages.

1.3.6 United Kingdom

The growing global health awareness is also evident in the UK, driving increased demand for nut products (Euromonitor International 2014f; Gray 2015). A Mintel (2010) study revealed that 44% of consumers in the UK purchased nuts as a healthy alternative to crisps. However, the study also showed that consumers are often confused about the nutritional value of nuts, preventing some purchases (Mintel 2010). Similar trends driving demand include consumer preferences for natural products (Gray 2015) and growth of the organic market (Scott-Thomas 2015).

The Independent Newspaper (2011) report that increased nut consumption is a reflection of the global shift away from frequent red meat consumption. People who regularly avoid meat products, termed flexitarians, join paleo consumers in high nut consumption patterns (Magee 2014). In addition to this health focus, increased nut consumption has been driven by a resurgence in home-cooking (Mintel 2010). The Independent Newspaper (2011) corroborates that celebrity chefs such as Jamie Oliver and Hugh Fearnley-Whittingshall are identified as influential on consumer choices.

2.0 NUT QUALITY STANDARDS AND REQUIREMENTS

Quality requirements for tree nuts and in some cases, specifically for canarium nuts, exist on a number of levels. The following section provides information about regulatory bodies and identifies documents in which the quality standards are declared.

2.1 Global

Codex Alimentarius is a body established by the UN, built on the collaboration between the Food and Agricultural Organisation and the World Health Organisation. Codex Alimentarius provide international food standards. Quality standards for canarium nuts were drafted in 2012.

Draft of a Standard for Galip Nut (Prepared by the Delegate for Papua New Guinea): ftp://ftp.fao.org/codex/meetings/CCNASWP/ccnaswp12/na12_14e.pdf. Codex Alimentarius have also published Hygiene Standards for Tree Nuts: http://www.codexalimentarius.org/standards/list-ofstandards/en/?provide=standards&orderField=fullReference&sort=asc&num1=CAC/RCP.

Additionally, companies can seek the accreditation from international companies and organisations. The International Organisation for Standardisation (ISO) publishes internationally recognised food quality standards. Standards of interest include ISO 16050 (which determines aflatoxin levels in nuts - http://www.iso.org/iso/home/store/catalogue_tc/catalogue_detail.htm?csnumber=29628), ISO 22000 Food Safety Management - http://www.iso.org/iso/home/store/catalogue_tc/catalogue_detail.htm?csnumber=60992) and ISO 9000 (Quality Management - http://www.iso.org/iso/iso_9000); however, it is recognised that attaining such certification is beyond the scope of the project at this stage.

Other Standards and internationally recognised certifications include the British Retail Consortium Global Food certification (http://www.brcglobalstandards.com/Manufacturers/Food/Whatitcovers.aspx), and The Hazard Analysis Critical Control Point (HACCP http://www.haccp.com.au/documents/HACCP4PPAUSOCT14LR.pdf). Again, reservations are held as to the achievability of these standards but they provide information as to the processes and product attributes that are valued.

2.2 China

2.2.1 Regional

China is a member state of the United Nations Economic Commission for Asia and the Pacific (UNESCAP). UNESCAP endorses the standards set forth by the United Nations Economic Commission for Europe (UNECE), which creates nut quality standards enforced across Europe and North America. Different standards are in place for each nut type and these are further differentiated by shelled and unshelled varieties.

UNECE Standards Concerning the Marketing and Commercial Quality Control of Sweet Almonds* unshelled: http://www.nutfruit.org/unece-standards-concerning-the-marketing-and-commercialquality-control-of-sweet-almonds-unshelled_47610.pdf

UNECE Standards Concerning the Marketing and Commercial Quality Control of Almond Kernals: http://www.nutfruit.org/unece-standards-concerning-the-marketing-and-commercial-quality-controlof-almonds-kernels_47608.pdf

2.2.2 National

China's Food Safety Law (2009) provides a comprehensive set of standards relating to production, packaging and transportation of imported foods. Quality standards are addressed by the National Food Safety Standards of China. These standards can be accessed at: http://www.cirsgroup.com/food/downloads/China_National_Standards__GB__download/. Imported nuts are currently governed by the Hygienic Standard on Food of Nuts (GB 16326-2005). However, on the 24th of May 2015, this will be replaced by the National Food Safety Standard on Nut and Seed Food (GB 19300-2014): http://www.fas.usda.gov/data/china-national-food-safety-standardnut-and-seed-food.

The Chinese government requires tree nut importers to provide a Phytosanitary Certificate such as this one from the USDA: http://www.aphis.usda.gov/import_export/plants/plant_exports/downloads/ppq572.pdf

This report by USDA also provides detailed information about the requirements of exporting food products to China: http://www.chilealimentos.com/medios/Servicios/Normas_internacionales/Norma_otros_paises/China/Food_and_Agricultural_Import_Regulations_and_Standards_Certification_Beijing_China_enro2010_USDA.pdf. This information sheet from the Agricultural & Processed Food Products Export Development Authority in India is also useful: http://agriexchange.apeda.gov.in/food_standards/Int_document/China.pdf

* Almond standards have been used most commonly as canarium nuts have been described as 'almond-like.' Standards regarding peanuts, pistachios, walnuts and other varieties are also available.

2.3 Japan

2.3.1 National

Nuts exported to Japan are subject to the Food Sanitation Law, which can be accessed at: http://www.mhlw.go.jp/english/topics/importedfoods/index.html. Complementing are the Guidelines on Hygienic Control of Import Processed Foods: http://www.mhlw.go.jp/english/topics/importedfoods/guideline/01.html. When products are deemed non-compliant with the Food Sanitation Law, they are issued a notification from the MHLW Quarantine Station. The INC report *Japan: Import Border Rejections – Nuts and Dried Fruits* describes the main issues identified in nut products, such as high levels of aflatoxins, sulphites and mould. This report is found at http://www.nutfruit.org/2010-japan-report_4774.pdf

The chapter on nuts in the *Guidebook for Export to Japan* by the Japan External Trade Organisation

(2011) provides detailed information about nut import procedures: http://www.jetro.go.jp/ext_images/mexico/mercadeo/3Enuts.pdf

2.4 India

2.4.1 National

The recently established Food Safety and Standard Authority of India (FSSAI) provides food quality standards for imported products. The latest version of India's Food Safety and Standards Rules are available at: http://www.fssai.gov.in/portals/0/pdf/fss_rules_2011_english_06-05-2011.pdf

India is a major producer of cashew nuts. These cashew nuts are graded according to the Cashew Kernels Grading and Marking Rules, provided by India's Agricultural Marketing Information Network: http://agmarknet.nic.in/cashewkernelsgmr.pdf. Additionally, the Bureau of Indian Standards have written specifications for cashew nuts and walnuts, which are available at: http://www.bis.org.in/index.asp under Fruits, Vegetables and Allied Products.

2.5 United States of America

2.5.1 Regional

The USA is a member state of the UNECE, meaning that it also complies with the standards identified as influential on the Chinese region.

2.5.2 National

Standards are also specified by the United States Government as to the quality of nuts to be sold domestically. Quality requirements include the colour, texture, size and uniformity of the nuts. Such quality standards are elements are set out by the United States Department of Agriculture (USDA) under the Agricultural Marketing Act 1946.

United States Standards for Grades of Almonds in the Shell: http://ucfoodsafety.ucdavis.edu/files/175432.pdf United States Standards for Grades of Shelled Almonds: http://ucfoodsafety.ucdavis.edu/files/175431.pdf

The USDA also provide a visual aid to accompany these standards: http://www.ams.usda.gov/AMSv1.0/getfile?dDocName=STELPRDC5098127

This handbook, although quite old, also provides more information as to the requirements of the US government: http://www.ams.usda.gov/AMSv1.0/getfile?dDocName=STELPRDC5098111

The United States Food and Drug Administration also has released a Guidance for Industry on labelling products considered major food allergens. They specify that 'hickory nuts' are to be included in this category, making them subject to these standards.

Guidance for Industry: A Food Labelling Guide: http://www.fda.gov/Food/GuidanceRegulation/GuidanceDocumentsRegulatoryInformation/LabelingNutrition/ucm064880.htm

2.6 Australia

2.6.1 National

Quality standards for nut products imported into Australia are declared in the Australia New Zealand Food Standards Code. Nuts are specifically addressed under Section 2.3.1. Other sections which may be relevant include: s 1.2.7 Nutrition, Health and Related Claims; Part 1.4 Contaminants and Residues; and Part 3.2 Food Safety Requirements. The full code can be accessed at http://www.foodstandards.gov.au/code/Pages/default.aspx. There are also a number of helpful user guides available at http://www.foodstandards.gov.au/code/userguide/Pages/default.aspx.

2.7 United Kingdom

2.7.1 Regional

Also a member state of UNECE, their nut quality standards are also relevant to products in the UK.

The European Union has also declared specific standards for fruit and vegetable products, which requires nuts to be of "sound, fair and marketable quality," (European Commission 2015a). This are outlined in Regulation (EU) No 543/2011 in Annex I, beginning page 54: http://eur-lex.europa.eu/legalcontent/EN/TXT/PDF/?uri=CELEX:32011R0543&from=en. Both shelled and in shell are exempt from these standards. However, the European Commission (2015a) note that compliance with UNECE qualifies products as acceptable.

Other relevant EU legislation includes (EC) No 1881/2006 which restricts aflatoxin levels in nuts – see Section 2 of Annex I, page 11 http://faolex.fao.org/docs/pdf/eur68134.pdf). Additionally, the European Union Help Desk allows potential importer to input their product code, origin and destination to find a user-friendly review of other applicable food safety requirements. This service is found at http://exporthelp.europa.eu/thdapp/display.htm?page=form%2fform_MyExport.html&docType=main&languageId=en. There is no specific product code for canarium nuts; however, the code for "other" varieties is 0802 90 85.

The European Commission's (2015b) food classification system determines products not consumed in high volumes within the region prior to 1997 as novel foods, providing the example of chia seeds. Caranarium Indicum were rejected as novel food products in 2000, as outlined at http://eurlex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32001D0017&from=EN.

2.7.2 National

National standards for nut quality are not specified in this case as the EU and UNECE standards provide the authority for all European countries. More reports are available through the International Nut and Dried Fruit Council. There database can be accessed at http://www.nutfruit.org/en/regulatoryscientific-affairs_6476. It may also be interesting to observe the standards used in the Philippines, a major producer of canarium nuts: ftp://law.resource.org/pub/ph/ibr/pns.28.2010.pdf

3.0 CANARIUM NUT COMPETITORS

3.1 Competing Types of Nuts

The International Nut and Dried Fruit Council's latest data reveals the top ten nuts consumed globally in 2013 (see Table 3).

Table 3: Global Nut Consumption by Type

Nut Type	Consumption in 2012 (Metric Tonnes)	Consumption in 2013 (Metric Tonnes)	Consumption Pattern 2012- 2013
Peanuts	35,990,518	35,990,513	-5
Almonds	929,472	1,102,492	+173,020
Cashew Nuts	560,008	675,339	+115,331
Walnuts	506,013	584,836	+78,823
Pistachio Nuts	703,560	544,291	-159,269
Hazelnuts	357,993	433,270	+75,277
Pecan Nuts	99,412	110,760	+11,348
Macadamia Nuts	41,505	37,092	-4,413
Amazonia (Brazil Nuts)	26,675	27,270	+595
Pine Nuts	28,789	20,867	-7,922

Peanuts, although technically a legume, are by far the most popular variety. Global peanut consumption has increased by 15.9% since 2009 and now seems quite stable (INC 2015). In contrast, almonds consumption is showing continued growth. Consumption has increased by 49.8% over the past five years, making almonds the world's second most highly consumed nut. In some markets, almonds have now surpassed peanuts as the most popular type (see Table 4). They are followed in popularity by cashew nuts, pistachio nuts, hazelnuts, pecan nuts, macadamia nuts, brazil nuts and finally, pine nuts.

The most growth was observed in hazelnuts with consumption increasing by 55% since 2009. Again, almonds came in second (49.8% growth rate), followed by walnuts (+34.14%) cashew nuts (+29%), macadamia nuts (+27.52%) and trailed by pecan nuts (+4.72%). Pine nuts showed an increase in

consumption of 7.02% from 2009. Prior to 2009, consumption was in steep decline; the market is now said to have recovered with consumption now higher than ten years prior.

Finally, decline was most evident in pistachio nut consumption, which fell by 10.36% from 2009. Brazil nuts also fell by 9.19%. These nuts, identified as the most highly consumed by the INC, vary in popularity globally. Table 4 depicts the consumption patterns of these nut types in major markets.

Table 4: Ranking of Most Popular Nut Types

	Top Ten Nuts Consumed in Each Market					
	China	**India**	**USA**	**UK**	**Australia**	**Japan**
1	Peanuts	Peanuts	Peanuts	Peanuts	Almonds	Almonds
2	Walnuts	Cashew Nuts	Almonds	Almonds	Cashew Nuts	Peanuts
3	Pistachio Nuts	Pistachio Nuts	Walnuts	Cashew Nuts	Macadamia Nuts	Cashew Nuts
4	Cashew Nuts	Walnuts	Cashew Nuts	Walnuts	Walnuts	Pistachio Nuts
5	Pine Nuts	Almonds	Pistachio Nuts	Brazil Nuts	Pistachio Nuts	Macadamia Nuts
6	Almonds	-	Pecan Nuts	Pistachio Nuts	Hazelnuts	Pecan Nuts
7	Macadamia Nuts	-	Hazelnuts	Hazelnuts	Brazil Nuts	-
8	Brazil Nuts	-	Brazil Nuts	Pecan Nuts	Pine Nuts	-
9	Pecan Nuts	-	Macadamia Nuts	Pine Nuts	Pecan Nuts	-
10	-	-	Pine Nuts	Macadamia Nuts	-	-

* Dashes indicate that the country was not among the top 20 consumers of that variety. Source: Adapted from INC (2015).

3.2 Competing Nut Producers

Bourke, Evans and Stevens (1994, p. 12) describe that there are “more than 50 species of Canarium (Burserace), spread from West Africa to Polynesia.” A summary of the most prominent species and their location is provided in Figure 2.

Figure 2: Prominent species and their location

Figure 2 illustrates some of the canarium species with reference to their origin. Thus, it is these regions that are the main producers of the nut, in competition with Papua New Guinea. Firstly, producers of the Melanesian species included the Solomon Islands and Vanuatu. Pili nuts from the Philippines are revealed to be the most highly cultivated and exported. Finally, varieties from Indonesia, China and Sri Lanka have their own markets.

3.2.1 The Solomon Islands

Bourke et al. (2005) estimate that 7000 tonnes of canarium nuts are grown each year in the Solomon Islands. Currently, the domestic demand for the nuts exceeds supply, just one of the inhibiting factors to the Solomon Islands as a major exporter (Bunt & Leakey 2008). The NGO Kustom Garden Association is currently working on a project to begin exporting canarium nuts to New Caledonia (Island Sun 2014).
The nuts are also cultivated in order to extract and export their oil. This occurs mainly on Makira/Ulawa Island where plantations were set up in the 1990s (Bunt and Leakey 2008). Other provinces involved in cultivation include Choisel, Guadaalcanal, Malaita and Western (Pauku, Lowe & Leakey 2010).

3.2.2 Vanuatu

Of course, development of export markets is also occurring in Vanuatu. The country has less supply than Papua New Guinea (Wallace 2014) but is more easily able to access its markets through tourism and reputation. Producers are focussing on canarium products as snacks for convenience, snacks for entertainment, exotic cooking ingredients and luxury gifts (Raciti 2014). The oil, called nangai oil is used in products include such as moisturisers and cosmetics (The Summit Vanuatu 2013).

3.2.3 Wider Pacific Region

The nuts are also native to Tonga (Evans 1999) and Samoa, yet they are not being grown commercially (Elevtich 206). However, Elevitch (2006) notes that varieties have been introduced to Fiji and North Queensland where they are cultivated on a small scale.

3.2.4 The Philippines

The Philippines is the most significant producer of the world's canarium nuts, locally called pili nuts. Most nuts are grown in the Bicol region: processors range from collectors who harvest wild trees to individual farmers and large scale plantations with the capacity of processing 60 metric tonnes per year (Philagrivest 2015). New processing plants are being developed on the Tablas Islands which aim to produce pili nuts and pili nut pulp oil for export to China (see Appendix A). Canarium nut plantations are also marketed as investment opportunities for foreigners (Bech's Organic Pili Nut Farm 2015). Outside of the commercial sector, both the Filipino Government and NGOs such as ACDI/VOCA have encouraged and facilitated planting Canarium Ovatum trees (Green World 2015).

Commercial export has recently become more and more viable. The Regional Executive Director of the Philippines Department of Agriculture, Marrilyn Sta. Catalina (cited in Calleja 2010) says that the country "has a monopoly on the foreign market," with the main export destinations being Hong Kong and Taiwan. The Canarium Luzonicum variety is also cultivated but mainly for its resin. Called elemi resin, this is used as a component of varnishes and distilled to extract oil, of which India is a major exporter (Lyth 2003).

3.2.5 Indonesia

Indonesia's canarium species, kenari nuts and java almonds are concentrated in Maluka and North Sulawesi (Elliot 2015). Domestically, kenari nuts are used in confectionaries and baked goods. It is also noted that oil is extracted, particularly for use in massage therapy. The nuts are currently being exported by companies such as Rempah Agro Indonesia and P.T Supa Surya Niaga, although no data is published as to annual quantities etc. Some companies operating in Indonesia source their product from Malaysia (Cefa Sdn Bhd 2015). Trade of java almonds has a long history with records showing the first imports into the USA in 1916 (USDA 1921). Today, they are exported to the USA and South Africa among other destinations.

3.2.6 Malaysia

Canarium Ovatum has been planted in Malaysia by the Department of Agriculture Sabah in order to conduct research (Maaruf et al. 2014). Research is currently focused on the properties, uses and extraction of canarium nut oil so that it may be more widely used (Maaruf et al. 2014). Oil extraction is an advancement in Malaysia where the domestic market have historically displayed a preference for raw

or pickled nuts (Innvista 2015). Although some producers in Malaysia provide nuts for export, it is widely noted that the short shelf-life of the nuts make this very difficult (FAO n.d; Innvista 2015).

3.2.7 China

The Canarium Album species, native to China, produces a fruit known as the Chinese Olive or kan lan (Davidson 2014). This variety is valued for its flesh rather than its kernel and has been eaten domestically since at least 600AD (Davidson 2014; Innvista 2015). They are not particularly cultivated for oil (Specialty Produce 2012). As such, Chinese producers do not provide competition for those in Papua New Guinea.

3.2.8 Sri Lanka

The main variety grown in Sri Lanka is Canarium Zeylanicum (Friedlaender 2007). The Forest Department of Sri Lanka (n.d) identify that nuts are collected on a small scale for use as resin and incense. As a result, the country is also determined not to be in competition with producers in Papua New Guinea.

3.3 Competing Nut Companies

Companies selling nut products determined to be in competition with canarium nuts have been identified in each of the primary and secondary markets. In cases where specific data on snack nut brands was not available, the most dominant companies in the sweet and savoury snack industry are listed. When this is the case, companies which sell nut products are highlighted in orange.

3.3.1 China

Hoover's Inc (2013) writes that "in China, the number of foreign-owned snack food companies is relatively small, but foreign companies control about half the snack food market." Burkitt (2012) writes that the top foreign snack food brands in China are: Want Want Holdings, Kraft Foods, Lilwayway, Danone, WM Wrigley Jr Company, Dove and Orion respectively. Updated data reveals that Want Want Holdings is in-fact the leading performer with 12.3% of the market in 2014 (Euromonitor International 2015c). They are followed by Guangdon Strong (Group) Co Ltd, the most prominent domestic company with 7.5% and PepsiCo China Ltd with 4.4% (Table 5).

Table 5: Competing Snack Companies in China and their Market Share

Company	Market Share (%)	Web Address/ Links to Nut Products
Want Want Holdings	12.3	http://www.want-want.com/en/wonderful/default_74595266874834944.aspx
Guangdong Strong (Group) Co Ltd	7.5	http://www.strongfood.com.cn/en/enproduct.aspx
PepsiCo China Ltd	4.4	http://www.pepsico.com.cn/
Shanghai Liwayway Food Ind Ltd	4.3	http://www.oishi.com.cn/en/about.htm (flavoured nuts, e.g. http://annepluggedme.blogspot.com.au/2011/11/oishi-pinattsuseaweed.html)

Orion China Co Ltd	3.9	http://en.orionworld.ru/about.html
Hefei Huatai Food Co Ltd	3.9	http://en.chacheer.com.cn/products_list.html (mixed nuts, e.g. http://www.e-cantonfair.com/products/chacha-pistachio-nuts-434122.html)
Fujian Qinqin Holding Co Ltd	2.5	http://www.fjqinqin.com/en/mybrand/qq/
Labixiaoxin (Fujian) Foods Industrial Co Ltd	2.3	http://www.lbxx.cn/en/product.php
Shanghai Tenwow Food Co Ltd	1.3	http://www.78wy.com/images/tenwow_salty_hickorypz10eace4-z1fedbf.html (natural flavoured nuts)
Ningbo Hengkang Food Co Ltd	1.2	http://www.china-hengkang.com/English/Product.aspx?type=21 (natural flavoured nuts)
Kraft Foods (now Mondelez China)	-	http://cn.mondelezinternational.com/brand-family
Danone	-	http://www.danone.com/en/for-all/our-4-business-lines/freshdairy-products/
WM Wrigley Jr	-	http://www.wrigley.com/global/brands/worldwidebrands.aspx#brandRegion6
Dove (A subsidiary of Mars)	-	http://www.mars.com/global/brands/chocolate.aspx
Fisher Nuts	-	https://www.fishernuts.com/

Focusing on snack nuts, the most popular variety is from Chacha Food Co Ltd, a subsidiary of Hefei Huatai Food Co (Wan 2014). Packaged nuts from Shanghai Liwayway Foods', Shanghai Tenwow Food Co Ltd and Ningbo Hengkang Food Co provide significant competition. Less prominent competitors include Fisher Nuts from the USA, Xiao Liu, Xufuji and Jiashili.

3.3.2 Japan

With 16% of the market in 2014, the well-established Calbee Foods Co Ltd, which specialises in chips, maintained its position as the most popular snack company (Euromonitor International 2015e). They were followed by Kameda Seika Co Ltd, a rice snack company, with 10.3%, as illustrated in Table 6. Such domestic companies continue to dominate the market due to their ability to capitalise on local flavours.

Table 6: Competing Snack Companies in Japan and their Market Share

Company	Market Share (%)	Web Address/Links to Nut Products
Calbee Foods Co Ltd	16.0	https://www.calbee.com/brands/
Kameda Seika Co Ltd	10.3	http://www.kamedaseika.co.jp/en/subsidiaries/subsidiariesIndex.html (all of these are rice snack brands. E.g. http://thienhakamedafood.com/en)
Natori Co Ltd	3.8	http://translate.google.com.au/translate?hl=en&sl=ja&u=http://www.natori.co.jp/&prev=search
Koikeya Co Ltd	3.7	http://koikeya.co.jp/commodity/
Bourbon Corp	3.2	http://www.bourbon.co.jp/catalog/categories
Sanko Seika Co Ltd	3.1	http://www.amazon.com/Sanko-seika-Japanese-Cheese-Almond-Import/dp/B00FGR6DY4

AEON Group	3.1	http://recipeofhealth.com/nutrition-calories/japanese-aeonmixed-nuts-889686rb (private label mixed nuts)
Seven & I Holdings Co Ltd	2.6	http://www.myfitnesspal.com/food/calories/seven-elevenjapan-mixed-nuts-139389479 (private label mixed nuts)
Iwatsuka Confectionery Co Ltd	2.6	http://www.iwatsukaseika.co.jp/index.shtml
Yamazaki Nabisco Co Ltd	2.6	http://www.yamazakipan.co.jp/english/yamazaki_group/#shokuhin
Denroku Co Ltd	2.4	http://www.denroku.co.jp/product_category/prd-ntskwr - also http://prairiem.com/product_detail_en.php?product_id=53
Meiji Co Ltd	1.9	https://www.asianfoodgrocer.com/asian-food/snackscandy/chocolate-cookies/meiji-chocolate-macadamia (nut chocolate)
Japanese Consumers Cooperative Union	1.9	http://jccu.coop/eng/products/index.php
Tohato Inc	1.7	http://www.amazon.com/Corn-Snack-Caramel-Roasted-Peanuts/dp/B0041J4R1E (nut and popcorn snacks)
Procter & Gamble Far East Inc	1.6	http://www.pg.com/en_US/index.shtml
Tarami Co Ltd	1.5	http://www.longdan.co.uk/?mod=prod&go=2&group=14&cate=144&id=1456
House Foods Corp	1.1	http://www.house-foods.com/categories/
Kyoritsu Foods Co Inc	1.0	http://www.kinomiclub.com/
CGC Japan Co Ltd	0.9	http://www.cgcjapan.co.jp/english/business/ (private label mixed nuts)
Lawson Inc	0.8	http://lawson.jp/en/product_service/product/
Frito-Lay Co Ltd	0.8	http://www.fritolay.co.jp/
Morinaga & Co Ltd	0.8	https://www.morinaga.co.jp/english/products/catalog/ (nut chocolate and cookies e.g. https://twitter.com/japaneseitems/status/558400148548911104)
Ezaki Glico Co Ltd	0.6	http://www.glico.co.jp/en/
Itochu Group	0.6	http://www.itochu.co.jp/en/business/food/
Toyo Nuts Co Ltd	0.6	http://www.toyonut.co.jp/
Kamoi Foods Co Ltd	0.6	http://www.ebay.com.au/itm/Almond-Dried-Sardines-SnackIRIKO-NIBOSHI-22g-From-Japan-/271613287395 (Seafood snacks with nut ingredients)
Uny Co Ltd	0.5	http://www.apitauny.com.hk/catalog/product_info.php?cPath=15_33&products_id=744 (private label nuts)
Kasugai Corp Japan	0.3	http://www.amazon.com/Kasugai-Roasted-Peanut-Japanese-Import/dp/B000BV37EY (mixed nuts)
Goshoku Co Ltd	0.2	http://www.goshoku.co.jp/english/products.html
Multifood Ltd	0.1	Component of Meiji Co Ltd
Meiji Seika Kaisha Ltd	-	http://www.meiji-seika-pharma.co.jp/english/
Others	29.4	-

Prominent nut products include Toyo Nuts' brand Ton's Nuts; mixed nut products from Natori Co Ltd, Denroku Co Ltd, Kyoritsu Foods Co Inc and Kasugai Corp; and private label nut products from supermarkets and convenience stores such as Aeon Group, CGC Co and Uny Co. Companies such as Bourbon Corp, Meiji Co Ltd and Morinanga & Co Ltd use nuts in cakes and chocolates while Sanko-Seika

Co Ltd makes a savoury "Rice Cake with Cheese and Almond."

3.3.3 India

Market Research from Euromonitor International (2015d) reveals that the market is led by Frito-Lay India who held 32% of the value share in 2014. However, domestic companies are experiencing increased success through targeting local markets. The most prominent companies in the market are listed in Table 7.

Table 7: Competing Snack Companies in India and their Market Share

Company	Market Share (%)	Web Address/Links to Nut Products
Frito-Lay India	32.2	http://www.pepsicoindia.co.in/brands/lehar.html
Haldiram Foods International Ltd	20.0	http://www.haldirams.com/festive-packs/roasted-saltedalmond.html
Balaji Wafers Pvt Ltd	8.2	http://www.balajiwafers.com/
ITC Ltd	7.0	http://www.itcportal.com/businesses/fmcg/foods.aspx
Prataap Snacks Pvt Ltd	3.6	http://yellowdiamond.in/namkeen.html
Bikanervala Foods Pvt Ltd	1.7	http://www.bikano.com/Namkeens
Bikaji Foods International Ltd	1.4	http://www.bikaji.in/products_namkeen.php
Parle Products Pvt Ltd	1.2	http://www.parleproducts.com/brands/parlenamkeen/
CavinKare Pvt Ltd	0.9	http://www.cavinkare.com/Peanut_candy.html
Agro Tech Foods Ltd	0.8	http://www.atfoods.com/our-brands/act-ii-popcorn.html
DFM Foods Ltd	0.8	http://www.dfmfoods.com/products-namkeen.html
SM Foods Ltd	0.6	http://www.smfood.com/
Jabsons Foods	-	http://www.jabsons.com/
Others	21.4	

Popular snack nut brands include Lehar Mixes from Frito-Lay with 1.3% value share in 2014, Jabsons Foods and Haldiram's festive packs. Many namkeen products also contain nuts; popular namkeen brands include Bikano, Balaji, Bikaji and Garden.

3.3.4 United States of America

Data from Statista (2013) shows that private label brands were the highest grossing nut snack brands in the US that year. As shown in Figure 3, this is followed by Planters Snack Nuts (owned by Kraft Foods), Wonderful, Blue Diamond and Emerald. The top ten snack brands were completed with a number of secondary brands of the already high-performing companies such as Planters Nutrition and Blue Diamond Smokehouse.

Figure 3: Graph of the Top Ten Snack Nut Brands in the USA (2013)

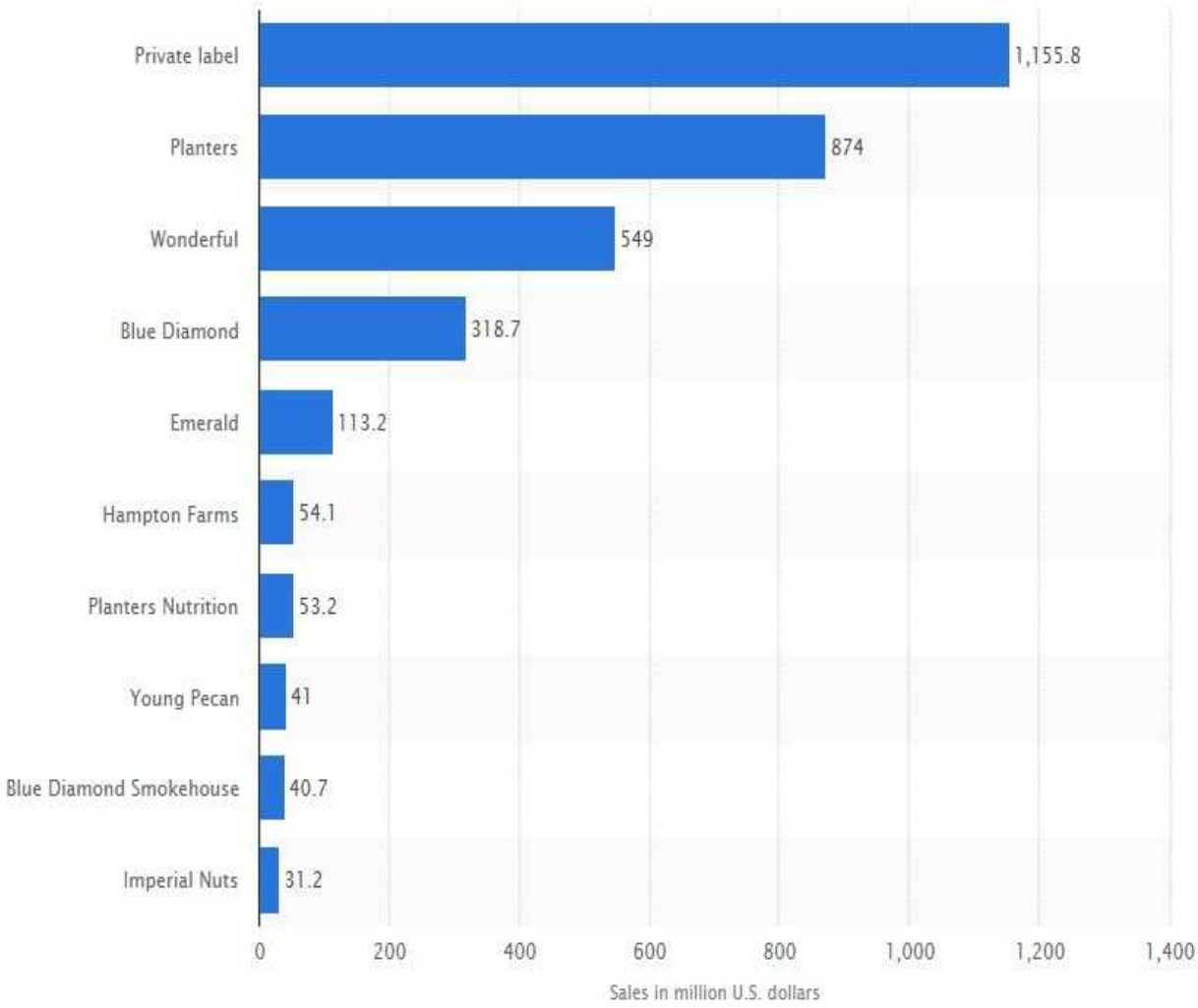


Table 8 provides the web addresses of each of these companies. Please note that this table is not highlighted because all companies referred to specialise in nut products.

Table 8: Competing Snack Companies in the USA and their Market Share

Company	Market Share (%)	Web Address/Links to Nut Products
Private Label	35.7	Examples of private label brands include Woodstock Farms Manufacturing (http://www.woodstockfarmsmfg.com/PrivateLabel/Pages/default.aspx) and Kar's Nuts (http://www.karsnuts.com/brands/private-label/).
Planters	27.0	http://www.planters.com/varieties/mixes.aspx
Wonderful	16.9	http://www.wonderfulbrands.com/
Blue Diamond	9.8	https://bluediamond.com/index.cfm?navid=3
Emerald	3.5	http://www.emeraldnuts.com/products/
Hampton Farms	1.6	http://www.hamptonfarms.com/our-products
Planters Nutrition	1.6	http://www.planters.com/varieties/nutrition.aspx
Young Pecan	1.2	http://www.youngpecan.com/default.asp?ID=1

Blue Diamond Smokehouse	1.2	http://store.bluediamond.com/Smokehouse-Almonds-_p_5.html
Imperial Nuts	0.9	http://www.starsnacks.net/

3.3.5 Australia

Euromonitor International (2014e) write that the Smiths Snack Foods is the "leading player in extruded snacks and nuts," holding 39% of the market share in 2013 (see Table 9). They are followed by Snack Brands Australia with 14% market share (Euromonitor International 2014e). Private labels hold a low amount of the market – they are sustained by their low price but are generally perceived to be low in quality. However, growth in private labels is predicted as Australians continue to seek value for money and supermarkets such as Woolworths and Aldi boost confidence in their quality (Euromonitor International 2014e).

Table 9: Competing Snack Companies in Australia and their Market Share

Company	Market Share (%)	Web Address/Links to Nut Products
Smiths Snack Foods (PepsiCo)	38.8	http://www.smiths.com.au/index.php/our_brands
Snack Brands Australia	14.3	http://snackbrands.com.au/Brands
Woolworths Ltd	5.2	http://www.woolworths.com.au/wps/wcm/connect/Website/Woolworths/Our+Brands/Macro/
Manassen Foods Australia Pty Ltd	5.0	http://www.manassen.com.au/Brand-Detail.asp?CategoryID=80&ProductID=7630
Sakata Rice Snacks Australia Pty Ltd	4.5	http://www.sakata.com.au/
Stuart Alexander & Co Pty Ltd	2.5	http://www.stuartalexander.com.au/brands.php
San Remo Macaroni Co Pty Ltd	2.5	http://sanremo.com.au/
Sunrice Australia Pty Ltd	2.0	https://www.sunrice.com.au/
Select Harvest Ltd	1.1	http://www.selectharvests.com.au/

Link Snacks Inc	0.9	http://www.jacklinks.com/
Nestle Australia Ltd	0.8	http://www.nestle.com.au/brands/snacks-and-muesli-bars
Green's General Foods Pty Ltd	0.8	http://greens.com.au/brands/lowan/
Fresh Food Industries Pty Ltd	0.6	http://www.ffiholdings.com.au/
AAB Holdins Pty Ltd	0.5	http://www.naturesselection.com.au/cmspage.php?intid=120
Superpop Pty Ltd	0.4	http://www.popcorn.com.au/categories/Retail/All-Products/
Amorenuts Australia Pty Ltd	0.2	http://www.trutaste.com.au/collections/others
Billabong Jerky	0.2	https://www.jerky.com.au/
Procter & Gamble Australia Pty Ltd	-	https://www.pg.com/en_ANZ/brands/all-brands.shtml
Sanitarium Health Food Co, The	-	http://www.sanitarium.com.au/
Goodman Fielder Ltd	-	http://www.goodmanfielder.com.au/index.php?q=node/4
Cadbury Schweppes Australia Ltd	-	http://www.schweppesaustralia.com.au/Our-Brands.aspx
Chrystal & Co	-	http://www.michaelfoods.com/news/newsview.cfm?PRKey=356
Arnott's Snack Foods	-	http://www.arnotts.com.au/products/
Macfarms of Hawaii Inc	-	http://macfarms.com/macadamianuts.aspx
Manassen Fine Foods Pty Ltd	-	http://www.manassen.com.au/Default.asp?cid=1&navid=1

In terms of nut snacks specifically, the top performing brands in Australia are Nobbys Nuts (A Smiths Snack Foods brand) with 5.7% of the market in 2013, Sun Sol with 0.9% and Meriram with 0.4% (both Select Harvest brands), Olympic from Fresh Food Industries with 0.6% and AAB Holdings' Mellow Yellow Brand with 0.5% (Euromonitor International 2014e). Amore Nuts and Macfarms Hawaii are also notable.

3.3.6 United Kingdom

With a 31% share of the market, Walkers' Snack Foods was the most prominent company in the industry in 2013 (Euromonitor International 2014f). Private labels from supermarket companies had a combined 17.2% share, followed by KP foods with 9.6% (Euromonitor International 2014f). Details as to the market's structure are provided in Table 10.

Table 10: Competing Snack Companies in the UK and their Market Share

Company	Market Share (%)	Web Address/Links to Nut Products
Walkers' Snack Foods Pty Ltd	31.3	https://www.walkers.co.uk/crisps-range
KP Foods Ltd	9.6	http://www.kpsnacks.com/our-products
Tesco Plc	7.2	http://www.tesco.com/groceries/product/details/?id=257142138
Kellogg Co of Great Britain	5.7	http://www.kelloggs.co.uk/en_GB/product-search.ptnull.pc-true.html

Asda Group Ltd	3.8	http://groceries.asda.com/asdawebstore/landing/home.shtml?cmpid=ahc-_-ghs-sna7-_asdacom-dsk-_-hp&#/aisle/910000975624
J Sainsbury Plc	3.5	http://www.sainsburys.co.uk/shop/gb/groceries/nuts/sain sburys-bbq-coated-peanuts-200g
Kettle Foods Co Ltd	2.8	http://www.kettlefoods.co.uk/our-hand-cooked-chips/
Whitworth Bros Ltd	2.5	http://www.whitworthbros.ltd.uk/
WM Morrison Supermarkets Plc	2.2	https://groceries.morrisons.com/webshop/getCategories.do?tags=%7C105651%7C102705%7C105098%7C105104% 7C108397
Quaker Trading Ltd	1.7	http://www.pepsico.co.uk/quaker-oats
Tyrrells Potato Chips Ltd	1.4	https://www.tyrrellscrisps.co.uk/nibbles/spicy-coatedpeanuts
Jack Link's UK Ltd	1.2	http://jacklinks.eu/en/products/
Seabrook Potato Chips Ltd	0.9	http://www.seabrookcrisps.com/our_range.php
Tayto Ltd	0.7	http://www.tayto.com/products/snacks.html
Union Snack Ltd	0.7	http://www.pretzel.co.uk/
Tangerine Confectionary Ltd	0.6	http://www.tangerineuk.net/our-brands/
Jacob's Bakery Ltd, The	0.5	http://www.jacobs.co.uk/products/
Lidl UK GmbH	0.5	http://www.lidl.co.uk/en/2486.htm?action=showDetail&id=23619
Intersnack Ltd	0.4	http://www.intersnack.com/our-brands-products/ourbrands/
Sun Valley Foods Ltd	0.4	https://www.sunvalleyfoods.com/our-products
Fruit Bowl	0.4	http://www.fruit-bowl.com/products
Red Mill Snack Foods Ltd	0.4	http://www.taquitos.net/snacks.php?manuf_code=36
Popchips Ltd	0.3	http://popchips.com/
Trigon Snacks Ltd	0.3	http://www.trigon-snacks.com/brands/
Cornscape Ltd	0.2	http://www.cornscape.co.uk/crazymaize.html
Sun-Maid Growers of California	0.2	http://www.sunmaid.com/products/products.html
Salty Dog Ltd	0.1	http://saltydog-grrr.com/nuts
Glisten Plc	0.1	http://www.glistenltd.com/Dormen_Foods/Home.aspx?id=7
Bobby's Foods Plc	0.1	http://www.bobbysfoods.co.uk/products/categories/snac ks/17/
Others	21.1	-

The most popular nut snack brands were topped by KP with 1.3% of the market in 2013. Other notable nuts snack brands are Sensations and Tiger Nuts (both by Walkers' Snack Foods), Planters and Big D by Trigon Snacks, Salty Dog Nuts and Dormen's Fine Quality Nuts from Halo Foods.

4.0 CURRENT AND PREDICTED MARKET TRENDS

4.1 Current and Predicted Global Food Trends

4.1.1 China

The dominant food trend affecting Chinese consumers is an increased focus on **health and nutrition**. In 2015, the health food market in China is expected to be worth $70 billion, an increase from $20 billion just five years earlier (CNBC 2015). Euromonitor International (2015c) also note that Chinese consumers display a new-found **demand for food safety** and increased quality regulations. Products which are increasing in popularity include **wine** – China is predicted to lead the world's wine consumption in 2015 (CNBC 2015) – and **fresh fruit**, a by-product of health consciousness (Friedman 2015). Finally, the demand for **convenience** foods continues to impact the market with consumers seeking snacks for energy in the morning and afternoon (Kuiler 2015).

4.1.2 Japan

Beginning in April 2015, the Japanese Consumer Affairs Agency is implementing new health food labelling laws. This is predicted to create **growth in the functional food** market (Moses 2015). Moses (2015) also writes that the increased **popularity of milk alternatives** observed in Australia (see Appendix 5 of the *Canarium Nut Marketing Strategy)* is occurring in Japan. According to Euromonitor International (2015e), there is **reduced demand for snacks**. This is noted to be a result of population demographics – population decline has resulted in fewer young people and many health consciousness older people. This report also notes that the snack market is experiencing **increasing Westernisation**, particularly appealing to young people (Euromonitor International 2015e).

4.1.3 India

Young Indian consumers with higher disposable incomes than ever before are driving increased **demand for premium packaged food products** such as ice-cream and confectionary (Euromontior International 2014b). Also once considered a luxury, both families and young people are dining out more frequently (Nusra 2015). In terms of packaged foods, current data notes that Indian consumers are beginning to covet **hygienic processing** the same way that has been observed in China (Euromonitor International 2015d). The Fast Moving Consumer Goods market is growing; it is estimated that this sector will be worth $74 billion by 2018 (Mirchandani 2015). In line with global trends, **health and nutrition** is a major focus yet consumers are **unwilling to compromise on taste** (Nusra 2015). Also following reflecting global shifts, environmental awareness and ethical food choices are increasingly valued (Nusra 2015). Giving **packaged foods as festive season gifts** has continued to grow in popularity (Euromonitor International 2015d).

4.1.4 United States of America

Consumers continue to display a **focus on health**, leading to increased growth in the snack segment, particularly popcorn and nuts – nuts are predicted to experience a 4% CAGR in 2015 (Euromonitor International 2014g). Growth is also expected in **organic food** which is estimated to experience a 14% CAGR between 2013 and 2018 (Daniells 2015). There is also an **increased focus on natural products** and avoidance of products which are genetically modified, known as GMOs (NPD 2015b). Mintel (2015) describes a growing **demand for transparency in labelling**. This is complemented by growth in the use of **mobile technologies to access information** about product ingredients as well as the corporate social responsibility practices of food companies (Meijers 2014).

The NPD (2015a) reports that the US has seen a steady **decline in the prevalence of dessert** – only 12% of the population eat dessert regularly, half that of 30 years ago. However, **snacking is increasingly popular,** especially amongst 18-34 year-olds (Euromonitor International 2014g). These young consumers are identified as **seeking bold flavours** – their preference for stronger spices and more new flavours is attributed to their more diverse cultural experiences than previous generations (Euromonitor International 2014g).

4.1.5 Australia

As noted in Appendix 5 of Raciti's (2014) *Canarium Nut Marketing Strategy,* Australians also value **healthy options** and **ethical production** (Weber Shandwick 2014). As this trend evolves, Australian consumers display a **preference for natural products**, without compromising on taste (Euromonitor International 2014e). There is also **growing demand for gluten-free and organic products** (Boothroyd 2014; Euromonitor International 2014e). These trends – along with the now established paleo and vegan markets – are cited by Boothroyd (2014) as driving the **popularity of dairy alternatives** such as almond milk. Additionally, **private label products** are expected to continue gaining popularity as consumers seek both value and premium products (Euromonitor International 2014e).

Other trends noted in 2014 which are predicted to continue include an **appreciation of convenience** (Langley 2015), **demand for exotic flavours** (Boothroyd 2014), **growth in food tourism** (Tourism Research Australia 2014), **socialisation of food choices** (Zubieta 2015) and **return to home-cooking** (Weber Shandwick 2014).

4.1.6 United Kingdom

Increased **demand for healthy snacks** was also observed in the UK, leading to **growth in the nuts sector** – such products have also replaced confectionaries to be placed near the checkout at retailers such as

Tesco and Lidl (Euromonitor International 2014f). This trend is predicted to continue with **strong private labels** being instrumental in making nut products more accessible (Euromonitor International 2014f). However, this health focus is debated. Wennstrom (2015) writes that consumers are less focused on calorie content and more **concerned about nutrition** while Askew (2015) espouses that consumers are purchasing healthy products with reluctance and disinterest.

Euromonitor International (2014f) establish that consumers **continue to seek convenience**. Consumers also display increasing **environmental and ethical consciousness**: the 'ugly food' trend is the marketing of fresh products that would normally be rejected by supermarket retailers due to its odd shape, for example, ASDA's "wonky fruit and vegetables" (Mortimer 2015). Askew (2015) cites the example of consumers in the UK boycotting companies accused of "supply chain bullying." She also notes that economic downturn in the UK has sparked increased **demand for comfort foods;** despite continued appreciation for balanced diets, consumers are more frequently rewarding themselves with sweets.

4.2 Reports or Media which Indicate Projections

4.2.1 Global

An article by Sampson (2014) reveals the projections made at the International Nut and Dried Fruit Conference in Melbourne in 2014. Industry leaders agreed that global demand for nuts will continue to increase – President of the INC Mr Sampson-Genest noted, "the tidal wave is coming," (Sampson 2014). Other projections made include growth in mature markets of the US and Europe – which rose 20% in 2014 – increased sophistication in China, popularity of nut-based milk products and continued demand from nutrition-seekers. The article:
http://www.weeklytimesnow.com.au/business/horticulture/international-experts-revealed-the-latestindustry-data-on-nuts-and-dried-fruit-at-world-nut-and-dried-fruit-congress-in-melbourne-lastweek/story-fnker6g8-1226925192613

Also recognising growing global demand, The Australian Nut Industry Council's (2015) *Industry Overview* attributes growth to the strengthening economies of developing markets such as India and Middle East. The article: http://nutindustry.org.au/ANIC/Industry-Overview.asp

4.2.2 China

The report *Fresh Food in China,* by Euromonitor International (2015c) predicts that demand for healthy products will continue to grow over the next five years. The report:
http://www.euromonitor.com/fresh-food-in-china/report

The Gale and Yang's (2015, p. 2) report *Fruit and Tree Nuts Outlook: China's Potential as an Export Market for Tree Nuts* predicts demand for nuts specifically is "rising dramatically." Increased urbanisation and higher disposable incomes are predicted to spur this trend. However, the report notes that demand may suffer in the wake of an anticorruption campaign preventing government officials from spending money on gifts and luxury food items. The report: http://www.ers.usda.gov/media/1811357/fts358sa.pdf

Complementing this, Euromonitor International's (2015c) report *Sweet and Savoury Snacks in China* forecast that the nut sector will be valued at 13,991.2 million CNY in 2019. Volume growth of 28.3% and value growth of 31.4% is projected over the 2014-2019 period. The report: http://www.euromonitor.com/sweet-and-savoury-snacks-in-china/report

4.2.3 Japan

An article by the Department of Foreign Affairs and Trade in Australia (2014) indicates that consumers will continue to seek convenience. With self-sufficiency declining, Japan is also predicted to import more and more of its fresh produce. Nuts are specifically identified as a growth market. The article: http://www.austrade.gov.au/Export/Export-Markets/Countries/Japan/Industries/Fruit-andvegetables#.VWSe9c7bJ7g

Euromonitor International (2015e) expect to see a decline in the snack product market as a result of Japan's falling population yet predict that those who do snack will seek diversity. The report: http://www.euromonitor.com/sweet-and-savoury-snacks-in-japan/report

Furthermore, an article by Carney (2014) predicts that the market for Western products will continue to gain popularity, especially among young consumers. The Article: http://www.abc.net.au/news/201410-16/japanese-cuisine-under-attack-from-western-food/5816510

4.2.4 India

Joshi's (2014) analysis of the Indian consumer market is comprehensive and insightful. He writes that, by 2025, 41% of the burgeoning population will be middle class, driving a 4.5% annual growth rate in consumption until then. Consumers are predicted to continue to value premium products, health and nutrition and convenience. The article: http://www.australianbusiness.com.au/internationaltrade/export-markets/india/indian-consumer-market

Considering snacks specifically, Euromonitor International (2015d, p. 3) predict "high volume growth" as a result of busier lifestyles and rising incomes. They forecast a 24.3% volume growth and 15.4% increase in nut sales by 2019, estimating the sector to reach a value of 1,352.0 million INR. The report: http://www.euromonitor.com/sweet-and-savoury-snacks-in-india/report

4.2.5 United States of America

A Marketline (2014d) report, *Savoury Snacks in the United States,* predicts that the snack market will grow by 14.8% between 2013 and 2018 to be worth $32 430.4 million. Growth is predicted to be at a slower rate yet will continue over the next five years. The report: http://advantage.marketline.com.ezproxy.usc.edu.au:2048/Product?pid=MLIP1407-0035

The millennial market is particularly expected to increase demand for snack products. Euromonitor International's report (2014g, p. 3) also states that "nuts is projected to experience the strongest growth over the forecast period with a value CAGR of 4% reaching sales of US$5.3 billion in 2019." They also project 13.9% volume growth between 2014 and 2019. http://www.euromonitor.com/sweetand-savoury-snacks-in-the-us/report

4.2.6 Australia

Langley (2014) assesses global food trends with a particular focus on Australian consumers to predict a growing market for convenience, transparency in labelling, healthy snacking, natural products and private labels. The article: http://ausfoodnews.com.au/2014/12/23/top-10-food-and-beverage-trendsfor-2015-innova-market-insights-with-other-comments-2.html

The noted desire for convenience is predicted to drive a 1% CAGR in the sweet and savoury snacks between 2013 and 2018, according to the latest report by Euromonitor International (2014e). Nuts which are marketed as organic are forecast to experience a 7% CAGR over the same period, reflecting the value of healthy, sustainable and ethical foods held by consumers. Nuts as a sector are predicted to increase by 17.4% in volume and 23.2% in value. The report: http://www.euromonitor.com/sweet-andsavoury-snacks-in-australia/report

4.2.7 United Kingdom

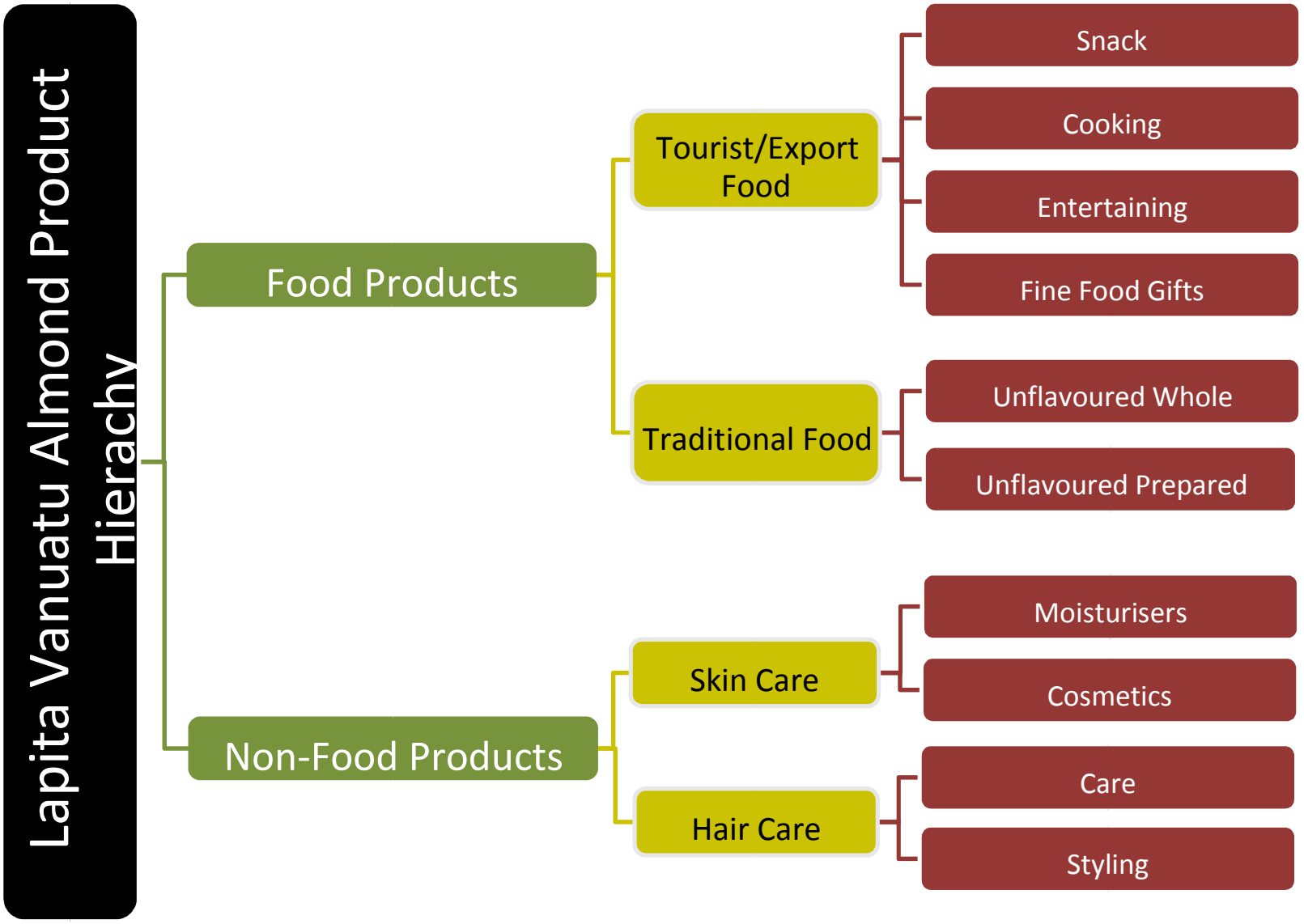
The UK's Institute of Grocery Distribution have predicted a slower growth rate in grocery sales between 2014 and 2019 than was observed in the previous five years, estimating the worth of the industry at £203 billion in 2019 (Gladding 2014). The importance of value and convenience is expected to continue. The article: http://www.igd.com/our-expertise/Retail/retail-outlook/21115/The-next-fiveyears-How-the-UK-grocery-market-will-evolve/

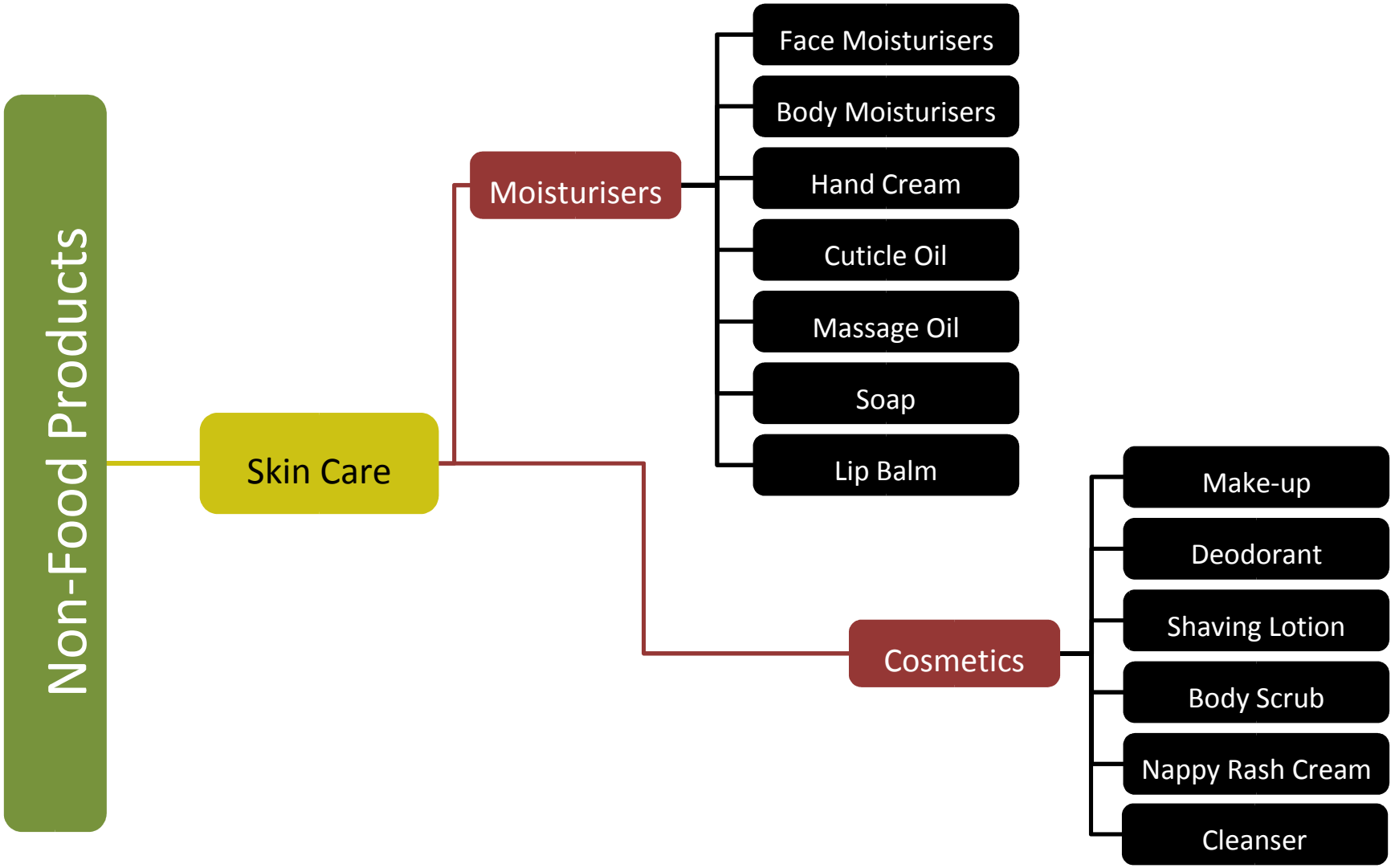
Discount stores in the UK are predicted to capitalise on the value-seekers market, such Euromonitor International (2014f) estimate that the snack sector will be worth £47,030.2 million by 2019. Nuts are forecast to experience a 17.1% volume growth and 17.4 % value growth over that period with sales predicted to reach £520.9 million in 2019. The report: http://www.euromonitor.com/sweet-andsavoury-snacks-in-the-united-kingdom/report

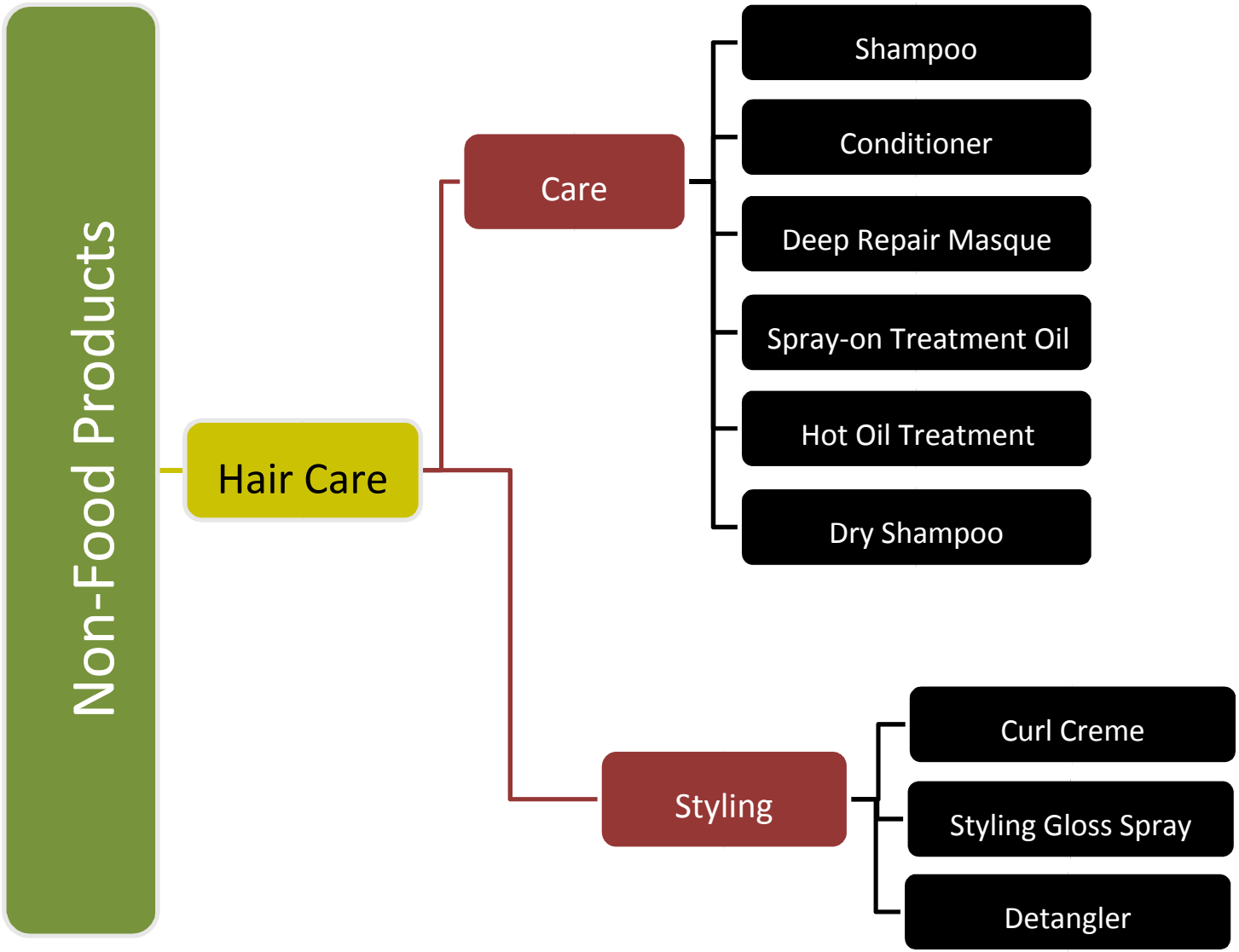
5.0 COSMETIC USES OF NUT OIL

The *Canarium Nut Marketing Strategy* produced for Vanuatu presents a product hierarchy for canarium nut products in cosmetic use (see Figure 4).

Figure 4: Recommended Comprehensive Product Hierarchy for Lapita Vanuatu Almond Brand from *Canarium Nut Marketing Strategy* for Vanuatu (Raciti 2014)




Non-Food Products
Skin Care
Moisturisers
Face Moisturisers
Body Moisturisers
Hand Cream
Cuticle Oil
Massage Oil
Soap
Lip Balm
Cosmetics
Make-up
Deodorant
Shaving Lotion
Body Scrub
Nappy Rash Cream
Cleanser


Non-Food Products
Hair Care
Care
Shampoo
Conditioner
Deep Repair Masque
Spray-on Treatment Oil
Hot Oil Treatment
Dry Shampoo
Styling
Curl Creme
Styling Gloss Spray
Detangler

5.1 Overview of Cosmetics Industry

5.1.2 China

The personal care industry in China was valued at $US33, 792.9 million in 2013 (Marketline 2014b). Marketline (2014b) forecast a 60.9% growth between 2013 and 2018. Euromonitor International (2015a) is more conservative but also predicts continued growth. The largest sector is skin care, which accounts for 39.9% of the industry's value, followed by haircare (14.9%) and oral hygiene (10%) (Marketline 2014b). The industry's most prominent company is Procter & Gamble, which holds 12.7% of market value in 2014; L'Oreal, Shiseido Co Ltd and Unilever were also popular, holding 9.8%, 3.6% and 3.3% of the market respectively (Euromonitor International 2015a).

5.1.3 Japan

Japan's personal care industry is growing at a much slower rate (5% growth is predicted between 2013 and 2018), with a value of $US37, 048.8 million in 2013 (Marketline 2014c). Euromonitor International (2014b) confirms that the industry experienced a 1% CAGR, reflecting both the nation's recovery from the earthquake in 2011 and innovative product development. As observed in China, skincare products dominated the market with 34.1% of the value share in 2013 with haircare the next largest sector, holding 16.1% (Marketline 2014c). Diverting from the pattern however, Japan's make-up sector was the third largest with 14.7% of the value in 2013 (Marketline 2014c). It is evident that the market favours domestic companies: Kao Corp obtained the largest value share (14.1%), followed by Shiseido Co Ltd (12.4%) and Kose Corp (5.2%) (Euromonitor International 2014b). Procter & Gamble, the most prominent multinational company, had a 4.4% value share.

5.1.4 Australia

In Australia, the personal care industry was valued at $US6, 500.7 million in 2013 (Marketline 2014a). Marketline (2014a) predict growth by 11% between 2013 and 2018. Value growth in 2013 – 2% CAGR – was deemed "modest" by Euromonitor International (2014a). The top performing sectors in 2013, as listed by Marketline (2014a) were skincare (15.2%), make-up (14.6%) and haircare (14.2%). Multinational corporations are the most powerful in the industry with Euromonitor International (2014a) revealing that the highest value share was held by Procter & Gamble (12.3%), L'Oreal Groupe (11.9%) and Unilever Group (9.1%).

5.2 Major Cosmetic Brands Using Nut Oils

5.2.1 China

Popular nut oil cosmetic products in China are illustrated in Table 11.

Table 11: Cosmetic Brands and Corresponding Oils in China

	Cosmetic Use	Major Brand/s	Nut Oil
Moisturisers	Face Moisturisers	Olay	Coconut
	Body Moisturisers	Cetaphil	Macadamia
	Hand Cream	Crabtree & Evelyn Hand Therapy	Macadamia, shea
		Watsons Collagen	Shea
	Cuticle Oil	Melvita Roll On	Argan
	Massage Oil	Laino	Almond
	Body Soaps (Liquid)	Imperial Leather	Almond, coconut
		Olay	Shea
	Body Soaps (Bar)	Naturaliste Bio	Argan, Shea
	Bath Melt	-	-
	Lip Balm	Kiehl	Almond
		Osmanthus Lipstick	Almond
Cosmetics	Make-Up	Shiseido	Macadamia
	Deodorant	-	-
	Shaving Cream	Aqua Mineral Maxi Smooth	Almond, argan, jojoba
	Body Scrub	-	-
	Nappy Rash Cream	-	-
	Cleanser	Shiseido	Macadamia
Hair Care	Hair Shampoo and Conditioner	Pantene	Coconut
		Head & Shoulders	Almond
	Hair Mask/Treatments	Dove Nutritive Therapy	Coconut, almond
		Naturaliste Bio	Argan, shea
	Styling Gloss	-	-
	Detangler	Pantene	Argan

The most prominent nut oils in the Chinese market include almond, argan, coconut and macadamia, as illustrated in Table 11.

5.2.2 Japan

Cosmetic products containing nut oil which are popular in Japan are listed in Table 12.

Table 12: Cosmetic Brands and Corresponding Oils in Japan

	Cosmetic Use	Major Brand/s	Nut Oil
Moisturisers	Face Moisturisers	Chanel	Canarium Luzonicum (http://www.chanel.com/en_AU/fragrancebeauty/Skincare--ULTRA-CORRECTIONLIFT-138775)
	Body Moisturisers	Curel	Shea

		Cetaphil	Macadamia
		Burt's Bees	Hazelnut
	Hand Cream	Coenrich Q10	Macadamia
	Cuticle Oil	Esprique	Almond
	Massage Oil	-	-
	Body Soaps (Liquid)	Kracie Naive	Jojoba
	Body Soaps (Bar)	Matsuyama Oil Co	Shea
	Bath Melt	-	-
	Lip Balm	Adrien Arpel	Almond
Cosmetics	Make-Up	Shiseido	Macadamia
	Deodorant	-	-
	Shaving Cream	-	-
	Body Scrub	-	-
	Nappy Rash Cream	Curash	Almond
	Cleanser	Kanebo	Almond
		Shiseido	Macadamia
Hair Care	Hair Shampoo and Conditioner	Asience	Argan
		Essential	Shea
	Hair Mask/Treatments	Oshimatsubaki Co	Camellia
		Neutrogena	Almond
Styling	Curling Crème	Pantene	Coconut, Jojoba
	Styling Gloss	Pantene	Argan
	Detangler	John Masters Organics	Canarium Luzonicum (https://johnmasters.com/products/haircare/citrus-neroli-detangler.html)

Table 12 indicates that nut oil is quite prominent in both skincare and haircare products in Japan. Both domestic and multinational companies are engaging with nut oils, the most popular being almond, macadamia and jojoba.

5.2.3 Australia

Table 13 provides an assessment of popular nut-oil-based cosmetic products in Australia.

Table 13: Cosmetic Brands and Corresponding Oils in Australia

	Cosmetic Use	Major Brand/s	Nut Oil
Moisturisers	Face Moisturisers	Aesop	Camellia Nut
		Lush	Coconut
	Body Moisturisers	Aveeno	Macadamia
		The Body Shop	Almond, Canarium Commune (https://www.lush.com.au/shop/product/product&product_id=71)

		Lush	Macadamia
	Hand Cream	Aveeno	Macadamia
		Nivea	Macadamia
	Cuticle Oil	The Body Shop	Almond
		OPI	Candlenut
	Massage Oil	Alba	Candlenut
		Penhaligon	Almond
	Body Soaps (Liquid)	Priya Body Wash	Macadamia
	Body Soaps (Bar)	Lush	Hazelnut
	Bath Melt	Lush	Walnut
	Lip Balm	Blistex	Almond
Cosmetics	Make-Up	Revlon	Coconut
		Silk Oil of Morocco	Argan
	Deodorant	-	-
	Shaving Cream	Jack Black	Macadmia
	Body Scrub	The Body Shop	Brazil nut
	Nappy Rash Cream	Curash	Almond
	Cleanser	Garnier	Candlenut
Hair Care	Hair Shampoo and Conditioner	Dove	Macadamia
		Garnier	Brazil nut
	Hair Mask/Treatments	Lush	Brazil nut
		Clear	Almond, argan, coconut
		Garnier	Brazil nut
Styling	Curling Crème	Stefan	Argan
		Silk Oil of Morocco	Argan
	Styling Gloss	Avon	Argan
	Detangler	Dove	Candlenut

From Table 13, it is evident that macadamia nut oil is commonly used, as is brazil nut and argan oil. Candlenut oil is used on occasion, especially in products originating from Hawaii.

5.3 Emerging Trends in the Cosmetics Industry

One of the most significant trends in the cosmetics industry in 2015 is the growing popularity and influence of Asian skincare products (Chu 2015; Matthews 2015 Trysimou 2015). As the largest sector in the industry, skincare is highly competitive and companies continue to innovate in order to differentiate themselves in the market (Chu 2015; Tyrimou 2015). Japanese products but most significantly, South Korean innovations are becoming adopted across Asia and although at a slower rate, also in Western markets (Chu 2015; Matthews 2015; The Beauty Club 2015; Tyrimou 2015).

Examples of these product innovations include liquid foundation in a cushion-compact, such as L'Oreal's Miracle Cushion and essence-based facial moisturisers, such as Shiseido Eudermine Revitalising Essence (The Beauty Club 2015).

These essence-based facial products also reflect the continued growth of oils which are "expected to continue to dominate skincare innovation not only as a format or ingredient but also as an extra product to be added to one's skincare routine," (Tyrimou 2015). Matthews (2014) confirms that nut oils are increasing in popularity globally, in the skin care sector, particularly for use in anti-aging products.
Adoption of oil products is also beginning to occur in the skincare to colour cosmetics sector (Park 2015). According to Gonzalez (2015), macadamia nut oil is now becoming the most favoured, taking over from coconut oil which grew in popularity in 2014 after endorsement from celebrities such as
Miranda Kerr. Such specialty ingredients are predicted to increase in value, especially in the US and Chinese markets (Matthews 2014).

The use of oil in haircare, the second largest sector globally is also growing (Matthews 2014).
Datamonitor (2014) writes that the use oil in haircare is becoming popular in mainstream products. Argan oil and almond oil are among some of the popular varieties which are valued for their hydration properties but also for their exotic origins (Datamonitor 2014). This market is becoming more and more competitive with producers seeking new oil varieties such as candlenut to differentiate themselves (Datamonitor 2014).

Cosmetic trends in China and Japan are being driven by a demand for convenience, which has reinforced the value of oil products as facial mists and hair moisturisers (Matthews 2014) and leave-inconditioners (Datamonitor 2014). The popular term shinagara cosme, meaning 'cosmetics while doing something else,' reflects this trend towards convenience (Matthews 2014). Time-saving products continue to hold value globally with 40% of consumers surveyed by Datamonitor (2014) indicating that they relied upon such products.

Other notable trends include significant a growth in the Brazilian Market (Matthews 2014) and the identification of "Pakistan, Morocco, Indonesia, Saudi Arabia, Vietnam and UAE" as emerging markets (Matthews 2015). Tyrimou (2015) predicts a stronger demand for the eradication of animal testing which is no longer mandatory in China and has been banned in India. Social media and technology are expected to continue to drive product innovation (Datamonitor 2015) with growth in the use of mobile technology to diagnose skin care needs and personalise products. There is also expansion in the electronic beauty sector with new device and lotion/oil combinations being developed to meet consumer needs (Datamonitor 2015).

6.0 POTENTIAL WHOLESALE AND RETAIL PRICES FOR NUTS

6.1 Price Comparison of Competing Nut Varieties

Table 14 provides a list of each market's most valuable nuts, in descending order, according to retail value.

Table 14: Nut Varieties and their Price Position in Each Market

	China	Japan	India	USA	Australia	UK
1	Pine nuts	Pine nuts	Walnuts	Pine nuts	Macadamia nuts	Pine nuts
2	Walnuts	Walnuts	Pistachio Nuts	Walnuts	Pecan nuts	Pecan nuts
3	Brazil Nuts	Almonds	Almonds	Pistachio nuts	Pistachio nuts	Macadamia nuts
4	Almonds	Pecan nuts	Cashew Nuts	Cashew nuts	Brazil nuts	Hazelnuts
5	Cashew nuts	Cashew nuts	-	Almonds	Cashew nuts	Walnuts
6	-	-	-	Brazil nuts	Almonds	Pistachio Nuts
7	-	-	-	-	-	Brazil nuts
8	-	-	-	-	-	Cashew nuts
9	-	-	-	-	-	Almonds

As Table 14 indicates, pine nuts are commonly high in price as are walnuts and macadamia nuts. It is also evident that almonds and cashew nuts are among the least expensive varieties globally. When interpreting this data, it must be noted that not all retailers observed stocked a full range of nuts. For example, the online retailer observed in China did not stock macadamia nuts; however, it is established that these nuts are popular amongst Chinese consumers. As such, the data is not comprehensive, yet provides a snapshot of current trends in both stock and pricing.

6.1.1 China

Chinese nut prices are compared through observation of retailers such as the online grocery store Kate & Kimi (http://www.kateandkimi.com/veggies/all-nuts-and-seeds/nuts.html). The Shanghai store stocks pine nuts as the most expensive variety (CN¥299.99/kg). Next are walnuts (CN¥196.00/kg), followed by brazil nuts (CN¥188.00/kg) and almonds (CN¥180.00/kg).

Finally, cashews are the least expensive variety (CN¥156.00). However, it is noted that Kate & Kimi do not stock pistachio nuts, the second most popular variety in China (behind walnuts) nor macadamia nuts, which are also quite highly valued. The ABC (McCarthy, Rogers & Sparkles 2015) reports that macadamia nuts currently have an export value of $3.50-$4.50 AUD/kg.

6.1.2 Japan

Observation of Tengu Natural Foods' online store (http://store.alishan.jp/index.php?main_page=index&cPath=11_71) indicates that pine nuts and walnuts are again the most expensive varieties, selling for JP¥10,260.00/kg and JP¥6,588/kg

respectively. Almonds and pecan nuts both retail for JP¥6,264.00/kg. Again, cashew nuts were the least valuable variety, JP¥4,590.00/kg.

6.1.3 India

The online company Dilli Grocery (http://www.dilligrocery.com/ps6/7-dry-fruits#/show-all) stocks shelled walnuts as their most expensive nut variety for ₨1523.81/kg. Pistachio nuts were valued at ₨952.38/kg, followed by almonds (₨904.76/kg) and finally, cashews – a domestic product – at ₨800.00/kg.

6.1.4 United States of America

Online grocery store Netgrocer.com stocks pine nuts as its most expensive variety by far: $US59.80/kg. Walnuts were the next most expensive at $US39.87/kg, then pistachio nuts at $US35.18/kg. Cashew nuts were valued at $29.90/kg and lastly, almonds and brazil nuts were the least expensive at $US26.58/kg. A review by the Agricultural Marketing Resource Centre (Huntrods 2013) provides a summary of nut prices in the US. In 2013, Pistachios were the most expensive variety at approximately $US3,992.74/T (export value). This is followed by pecans ($US3,150.59/T), walnuts ($US2,765.95/T) and the most popular variety, almonds at $US2,529.41/T. These varieties were trailed by hazelnuts ($US1,827.08/T) and macadamia nuts ($US1,600.00/T).

6.1.5 Australia

Observation of retailers indicates that macadamia nuts are the most expensive variety. They are sold by online retailer Harris Farm (http://www.harrisfarm.com.au/collections/nuts-mixes-seeds?page=1) for $AUD44.95/kg. Pecans are the next most expensive at $AUD39.96/kg, followed by pistachio nuts at $AUD33.98/kg. Both brazil nuts and cashew nuts were valued at $AUD27.96 and finally, almonds were the least expensive variety at $AUD25.98/kg. The Australian Nut Industry Council's (2014) report, *Growing for Success,* reveals that of all varieties, hazelnuts have the highest farmgate value:

$AUD7,751.93/T in 2014. Following this was pistachio nuts ($AUD7,627.11/T) and almonds ($AUD7,002.80/T). Although not a popular variety, chestnuts had a farmgate value of $AUD5,217.39/T, followed by pecan nuts ($AUD4375.00/T), walnuts ($AUD3985.50/T) and finally, macadamia nuts, which were valued at $AUD3004.92/T.

6.1.6 United Kingdom

Nut prices in the UK are also assessed through the case study of British online retailer, Country Products (https://www.countryproducts.co.uk/shop/fruits-nuts-seeds/nuts). Their website reveals that the most expensive nut variety instock is pine nuts, which retail for £40.23/kg. At a significantly lower cost, this is followed by pecan nuts (£26.74/kg), macadamia nuts (£26.27/kg) and hazelnuts (£20.08/kg). Finally, in

the lowest price range were walnuts (£16.43/kg), pistachio nuts (£15.43/kg), brazil nuts and cashew nuts (both £14.73/kg) and almonds (£13.41/kg).

6.2 Comparison of Price between Different Nut Forms

6.2.1 China

In China, flavoured nuts are slightly more expensive than natural varieties. For example, Planters Sweet N Crunchy Peanuts retail for CN¥144.87/kg, compared to CN¥120.00/kg for Planters Cocktail Peanuts (http://www.gzgrocery.cn/snacks/nuts.html). It was also evident through assessment of online retailers that whole nuts are more valuable than other forms; Kate & Kimi's whole almonds are valued at CN¥180.00/kg whereas almond slices sell for CN¥153.00/kg. China imports both shelled and unshelled varieties of nuts, for example, walnuts, pistachio nuts and macadamia nuts (Gale & Yang 2015). Honan (2014) notes that, through cultural influences, many Chinese consumers prefer to open the nuts themselves.

6.2.2 Japan

Observation of retailers indicates that in Japan, natural varieties are valued more than processed products. For example, The Foreign Food Buyers Club (http://www.fbcusa.com/general-store-anddeli/snacks-and-dessert/nuts.html) stocks natural almonds for JP¥4785.50/kg, compared with salt and vinegar flavoured almonds for JP¥4495.47/kg. Powdered forms are evidently more expensive than whole nut varieties. This is illustrated by Tengu Natural Foods which stocks almond powder for JP¥10,260/kg, while whole almond kernels are JP¥6264/kg. None of the retailers observed stocked nuts inshell, possibly indicating that these are not valued by consumers. In corroboration, the Australian Nut Industry Council (2014) writes that Japan imports chestnuts and macadamia nuts in kernel form.

6.2.3 India

In-shell varieties appear to be more accessible in India and generally retail for a much lower price. For example, the online retailer Big Basket (http://bigbasket.com/ps/?q=nuts) stocks premium walnuts for ₨1616/kg, while premium in-shell walnuts cost ₨595/kg. However, this trend is contradicted by pistachio nuts which are sold by one retailer (http://www.naturesbasket.co.in/Online-groceryshopping/Indian-Grocery/Flours-Grains-More-/Nuts-Dry-Fruits/301_0_0) in shell for ₨1490/kg while selling kernels for ₨2525/kg. Value-added products such as flavoured nuts appear to be on par with natural varieties in terms of price; Big Basket's private label salted cashews retail for ₨1260/kg and the same price applies to sweet and pepper flavoured varieties.

6.2.4 United States of America

American retail outlets show a much higher ratio of packaged and processed nuts than other markets; observation indicates that small, individual snack packages are more popular than large quantities.

However, natural and flavoured varieties are most often very similarly priced. For example, NetGrocer.com stocks both Emerald's Natural Almonds and Cinnamon Roasted Almonds for $US6.15/kg. In terms of form, retail prices suggest that whole nut products are more valued than processed forms. This is illustrated by Hickory Harvest's almonds; whole almonds are sold for $US16.00/kg while both sliced and slivered almonds cost $US32.00/kg. Additionally, the retailers observed did not stock any nuts in-shell.

6.2.5 Australia

In contrast, Australian retailers such as Coles and Woolworths supermarkets do stock nuts in shell. For example, Coles sell 'Chestnuts Loose' for $AUD8.50/kg and 'Peanuts In Shell' for $AUD12.00/kg. Observation of retailers also suggests that the market places higher value on natural nuts than flavoured products. In Coles, natural macadamia nuts are priced at $AUD45.71/kg while honey-roasted macadamia nuts cost $AUD42.50/kg; similar prices are displayed in Woolworths. In a similar fashion observed in the USA, although to a less severe extent, Australian consumers appear to value whole nut products more than other forms. This is illustrated by Yummy Almond products; whole blanched almonds are sold for $AUD31.92/kg while flaked almonds and slivered almonds each retail for $AUD37.52/kg through the online retailer, Harris Farm (http://www.harrisfarm.com.au/collections/nuts-mixes-seeds?page=2).

6.2.6 United Kingdom

Evidence suggests that British consumers' value flavoured nut products more than natural products. This is illustrated by the sale of Tesco (http://www.tesco.com/groceries/product/browse/default.aspx?N=4294782882&Ne=4294793660) Roasted Salted Peanuts for £3.99/kg while the BBQ Coated, Piri Piri Coated and Sweet Chilli Coated varieties cost £4.95/kg. As a further example, KP's Dry Roasted Peanuts retail for £6.00/kg while Honey Roasted Peanuts cost £11.10/kg. Prices observed across many retailers reveal little difference in the value of whole products and other forms. For example, Tesco's Whole Almonds, Flaked Almonds and Ground Almonds are equally priced at £11.50/kg. The same was observed for Essential Almonds, an organic variety, which stock whole blanched almonds and flaked almonds for £23.92/kg. This trend was contradicted however, by Suma Walnuts sold by Naturalgrocer.co.uk; whole walnuts cost £21.96/kg while walnut halves had a slightly higher value, £23.96/kg. In shell nut products are not prominent in the British market – the only variety available at all of the observed retailers was monkey nuts (peanuts in shells).

7.0 SURVEYS OF AUSTRALIAN, JAPANESE AND CHINESE NUT CONSUMERS

Surveys of Australian, Japanese and Chinese nut consumers were undertaken in 2015 via a privacy compliant, global, research panel provider. A total of 1500 responses were received, with approximately 500 from each country. A summary of the survey and results are provided in Appendix 2.
Screening questions ensured that respondents were over 18 years of age (to comply with USC Human Ethics Requirements), citizens of their respective countries, and were consumers of nuts.

7.1 Summary of Part A of Survey

Australian and Chinese consumers eat nuts frequently, as part of their regular diet and having been doing so for a long time. However, Japanese respondents indicated that nut consumption is not frequent or as part of a regular diet, indicating a different consumption behaviour that is less habitual than that of Australian and Chinese nut eaters.

Australian and Japanese nut consumers have a similar pattern in their consumption, eating nuts occasionally irrespective of day, event/activity or season. Chinese nut eaters consumed nuts more frequently on weekends, holidays, in Autumn, Winter and Spring.

Australians are least likely to consume nuts for breakfast, at study or work, or while commuting. Japanese nut eaters tend to consume nuts as part of a dessert, for an afternoon snack, at home, with others but more so when they are alone. Consumption of nuts was markedly different for Chinese consumers. While Chinese consumers rarely eat nuts for lunch, nuts are consumed for all other meals most frequently as a dessert, an afternoon snack and at home, alone.

When comparing across different types of nuts, Australians eat a diversity of nuts, with the exception of Pecan nuts. Japanese consumers are less likely to eat brazil nuts, hazelnuts, pecan nuts and pine nuts; but eat all other types. Chinese consumers eat all nuts, with walnuts and peanuts most frequently consumed.

While Chinese consumers occasionally bought nuts as a gift for other people, the Australian and Japanese consumers did not. Supermarkets were the main retail outlet from which nut consumers in all countries their nuts from. While Chinese consumers purchased nuts occasionally or frequently from online sellers, this was not the case for the other countries.

Australians tend to favour salted, roasted and unroasted nuts; Japanese consumers favoured salted, roasted and sugar-coated nuts; and Chinese consumers ate all nut forms (see Q6, Appendix 2) with a clear

preference for roasted nuts. Cosmetic uses of nut oil (e.g. in hair products or body creams) were more likely purchased by Chinese consumers.

When buying nuts for themselves, a large proportion of consumers in all countries could not recall the brand name, indicating that nuts may be perceived as a commodity. Among those who could recall the brand name, Australians identified Nobby's Nuts brand; Japanese consumers identified Kameda Kakinotane brand; and Chinese consumers recalled Great Value branded nuts as the ones they purchase most. Japanese consumers bought smaller sized nut packages, followed by Australians with medium sized nut packages and Chinese consumers purchased larger package sizes. Australians were prone to pay the least for nuts relative to the Japanese and Chinese consumers. Similar findings were apparent when exploring the purchasing of nuts to share with others. Chinese consumers were more likely to share nuts with others, while Australians and Japanese consumers are less likely to engage in such practices. Japanese and Australian consumers also tended to not buy nuts as a gifts for others; but in all countries, consumers were likely to pay more for gift nuts than nuts for personal consumption.

7.2 Summary of Part B of Survey

For Australian consumers, the most important nut attributes were: a) easy to eat, b) ready to eat from the package, c) packaged in a way that they are easy to handle, c) resealable packages and d) packages that allow them to see the nuts inside. For Japanese consumers, the most important nut attributes were: a) easy to eat, b) ready to eat from the package, and c) resealable packages. For Chinese consumers, all of the attributes listed were regarded as important (see Q16, Appendix 2).

For Australian consumers, it was very important that the nuts a) taste good, b) are fresh; and c) are of a consistent high quality. For Japanese consumers, it was important that the nuts a) taste good; b) are fresh; c) are of a consistent high quality; and d) have a pleasant texture. For Chinese consumers, all of the attributes listed were regarded as either 'very important' or 'important' (See Q17, Appendix 2).

It is very important to Australian, Japanese and Chinese consumers that the nuts a) meet food safety standards, and b) are free from chemicals and preservatives.

While Australians preferred to purchase nuts from their own country. Japanese consumers indicated that country-of-origin issues were of only moderate importance. Country-of-origin issues were of relatively greatest importance to Chinese consumers.

The importance of nuts being 'good value for money' was common to all countries, as too was availability in supermarkets and shops that were conveniently located close to where people live, study or work.

7.3 Summary of Part C of Survey

Australian, Japanese and Chinese consumers were only 'a little familiar' with the South Pacific Islands. The term 'South Pacific Island Nuts' conjured up images of beaches, the natural environment and sunshine. Thus, these are recommended as branding and packaging images in all three countries. Chinese consumers had more favourable attitudes towards the South Pacific Island nuts than the Australian and Japanese consumers. As such, it would seem that the market uptake of Canarium nuts in China is likely to be faster than for the other countries surveyed.

The vast majority of respondents in all countries had not heard of any of the four common names for Canarium nuts; but **all agreed that Galip Nuts was their most preferred brand name**. A range of other brand names were suggested; most of which appear transferrable across all countries.

7.4 Summary of Part D of Survey

In terms of the pricing of nuts, Australians are sensitive to differences in the price of nuts, more so than Japanese and Chinese consumers. As such, price or quantity discounts will more likely lead to an increase in nuts sales to Australians consumers. Japanese consumers were more likely to be purchase nuts with a discounted price (as opposed to a quantity discount). Chinese nut consumers indicated they will buy more nuts when either price or quantity discounted.

All country respondents indicated a general preparedness to pay more for nuts from the South Pacific, however this was **only up to 10% more** than other nuts on the market. Chinese consumers valued certification, however this was not the case of Australian and Japanese consumers.

7.5 Summary of Part E of Survey

Australians could be encouraged to buy South Pacific Island nuts if a) a friend or family member gave them the nuts as a gift, or b) they samples the nuts and places they shop for food. Japanese consumers could be encouraged via sampling the nuts in the places they shopped. Chinese consumers could be encouraged via sampling as well as demonstrations on how to use the nuts in recopied at the places where they shop for food. While all countries were open to other methods, the notion of 'free samples' dominates as the primary avenue to encourage the purchasing of Canarium nuts.

7.6 Summary of Part F of Survey (Australian respondents only)

Australians felt that supporting developing countries by purchasing their products was the right thing to do and saw it as a way to facilitate opportunities for developing countries to build their economies.

Respondents liked to help others and had positive feelings and high regard for the South Pacific Island nations.

7.7 Summary of Part G of Survey

Australian and Chinese consumers had a greater general interest in food and cooking than Japanese consumers. Although Australians did not regard themselves as 'foodies', Chinese consumers were undecided about their 'foodie' status. Regarding food from other cultures, Australians did not display any neophobia, or fear of new foods, and thus are open to new and different foods from other countries.

7.8 Summary of Part H of Survey (Australian respondents only)

Australians give gifts to family and occasionally to friends on special occasions, these comprise of food in some instances. Food gift baskets are rarely if ever used as gifts and where purchased are generally bought at a bricks-and-mortar retailer rather than online.

7.9 Summary of Part I of Survey (Australian respondents only)

It was found that Australians online behaviour related to food was limited. The top websites referred to when searching for food on the internet were the recipe sites of Coles and Woolworths Supermarkets, and the larger recipe sites of Taste.com.au and Allrecipies.com.au. These websites represent influential vehicles for showcasing the use of Canarium nut products in recipes.

7.10 Summary of Part J of Survey (Australian respondents only)

It was found that Australian respondents made little use of social media; hence its role as a promotion vehicle for marketing campaigns is seemingly limited.

7.11 Summary of Part K of Survey

Respondents in all countries reported a medium household income. There was a relatively equal gender split and the vast majority of respondents were employed across a wide range of industries.

Chapter 2:

Domestic Market Opportunities for PNG Produced Canarium Products

Colin Bunt Macro Consulting Group Pty Ltd

8.0 GENERAL INFORMATION FOR NEW CANARIUM ENTREPRENEURS

8.1 Unmet domestic market demand

There is reportedly significant, unmet demand for Canarium within Papua New Guinea and throughout Melanesia where it is well known and highly valued, yet not widely available commercially (PARDI 2012). Maximizing domestic market potential will be a critical 'first step' for the embryonic Canarium industry in PNG. The domestic market will be especially important in regards to establishing commercial harvesting, processing, distribution and marketing systems, generating income and cash flows for growers and processors and providing a mechanism for ongoing product development and new market testing (NARI Canarium Conference and Workshop, September 2014). Chapter 2 of this Report has been developed for potential Canarium entrepreneurs, both familiar and unfamiliar with the PNG food and beverage industries.

8.2 Market demographics

Papua New Guinea has a population of approximately 7.3 million people. The Papua New Guinea mainland and its six hundred islands have a total area of 463,000 square kilometres. Society in Papua New Guinea ranges from traditional village-based living featuring subsistence and small scale cash-crop agriculture, to modern urban life in the main cities of Port Moresby, Lae, Madang, Wewak, Goroka, Mt Hagen, and Rabaul. Some 85 per cent of the population directly derive their livelihood from farming and 15 per cent of the population live in urban areas. Population growth is currently estimated at 1.8 per cent per annum (DFAT, 2015).

8.3 Economic overview

Going into 2015 Papua New Guinea had experienced over a decade of economic growth, with expanding employment opportunities and strong growth in government expenditure and revenues. This economic performance has been driven by high international prices for Papua New Guinea's exports (including for agriculture), conservative Government economic policies and construction works related to large projects, including LNG. Papua New Guinea has a dual economy, made up of a formal and informal economy. The formal economy is dominated by large-scale resource projects and employs around 15% of the workforce. Mineral deposits, including copper, gold, and oil, account for nearly twothirds of total export earnings. The informal economy which is made up mainly of agriculture provides employment or a subsistence livelihood for approximately 85% of Papua New Guinean people.

Despite recent strong economic growth significant challenges still face PNG; including maintaining investor confidence, governance issues such as ensuring integrity within Government institutions and maintaining good relations with neighbouring countries and major trading partners. Other challenges include serious, long standing law and order problems and land tenure issues (DFAT, 2015).

Tables 15 and 16 highlight various demographic and economic indicators applicable to enterprise planning within PNG agrifood industries and markets.

Table 15: Papua New Guinea – Relevant Demographic Indicators

Indicator	Figure
Population	7.3 million
Population growth rate	1.84%
Urban population	13.3%

Rate of urbanization	2.12%
Median age	22.4 years
Percentage of the population under 25 years of age	54.7%
Percentage of the population living below the poverty line	37%

Source: USCIA 2015

Table 16: Papua New Guinea – Relevant Economic Indicators

Indicator	Figure
GDP (US$bn)	20.0
GDP per capita (US$)	2,597
Real GDP growth (% change year on year)	19.3
Inflation (% change year on year)	4.8

Source: DFAT 2015

9.0 RELEVANT MARKET CHARACTERISTICS

9.1 Recent growth in the high end food and beverage sector

In regards to the food and beverage industry, as recently as 2011 the Papua New Guinea food and beverage market was described as a relatively unsophisticated, price-driven market in which suppliers must be prepared to supply relatively small volumes on a relatively frequent basis (Austrade, 2011).

However Austrade also reported an increase in food and beverage imports into Papua New Guinea from Asia, including China. This is partly due to an increase in the Asian business community in PNG and also increased consumer demand in Papua New Guinea for a greater variety of food choices (Business Advantage PNG, April 2015). An indicator of this increased market diversity can be seen in the major opportunities nominated for Australian exporters in Papua New Guinea's food and beverage market (table 17).

Table 17: Nominated Food and Beverage Opportunities in the Papua New Guinea Market

Fresh fruit and vegetables – fruits, exotic vegetables, salad greens
Dairy products – fresh milk, cheese, butter, ice cream
Meat – beef and lamb cuts
Beverages – wine, fruit juice, flavoured milk, sports and health drinks
Ethnic food – Asian, Indian, Italian and Mexican
Grocery products – pasta, breakfast cereal, snacks, condiments
Frozen foods – vegetables, pizza, pastry
Gourmet foods – salamis, flavoured cheese, dips and pates
Food ingredients for the manufacturing sector

Source: Austrade, 2011

In the last 5 years there have been clear indications that Papua New Guineans and in particular a rising middle class are demanding not only higher quality food but more variety as their incomes rise. This demand is also being driven by significant activity within the formal economy, in particular the PNG LNG Project which is increasing the size of the expatriate community. These factors are resulting in greater opportunities for quality focussed Papua New Guinean food and beverage entrepreneurs (Business Advantage PNG, April 2015).

9.2 Taxes and tariffs on imported nuts

Papua New Guinea has a single rate value added tax (VAT) of 10 per cent. This is applicable to most goods imported into PNG and on customs or excise duty paid on importation. VAT is collected as part of the normal procedure at the point of entry (Austrade, 2014)
In terms of tariffs, Papua New Guinea Customs use the single column based on the Harmonised system. Most duties are applied ad valorem using the World Trade Organisation (WTO) valuation code guidelines of CIF value.

Imported nuts attract a tariff of 25%, with an exception being cashews which attract a tariff of 40%. These rates are valid from 1st January 2015 to 31st December 2017 (Papua New Guinea Import and Export Customs Tariffs, 2012 Edition). The high taxes and tariffs imposed on imported nuts present a major pricing advantage domestically for the Papua New Guinean Canarium industry.

10.0 DOMESTIC MARKET ANALYSIS

10.1 Food retailing

Most food retailing in PNG is via independent shops or supermarkets. Suppliers to shops and supermarkets must appreciate that retailers are basically modern day traders whose business success largely depends on how profitability they can on-sell goods. Retailers expect their suppliers will understand how they operate and what they need and will act accordingly (DEPI, 2014). Generally retailers want and need:

Products that are 'retail shelf ready'

Products that match the needs and wants of the consumer segments they are servicing

Delivery of a consistent and reliable supply of product to an agreed specification and price

Suppliers will have the capacity to grow as the retailer's own business grows

Suppliers will have an understanding of all relevant packaging, labelling and food regulation requirements

Suppliers will be experienced negotiators and understanding of the competitive elements within the retail sector

In order to increase sales suppliers will be willing to pay to promote their products within the retail environment and also by way of broader promotion and advertising

If suppliers do not fully understand how retail systems work they will deal through specialist brokers and agents, rather than attempt to deal directly with the retailer themselves (DEPI, 2014)

10.2 Potential for Canarium in domestic retail markets

The potential demand for Canarium as a commercial food product in Papua New Guinean supermarkets has been reported as positive (Cornelius et al, 2012). Positive attributes of Canarium nominated by Papua New Guinea retailers include:

The high degree of familiarity with Canarium amongst Papua New Guineans in its traditional product form, that is, kernels sold in 'karamaps' in traditional markets during the Canarium harvest season

The fondness of Papua New Guineans for Canarium as an indigenous, versatile, healthy and tasty food product

The comparatively high retail cost of many imported nuts, especially tree nuts. Imported nuts attract a duty of 25% to 40% and often come in large sized, relatively expensive retail packages. Both these factors present significant pricing advantages for domestically grown and processed nut products

Canarium is currently available only in traditional markets and only when in season. Retailers suggest that the public would respond well to year round availability of commercially produced and packaged Canarium nuts

Papua New Guineans are said to be very loyal to local food products, Papua New Guinean brands and Papua New Guinean domiciled food manufacturing companies

Demand for quality foods is growing in Papua New Guinea (PNG Business Advantage, April 2015) and opportunities exist for healthy snack food options, positioned as a tasty, affordable alternative to less healthy snack products (Cornelius et al, 2012)

10.3 Market competitors - imported nuts

The major 'like for like' competitor to Canarium nuts are imported tree nuts, such as almonds and cashews. However, imported tree nuts reportedly achieve limited sales at the retail level due to high prices (Cornelius et al, 2012). Table 18 indicates randomly selected retail prices for a range of tree and ground nut products for sale in various retail outlets in Port Moresby.

Table 18: Sample of Imported Retail Nut Products – Nut Type and Price

Nut Type	Pack Size (grams)	Retail Price (K)
Tree Nuts		
Almonds	130	12
Macadamias	110	14

Hazelnuts	**120**	**13**
Cashews	**120**	**13**
Pistachios	**80**	**20**
Walnuts	**150**	**18**
Pecans	**125**	**29**
Ground Nuts		
Australian Peanuts	**500**	**16**
Chinese Peanuts	**185**	**3.3**

Source: Various Port Moresby supermarkets

Peanuts from China are the only imported nuts achieving significant retail sales in Papua New Guinea. This product is therefore a significant competitor to Canarium in the very price driven PNG retail market. The volume of Chinese peanuts being imported into Papua New Guinea has been estimated at 120t per annum (Cornelius et al, 2012).

10.4 Retail product form

Studies suggest that the ***initial product offerings of Canarium into the PNG market should be in a form consumers are already familiar with, that is raw, dried and roasted***. Papua New Guinean consumers view Canarium as a healthy, natural product. Retailers have recommended that care should be taken that any value adding initiatives should not contradict the perception of Canarium as a tasty yet healthy snack food.

Some types of value adding seen in the global nut industry (such as chocolate coated nuts) may be better suited to high value export markets. However, small niche opportunities may exist domestically to market these types of value added products in selected outlets (refer Section 10.9)

10.5 Retail packaging and labelling

Packaging options which promote and protect the product and in which the nuts are clearly visible are recommended for the Papua New Guinean retail sector. Consumers are reportedly very wary of packaging in which contents cannot be seen, especially when making 'first time' purchases of unfamiliar brands.

An example of branded, clearly labelled retail nut packaging in which the nuts are plainly visible to consumers (front and rear views, Hole-Sum Brand, IGA Australia Supermarkets, June 2015)

It is recommended that labelling of commercial Canarium products for domestic retail markets comply with relevant national *and* international food standards. Papua New Guinean retailers nominate Australian standards as being an appropriate benchmark for PNG food manufacturers. Appropriate labelling will not only ensure legal compliance, it will enhance access into new markets and build consumer confidence in the products being sold. More information on relevant aspects of food labelling and food standards can be found on the Australian and New Zealand Food Standards website http://www.foodstandards.gov.au/industry/labelling/pages/default.aspx

10.6 Retail branding and promotion

Wholesalers and retailers in PNG have recommended that commercial Canarium products be positioned as "locally manufactured snack food products" available year round at a standardized retail price and quality, rather than as a seasonally available, variable cash crop.

The Papua New Guinea market is very brand conscious and brand loyal (PNG Business Investor, March 2015) with significant brand loyalty afforded to Papua New Guinea companies and even multinationals with processing operations in Papua New Guinea (such as Coca Cola).

Some retailers have suggested that one dominant domestic Canarium brand be developed and promoted, with this brand strongly and obviously "Papua New Guinean." The rationale being that once one dominant brand becomes established in the market it would be difficult for other competitors to capture its market share due to consumer brand loyalty.

Examples of popular, successful and definably Papua New Guinean food and beverage brands

Promotion is reportedly very important in the Papua New Guinea retail market, particularly when launching new products and brands. Taste testing, cooking demonstrations and point of sale displays and promotions have been recommended as particularly effective. Social media is rapidly growing in importance whilst print and multi-media advertising is said to be less effective and far more costly.

Specialist merchandisers in major markets like Port Moresby can be employed to carry out promotional activities on behalf of food and beverage suppliers and provide direct feedback on market trends and consumer responses to product offerings. Wholesalers and distributers can also be directly involved in developing and coordinating promotional activities, in partnership with suppliers. Wholesalers and distributors reportedly reward any exclusivity in supply arrangements with an appropriately enhanced effort in marketing and promotion of that product line (Cornelius et al, 2012).

10.7 Domestic food service and food manufacturing markets

Examples of food service and food manufacturing markets in Papua New Guinea potentially available to Canarium enterprises producing nut based food products include:

Biscuit, cake, snack food and cereal manufacturers

Mining camp caterers

Hotels and restaurants

Airlines

Hospitals and other institutions (for example, army barracks)

Expectations of buyers differ with each mode of operation. However, some key and common expectations in this sector include:

Reliable product is supplied at agreed quality levels

Products are provided at consistent prices

Early notification is given about changes in product availability

Suppliers provide products with a shelf life and a portion size that suits the market

Responsive order processing and delivery systems exist to cater for changes in demand

Order sizes and frequency of delivery minimise wastage

Information technology is used wherever possible to minimise paperwork and transaction costs

Buyers in this sector are attracted to products with a fixed price and a known supply window. This, for example, allows timely organisation of meal plans, pricing or production schedules. Buyers sometimes prefer to deal through agents or wholesalers that manage supply so as to simplify their purchasing processes.

This sector is also responsive to value-added products. Examples includes products that are ready to use (for example, par baked bread products), packed in meal sized portions and have a shelf life that reduces reordering but maintains quality (DEPI, 2015).

Studies to date have found the food service and manufacturing sector in PNG to be cautious in their response to the potential for Canarium. Reasons given for this include:

The sector prefers to test and evaluate actual product samples from suppliers prior to offering any definitive comment on purchasing potential. That is, commercially produced product samples of an acceptable quality standard will need to be developed for circulation and testing by potential buyers for a full assessment. Even when samples are approved all buyer requirements and purchasing specifications must be met in order to actually gain market entry

Food safety is a critical factor in the food service and food manufacturing sectors. Products sourced must generally be fully ‘guaranteed’ in terms of food safety. HACCP plans and formal compliance

with relevant Food Safety Standards is increasingly required of suppliers before food service and food manufacturing sectors can consider including new ingredients in meal plans, baking schedules etc.

The PNG food service and food manufacturing sector is reportedly less price sensitive than the retail sector and expects to pay international or import equivalent prices for international quality products and supply arrangements. Wholesalers and distributors serving the food service and food manufacturing industries work closely and collaboratively with their customers, to the extent of employing chefs and bakers to demonstrate product versatility and developing recipes for industry use.

Packaging in the food service and food manufacturing sectors is more simplistic (less graphics) and volume orientated than retail, thereby reducing manufacturing costs. For example, nut flakes and nut meal is generally delivered in 1 kilo packs or larger. Branding of food manufacturing and food service supplies is also far less important in comparison to supplying end products targeted at consumers within a retail environment (Cornelius et al, 2012).

10.8 Retail pricing considerations

Papua New Guineans already familiar with Canarium are well aware that nuts sold in traditional markets generally sell for 2 kina per karamap (usually measured by number of kernels rather than weight). This traditional "market price" creates a perception amongst many domestic consumers of what is a "fair price" for Canarium in a "snack pack" form.

5 kina for a 50 gram pack was found to be an ***acceptable price*** threshold amongst consumers buying packaged Canarium nuts at the MSG Trade Fair held i n Port Moresby in late 2014. The Canarium product sold at the Trade Fair was very well received and considered to be of high quality in terms of taste and presentation.

Pricing thresholds of less than 5 kina for packaged Canarium have also been noted in previous consumer studies in PNG (Nevenimo et al 2005).

The fact that consumers can buy Chinese peanuts which are a popular, branded nut snack for an acceptably low price in PNG shops must also be seen by the Canarium industry as a major issue from a

market competition perspective, even though Canarium would appear to have quality and "locally produced" advantages over these imported products.

High quality Canarium produced by NARI and then promoted and sold at the MSG Trade Fair in Port Moresby, November 2014

Papua New Guinean consumers are generally price sensitive and research suggests that small packs of food and beverage products priced at a relatively affordable figure sell far better than larger packs with a higher sale price, even if the larger packs represent significantly better overall value in terms of cost per gram or millilitre.

Examples mentioned by retailers of small pack 'best sellers' in PNG are 250ml bottles of oil, 50gm packs of milk powder, 750 ml bottles of cordial and 50gm packs of coffee (Cornelius et al, 2012). The popularity of these small, affordable items is due to consumer spending constraints, meaning many shoppers prefer to buy a wider range of products with their available shopping budget, rather than a lesser number of "better-value" yet higher priced products in larger pack sizes.

There is no standard snack pack size for nuts, but many smaller sized snack packs in Australian supermarkets range from 40 to 50 grams. By contrast, it is well worth noting that the imported tree nuts listed in Table 18 are relatively large pack sizes by weight with a resultant high sale price. For comparative purposes the actual sale price for each product listed has been converted to a 50 gram equivalent in Table 19.

Table 19: Imported Retail Tree Nut Products with Prices Calculated per 50 grams

Tree Nut Type	Pack Size (grams)	Retail Price (K)	Price calculated per 50 grams (K)
Almonds	130	12	4.61
Macadamias	110	14	6.36
Hazelnuts	120	13	5.41
Cashews	120	13	5.41
Pistachios	80	20	12.50
Walnuts	150	18	6.00

Pecans	125	29	11.60

Source: Various Port Moresby supermarkets

Table 19 indicates that 50 gram packs of Canarium whole kernels selling at a retail price of 5 kina would be in the same price range in real terms as Almonds, Macadamia, Hazelnuts, Walnuts and Cashews. ***It is likely that Canarium would actually be seen by many PNG consumers as "more affordable" than the other tree nuts on offer; if the package sizing strategy outlined in this Report was implemented.***

10.9 Niche market opportunities in PNG

Expatriates in PNG are often well aware of and expect to pay "local" prices for food and beverage products in retail (supermarket) environments. However, expatriates also expect premiums to be charged at specialist venues such as Resorts, Hotels, Airport Lounges and Duty Free Shops. The limited size of these specialist high end markets in Papua New Guinea make this market segment a small niche opportunity. However, these high end venues, being frequented by international visitors as well as expatriates, also offer excellent opportunities to test out new Canarium export products including value added lines (e.g. chocolate coated nuts) and Canarium cosmetics. Export market testing 'on-shore' can be a viable and cost effective part of a broader export market strategy.

11.0 DETERMINING ECONOMIC VIABILITY

11.1 Domestic market demand and value projections

Given the lack of a commercial Canarium industry in PNG it is impossible to predict domestic market demand with absolute certainty. However, a meaningful attempt at estimating demand (the potential size and value of the domestic market opportunity) is needed for business feasibility and planning purposes.

Nut consumption in developed markets varies widely. As a point of comparison, consumption of Macadamia kernels within Australia was projected to be 3591 tonnes in 2014 (Nut Industry Council, 2014). The Australian population in 2014 was approximately 23.8 million (Australian Bureau of Statistics, 2015). This equates to 150 grams of Macadamia kernels consumed per capita in Australia in 2014.

If, due to income constraints and population demographics, only 25% of Papua New Guinea's population of 7.1 million people consumed 150 grams of Canarium kernels per year this would equate to an annual domestic market consumption of 266 tonnes. This demand projection can be considered realistic given the estimated consumption of Chinese peanuts in PNG of 120 tonnes approximately per year.

A 50gm pack (kernels) selling at a retail price of 5 kina per pack equates to a retail value of 100 kina per kilogram. Assuming a domestic demand of 266 tonnes this indicates an annual domestic market retail value of 26.6 million kina.

Demand and pricing estimates in this report should be considered a starting point only for Canarium businesses and Value Chains when considering entering the domestic retail market and each specific business and marketing scenario should be evaluated on its own merits. Note that retailer margins for non-essential food and beverage products in PNG reportedly range from 30% to 50% plus VAT where applicable. This depends on a range of factors including product type, sale volumes and retailer business policies. Retailers generally consider their margins to be business-in-confidence and negotiate with their suppliers accordingly.

11.2 Other factors in determining enterprise viability

Deciding whether a production and marketing system is viable requires more than calculating costs and margins. Other elements that need to be considered include:

Production capacity (for example, units able to be processed per hour at what cost, total production hours available within a given period of time)

The volume of product that can be *guaranteed* to be supplied to each market segment or buyer on a reliable and continuing basis

If processing facilities and operating systems can be modified to meet changes in market demand, and, what would be the financial impact of making these changes

What risk management strategies might be needed for example, alternative or additional suppliers of nuts-in-shell if nut harvest yields are less than expected

Who might be competitors in the Canarium domestic market and what could their potential impact be on market supply, demand and price?

At the time of writing the Canarium processing and marketing industry in PNG is in its absolute infancy so economic benchmarks have yet to be set or evaluated within a commercial environment. Therefore, each enterprise or Value Chain must endeavour to calculate their specific harvesting, processing, distribution and marketing costs using the most up-to-date information available.

NARI is currently accumulating valuable experience and knowledge as a consequence of the Canarium Pilot Factory operating in East New Britain. NARI is also expected to be a hub for ongoing research into processing a range of Canarium products and will be actively involved in extending knowledge and information to the PNG Canarium Industry as it becomes available.

It is strongly recommended that before any investment takes place NARI be consulted on the very latest information regarding equipment options, labour requirements, technical processes, likely costs and other relevant issues associated with establishing and operating a Canarium processing and marketing venture in PNG.

Chapter 3:

PNG Canarium – Becoming Market Ready

12.0 DEVELOPING A PNG CANARIUM MARKETING STRATEGY

The research undertaken and recommendations included in this Report reflect that product development and marketing strategies will need to suit a wide range of PNG Canarium enterprises, including large scale businesses, grower and community groups and SMEs.

This Project will see development of a PNG Canarium Marketing Strategy based in part on the potential market opportunities included in this Report. The Strategy will be designed to stimulate and guide the industry from a marketing perspective as it evolves. The Project team continue to liaise with individuals and organisations in PNG who may become involved in primary and secondary processing, distribution and marketing in domestic or export markets. This continuing consultation will ensure that the PNG

Canarium Marketing Strategy produced in late 2015 is well supported by both the PNG Government and the Private Sector. Also that it is commercially relevant beyond the life of the Project; in anticipation of future processing and marketing activity.

Chapter 3 focuses on the continued development of the PNG Canarium Industry by considering how the Industry can better become market ready. Chapter 3 includes an evaluation of the types of Canarium Value Chains that may evolve in PNG from "the farm to the consumer". It also reflects the very strong likelihood of new entrepreneurs emerging (especially SMEs and regionally based grower and community groups) who may have little or no knowledge of commercial agrifood marketing, especially in export markets. It is anticipated that these people will want to acquire an understanding of export marketing fundamentals such as the potential range of marketing costs and product pricing methodologies as part of their business planning and enterprise development activities.

13.0 CANARIUM VALUE CHAINS

13.1 What exactly are Value Chains?

One definition of a Value Chain is "the full range of value adding activities required to bring a product or service through the different phases of production, including procurement of raw materials and other inputs" (Webber et al, 2010). Other definitions include "businesses connected within a chain producing, transforming and bringing goods and services to end-consumers through a sequenced set of activities" (Henriksen et al 2014) and "a strategic network among a number of business organizations" (Donovan et al 2006)

Agricultural marketing strategies in developing countries are often based on the concept of "inclusive Value Chains" which place emphasis on finding ways in which small-scale farmers and SMEs can be better involved in Value Chains so as to improve their economic circumstances (Haggblade et al, 2012).

13.2 Why an understanding of Value Chain concepts is important in Agricultural Marketing

Every business and activity in a Value Chain is adding cost to the final product but they should also be adding value. Ultimately however, the most important stage of any Value Chain is right at the end, that is, with the consumer.

If end consumers aren't happy, day in day out, with the quality and value of the products they have purchased that Value Chain has failed and ***everyone*** involved in the Chain loses, no matter which business or person in that Value Chain is directly responsible for the breakdown in quality or value.

Agricultural Value Chains often have the added Quality Management challenge of producing and marketing perishable, seasonally produced food products. An Agricultural Value Chain can also be very diverse with a potential mix of small scale farmers, large scale farmers, small processors, larger processors, distributors, wholesalers, retailers, exporters and more.

Regardless of size and function each business or 'link' in the Value Chain must be operating effectively and as planned for the Value Chain as a whole to succeed by way of satisfied consumers and profitable, repeat business.

13.3 Potential Canarium Value Chains in Papua New Guinea

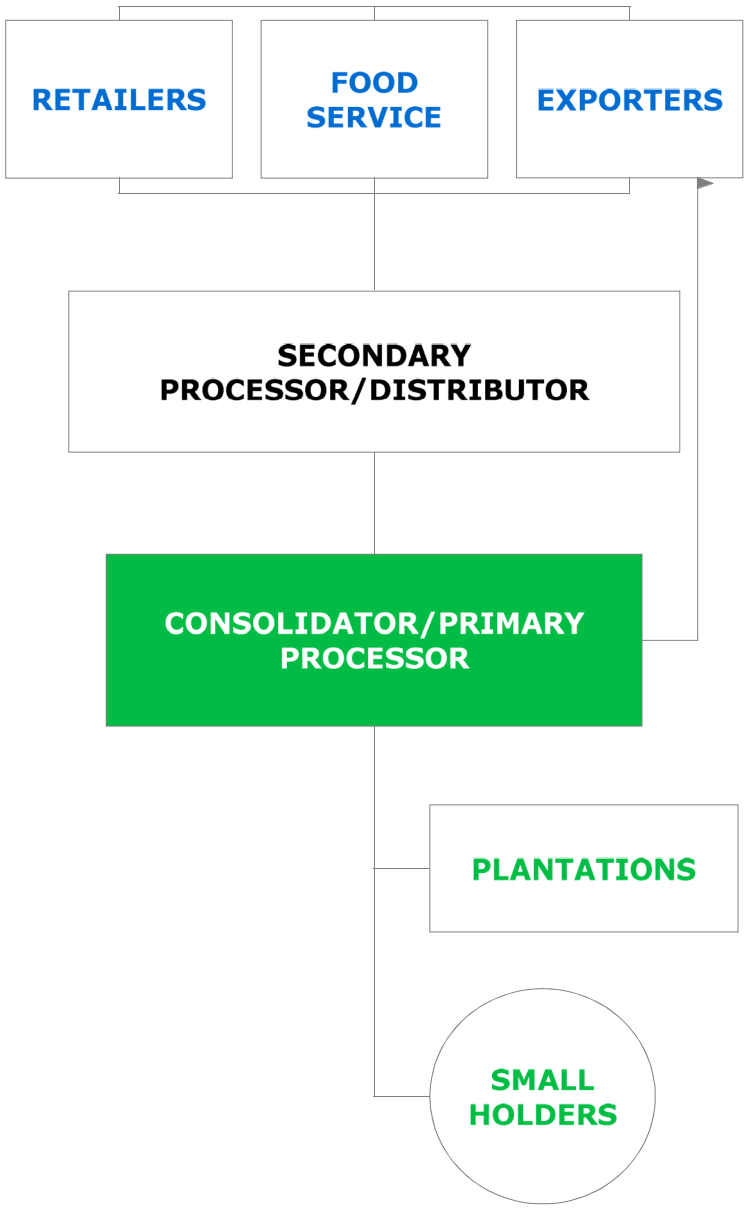
The main focus of Canarium industry development in PNG to date has been on creating a reliable supply of consistent quality raw material by way of plant selections, nursery upscaling and subsequent distribution of trees. The distributed trees are predominantly being used as shade rows within cocoa plots. Canarium therefore has multiple benefits for growers; an effective and compatible shade tree, long term timber resource and nut crop.

As there is currently no marketing of commercially produced Canarium products within Papua New Guinea, Canarium marketing systems and Value Chains in PNG need to be considered as 'potential' or 'optimal' rather than actual systems as yet.

The following examples are Value Chain Models that could develop in the PNG Canarium Industry. Each model is described graphically with advantages and disadvantages of each discussed.

Businesses or entrepreneurs considering entry into the commercial Canarium Industry, especially in the processing and marketing sectors can use these Models for planning purposes; particularly in terms of determining a Value Chain structure and range of business relationships that best suits their own circumstances, aspirations and available resources.

Figure 5: Model A: An example of a Canarium Value Chain featuring links to the Cocoa Industry



NB: Model A is based on well-established Cocoa Buyers/Traders acting as Canarium 'Consolidators/Primary Processors'

Model A: Advantages and disadvantages

The already well established policies, business and operating structures of the cocoa buying and processing companies could see them operating as ***Value Chain hubs*** in the PNG Canarium industry; acting as ***product consolidators*** and ***primary processors*** prior to forwarding product on to established secondary processors for any additional processing, final packaging and distribution to markets.

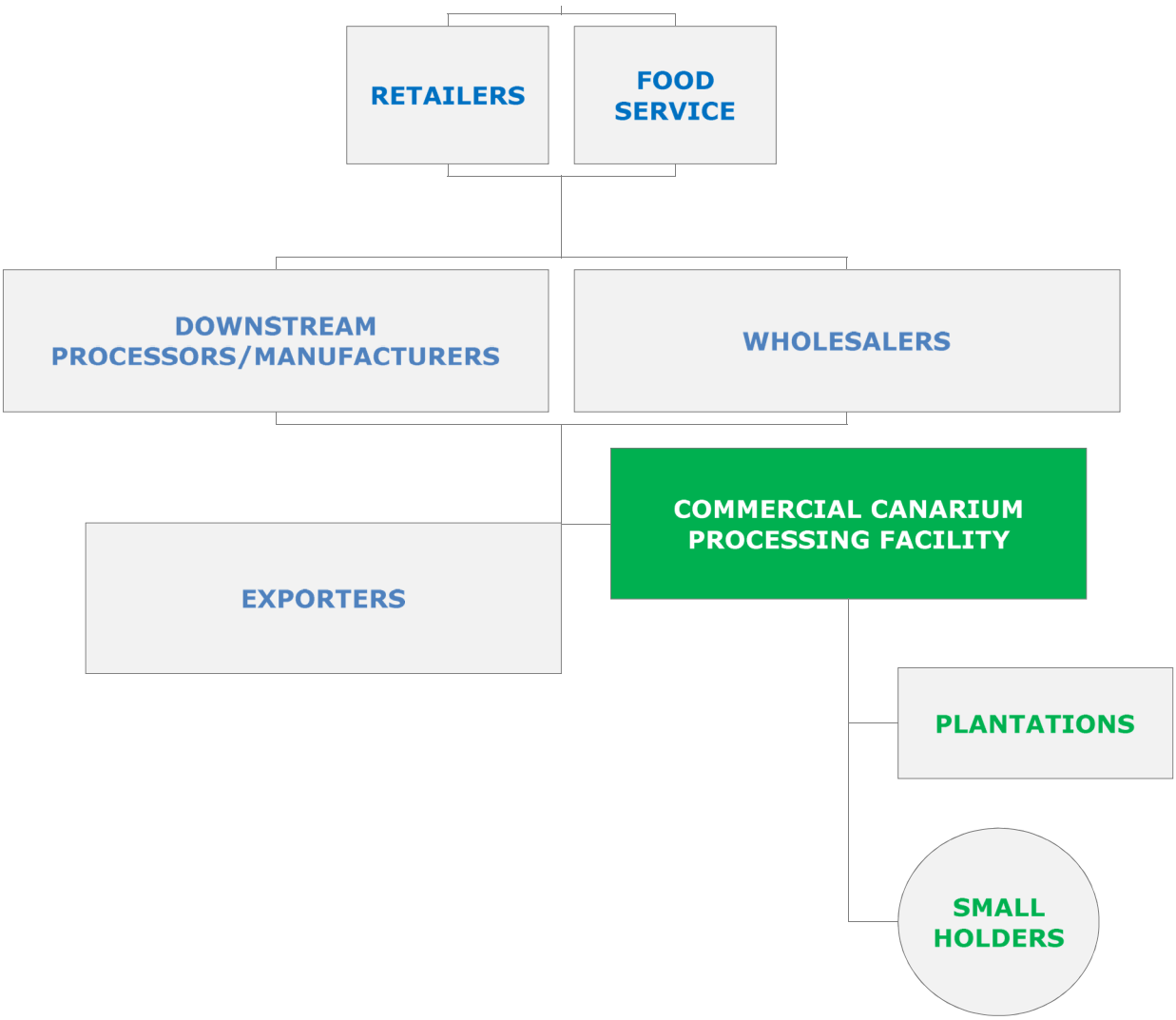
Cocoa buyers and traders in East New Britain, such as the East New Britain Development Corporation (ENBDC) and Agmark, are contenders to be participants in the commercial development of Canarium in the short to medium term. These organisations have definitive advantages over new/start-up industry participants and a vested interest in Canarium succeeding as a commercial crop. The cocoa companies have:

- Access to significant volumes of raw material from their own Canarium plantings
- Access to significant volumes of raw material from their (thousands) of cocoa grower suppliers who have planted Canarium over the last few years
- Well established business relationships with their grower suppliers and a desire to support these people in achieving diversified and increased farming incomes
- Established collection and distribution networks, infrastructure and equipment in place (e.g. cocoa buying points, processing and storage facilities, road and sea freight systems). Canarium collection, processing and distribution could conceivably be undertaken parallel to existing cocoa systems (with appropriate cross-contamination safeguards)

In Model A the established secondary processors could maximise Canarium market development due to their product manufacturing expertise, existing market relationships and marketing knowledge

- Model A would still require investment in dedicated primary processing lines for Canarium so as not to cross-contaminate cocoa dryers etc.
- Large scale pre-harvest, processing and post-harvest protocols for Canarium have yet to be developed, tested or implemented and economic benchmarks have yet to be established

Figure 6: Model B: An example of a Canarium Value Chain featuring a medium to large scale Canarium Processing Facility



Model B: Advantages and disadvantages

Model B is based on the establishment of dedicated, medium to large scale Canarium processing facilities based within East New Britain or elsewhere.

Such facilities could act as industry and Value Chain hubs

A high volume of Quality Assured product could be produced using this Model which would help push market development, particularly in international markets

The NARI pilot facility could act as a technical resource for such ventures

- Dedicated Canarium Processing Factories may only operate seasonally and could be greatly impacted by harvesting yield variations
- Inherent business relationships, product handling and distribution systems may not exist, as opposed to those already enjoyed by cocoa companies (as primary processors and consolidators) in Model A
- Significant up-front investment would be needed (facilities and equipment) and operating challenges would be likely (for example, large scale raw material procurement and product handling systems, timely repairs and maintenance of critical processing equipment)
- High volume harvesting, processing and post-harvest protocols for Canarium have yet to be developed, tested or implemented and economic benchmarks have yet to be established

Figure 7: Model C (i): An example of a Canarium Value Chain featuring smaller scale processing by SMEs and Community Groups

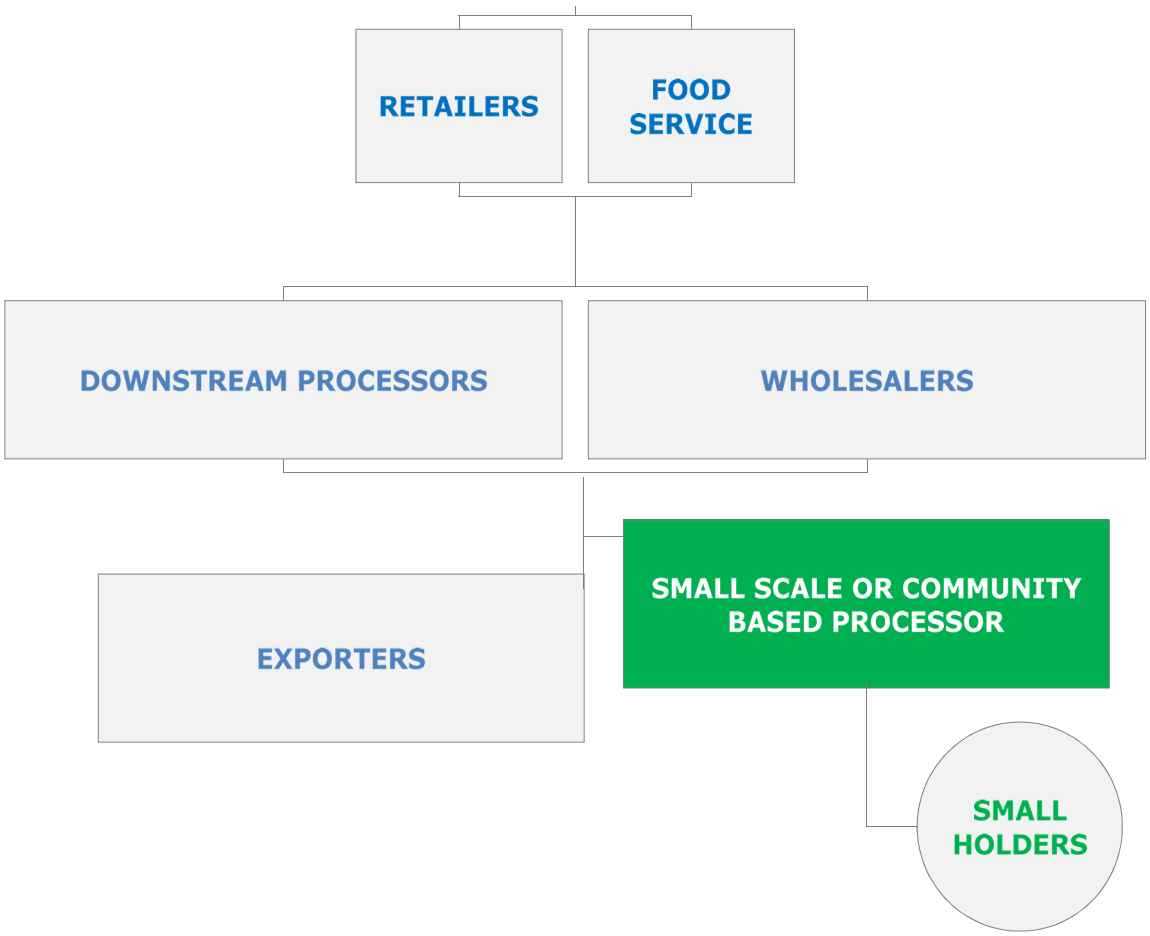
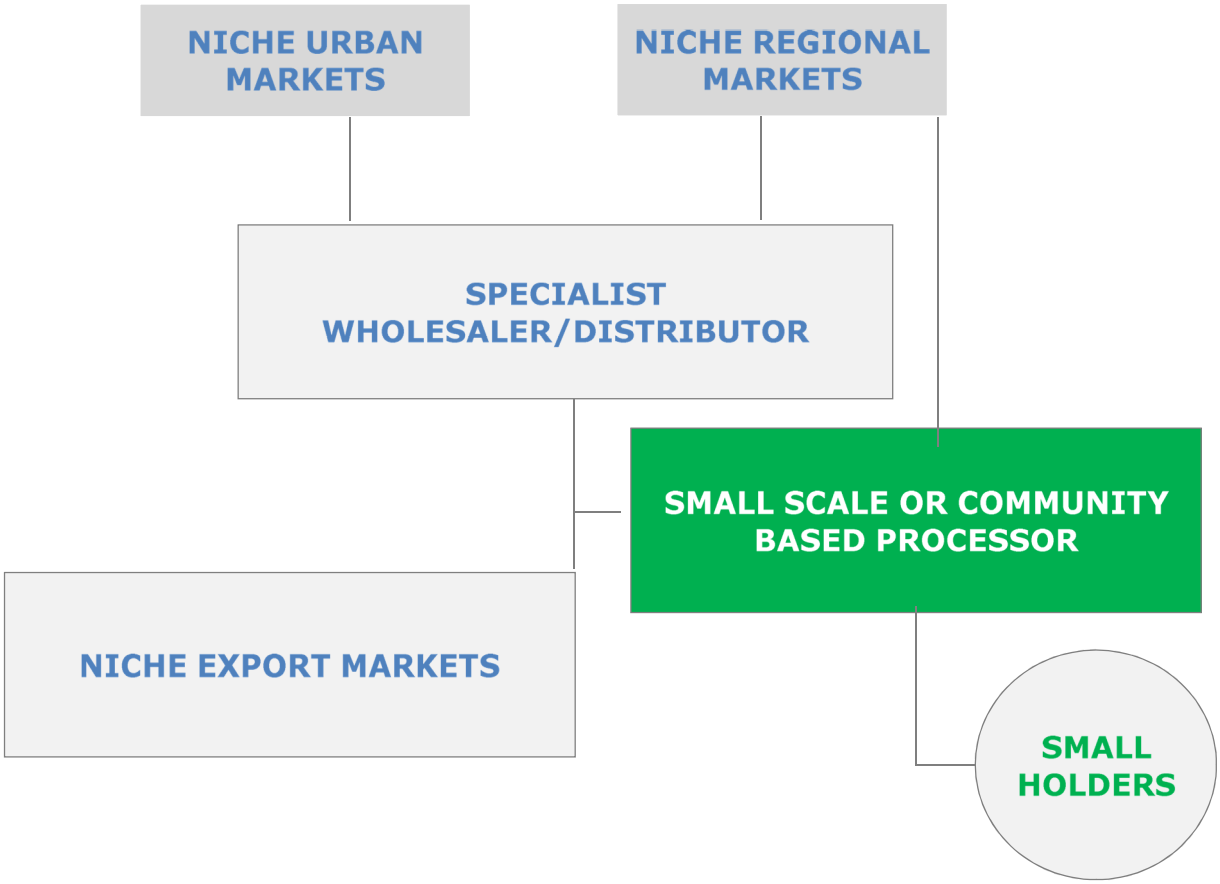


Figure 8: Model C (ii): An alternative example of a Canarium Value Chain featuring smaller scale processing by SMEs and Community Groups



Model C: Advantages and disadvantages

Model C shows two examples of small or niche market orientated processing ventures with differing marketing channels, which could be centred on East New Britain or elsewhere in PNG

Model C indicates direct community and SME involvement in processing and marketing. This may result in increased smallholder involvement leading to direct benefits in terms of employment and income generation, especially in regional and rural areas

High value, differentiated product could be produced on a small scale using these models to facilitate market development, particularly in boutique or niche markets

The NARI pilot facility may provide a number of services to support these types of enterprises, for example, by acting as a technical and training resource

- Assistance would likely be needed to fund the setup and operation of these type of Value Chains, including finance, technical and marketing support
- Inherent business relationships and product handling and distribution systems are less likely to exist, as opposed to those already enjoyed by cocoa companies (as primary processors and consolidators) in Model A
- Significant (by SME and Community standard) up-front investment may be needed for facilities and equipment and operating challenges would be likely, for example, access to retail standard packaging and labelling and obtaining cost effective transportation of product to distant markets

14.0 EXPORT PRICING METHODOLOGIES

It is anticipated that many businesses in the evolving PNG Canarium industry will be new to export. This section of the Report has been included for those businesses and Value Chains, particularly involving SMEs and Community Groups, as an introduction to the types of activities needing to be undertaken by successful exporters. Online resources referenced extensively in developing this section included:

International Chamber of Commerce 'The New Incoterms' http://iccwbo.org/incoterms/id3045/index.html

Austrade 'About exporting' www.austrade.gov.au/How-to-export/default.aspx

USDA Foreign Agricultural Service 'Exporting' www.fas.usda.gov/topics/exporting

These websites are good examples of resources being provided by government and other agencies, to assist their stakeholders in becoming export ready.

In a new industry such as PNG Canarium, actual costs have to be estimated without the benefit of historical knowledge or proven economic benchmarks. This means that entrepreneurs must take ***extreme care*** when calculating costs and when quoting prices to potential customers. ***This applies to all markets, both domestic and export.***

14.1 Export pricing compared to domestic market pricing

Pricing for any market requires an understanding of relevant transactions, costs, demand and competition in that market. When exporting these variables are likely to far exceed those in domestic markets. Careful analysis of the export markets chosen and an accurate assessment of an appropriate export price will determine whether an export venture is competitive and can ultimately be profitable.

14.2 Options for calculating an export price

The traditional method of price calculation is the 'cost-plus' approach. The price calculation will include the components of domestic price, plus the addition of costs that are specific to the export transactions. 'Marginal' or 'differential' costing is a technique commonly employed by food manufacturers and processors. This method establishes the base price of a product or service using the direct costs of production and sales, with fixed costs apportioned to the volume of the sale.

An alternative pricing technique involves working towards an anticipated, competitive market price. This method determines whether the exporting business can actually be viable in that market at a price the market is likely to accept.

14.3 Export cost components

Export market development can involve a range of costs that do not apply to domestic sales. Knowledge of these costs increases through ongoing monitoring of market and industry conditions and through experience. It is critical at the outset that entrepreneurs recognise these costs and include realistic values for them.

Some of the costs specific to export include international market research, overseas travel, (potentially) translations, international freight forwarding and shipping. Export costs may also include additional packing and packaging, product modifications, labelling, compliance with foreign standards, insurance, credit checking, export documentation and export financing charges (Austrade, 2006).

14.4 Costs that can be underestimated or overlooked

Without adequate research into all elements of an export price potential "deals" that initially appear attractive may prove unprofitable or unviable in practical terms. Most critically, exporters must ensure that the understanding they have with their buyer is clear and well documented. Cost elements that can be overlooked or under-estimated include:

Modifications to the product (for example, differing processing techniques and product "recipes" to suit specific market flavour profiles)

Unanticipated freight and handling costs due to a misunderstanding of trading terms and agreements

Documentation requirements such as certificates of origin, quarantine and health certificates

Insurances, finance and banking charges can be export specific, for example, foreign exchange risk management products

Delays in customs clearance are common in many markets. Exporters must ensure that liabilities for delivery are worded explicitly in contracts to avoid additional charges. Errors associated with packaging, documentation and labelling can also result in rejection of product at the port of entry; resulting in high expenses in remediation or product return

The wording on all documents must be precise and match contractual requirements. Simple mistakes in clauses can cause large problems, such as unanticipated delays in receiving payment. Terminology used in export markets may be different that the country of origin and this can result in misunderstandings between sellers and buyers (Austrade, 2006)

14.5 The marginal or differential costing model

Marginal or differential costing is a export pricing technique which is based on calculating variable costs (such as direct labour and materials) and variable manufacturing overheads (such as electricity costs incurred by operating dryers and ovens). Marginal costing enables businesses to calculate the **breakeven point,** the minimum price at which the business can profitably sell to an export customer (Austrade, 2006).

In the example shown in Table 20 the export selling price for a 100 gram package of nuts is the equivalent of 10 kina.

Table 20: Marginal or Differential Costing Example

SALES (100 gram packages of roasted Canarium nuts)

	40,000 PACKAGES SOLD		20,000 PACKAGES SOLD	
	TOTAL (kina)	PER PACKAGE (kina)	TOTAL (kina)	PER PACKAGE (kina)

Sales Revenue	400,000	10.00	200,000	10.00
Variable Costs	160,000	4.00	80,000	4.00
Contribution	*240,000*	*6.00*	*120,000*	*6.00*
Fixed Costs	150,000	3.80	150,000	7.50
Net Profit/Loss	**90,000**	**2.20**	**(30,000)**	**(1.50)**

Source: Austrade 'Guide to Export Pricing' 2006

To determine the minimum price that this Canarium business can sell to export buyers it is necessary to calculate the *break-even point*.

The *contribution margin* is the difference between the sale price and variable cost divided by the sale price. In this example the margin is 60%.

(10 minus 4 = 6)

(6 divided by 10 = 0.6 or 60%)

The break-even point is calculated by dividing the fixed costs (150,000 kina) less the net profit (0 kina to actually break-even) = 150,000 kina divided by the contribution (6 kina).

(150,000 minus 0 = 150,000)

(150,000 divided by 6 = 25,000)

Therefore, in the example shown in Table 20 the business would need to produce 25,000 packages at a selling price of 10 kina to break even.

Production in excess of 25,000 packages @ 10 kina would result in a profit, whilst production of less than 25,000 packages @ 10 kina would result in a loss.

14.6 Determining a preferred export end-market price

Table 21 gives an example of how an agrifood manufacturer/exporter can determine an end market price (for example, the retail sale price) including making allowance for an acceptable profit margin. Of course the price being set must be competitive within that export market.

Note this example illustrates a realistic calculation process only. The product, customer, costs and expected margins are all hypothetical. Actual transactions and costs in a real life scenario would apply depending on the specific production and marketing circumstances.

Table 21: Example of a preliminary calculation of an export retail price (2 pages)

Product Name	***"Nancy's Nutty Snack Bars"***		
Origin	PNG		
Destination	Singapore		
Customer	***"Singapore Superstore"***		
Base currency	PNG Kina (PGK)		
Foreign currency	Singapore Dollar (SGD)		
Exchange rate	1 PGK = 0.5 SGD		
Cost per Retail Unit			
(1 individually packaged Bar)		**PGK**	**SGD**
Manufacturing			
Variable costs			
Raw materials		0.18	0.09
Manufacturing labour		0.30	0.15
Utility costs (electricity, gas)		0.01	0.005
Inner packaging		0.01	0.005
Outer packaging		0.02	0.01

Fixed costs			
Share of business overheads		0.20	0.1
Finance costs		0.30	0.15
Total Manufacturing Costs		**1.02**	**0.51**
Transport to port		0.02	0.01
Loading and port charges		0.03	0.015
Sub-total		**1.07**	**0.535**
Manufacturers Preferred Profit Margin	25%	0.27	0.13
FOB Cost		**1.34**	**0.67**
Freight to country of destination		0.25	0.125
Documentation		0.01	0.005
Insurance		0.03	0.015
Tariffs and duties		0.09	0.045
Inspections		0.02	0.01
CIF Cost		**1.74**	**0.87**
Agent/Distributors margin	10%	0.17	0.085

Wholesalers margin	10%	0.17	0.085
Retailers margin	30%	0.52	0.26
Promotion	5%	0.09	0.045
Advertising	3%	0.05	0.025
Shelf fee	2%	0.03	0.015
Reimbursements on expired items	1%	0.02	0.01
Minimum Export Retail Price Required		**2.78 PGK**	**$1.38 SGD**

14.7 Incoterms

Incoterms such as 'FOB' (Free On Board) are part of a 'common language' used extensively in international markets by buyers and sellers alike. First introduced in 1939, Incoterms are international rules for the interpretation of trade terms. Incoterms make international trade easier and helps traders in different countries to understand one another. These standard trade definitions are the most commonly used in international contracts are protected by ICC copyright.

Incoterms are widely used throughout the world. They are used to divide transaction costs and responsibilities between buyer and seller and also reflect transportation practices. Incoterms deal with questions related to the delivery of the products from the seller to the buyer. This includes the carriage of products, export and import clearance responsibilities, who pays for what and who has risk for the condition of the products at different locations within the transport process (ICC, 2015).

Incoterms are devised and published by the International Chamber of Commerce (ICC). Authorized translations into 31 languages are available from ICC national committees. For precise definitions of all

Incoterms and the corresponding responsibilities and liabilities of both buyers and sellers readers should visit the ICC website (http://iccwbo.org/incoterms).

Chapter 4:

Ranking Canarium Markets and Products

Colin Bunt Macro Consulting Group Pty Ltd
Maria Raciti University of the Sunshine Coast

15.0 SELECTING SUITABLE MARKETS FOR PNG CANARIUM AT INDUSTRY INCEPTION

15.1 Market research spectrum

Chapter 4 summarises the research within this and previous Canarium projects as to where viable market opportunities may exist for commercial Canarium products produced in Papua New Guinea.

15.2 Market selection criteria

Canarium is highly valued as a traditional food in PNG and in Melanesia as a whole. There is unmet demand for Canarium within Papua New Guinea where it is very well known but not available commercially beyond traditional markets. Preferential market access arrangements between Melanesian countries also favour regional trade (MSG, 2015).

Maximizing domestic market potential will be a critical starting point for the PNG Canarium industry. Ultimately however Canarium is viewed as being a very important export market crop. Large, dynamic export markets are needed if PNG Canarium is to meet its economic potential.

Whilst many international markets exist for nut exports the scope of this Project requires that markets are selected that provide a good "fit" with PNG and with Canarium. Three export markets that provide that good fit have been chosen for consideration in this Report. These international markets are:

China

Japan

Australia

15.3 Market linkages with PNG

During the life of the Project numerous stakeholders have expressed confidence in developing harvesting and processing systems. However concerns are frequently expressed as to the potential difficulties and cost of entering and developing new export markets, especially with the essentially "unknown" product that is PNG produced Canarium.

On that basis potential ***export markets have been selected that are not only significant international nut markets, but markets that have strong trade linkages with PNG and in which direct, hands-on inmarket support can be provided to Canarium entrepreneurs***. These factors greatly enhance the potential for sustainable export marketing success.

15.4 Positive attributes of the selected export markets

Agricultural products account for 23.8% of Papua New Guinea's merchandise exports worth $1332 (million US$ FOB) in 2013 (WTO, September 2014).

The countries selected as having good potential for Canarium exports are major PNG trading partners in terms of both exports and imports (refer Tables 22a and 22b). Accordingly political, trade and business linkages are firmly established between respective Governments and within the Private Sector.

Table 22a Papua New Guinea Global Merchandise Trade Relationships - Exports

Export Destinations (ranking)	% total merchandise exports
1. Australia	35.9%
2. EU (multiple countries)	20.2
3. Japan	11.7
4. China	6.7%
5. Singapore	5.6

Source: WTO, September 2014

Table 22b Papua New Guinea Global Merc

andise Trade Relationships - Imports

Import Sources (ranking)	% total merchandise imports
1. Australia	34.4
2. Singapore	14.3
3. EU (multiple countries)	8.3
4. China	6.9
5. Japan	6.4

Source: WTO, September 2014

Besides the extent of trade relationships between PNG and the selected export markets other positive elements include:

- The countries selected import large volumes (relative to population size) of nuts and nut based products. The research summarised in Chapter One of this Report indicates that China, Japan and Australia are amongst the world's largest nut markets
- Pacific Islands Trade and Invest (PITI) have offices and staff in China, Japan and Australia. This Agency can provide invaluable marketing support on a continuing basis to PNG Canarium exporters
- There is a wide variance in market size in the countries chosen and each has good to very good growth potential

Small, niche market through to commodity type marketing opportunities are able to be identified across this market spectrum ("something for everyone" from SMEs to corporates)

Transport linkages between PNG and the selected countries are well established and reliable

15.5 Critical in-market support for Canarium exporters

Agencies such as Pacific Islands Trade and Invest (PITI) can greatly assist Canarium export development as the commercial industry develops. As stated, this is an area that has been identified as being of major concern and importance to prospective Canarium investors in PNG.

PITI is an arm of the Pacific Islands Forum Secretariat that develops and services export-capable businesses in 14 Pacific Island countries, including PNG. PITI is the primary Pacific Islands agency tasked with developing export activity within member countries and works with Pacific Island exporters in accessing and building international markets for their products.

PITI services that are highly relevant to the emerging PNG Canarium industry include:

- Connecting exporters with international buyers, importers and distributors;
- Providing practical export advice, market information and technical expertise including product testing;
- Helping export-capable businesses and industries in becoming export ready;
- Providing promotional support, market exposure and facilitating business connections at trade exhibitions and on a one to one basis within target markets (Pacific Islands Trade and Invest, 2015)

Part of the PITI stand at the Fine Foods Exhibition, Melbourne, 2012 (image sourced from PITI website)

15.6 Commercialising Canarium products

A broad range of food and non-food products can be produced using Canarium nuts, although there is significant product development and market testing to be done in this area, particularly in consideration of large scale commercialisation. Potentially viable food and non-food markets for Canarium products have been considered and summarised in Section 16 for the following market destinations; Papua New Guinea, China, Japan and Australia.

16.0 SUMMARIES OF CANARIUM MARKET AND PRODUCT DEVELOPMENT OPPORTUNITIES

16.1 PNG Market – Canarium Products

Table 23 summarises significant market attributes relevant to Canarium products in the Papua New Guinean market, including:

Key market segments and characteristics

Drivers of demand

Relevant Canarium research results

Highest ranking market opportunities Other products with probable market potential

Significant competition for PNG Canarium

Table 23: Summarised Opportunities for Canarium Products in the PNG Market

Key Market Segments and Characteristics o *A rising, urban middle class is demanding higher quality, more diverse food and beverage offerings* o *Parents are seeking healthy snacks for their children, for example for inclusion in school lunches* o *Papua New Guineans, particularly in urban areas, don't normally have access to Canarium* o *Supermarkets are heavily reliant on food and beverage imports and responsive to PNG suppliers* o *PNG has large sized food caterers, including mining camps and institutions such as hospitals* o *High end niche markets exist, including leading hotels, restaurants, resorts and Duty Free shops*

Drivers of Demand o *A desire by many Papua New Guineans to purchase indigenous, healthy, PNG produced foods* o *Consumer familiarity and a strong liking for Canarium in its traditional forms*

- o *The high cost of imported tree nuts due to taxes, tariffs and market inappropriate pack sizes* o *Well known PNG brands and locally based companies are supported by local consumers* o *There is a shift amongst consumers to a healthier diet with nutritional foods gaining in value* o *Disposable incomes are rising amongst middle class consumers*
- o *Increasing incomes are moving consumption patterns towards higher quality food products*

Relevant Canarium Research Results o *Initial product offerings should be in a form consumers are familiar with; raw, dried and roasted* o *Retail pack sizes should reflect consumer preferences for affordable grocery items* o *Consumers are wary of packaging in which contents cannot be seen*

o *Consumers are very responsive to in-market displays and product sampling promotions* o *Food service and food manufacturers increasingly require that suppliers have food safety systems* o *Retailers demand guaranteed supply of consistently priced, quality products from their suppliers*

Highest Ranking Market Opportunities

o *Quality raw, dried and roasted whole kernels sold in retail outlets. Product attributes to include:*

- *50 gram (or in the range thereof) packages retailing for approximately 5 kina*
- *Packaging to clearly show the product contained therein*
- *Strong PNG branding and in-store promotional strategies to be implemented*

Other Products with Probable Market Potential o *Canarium nuts packaged as high quality PNG souvenirs and gifts* o *Canarium oil suitable for cooking* o *Canarium used in cosmetics (potential niche markets including online sales & the tourism sector)* o *Nut by-products (flakes, nut meal, slivers) targeted at the food service and manufacturing sectors*

Significant competition for PNG Canarium o *Canarium sold in traditional markets (in season) at comparatively low prices* o *Chinese peanuts, very popular with consumers and sold by retailers for relatively low prices*

16.2 Chinese Market - Canarium food products

China can be considered a potentially very important and suitable export food market for PNG Canarium.

Table 24 summarises key aspects of the Chinese market relevant to Canarium food products, including:

Market segments and characteristics

Drivers of demand

Relevant Canarium survey results

Ranking of products

Significant competition for PNG Canarium

As well as snacks, Chinese consumers will purchase larger packages of nuts to share with others

- *Chinese consumers rate the following nut product attributes as important or very important:*
  - *Nuts taste, look and smell good, are fresh, nutritious, of a consistent high quality and organic*
  - *Prepared 'ready to eat' in convenient sized packages*
  - *Packaged in an environmentally friendly way*
  - *Packages that keep product fresh and allow consumers to see what they are buying*
  - *Products meet food safety standards and are free from chemicals and preservatives*
- *Country of origin issues are important to Chinese consumers*
- *Chinese consumers will buy more nuts when either price of quantity is discounted*

Highest Ranking Market Opportunities
- *High quality, roasted whole kernels sold in supermarkets for personal consumption, including:*
  - *Branding targeting the defined market segments (e.g. young, educated, worldly, middle class)*
  - *Product promoted as being tasty, natural, healthy, nutritious, providing energy and convenient*
  - *Promotions to include in-store displays and sampling opportunities*
  - *Resealable packaging ranging in size from 50 to 300 grams with nuts also visible to consumers*
  - *Pricing to be no more than 10% above the market average for similar products*
  - *Food safety certification achieved (very important) and organic certification (preferred)*

Other Products with Probable Market Potential
- *Canarium nuts in shell*
- *Canarium nuts in various forms packaged as high quality gifts*
- *Flavoured Canarium nuts (for example; salted, sugar coated, spicy)*
- *Canarium cooking oil*
- *Nut by-products (flakes, nut meal, slivers)*

Significant Competition
- *The Philippines; currently increasing production of Canarium (pili) nuts and oil for export to China*

16.3 Japanese Market - Canarium food products

Japan can be considered a potentially important and suitable export food market for PNG Canarium.

Table 25 summarises significant aspects of the Japanese market relevant to Canarium food products, including:

Market segments and characteristics

Drivers of demand

Relevant Canarium survey results

Ranking of products

Significant competition for PNG Canarium

- *Products meet food safety standards and are free from chemicals and preservatives* o *Japanese consumers will buy more nuts when price rather than quantity is discounted*

Highest Ranking Market Opportunities o *High quality, natural & flavoured kernels sold in supermarkets for personal consumption, including:*

- *Branding to target the defined market segments (e.g. women, singles, young and the elderly)*
- *Product promoted as being tasty, natural, healthy, nutritious and convenient*
- *Promotions to include in-store displays and sampling opportunities*
- *Resealable packaging in small sizes with nuts visible to consumers*
- *Pricing to be no more than 10% above the market average for similar products*
- *Food safety certification achieved (very important) and organic certification (preferred)*

Other Products with Probable Market Potential o *Nut based dairy milk substitutes* o *Canarium nuts in various forms packaged as high quality gifts* o *Nut by-products (flakes, nut meal, slivers, powder)*

Significant Competition o *The Philippines; currently increasing production of Canarium (pili) nuts and oil for export*

16.4 Australian Market - Canarium food products

Australia can be considered a potentially important and suitable export food market for PNG Canarium.

Table 26 summarises significant aspects of the Australian market relevant to Canarium food products, including:

Market segments and characteristics

Drivers of demand

Relevant Canarium survey results

Ranking of products

Significant competition

- *Come in resealable packages so nuts stay fresh*
- *Packaging allows consumers to see the nuts they are buying*
- *Products meet food safety standards and are free from chemicals and preservatives* o *Australian consumers are price sensitive and buy more nuts when price and quantity is discounted*

Highest Ranking Market Opportunities o *High quality whole kernels sold in retail outlets for personal consumption, including:*

- *Natural, roasted and salted product lines for specific market segments, including organics*
- *Branding to target the defined market segments (e.g. people in the 50 to 64 age bracket)*
- *Products promoted as being tasty, natural, healthy, nutritious and convenient*
- *Promotions to include in-store displays and sampling opportunities*
- *Resealable packaging in small to medium sizes with nuts visible to consumers*
- *Pricing to be no more than 10% above the market average for similar products*
- *Food safety certification (very important) and organic certification (important)*

Other Products with Probable Market Potential

o *Nut based dairy milk substitutes* o *Nut by-products (flakes, nut meal, slivers)*

Significant Competition o *Australian macadamias; the indigenous and very reputable 'high quality' nut in the market*

16.5 Market opportunities in China for cosmetic products featuring nut oils

China can be considered a potentially very important and suitable export market for non-food PNG Canarium products.

Table 27 summarises key aspects of the Chinese market relevant to cosmetic products featuring nut oils, including:

Market segments and characteristics

Drivers of demand

Potential product lines

Significant competition for PNG Canarium

Table 27: Summarised Opportunities for Cosmetics Featuring Nut Oils in the Chinese Market

CHINA
Market Segments and Characteristics
o *Estimates of growth in the Chinese cosmetics market extends to 60.9% between 2013 and 2018* o *Skincare products dominate the Chinese cosmetics market with 39.9% total market share* o *Haircare products are the next largest segment with 14.9% total market share* o *Almond, Argon, Coconut & Macadamia are the most noted cosmetic nut oils* o *Use of Macadamia oil in cosmetics (e.g. moisturisers, make-up, cleaners, creams) is growing rapidly* o *South Korean cosmetic products and innovations are being adopted across Asian markets* o *Speciality ingredients such as macadamia are predicted to increase in value in the Chinese market* **Drivers of Demand**
o *Nut oils are growing in popularity, particularly in skin care lines including anti-aging products* o *In a very competitive market manufacturers are seeking new oils to differentiate their products* o *Nut oils are valued for their attributes (e.g. hydration properties) but also for their exotic origins* o *Product development trends are being driven by a demand for convenience (in terms of ease of use)* o *Nut oil products fit the convenience profile, e.g. facial mists and hair moisturisers* **Potential Product Lines**
o *Inclusion in skin care moisturisers (e.g. creams, oils, balms and soaps)* o *Inclusion in skin care cosmetics (e.g. make-up, deodorant, lotions and cleansers)* o *Inclusion in hair care products (e.g. shampoos, conditioners, sprays, styling products)* o *Inclusion of oils and resins in fragrances and essences*
Significant Competition for PNG Canarium
o *The Philippines; currently increasing production of Canarium (pili) oil for export, including China* o *The Philippines also harvest resin from Canarium trees for use by global perfume companies, refer: http://www.mb.com.ph/growing-demand-for-manila-elemi-a-big-boost-to-bicols-pili-industry/*

16.6 Market opportunities in Japan for cosmetic products featuring nut oils

Japan can be considered a potentially important and suitable export market for non-food PNG Canarium products.

Table 28 summarises key aspects of the Japanese market relevant to cosmetic products featuring nut oils, including:

- Market segments and characteristics
- Drivers of demand
- Potential product lines
- Significant competition for PNG Canarium

Table 28: Summarised Opportunities for Cosmetics Featuring Nut Oils in the Japanese Market

JAPAN
Market Segments and Characteristics
o *The Japanese market favours locally produced Japanese cosmetics over international brands*
o *Japanese cosmetic companies are innovative and use imported nut oils in a range of products*
o *Growth in the personal care industry is estimated to be 5% between 2013 and 2018*
o *Skincare products dominate the Japanese cosmetics market with 34.1% total market share*
o *Haircare products are the next largest segment with 16.1% total market share*
o *Almond, Jojoba Macadamia are the most noted cosmetic nut oils in the Japanese market*
o *Use of Macadamia oil in cosmetics (e.g. moisturisers, make-up, creams) is growing rapidly*
Drivers of Demand
o *Nut oils are growing in popularity, particularly in skin care lines including anti-aging products*
o *In a very competitive market cosmetic manufacturers are seeking new oils to differentiate products*
o *Nut oils are valued for their attributes (e.g. hydration properties) but also for their exotic origins*
o *Product development trends are being driven by a demand for convenience (in terms of ease of use)*
o *Nut oil products fit the convenience profile, e.g. facial mists and hair moisturisers*
Potential Product Lines
o *Inclusion in skin care moisturisers (e.g. creams, oils, balms and soaps)*
o *Inclusion in skin care cosmetics (e.g. make-up, deodorant, lotions and cleaners)*
o *Inclusion in hair care products (e.g. shampoos, conditioners, sprays, styling products)*
o *Inclusion of oils and resins in fragrances and essences*
Significant Competition for PNG Canarium
o *The Philippines; currently increasing production of Canarium (pili) oil for export*
o *The Philippines also harvest resin from Canarium trees for use by global perfume companies, refer:*
http://www.mb.com.ph/growing-demand-for-manila-elemi-a-big-boost-to-bicols-pili-industry/

16.7 Market opportunities in Australia for cosmetic products featuring nut oils

Australia can be considered a potentially important and suitable export market for non-food PNG Canarium products.

Table 29 summarises key aspects of the Australian market relevant to cosmetic products featuring nut oils, including:

- Market segments and characteristics
- Drivers of demand
- Potential product lines
- Significant competition for PNG Canarium

Table 29: Summarised Opportunities for Cosmetics Featuring Nut Oils in the Australian Market

AUSTRALIA
Market Segments and Characteristics
o *Macadamia cosmetics are being developed and produced commercially by Australian companies*
o *Use of Macadamia oil in cosmetics (e.g. moisturisers, cleansers, creams) is growing rapidly*
o *Brazil Nut, Argon, Coconut & Macadamia are the most noted cosmetic nut oils*
o *Estimates of growth in the Australian cosmetics market extend to 11% between 2013 and 2018*
o *Skincare products are the largest segment of the Australian market with 15.2% total market share*
o *Make-up products are the next largest segment with 14.6% total market share*
o *Haircare products are the third largest segment with 14.2% total market share*
Drivers of Demand
o *Nut oils are growing in popularity, particularly in skin care lines including anti-aging products*
o *In a very competitive market cosmetic manufacturers are seeking new oils to differentiate products*
o *Nut oils are valued for their attributes (e.g. hydration properties) but also for their exotic origins*
o *Product development trends include consumer demand for convenience (in terms of ease of use)*
o *Nut oil products fit the convenience profile, e.g. facial mists and hair moisturisers*
Potential Product Lines
o *Inclusion in skin care moisturisers (e.g. creams, oils, balms and soaps)*
o *Inclusion in skin care cosmetics (e.g. make-up, deodorant, lotions and cleansers)*
o *Inclusion in hair care products (e.g. shampoos, conditioners, sprays, styling products)*
o *Inclusion of oils and resins in fragrances and essences*
Significant Competition for PNG Canarium
o *Australian macadamia, as an indigenous nut oil used in Australian produced cosmetic products*
o *The Philippines; currently increasing production of Canarium (pili) oil for export*
o *The Philippines harvest resin from Canarium trees for use by global perfume companies, refer:*

http://www.mb.com.ph/growing-demand-for-manila-elemi-a-big-boost-to-bicols-pili-industry/

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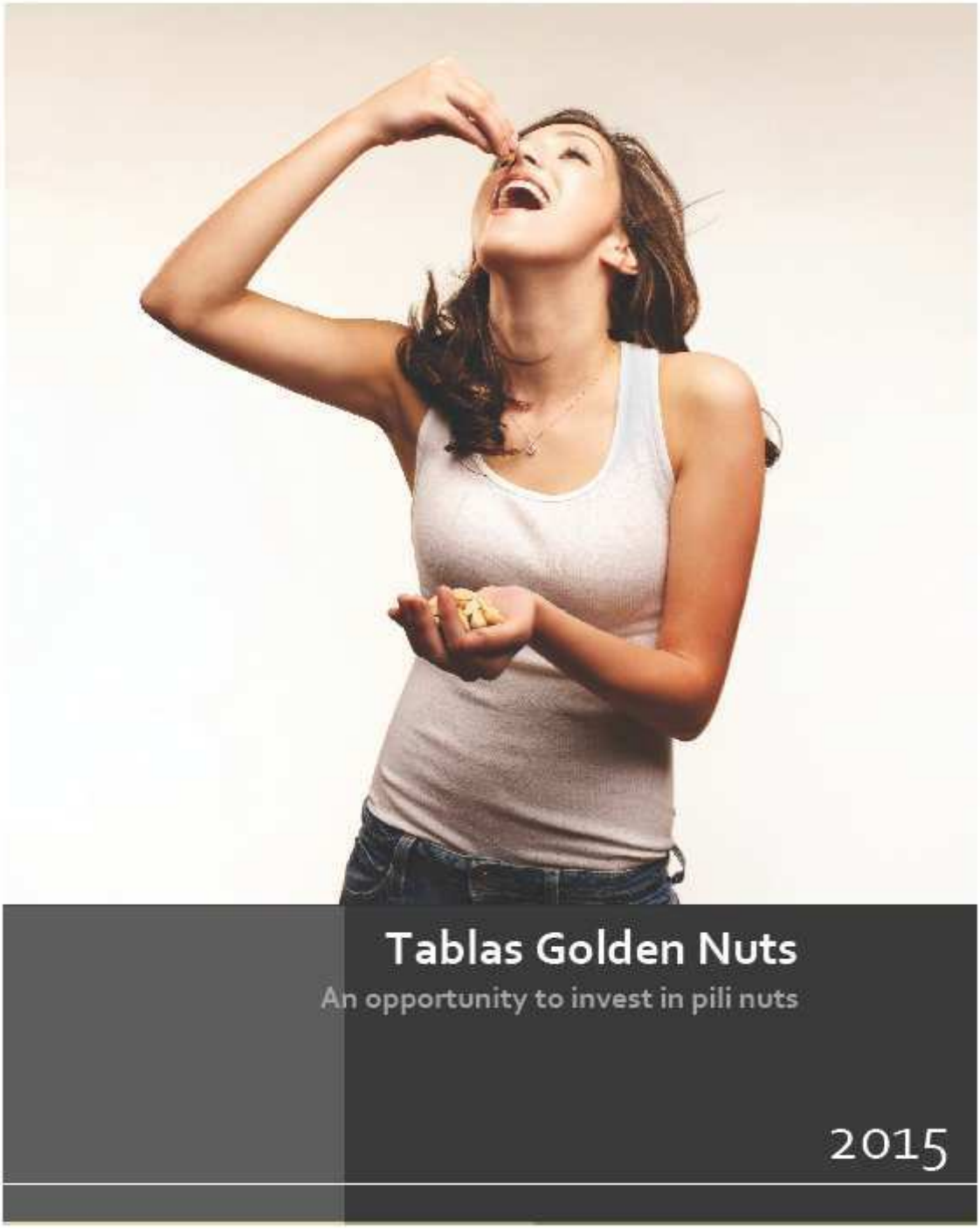
Appendix A – Investment Brochure – Tablas Golden Nuts

Tablas Golden Nuts, Inc



Source: Tablas Golden Nuts (2015).

APPENDIX B – CHINA, JAPAN AND AUSTRALIA SURVEY SUMMARY

2015 Tri-Country Survey of General Nut Consumers

AU = Australia (n=502); JP = Japan (n=500); CH = China (n=503)

SCREENING QUESTIONS

S1. Which one of the following age groups do you fall into? AU 55 years+ (33.8%); **JP** 55 years+ (41.6%); **CH** 25-34 years (33.1%)

S2. How often do you eat nuts? AU A few times a year (24.1%); **JP** A few times a year (36%); **CH** More than once per week (32.5%)

SURVEY QUESTIONS Part A: Your general nut consumption

1. Eating nuts is something…	AU	JP	CH
I do frequently	Agree 42.3%	Disagree 31.4%	Agree 57.8%
That is part of my usual dietary routine	Agree 37.0%	Disagree 27.8%	Agree 50.0%
I have been doing for a long time	Agree 52.5%	Agree 38.6%	Agree 51.6%

Scale = Strongly Disagree; Disagree; Undecided; Agree; Strongly Agree

2. How often do you eat nuts…	AU	JP	CH
On weekends	Occasionally 41.6%	Occasionally 47.6%	Frequently 56.0%
On weekdays	Occasionally 41.6%	Occasionally 47.0%	Occasionally 42.0%
On holidays	Occasionally 42.9%	Occasionally 46.2%	Frequently 52.4%
On days that you study or work	Occasionally 33.6%	Occasionally 26.0%	Occasionally 42.2%
In Summer	Occasionally 38.2%	Occasionally 45.0%	Occasionally 42.0%
In Autumn	Occasionally 40.4%	Occasionally 50.2%	Frequently 52.4%
In Winter	Occasionally 41.0%	Occasionally 49.8%	Frequently 57%
In Spring	Occasionally 39.2%	Occasionally 48.05%	Frequently 46.8%

Scale = Never; Very Rarely; Rarely; Occasionally; Frequently; Very Frequently

3. How often do you eat nuts…	AU	JP	CH
As part of your breakfast	Never 36.2%	Never 45.0%	Occasionally 24.9%
As part of your lunch	Occasionally 29.0%	Never 24.6%	Rarely 25.3%
As part of your dinner	Occasionally 30.6%	Never 35.2%	Occasionally 27.5%
As part of your dessert	Occasionally 27.4%	Occasionally 33.4%	Occasionally 28.9% Frequently 28.9%
For a morning snack	Occasionally 32.2%	Never 29.2%	Occasionally 29.9%
For an afternoon snack	Occasionally 40.0%	Occasionally 36.4%	Frequently 37.3%
At home	Occasionally 34.8%	Occasionally 44.0%	Frequently 54.2%
At study or work	Never 28.0%	Never 51.0%	Occasionally 38.6%
While commuting	Never 43.1%	Never 62.2%	Occasionally 25.7%
With others	Occasionally 44.7%	Occasionally 30.4%	Occasionally 40.4%
When alone	Occasionally 38.2%	Occasionally 43.0%	Frequently 44.8%

Scale = Never; Very Rarely; Rarely; Occasionally; Frequently; Very Frequently

4. How often do you…	AU	JP	CH
Eat almond nuts	Occasionally 38.2%	Occasionally 50.2%	Occasionally 43.6%
Eat brazil nuts	Occasionally 32.0%	Never 54.4%	Occasionally 33.9%
Eat cashews nuts	Occasionally 38.0%	Occasionally 42.0%	Occasionally 37.8%
Eat hazelnuts	Occasionally 32.2%	Never 26.8%	Occasionally 42.8%
Eat macadamia nuts	Occasionally 40.0%	Occasionally 40.6%	Occasionally 36.7%

Eat pecan nuts	Rarely 26.6%	Never 59.0%	Occasionally 35.5%
Eat pine nuts	Occasionally 26.4%	Never 42.2%	Occasionally 36.3%
Eat pistachio nuts	Occasionally 31.4%	Occasionally 30.0%	Occasionally 38.8%
Eat walnuts	Occasionally 35.6%	Occasionally 32.4%	Frequently 46.2%
Eat peanuts	Occasionally 39.4%	Occasionally 43.6%	Frequently 48.4%
Eat nuts that are imported from other countries	Occasionally 37.2%	Occasionally 29.2%	Occasionally 39.4%
Eat nuts in shell	Occasionally 27.6%	Occasionally 27.0%	Occasionally 40.0

Scale = Never; Very Rarely; Rarely; Occasionally; Frequently; Very Frequently

5. How often do you buy nuts…	**AU**	**JP**	**CH**
As a gift for other people	Never 34.8%	Never 53.4%	Occasionally 43.6%
To eat with other people	Occasionally 40.6%	Never 32.6%	Occasionally 34.1%
From a supermarket	Frequently 35.0%	Occasionally 44.6%	Frequently 43.6%
From a convenience store	Never 34.2%	Never 29.0%	Occasionally 33.1%
From vending machines	Never 56.7%	Never 69.0%	Never 37.5%
From an online seller	Never 69.2%	Never 54.0%	Occasionally 31.7% Frequently 31.3%
From markets	Never 30.6%	Never 56.4%	Occasionally 39.0%
From street vendors	Never 52.3%	Never 62.4%	Occasionally 34.7%
From a café or food outlet	Never 49.1%	Never 58.6%	Occasionally 24.7%
From a specialty health food shop	Never 35.8%	-	-

Scale = Never; Very Rarely; Rarely; Occasionally; Frequently; Very Frequently

6. How often do you buy…	**AU**	**JP**	**CH**
Unroasted nuts	Occasionally 33.2%	Never 50.2%	Occasionally 29.1%
Roasted nuts	Occasionally 38.6%	Occasionally 38.6%	Frequently 43.2%
Salted nuts	Occasionally 39.8%	Occasionally 45.6%	Occasionally 36.1%
Sugar-coated nuts	Never 31.6%	Occasionally 25.8%	Occasionally 33.1%
Honey-coated nuts	Never 31.0%	Never 39.0%	Occasionally 28.5%
Spicy flavoured nuts	Never 30.4%	Never 42.8%	Occasionally 24.9%
Mixed flavoured nuts (e.g. sweet and salty)	Never 35.4%	Never 36.6%	Occasionally 32.3%
Nut cooking oil	Never 40.0%	Never 57.8%	Occasionally 27.3%
Nut body creams, soaps or oils	Never 53.3%	Never 66.4%	Occasionally 25.1%
Cosmetics with nut oil as an ingredients	Never 56.9%	Never 70.4%	Never 23.9%/ Occasionally 23.5%
Hair products with nut oil as an ingredient	Never 55.9%	Never 70.4%	Occasionally 25.1%

Scale = Never; Very Rarely; Rarely; Occasionally; Frequently; Very Frequently

7. **When buying nuts for yourself, which brand do you buy the most? AU** – Don't know/not sure (27.2%); Nobby's (22.1%); **JP** – Kameda Kakinotane (53.4%); Don't know/not sure (31.6%); **CH** – Don't know/not sure (39.6%); Great Value (14.9%)

8. **When buying nuts for yourself, what is the package size and/or weight that you buy the most? AU** – Don't know/not sure (18.1%); Between 150g-200g (15.7%); **JP** – Don't know/not sure (23.4%); Between 50g-100g (22.0%); **CH** – Between 300-500g (26.9%); Between 200g-300g (21.5%)

9. **When buying nuts for yourself, what is the average price that you pay per package? AU** – $5-$10 (42.1%); Under $5 (20.1%); **JP** – 95 円～475 円未満 (58.2%); 475 円～950 円未満 (14.8%); **CH** – ¥20- ¥50 (41.8%); ¥50 - ¥75 (21.1%)

10. **When buying nuts to share with others, which brand do you buy the most? AU** – Nobby's (21.5%); Don't know/not sure (20.5%); I do not buy nuts to share with others (17.3%); **JP** – Kameda Kakinotane (48.0%); I do not by nuts to share with others (22.8%); Don't know/not sure (16.8%); **CH** – Don't know/not sure (35.1%); Great Value (15.3%); Wonderful

Pistachios (11.8%); I do not buy nuts to share with others (4.0%)

11. **When buying nuts to share with others, what is the package size and/or weight that you buy the most? AU** - Between 300g-500g (17.8%); Between 150g-200g (17.3%); Between 200g-300g (15.9%); **JP** – Don't know/not sure (20.7%); Between 50g-100g (22.3%); Between 100g-150g (22.0%); **CH** – Between 300-500g (25.7%); Between 200g-300g (21.2%); Between 150g-200g (16.6%)

12. **When buying nuts to share with others, what is the average price that you pay per package? AU** – $5-$10 (38.0%); $10-$15 (25.7%); **JP** – 95 475 (53.9%); 475 950 (21.5%); **CH** – ¥20- ¥50 (35.5%); ¥50 - ¥75 (20.5%)

13. **When buying nuts to give as a gift to another person, which brand do you buy the most? AU** – Nobby's (14.1%); Don't know/not sure (18.7%); I do not buy nuts to as gifts for others (46.7%); **JP** – Kameda Kakinotane (14.4%); I do not by nuts to as gifts for others (65.2%); **CH** – Don't know/not sure (35.1%); Great Value (11.6%); Wonderful Pistachios (11.4%); I do not buy nuts as gifts for others (9.0%)

14. **When buying nuts to give as a gift to another person, what is the package size and/or weight that you buy the most? AU** - Between 150g-200g (114.6%); Don't know/not sure (25.0%); **JP** – Don't know/not sure (20.1%); Between 50g-100g (19.5%); **CH** – Between 300-500g (30.4%); Between 200g-300g (18.6%)

15. **When buying nuts to give as a gift to another person, what is the average price that you pay per package? AU** – $5-$10 (32.1%); $10-$15 (25.0%); **JP** – 95 475 (31.0%); 475 950 (23.0%); **CH** – ¥20- ¥50 (20.1%); ¥50 - ¥75 (22.1%); (CN) ¥75 - ¥100 (20.4%)

PART B: Nut attributes that are important to you

16. It is important to me that the nuts I eat…	AU	JP	CH
Are prepared in a way that they are easy to eat	Important 42.5%	Important 43.4%	Important 51.0%
Are prepared in a way that they are ready to eat from the package	Important 40.2%	Important 42.4%	Important 45.0%
Are packaged in a way that they are easy to handle	Important 40.6%	Important 39.6%; Moderately Important 39.0%	Important 47.8%
Are packaged in a way that Important can take them with me wherever Important go	Moderately Important 32.2%	Moderately Important 37.0%	Important 44.4%
Are packaged in an environmentally friendly way	Moderately Important 37.4%	Of Little Importance 36.8%	Important 43.0%
Come in resealable packages so they stay fresh for longer	Important 33.0%	Important 34.6%	Important 42.8%
Come in packages that allow me to see the nuts that are inside	Important 34.8%	Moderately Important 32.0%	Important 44.8%
Come in package sizes that help me control my calorie intake	Moderately Important 26.0%; Of Little Importance 25.8%	Of Little Importance 37.4%	Important 39.8%

Scale = Not Important At All; Of little Importance; Moderately Important; Important; Very Important

17. t is important to me that the nuts I eat…	AU	JP	CH
Taste good	Very Important 59.0%	Important 48.8%	Very Important 45.6%; Important 43.4%
Look good	Important 36.8%	Moderately Important 39.0%	Important 44.8%
Smell nice	Important 43.7%	Moderately Important 38.8%	Important 52.2%
Are fresh	Very Important 56.9%	Important 39.0%	Very Important 51.8%
Are of a consistent high quality	Very Important 50.1%	Important 36.4%	Very Important 44.2%
Have a pleasant texture	Important 39.2%	Important 48.0%	Important 44.6%; Very Important 43.0%

Are organic	Moderately Important 35.8%	Moderately Important 34.0%	Important 39.2%
Are nutritious	Important 35.2%	Moderately Important 37.6%	Important 46.8%

Scale = Not Important At All; Of little Importance; Moderately Important; Important; Very Important

18. It is important to me that the nuts I eat…	**AU**	**JP**	**CH**
Keep me healthy	Important 37.8%	Moderately Important 37.4%	Important 46.8%
Meet food safety standards	Very Important 49.9%	Important 37.6%	Very Important 49.6%
Are free from chemicals and preservatives	Very Important 42.1%	Important 35.2%	Very Important 46.0%
Satisfy my hunger	Important 38.2%	Moderately Important 39.0%	Moderately Important 38.8%
Make me feel good	Important 36.8%	Moderately Important 39.2%	Important 55.0%
Are like the nuts Important ate when I was a child	Moderately Important 26.2%	Of Little Importance 44.6%	Important 43.6%

Scale = Not Important At All; Of little Importance; Moderately Important; Important; Very Important

19. It is important to me that the nuts I eat…	**AU**	**JP**	**CH**
Are familiar	Moderately Important 36.8%	Moderately Important 40.6%	Important 45.2%
Have the country of origin clearly marked on the package	Important 31.4%	Moderately Important 31.8%	Important 39.0%
Come from countries that I know about	Important 33.4%	Moderately Important 34.6%	Important 42.8%
Come from countries that I think positively of	Important 32.0%	Moderately Important 33.2%	Important 38.6%
Are from my own country	Very Important 38.8%	Moderately Important 34.8%	Moderately Important 42.4%

Scale = Not Important At All; Of little Importance; Moderately Important; Important; Very Important

20. It is important to me that the nuts I eat…	**AU**	**JP**	**CH**
Are good value for money	Important 39.2%	Important 45.4%	Important 53.8%
Are priced lower that other nuts	Moderately Important 39.4%	Moderately Important 43.8%	Moderately Important 42.4%
Are widely available in shops and supermarkets	Important 39.6%	Moderately Important 39.6%	Important 48.2%
Can be bought in shops close to where I live, study or work	Important 40.6%	Moderately Important 31.2%	Important 43.0%

Scale = Not Important At All; Of little Importance; Moderately Important; Important; Very Important

Part C: Your thoughts about nuts from the South Pacific Islands

21. How familiar are you with the South Pacific Islands (e.g. Fiji, Vanuatu, Solomon Islands, Papua New Guinea, Samoa, New Caledonia)? **AU** – A little familiar 39.4%; **JP** – A little familiar 53.4%; **CH** – A little familiar 35.7%

22. When you hear the term 'South Pacific Island nuts', what the first three things that come to mind?

AU	**JP**	**CH**
Beach/Islands/natural environment	Variety	Beaches/Sky/Islands/Beautiful environment
Cruising	Blue seas/bathed in sunshine/coconut palms	Abundance/rich natural resources
Grown naturally/fresh	Healthy/natural/fresh	Deep/primitive forests

Paradise	Tropical	Warmth
Sunshine	Salty	Small, exquisite islands

23. Your initial perceptions about nuts from the South Pacific Islands are best described as:

	1	2	3	4	5	
Like			AU JP CH			Dislike
Good		CH	AU JP			Bad
Positive		CH	AU JP			Negative
Pleasant		CH	AU JP			Unpleasant
Interesting		CH	AU JP			Uninteresting Distinctive
	CH	AU JP			Common	
Tasteful		CH	AU JP			Tasteless
Appetising			AU JP CH			Unappetising
Healthy		CH	AU JP			Unhealthy
Superior			AU JP CH			Inferior
Inexpensive			AU JP CH			Expensive
Excellent quality		CH	AU JP			Poor quality
Consistent quality		CH	AU JP			Inconsistent quality
Carefully produced		CH	AU JP			Not carefully produced
Would like to try		CH	AU JP			Would not like to try
Would definitely consider buying it		CH	AU JP			Would definitely not consider buying it
For me		CH	AU JP			Not for me

24. Have you heard of the following types of nuts from the South Pacific Islands?

A. Canarium nuts **AU** – No 94.0%; **JP** – No 92.8%; **CN** – No 64.3% B. Nangai nuts **AU** – No 94.4%; **JP** – No 95.0%; **CN** – No 63.9% C. Ngali nuts **AU** – No 95.8%; **JP** – No 93.6%; **CN** – No 67.9% D. Galip nuts **AU** – No 96.2%; **JP** – No 94.2%; **CN** – No 72.3%

25. Rank the potential brand names for the nuts from the South Pacific Islands in the order that you prefer them (1 = prefer this nut brand name the most – 5 = prefer this nut brand name the least)

AU – Most preferred brand name = Galip nuts
JP – Most preferred brand name = Galip nuts
CH – Most preferred brand name = Galip nuts

26. Do you have any other suggestions for a brand name for the nuts from the South Pacific Islands? _____

AU	JP	CH
Aloha Nuts	Minami Taiheiyo (South Pacific) Nuts	South Pacific Nuts
Blue Water Nuts	Golden Ocean Nuts / Ocean Nuts /Oceania Nuts	Cheery Nuts
Oceania Nuts	Galina Nuts / Gaugin Nuts	Godiva Nuts
Island Delights	Happy Nuts	Three Squirrels / Squirrel Nuts
Pacific Canarium / Pacific Delights / Pacific Pearls	Pacifica Nuts	Note: A number of comments referred to use of existing brand names (e.g. Wonderful Pistachios)
Tropicana Nuts / Tropical Paradise Nuts / Tropical Delight	Sun's Bounty	
Terrific Pacific Nuts	Treasure Nuts / Tropical Island Nuts	

Part D: The pricing of nuts

27. In general…	AU	JP	CH
I buy the cheapest nuts that are available	Disagree 38.4%	Undecided 49.0%	Disagree 35.1%
I am more likely to buy nuts when there is a quantity discount (e.g. buy two and get one free)	Agree 41.7%	Undecided 40.2% Agree 35.4%	Agree 47.6%

I am more likely to buy nuts that are on sale at a discounted price	Agree 41.9%	Agree 41.8%	Agree 49.4%
I am sensitive to differences in the prices of nuts	Agree 40.6%	Undecided 46.6%	Undecided 43.4%
I buy my favourite nut irrespective of the price	Agree 38.4%	Undecided 47.2%	Agree 37.1% Undecided 36.7%
I typically seek out low-price, discount shops to buy nuts from	Disagree 37.8%	Undecided 47.8% Agree 28.0%	Undecided 37.6% Agree 29.9%
I typically buy nuts from shops that source nuts from growers who engage in sustainable farming practices.	Undecided 41.0% Agree 26.2%	-	-

Scale = Strongly Disagree; Disagree; Undecided; Agree; Strongly Agree

28. In general…	**AU**	**JP**	**CH**
I would be prepared to pay more for nuts from the South Pacific Islands if I knew that buying these nuts would help improve the future of these developing countries.	Undecided 40.8% Agree 30.2%	Undecided 56.4% Agree 22.2%	Agree 53.6% Undecided 29.3%
I would be prepared to pay more for nuts from the South Pacific Islands if the nuts were a certified by Fair Trade, Organic, Rainforest or UTZ organisations.	Undecided 38.6% Agree 32.8%	Undecided 53.0% Agree 25.0%	Agree 48.4%
I would be prepared to pay 5% more for nuts that were clearly branded as being from the South Pacific Islands	Undecided 40.2% Agree 23.1%	Undecided 51.6% Disagree 22.0%	Agree 43.8% Undecided 33.9%
I would be prepared to pay 10% more for nuts that were clearly branded as being from the South Pacific Islands	Undecided 41.7% Disagree 28.0%	Undecided 51.8% Disagree 29.8%	Undecided 49.2% Agree 27.7%
I would be prepared to pay 15% more for nuts that were clearly branded as being from the South Pacific Islands	Undecided 36.6% Disagree 32.8% Strongly Disagree 20.5%	Undecided 46.8% Disagree 33.4%	Undecided 45.8% Disagree 24.7%

Scale = Strongly Disagree; Disagree; Undecided; Agree; Strongly Agree

Part E: Ways to encourage you to buy South Pacific Island nuts

29. I could be influenced to buy South Pacific Island nuts if...	**AU**	**JP**	**CH**
I saw the nuts being prepared and served on a cooking show	Undecided 37.8% Agree 26.4%	Undecided 45.6% Agree 32.4%	Agree 43.6% Undecided 35.9%
I saw the nuts prepared and served by a celebrity chef	Undecided 34.8% Disagree 24.5%	Undecided 46.6% Agree 28.4%	Undecided 40.0% Agree 33.3%
I saw or heard advertisements for the nuts often	Undecided 36.2% Agree 29.6%	Undecided 45.2% Agree 33.4%	Agree 40.6% Undecided 35.1%
I saw or heard others talking about the nuts on social media	Undecided 35.4% Disagree 23.7%	Undecided 49.4% Agree 24.6%	Agree 38.4% Undecided 37.3%
Agree friend or family member recommended the nuts to me	Agree 48.9% Undecided 29.4%	Undecided 45.0% Agree 35.2%	Agree 51.4% Undecided 26.5%
I saw a friend or family member eating the nuts	Agree 42.9% Undecided 33.4%	Undecided 46.8% Agree 33.8%	Agree 54.4% Undecided 24.1%
Agree friend or family member gave the nuts to me as a gift	Agree 44.5%	Undecided 45.4%	Agree 48.4%
I saw people other than my friends or family eating the nut	Undecided 43.1% Agree 29.6%	Undecided 56.2% Agree 24.8%	Agree 51.0% Undecided 33.1%

I could find out more about the nuts online	Undecided 37.0% Agree 34.2%	Undecided 48.6% Agree 31.4%	Agree 52.6% Undecided 26.1%
There were recipe cards using the nuts at the places I shop for food	Undecided 38.4% Agree 26.2%	Undecided 52.0% Agree 25.0%	Undecided 37.6% Agree 37.6%
I sampled the nuts at the places I shop for food	Agree 47.3%	Agree 40.4%	Agree 51.0%
There were demonstrations on how to use the nuts in recipes at the places I shop for food	Undecided 34.0% Agree 33.2%	Undecided 50.8%	Agree 45.4%
There was an event, such as a festival, that focused upon the nuts	Undecided 40.6%; Agree 28.4%	Undecided 45.0%; Agree 34.0%	Undecided 41.4% Agree 36.9%

Scale = Strongly Disagree; Disagree; Undecided; Agree; Strongly Agree

Part F: Your support for products from developing countries

30. Supporting developing countries by buying their products…	**AU**	**JP**	**CH**
Is important to me	Undecided 38.4%; Agree 37.6%	-	-
Is the right thing to do	Agree 44.7%; Undecided 35.8%	-	-
Makes me feel good	Agree 38.6%; Undecided 36.6%	-	-
Is something more people should do	Agree 42.1%; Undecided 37.0%	-	-
Will benefit them in the future	Agree 51.1%; Undecided 31.4%	-	-
Will allow them to achieve their goals	Agree 49.7%; Undecided 34.8%	-	-
Will lead to opportunities they would not otherwise have had	Agree 51.1%; Undecided 32.2%	-	-
Will allow them to build their economy	Agree 54.1%; Undecided 28.0%	-	-
Will change the trajectory of their lives	Agree 41.9%; Undecided 41.2%	-	-
Will improve the quality of their lives	Agree 44.1%; Undecided 39.2%	-	-

Scale = Strongly Disagree; Disagree; Undecided; Agree; Strongly Agree

31. In general…	**AU**	**JP**	**CH**
I like to help others	Agree 64.0%; Strongly Agree 18.7%	-	-
I would describe myself as a very generous person	Agree 50.3%; Undecided 31.2%	-	-
I prefer to support developing countries by purchasing their products rather than giving money to a charity to help them	Agree 41.4%; Undecided 38.0%	-	-
I like to support developing countries that I know many other people support	Undecided 45.9%; Agree 27.0%	-	-
I like to support developing countries that are well known	Undecided 42.7%; Agree 29.0%	-	-
I have a high regard for the South Pacific Islands	Agree 48.3%; Undecided 35.8%	-	-
I have positive feelings towards the South Pacific Islands	Agree 49.9%; Undecided 32.8%	-	-

Scale = Strongly Disagree; Disagree; Undecided; Agree; Strongly Agree

32. While I say I would support developing countries by buying their products…	**AU**	**JP**	**CH**
In reality I am unlikely to purchase their products on a regular basis	Undecided 45.1%; Agree 31.8%	-	-
In reality other attributes, such as price, are more important to my product choices	Undecided 37.4%; Agree 34.2%	-	-
In reality I will continue to buy my regular products	Undecided 44.7%; Agree 38.6%	-	-

Scale = Strongly Disagree; Disagree; Undecided; Agree; Strongly Agree

Part G: Your general interest in food and cooking

33. Regarding food and cooking in general…	**AU**	**JP**	**CH**

Healthy eating is absolutely essential to me	Agree 53.7%	Undecided 43.6%	Agree 43.0%
I am always looking for new foods to try	Agree 42.9%	Undecided 39.4%	Agree 50.6%
I like to experiment with food from different cultures	Agree 45.1%	Undecided 37.4%	Agree 52.2%
I am proud of my knowledge of food and cooking	Agree 38.8%	Undecided 46.4%	Agree 47.0%
Cooking is one of life's great pleasures	Agree 40.6%	Undecided 39.0%	Agree 47.0%
My cooking skills help express who I am	Agree 32.8%	Undecided 44.2%	Agree 43.6%
I love cooking for others	Agree 36.6%	Undecided 41.6%	Agree 39.8%
I am considered a real 'foodie' by others	Disagree 32.0%	Undecided 38.0%	Undecided 37.3%
People know me as a gourmet	Disagree 34.6%	Undecided 36.6%	Undecided 37.1%
My interest in food defines who I am	Disagree 30.2%	Undecided 43.0%	Agree 53.6%

Scale = Strongly Disagree; Disagree; Undecided; Agree; Strongly Agree

34. Regarding food…	**AU**	**JP**	**CH**
I am constantly sampling new and different foods	Agree 40.8%	-	-
If I don't know what is in a new or different food, I won't try it	Agree 32.0% Disagree 30.4%	-	-
I like foods from cultures different to my own	Agree 57.5%	-	-
Foods from cultures different to my own are exciting to eat	Agree 53.9%	-	-
At social events, I will try new or different foods	Agree 58.1%	-	-
I have no fear with eating foods that I have never eaten before	Agree 42.3%	-	-
I will eat almost anything	Agree 37.0%	-	-
I like going to places where foods from cultures different to mine are served	Agree 51.7%	-	-
I am very particular about the foods I will eat	Agree 37.8%	Undecided 41.0%	Agree 59.2%
I don't trust new and different foods	Disagree 39.4%	-	-

Scale = Strongly Disagree; Disagree; Undecided; Agree; Strongly Agree

Part H: Your general gift giving behaviour related to food

35. How often do you…	**AU**	**JP**	**CH**
Give gifts to family for special occasions (e.g. birthdays, Christmas)	Frequently 33.8%	-	-
Give gifts of food to family for special occasions (e.g. birthdays, Christmas)	Occasionally 35.2%	-	-
Buy food items while on holidays to give as gifts to family upon your return home	Occasionally 26.8%	-	-
Give gifts to friends for special occasions (e.g. birthdays, Christmas)	Occasionally 37.2%	-	-
Give gifts of food to friends for special occasions (e.g. birthdays, Christmas)	Occasionally 33.6%	-	-
Buy food items while on holidays to give as gifts to friends upon your return home	Occasionally 26.8%	-	-
Buy food items while on holidays to eat yourself upon your return home	Occasionally 32.6%	-	-
Buy food gift baskets comprised of foods familiar to the receiver	Never 26.2%; Rarely 24.9%	-	-
Buy food gift baskets comprised of foods unfamiliar to the receiver	Never 33.6%; Rarely 24.9%	-	-
Buy food gift baskets comprised of a mix of foods both familiar and unfamiliar to the receiver	Never 31.6%; Rarely 23.7%	-	-
Buy food gifts online from an Australian seller	Never 46.9%; Occasionally 15.9%	-	-
Buy food gifts online from an international seller	Never 55.7%	-	-

Scale = Never; Very Rarely; Rarely; Occasionally; Frequently; Very Frequently

Part I: Your general online behaviour related to food

36. How often do you…	**AU**	**JP**	**CH**

Buy your own food online from an Australian seller	Never 51.5%; Rarely 14.7%	-	-
Buy your own food online from an international seller	Never 68.0%; Rarely 12.1%	-	-
Search the Internet for information on food	Occasionally 32.8%; Rarely 16.3%	-	-
Search the Internet for images or photos of food	Never 28.0%; Occasionally 27.4%	-	-
Search the Internet for videos about food	Never 35.2%; Occasionally 22.7%	-	-
Share websites, photos or videos about food on social media	Never 51.9%; Rarely 16.5%	-	-

Scale = Never; Very Rarely; Rarely; Occasionally; Frequently; Very Frequently

37. Please list the top three websites that you visit when searching for food on the Internet. AU only - Coles Supermarket recipe site (recipes.coles.com.au); Woolworth's supermarket recipe site (woolworths.com.au); Taste.com.au; Allrecipes.com.au

Part J: Your general use of social media

38. How often do you…	**AU**	**JP**	**CH**
Read social media postings	Never 24.3%; Occasionally 21.5%; Frequently 21.1%	-	-
Comment on social media postings, status updates, photos etc.	Never 32.0; Occasionally 19.5; Frequently 15.1%	-	-
Click "Like" to a social media posting, photo etc.	Never 30.2; Occasionally 21.9; Frequently 16.3%	-	-
Check your Facebook page or other social media that you use	Never = 26.4; Frequently 24.3; Occasionally 19.3%	-	-
Browse social media profiles and photos	Never = 28.8; Occasionally 24.1; Frequently 14.7%	-	-
Check your social media profiles at work or study	Never 49.7; Occasionally 14.1; Rarely 12.5%	-	-
Post social media status updates	Never 39.0; Occasionally 19.7; Very Rarely 15.5%	-	-
Check your social media profile from your smartphone	Never = 50.9; Occasionally = 14.9%; Frequently 10.5%	-	-
Post photos on social media	Never 40.6%; Occasionally 20.9%; Rarely = 12.9%; Very Rarely = 12.9%	-	-

Scale = Never; Very Rarely; Rarely; Occasionally; Frequently; Very Frequently

Part K: Demographics

39. Which of the following best describes your household's income? AU – Medium income household (56.9%); **JP** – Medium income household (58.0%); CH – Medium income household (77.9%)

40. What is your gender? AU – Male 57.9%; Female 42.1%; **JP** – Male 56.6%; Female 43.4%; **CH** – Male 52.2%; Female 47.8%

41. What is your current occupation? Vast majority in all countries were employed in a wide range of industries.

Thank you for your participation.

Appendix 11.6 *Commercial roasting of Canarium indicum*

Introduction

There is great potential to develop a commercial *Canarium indicum* industry in PNG (Nevenimo et al. 2008), however, there is limited knowledge of postharvest processing of canarium kernels (Wallace et al. 2010).

Nuts are often roasted to add value before sale. Roasting of nuts improves palatability, enhances flavour, colour, texture and appearance of nuts (Özdemir et al., 2001). Roasting sometimes causes kernels to appear less attractive, by excessive browning known as after roast darkening in macadamias (Albertson et al., 2005; Walton and Wallace, 2008), or internal browning, known as brown centres in roasted hazelnuts (Özdemir et al., 2001).

It is important to understand and supply products that meet consumer preferences. Saklar et al. (2001) found that consumers require moderately coloured roasted hazelnut kernels and that lightly coloured as well as dark roasted kernels were less acceptable. The temperature and time length for roasting should therefore be set to achieve the desired colour.

Previous studies at the National Agricultural Research Institute in Keravat PNG, found that fresh canarium kernels could be roasted at 125°C for 10 minutes without adversely affecting colour. Moderate levels of severe mottled colour of kernels commenced at lower temperature (11% at 120°C for 10 minutes). If the results for colour are balanced against those for mottled colour, the regime of 115°C for 20 minutes appears to produce acceptable colouring of roasted kernels. Accordingly, it is recommended that canarium kernels be roasted at 115°C for 20 minutes or 120°C for 10 minutes.

Information on these roasting experiments were shared with processors in Solomon Islands and Vanuatu. This data has also since been presented as a poster at the International Horticultural Congress in Brisbane in August 2014. The journal article “A roasting study for the tropical nut *Canarium indicum* (Burseraceae)” has been submitted for inclusion in the ACTA hort publication.

Trials were also undertaken in Vanuatu at Lapita Café with roasting, salt roasted, sugar and honey coated canarium products.

Methods

Using commercial equipment in Vanuatu, *Canarium* kernels were:

- air roasted for 10 minutes at temperatures of 110°C, 120°C and 150°C;
- after immersion in a saturated brine solution kernels were air roasted for 10 minutes at temperatures of 120°C and 150°C;
- to achieve sugar coating, the kernels were immersed in a sugar solution (1/2 cup water; 1 cup sugar) and air roasted for 20 or 30 mins at 150°C.

Results

The best product for salt roasting was found from roasting at 150^{o}C for 10 minutes and Sugar coated nuts were roasted for 150^{o}C for 30 minutes.

After informal taste panels, undertaken at Lapita Café further trials showed that:-Roasting for 10 minutes at 150^{o}C produced a more accepted product. Salt roasting using the 15% salt solution was preferred and sugar roasting nuts the had been dipped in one cup sugar

dissolved in half a cup hot water (not boiled) for either 30 and 40 minutes at 150^{o}C was visually appealing. Those dried in the desiccator for 18 hours were the least sticky.

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Appendix 11.7 *Processing Methods for Canarium Nuts in the Pacific*

H.Wallace, B. Randall, E. Grant, K. Jones and D. Walton
Genecology Research Centre
University of the Sunshine Coast
Maroochydore
Australia

M. Poienou, Tio Nevenimo
National Agricultural Research Institute
Papua New Guinea

J. Moxon
Cocoa Board of Papua New Guinea
Kokopo
Papua New Guinea

R. Pauku
Maraghoto Holdings
Honiara
Solomon Islands

Keywords: nut quality, solar drier, *Canarium indicum*, Papua New Guinea, Solomon Islands, Vanuatu

Abstract

Nuts have huge potential to improve the livelihood of the rural poor in developing countries and meet the Millennium Development Goal to eradicate extreme poverty and hunger. Nuts often have a high protein and oil content, giving them excellent nutritional value. They can be processed and stored for long periods and therefore can improve food security, be sold for cash or processed and exported to distant markets, thus helping the rural poor to participate in the cash economy. We report here on three processing systems for *Canarium indicum* nuts developed in three Pacific Island countries: Papua New Guinea, The Solomon Islands and Vanuatu. Centralised processing has been developed in Papua New Guinea and fruit is purchased from smallholders at a central processing facility. The fruit is depulped, the nut-in-shell is cracked, the testa is removed and kernel is dried using ovens in this facility. This provides a very high quality product and reduces the risk of microbial contamination. In decentralised processing systems, the farmers in remote locations crack and dry the nuts using traditional methods (Solomon Islands) or solar driers (Vanuatu) then sell the dried kernel to a centralised processor. This reduces transport costs and required no infrastructure, but there is a greater risk of poor quality kernels or microbial contamination. In village cracking systems in Vanuatu the fruits are processed and cracked in the village and supplied as fresh, high moisture content kernel-in-testa to secondary processors. This is a hybrid system that minimizes transport costs and risks of contamination. However this system requires delivery to the processor immediately after cracking to stabilize the kernel. The most appropriate system for processing will depend on each country's unique circumstances.

INTRODUCTION

Globally, just five species, walnuts, hazelnuts, pistachios, almonds and cashews make up more than 90 % of the trade in tree nut (International Nut Council, 2014). Many other species of edible nuts have potential to be domesticated and sold commercially. Nuts have huge potential to improve the livelihood of the rural poor in developing countries and meet the Millennium Development Goal to eradicate extreme poverty and hunger. Nuts often have a high protein content, and can be stored for long periods and therefore can improve food security. Packaged nuts can be sold for cash, processed and exported to distant markets, thus helping smallholders to participate in the cash economy.

Canarium indicum is an agroforestry tree in Eastern Indonesia and the Pacific that produces edible nuts and timber. The tree has been domesticated in traditional agricultural systems in Papua New Guinea for over 6000 years (Matthews and Gosden, 1997). *C. indicum* produces kernels with an oil content of 67 – 75 % and the nuts are mostly traded fresh in village markets, either as nut-in-shell or kernel-in-testa (Leakey et al., 2008). Women conduct the majority of farming and trading activity of *C. indicum*, and women's activities include tree cultivation, harvesting, processing and selling (Nevenimo et al., 2007). Currently *C. indicum* is grown mostly in smallholder blocks, or harvested from the wild.

A strong industry based on processed *C. indicum* kernel has great potential to improve the livelihoods of rural households in Pacific countries (Evans, 1996; Nevenimo et al., 2007; Wallace et al., 2010). *C. indicum* has been the focus of efforts by donor agencies to commercialize the industry with a strong focus on processing systems (Wallace et al., 2012). Harvesting and postharvest processing systems can impact on quality in other nut such as walnuts and macadamia (Kader and Thompson, 1992; Walton and Wallace, 2008; Wallace and Walton, 2011). In particular timely harvesting and careful postharvest handling are critical to ensure the quality of nuts is not compromised and nuts are not contaminated or damaged (Walton and Wallace, 2009; 2010). Processing of *C. indicum* involves four key stages: 1) depulping the fruit to remove the fleshy exocarp, 2) cracking to extract the kernel-in-testa from the shell, 3) removing the testa from the kernel, 4) stabilizing the kernel by drying. We describe here three processing systems for *C. indicum* in Pacific countries: centralised, decentralised and a hybrid system, village cracking and compare the advantages and disadvantages of each.

CANARIUM PROCESSING SYSTEMS

Centralised processing system: PNG system

In this a totally centralised system where the smallholders sell the whole fruit, including the pulp, to a processing centre. Fresh purple fruit is depulped by dipping in hot water, and the pulp is removed by hand. Nut-in-shell are then allowed to air dry for several days. In the second stage nut-in-shell is cracked using a modified macadamia cracker to remove the nutin-testa (Fig. 1). The testa is removed with a hot water dip in a sterile factory area. The kernel is then dried in ovens for 2 days. A pilot plant using this system exists at the National Agricultural Research Institute at Kerevat in PNG and processing methods are currently being refined.

Decentralised processing systems: smallholder processing to kernel stage

This processing system is common in remote areas in the Solomon Islands where there is little access to electricity or transport. Smallholders in remote locations process the nuts to stable dried kernel product using traditional methods then sell the kernel to a centralised

processor. Smallholders either harvest the fruit or nut-in-shell. They then crack the fruit (with the pulp on) or nut-in-shell using traditional methods (usually 2 stones). Cracking is labour intensive and it takes 2 full days to fill one 20 litre bucket of kernel. They then remove the testa and dry the kernel on a traditional stone oven (Fig. 2). The kernel is then transported to distant markets using airtight buckets. The kernel may be dried further if required by a secondary processor. This system needs no specialised equipment, only traditional inputs.

Decentralized processing: solar driers

A recent modification of traditional methods is now being used in some villages in Vanuatu. Traditional harvesting and cracking methods are used and the testa is removed by hand. A direct sunlight (forced circulation), low profile tunnel dryer is being used to dry kernel to a low moisture content where it is stable (Fig. 3). Smallholders are selling their products either to a secondary processor to directly into local markets.

Village cracking: Smallholder processing to cracking stage

This is a hybrid system between centralised and decentralised processing. This system undertakes the first stages of processing in the village and then further processing is undertaken by a secondary processor. Farmers harvest either fruit-in-pulp or nut-in shell (without the pulp). Farmers crack the nut-in-shell with traditional methods and supply nut-intesta to the secondary processor within 24 hours of cracking. Timing is critical to prevent kernel contamination or deterioration, as the kernel is at a high moisture content at cracking. The secondary processor will remove the testa and dry the product at a central facility using hot air dryers.

ADVANTAGES AND DISADVANTAGES OF EACH SYSTEM

There are advantages and disadvantages with the different systems. In other nut crops, drying systems are critical to ensure quality (Walton and Wallace, 2011; Walton et al., 2013). In addition, the risk of contamination by pathogens such as *Escherichia coli* and *Salmonella spp*. during processing is reduced by clean handling practices, proper drying and safe storage (Özilgen and Özdemir, 2001). The most effective microbial control mechanism is to dry the product to moisture levels that will not support mould growth. The centralised processing system has the best control of drying systems and food safety and has produced a very high quality product with almost no breakage. This system requires that smallholders have good access to infrastructure and reliable and cheap transport systems to ensure that fruit in pulp can be delivered to the factory before the quality deteriorates.

The decentralized system has advantages compared to the centralized processing system when production areas are remote from markets, and smallholders are faced with high transport costs and unreliable transport schedules. This is the situation in many remote islands of the Pacific where *C. indicum* is grown. The pulp and shell adds substantially to transport costs and it is more efficient to only transport the kernel to markets. In addition this system requires no special infrastructure, only traditional knowledge. Transport costs are minimized and transport can occur when it is convenient for smallholders. However traditional methods of processing the nuts may be unhygienic and detrimental to kernel quality (Evans, 1996; Nevenimo, et al. 2007). This system will require stringent testing to ensure food safety or alternatively may be best suited to secondary products such as oil for cosmetics.

The village cracking processing system has the benefits of low transport costs, and has lower risks of microbial contamination compared to traditional methods. The kernel-intesta

is quite robust for transport with the testa protecting the kernel from physical damage. However cracking exposes the kernel-in testa to microbial contamination. Blanching or steaming at the secondary processor will kill live microbes, but not remove accumulated aflatoxins. Testa removal is a manual process and the risk of re-contaminating the kernel can be minimized by careful handling procedures in a central processing unit. This processing system needs good coordination between the processor and the smallholders to ensure that the kernel-in-testa can be transported and processed quickly after it is cracked, otherwise the kernel-in-testa may become contaminated or deteriorate.

CONCLUSIONS

Each of the three processing systems have advantages and disadvantages. Central processing produces high quality products, but requires good access to infrastructure and transport. Decentralised processing has low inputs and is suitable for remote locations but has risks with quality and food safety. This system may be best suited for oil products. Village cracking systems are able to minimize transport costs and reduce the risk of contamination, but need excellent coordination and logistic planning to ensure fresh kernel-in-testa is transported and processed quickly. Processing systems need to be tailored to each country's unique circumstance to ensure a strong processing industry based on *C. indicum*.

ACKNOWLEDGEMENTS

Funding for this project was provided by the ACIAR FST/2006/048, FST/2010/013 and PARDI/2010/03.

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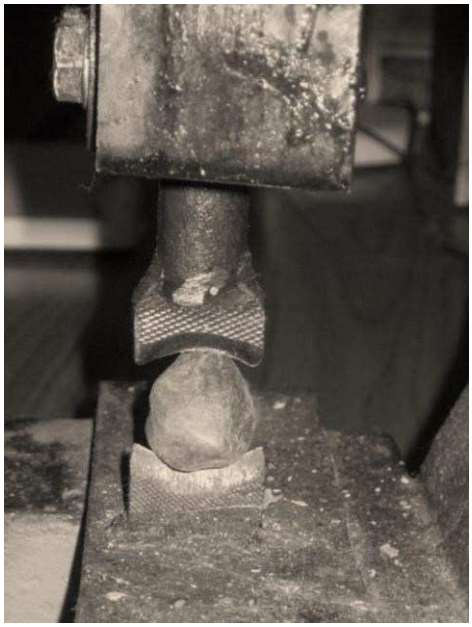

Fig.1. A macadamia cracker modified for *Canarium indicum*. Note the nut-in-shell positioned between the two blades.

Fig. 2. A traditional stone oven used for drying *Canarium indicum* kernels in the Solomon Islands. The oven is lined with leaves and stones are placed on top of the kernels.

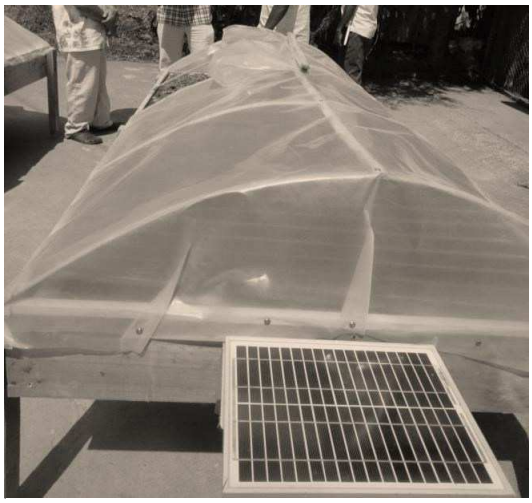

Fig. 3. A solar dryer used for drying *Canarium indicum* kernel in Vanuatu

Appendix 11.8 *New processing methods for canarium: Drying fresh canarium kernels*

Introduction

Processors have indicated a preference to crack canarium nuts fresh and dry and process kernels, rather than drying and storing nut in shell. Currently there is no information on the appropriate temperate and time for drying kernels that will result in good quality nuts. This requires a good understanding of moisture loss and temperature tolerances of kernels to ensure quality. Four experiments were conducted in Vanuatu during October 2012 to determine moisture loss from *Canarium indicum* kernels during drying at a range of oven temperatures. A further experiment to monitor temperatures and moisture loss using a commercial wood fired drying and processing system was undertaken.

Methods

Oven drying at different temperatures

Moisture loss from *Canarium indicum* kernels during drying for 6 hours at each temperature (80°C, 60°C, 50°C and 40°C) in electric ovens was investigated. The initial moisture content of the kernels and the moisture content at the conclusion of the drying process were determined by weighing the kernels and drying kernels at 105°C for 15 hours (overnight) at the completion of the drying process.

Commercial Drying

Temperatures inside the ovens were recorded hourly as well as being monitored with Tinytag temperature and humidity data loggers. Water activity (a_w) of nut sub-samples were checked initially and every two hours during the drying process. The initial moisture content of the kernels and the moisture content at the conclusion of the drying process were determined by drying at 105°C for 15 hours (overnight) at the completion of the drying process.

Results

Oven drying at different temperatures

Temperature of drying significantly affected the final moisture content of kernels. Nuts dried at 50°C and below did not achieve moisture contents below 10% (Fig 1.1). Commercially dried nuts and nuts dried at 60°C had a significantly lower moisture content compared with the oven dried nuts ($P < 0.001$, Fig. 1.1.).

Moisture content dropped significantly after 1 hour at all oven temperature 80°C, 60°C, 50°C and 40°C) but did not change any further after the first hour ($P < 0.001$; $P < 0.001$; $P < 0.001$ and $P < 0.001$ respectively) (Fig 1.2. to Fig.1.5)

Changes in colour and quality were also observed, with kernel dried at higher temperatures much darker than those dried at lower temperatures (Fig 1.6). The whiter colour of kernel dried at 40°C and 50°C indicates minimal cellular damage and will be more acceptable to consumers.

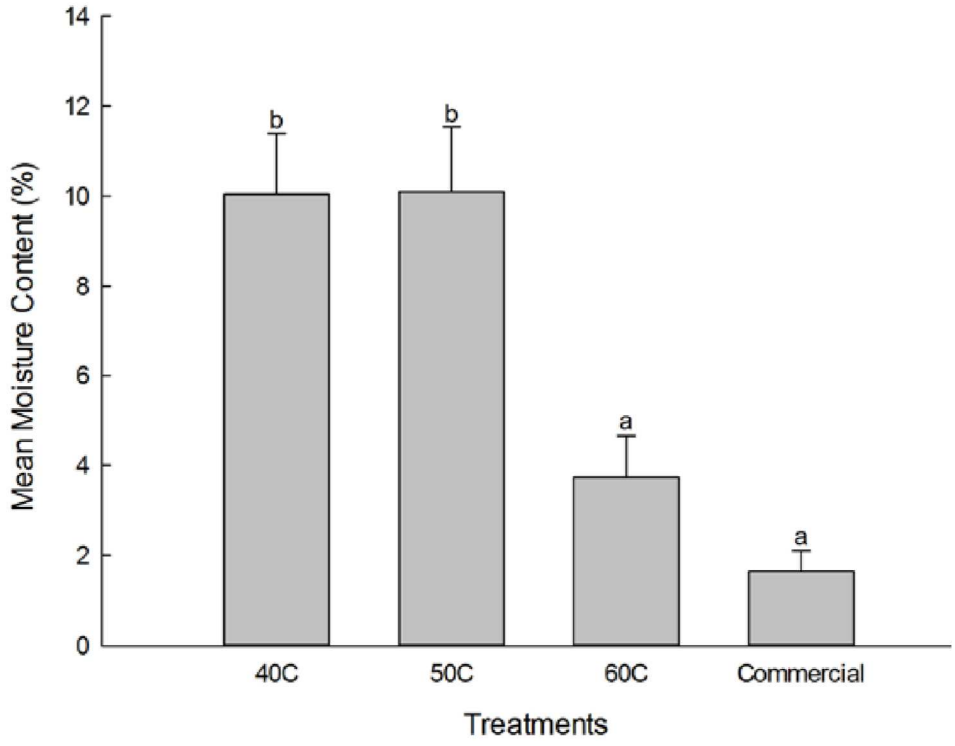

Fig 1.1. Final Moisture Content after 6 hours drying *Canarium indicum* kernel at different temperatures

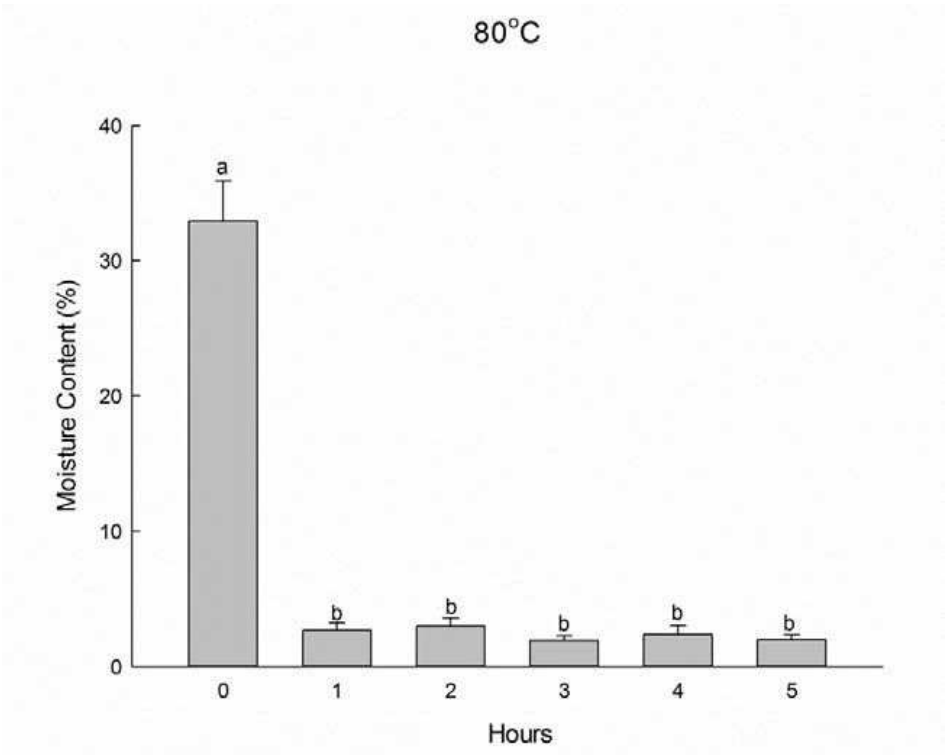

Fig 1.2. Hourly moisture content on *Canarium indicum* kernel during drying for 6 hours at 80°C.

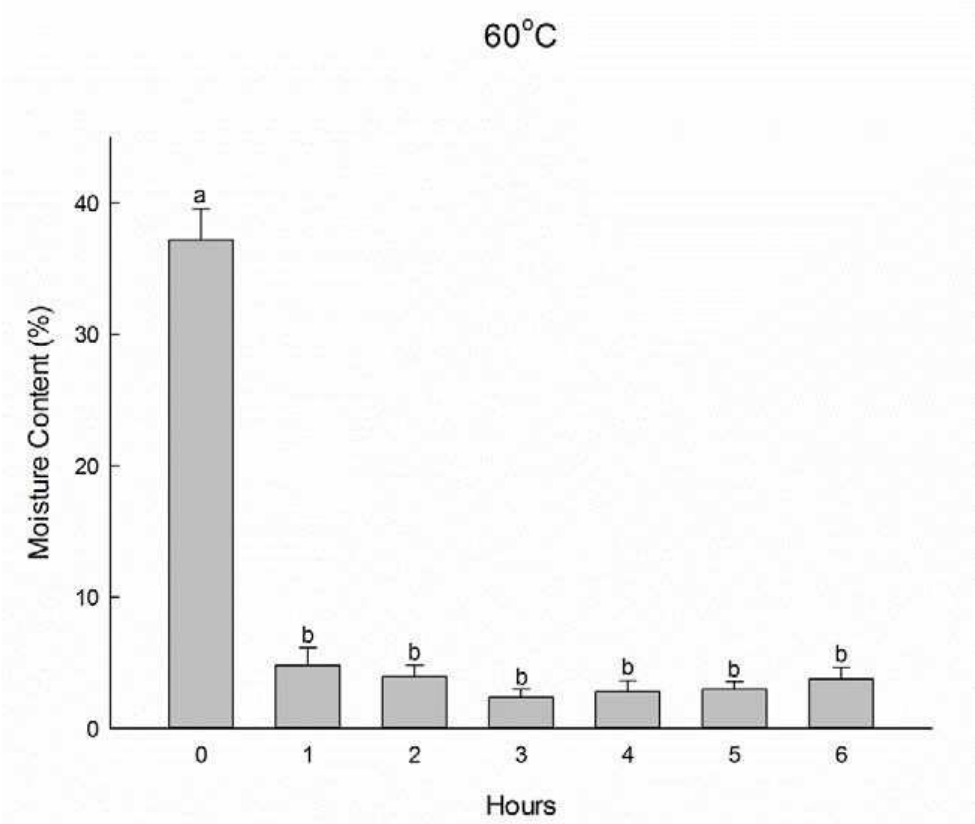

Fig 1.3. Hourly moisture content on *Canarium indicum* kernel during drying for 6 hours at 60°C.

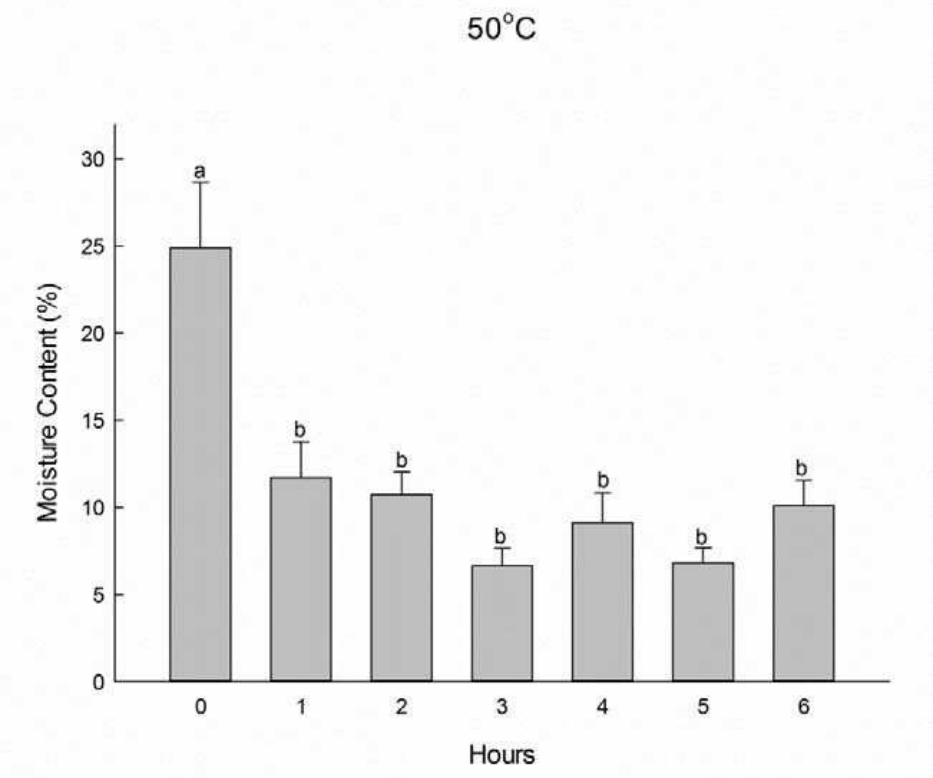

Fig 1.4. Hourly moisture content on *Canarium indicum* kernel during drying for 6 hours at 50°C.

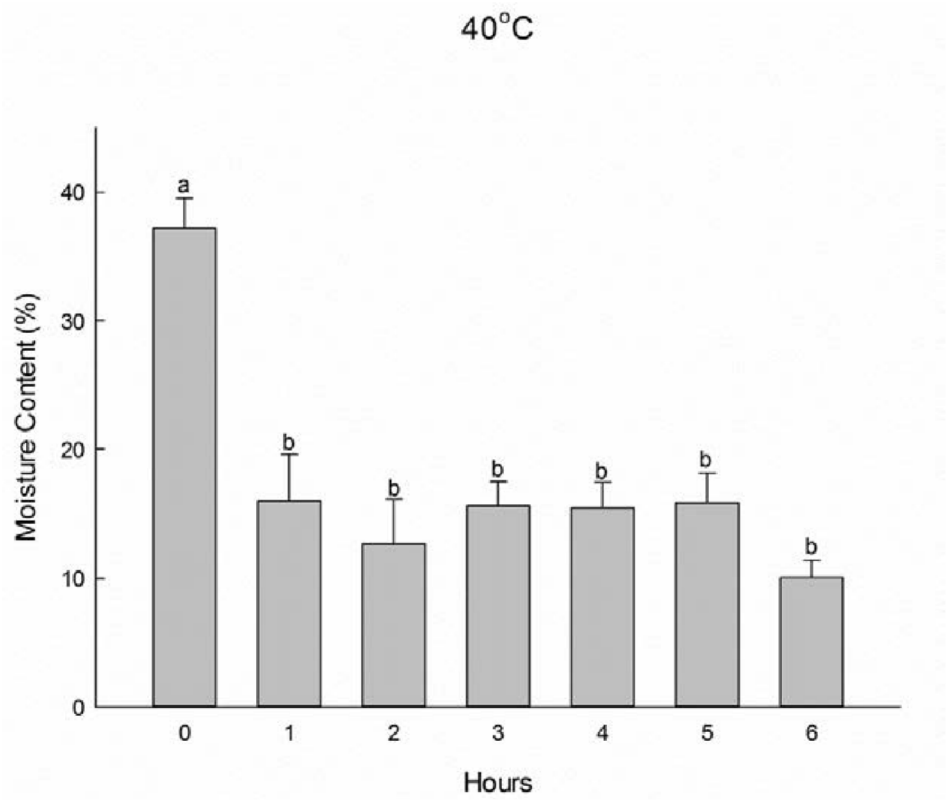

Fig 1.5. Hourly moisture content on *Canarium indicum* kernel during drying for 6 hours at 40°C.

Commercial drying

Temperatures within the commercial oven were not consistent in different areas of the oven and not stable over time, with the temperature fluctuating between 50°C and 68°C (Fig. 1.7).

Hourly moisture content measurements within the commercial treatment were significantly different after the first hour, third hour, the forth hour and the sixth hour ($P < 0.001$) (Fig 1.8).

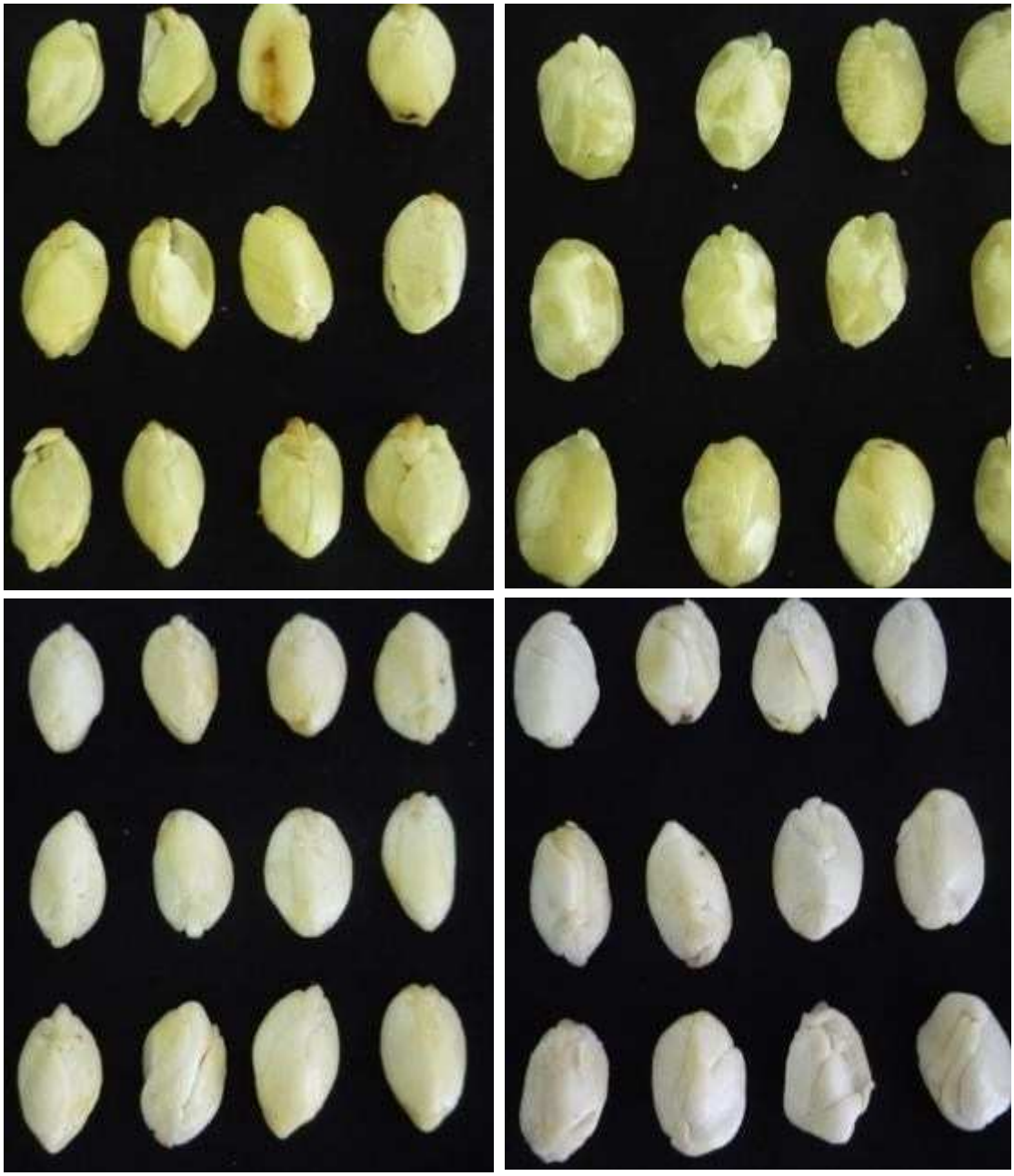

Fig 1.6. Colour of Canarium kernel dried for 6 hours at 80°C (top left), 60°C, 50°C and 40°C (bottom right).

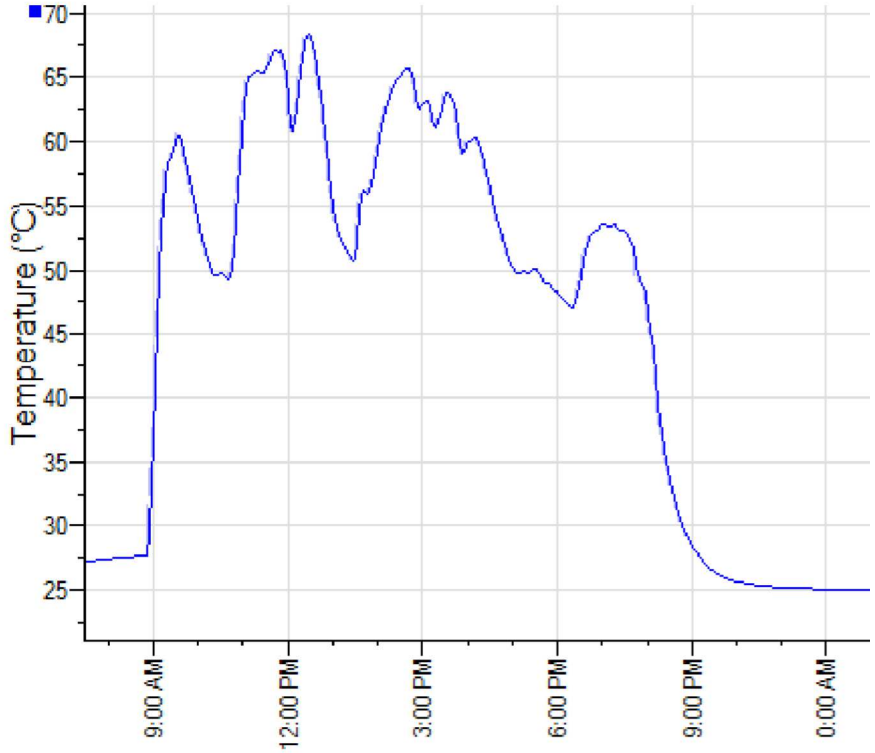

Fig 1.7 Temperature fluctuations during commercial drying of *Canarium indicum* during drying in a wood fired oven.

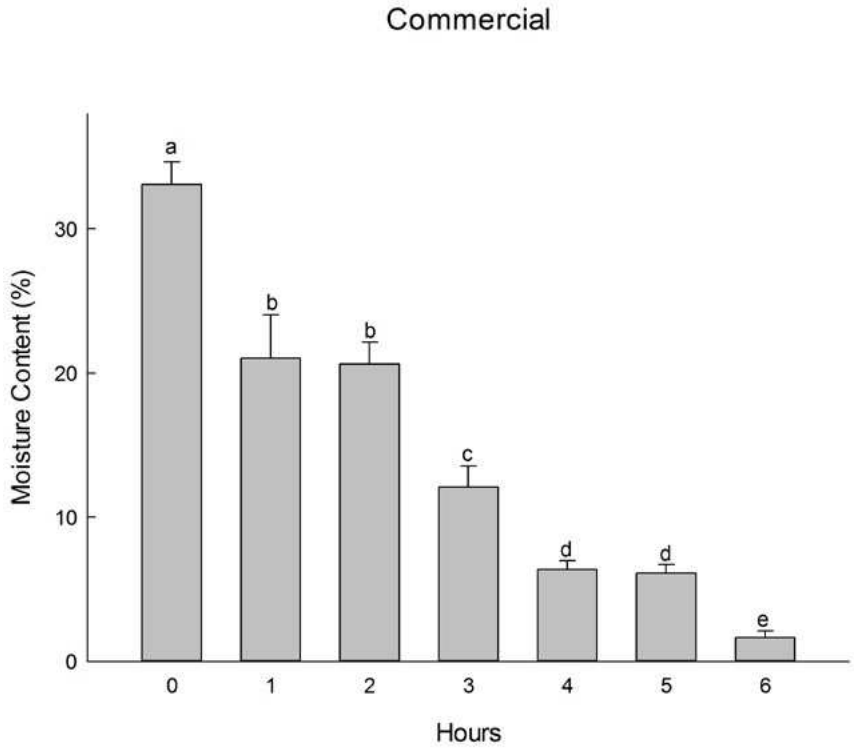

Fig. 1.8. Hourly moisture content of *Canarium indicum* kernel during commercial drying for 6 hours.

Summary
These results show that consistent temperatures of above 60°C will reduce kernel moisture content to below 5 % in only 1 hour but may have a detrimental effect on colour and storage potential. Temperatures of 50°C, even after 6 hours of drying, produced a whiter coloured kernel that may have longer storage potential. However temperatures of 50°C only reduced moisture content to around 10% even after 6 hours. This is insufficient for long term storage and further drying is needed to reduce moisture content to 3%.
The temperature fluctuations demonstrated by the commercial wood fired drying highlighted the inherent challenges in this process. Methods to dry kernels with greater temperature control are needed to produce consistent commercial quality kernels.

Appendix 11.9 *Methods for processing by-product broken pieces (oil, nut-meal for biscuits etc.)*

Canarium indicum nuts have a long history of traditional use, are valued for the edible nuts and have cultural significance in Papua New Guinea and Vanuatu. Indigenous tree nuts have the potential to alleviate hunger and poverty in developing countries (Leakey et al. 2005). An industry utilising their traditional pili nut (*Canarium ovatum*) is being developed in the Philippines (Coronel 1994). The *Canarium indicum* nut industry in Papua New Guinea, Solomon Islands and Vanuatu is in its infancy with potential for commercialization of the edible nuts (Bunt and Leakey 2008; Nevenimo et al. 2008: Wallace et al. 2010).

While whole nuts have greater value, in any commercial operation, wastage needs to be minimised. We examined post harvest processes that would utilise the by-products broken pieces from commercial operations to maximise efficiency, minimise waste and add value to the final product. In particular, we focused on use of broken pieces of Canarium nuts for nut-meal and oil production.

Because of the mild flavour *Canarium indicum* can be substituted in many recipes that use nuts such as biscuits. *Canarium indicum* contains a range of healthy oils consisting of approximately 50% saturated fat (34% palmitic and 13% stearic), 38% monounsaturated (oleic) and 14% polyunsaturated (linoleic) (Nevimenino et al. 2007).

Commercial operations are currently utilising broken pieces of canarium. Lapita Café in Vanuatu uses broken pieces of canarium nuts in biscuits and oil production, Maraghoto Holdings Ltd in the Solomon Islands is producing oil for cooking and cosmetics, Jedom Organic Foods in Solomon Islands is using broken pieces of canarium nuts in muesli; ACTIVE in Vanuatu use canarium oil in cosmetics and candle production and The Summit Café in Vanuatu also has a small scale hydraulic press that they use in their product development laboratory for small batch processing to produce cosmetics and candles.

The fruit contains an endocarp and the edible kernel has a high oil content of 67 – 75 % which can be used for cooking (Nevenimo et al., 2007; Leakey et al., 2008). Oil presses using a screw to compress canarium kernels and extract the cold pressed oil have been used but found to be difficult to use. Oil presses using a hydraulic press to extract the oil are much more effective (Figure 1). A coconut oil press from Axis Industrial Ltd., from New Zealand, that is capable of holding 15 litres meal per pressing was purchased and supplied to National Agricultural Research Institute in Papua New Guinea. The cost was NZ$ 3,380, however including freight and insurance to Port Moresby NZ$4,215.00.

A more economical solution would be to manufacture a similar product on site along the design of Figure 2. This would need to be manufactured from food grade materials.

Figure 1. Coconut oil press from Axis Industrial Ltd (new Zealand) holds 15 litres meal per pressing.

Figure 2. A similar “homemade” oil press using an hydraulic car jack to provide the necessary pressure.

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Appendix 11.10 *Information provided to processors about shelf life experiments*

Two experiments have been undertaken on shelf life with nuts from Vanuatu and the Solomon Islands. Reports containing the following general information as well as the specific results have been submitted to the respective industrial partners.

Key factors for shelf life of any food product include the initial moisture content or water activity (a_w), microbial contamination, temperature and the microclimate within the packaging (particularly available oxygen and relative humidity). These factors affect microbial growth, enzyme activity and the decomposition of chemicals within the food (figure 1). Elevated moisture content and temperature increases the rate of enzyme activity resulting in the breakdown of sugars and free fatty acids to other products that contribute to rancidity in foods.

Two industry standard methods for analysing deterioration of foods are measuring Peroxide Values and Free Fatty Acids and comparing these values over time. Free Fatty Acid values measures hydrolytic rather than oxidative rancidity, but these free fatty acids are then used by enzymes in oxidative deterioration. Peroxide Values measures the production of hydroperoxides during lipid oxidation and are considered an indicator of shelf-life.

Recommendations from the Australian Macadamia industry are that the moisture content should be less than 1.5%; Recommendations from the Australian Macadamia industry for peroxide values have recently been amended from 6.0 meq/g oil (milliequivelants/g oil) to peroxide values less than 3.0 meq/g oil (milliequivelants/g oil) and free fatty acids less than 0.5%.

In previous experiments undertaken, canarium kernel was vacuum packed at approximately 4.8% moisture content. When stored at 25°C, after 11 months the Peroxide Values remained at 0.31(meq/kg), however, Free Fatty Acids increased from the initial reading of 0.11% to 0.31% during storage. When stored at ambient temperatures in PNG, after 6 months, the Peroxide Values remained at 0.38(meq/kg), however, Free Fatty Acids increased from the initial reading of 0.17% to 0.28% during storage

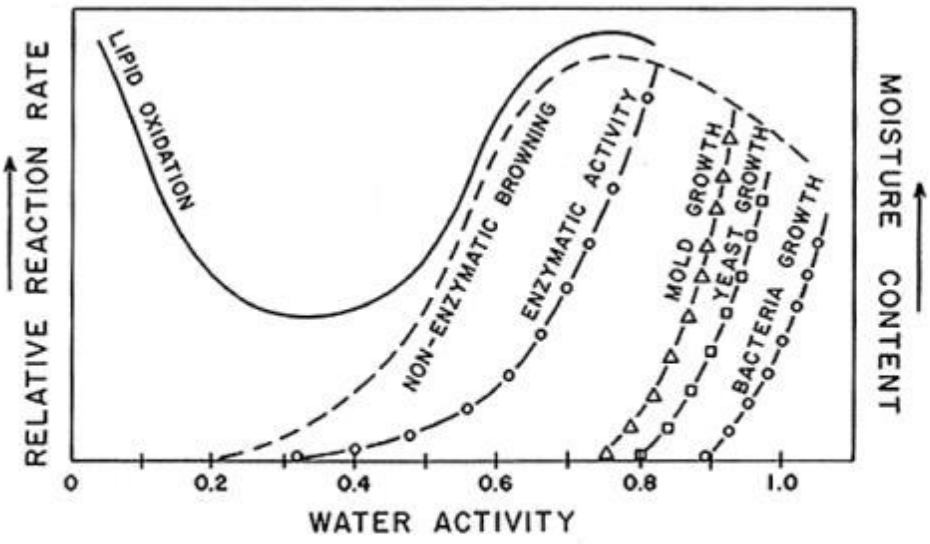


FIGURE 14. Stability of foods as a function of water activity.

From Labuza, TP, 1971. Kinetics of Lipid Oxidation in Foods. CRC Critical Reviews in Food Technology Vol.2 (3): 355-405.

October 1971 383

Figure 1. Food stability as determined by water activity

Commercial A

Initially when the canarium nuts from Commercial A were packaged for this storage experiment, the moisture content was 3.12% and water activity was 0.638a_w. Initial Peroxide values were 3.93 meq/g and free fatty acid values were 0.19%.

The canarium nuts for the three month tests were at moisture content of 3.39%, water activity 0.603a_w, peroxide values were 3.06 meq/g and free fatty acid values 0.26% (Table 1).

Table 1. Peroxide and Free Fatty Acid values for storage trial **Vanuatu**

Treatment	**Peroxide Values (meq/g)**	**Free Fatty Acids %**
Initial	3.80	0.253
	4.77	0.248
	3.19	0.213
	3.95	0.063
Mean (SE)	3.9275 (0.32538)	0.1943 (0.4465)
3 Monthly	0.55	0.194
	1.10	0.239
	3.46	0.229
	2.38	0.405
	5.84	0.267
	5.00	0.236
Mean (SE)	3.0550 (0.86132)	0.2617 (0.03022)
6 Monthly	3.89	0.43
	5.26	0.08
	4.65	0.21
	7.22	0.44
	9.36	0.29
	6.75	0.33
Mean (SE)	6.188 (0.8155)	0.297 (0.560)
9 Monthly	2.89	0.47

	3.38	0.56
	4.41	0.42
	2.8	
	5.3	0.59
	2.92	0.37
Mean (SE)	3.617 (0.584)	0.381 (0.449)

Commercial B

Initially when the canarium nuts from Commercial B were packaged for this storage experiment, the moisture content was 2.538 (SE 0.023). Initial Peroxide values were 0.678 meq/g and free fatty acid values were 0.164%.

Three month tests results were peroxide values 0.81 meq/g and free fatty acid values 0.368 % Six month tests results were peroxide values 1.384 meq/g and free fatty acid values 0.344 % Nine month tests results were peroxide values 1.56 meq/g and free fatty acid values 1.106 % (Table 2).

Table 2. Peroxide and Free Fatty Acid values for the storage trial **Solomon Islands**

Treatment	**Peroxide Values (meq/g)**	**Free Fatty Acids %**
Initial	0.62	0.11
	0.48	0.12
	0.46	0.11
	0.93	0.25
	0.92	0.23
Mean (SE)	0.678 (0.104)	0.164 (0.031)
3 Monthly	0.78	0.25
	0.88	0.30
	0.73	0.26
	1.07	0.55
	0.59	0.48

Mean (SE)	0.81 (0.801)	0.368 (0.616)
6 Monthly	1.4	0.35
	1.44	0.3
	1.49	0.22
	1.25	0.25
	1.34	0.6
Mean (SE)	1.384 (0.416)	0.344 (0.677)
9 Monthly	1.34	0.6
	1.48	0.44
	2.09	1.49
	1.28	1.76
	1.61	1.24
Mean (SE)	1.560 (0.144)	1.106 (0.254)

The initial moisture content was higher from Commercial A than Commercial B with the higher peroxide values from Commercial A indicating shorter storage potential. For commercial A, initial moisture content at 3.12% was too high and the peroxide values after 3 months was greater than 3.0 meq/g oil (milliequivelants/g oil), indicating that at this initial moisture content, although free fatty acid levels were acceptable, shelf life was restricted to only 3 months.

For Commercial B with an initial moisture content of 2.5%, the free fatty acid levels was greater than 0.5%, indicating that although peroxide values were acceptable, shelf life was restricted to 9 months

Appendix 11.11 *Trainer training presentation: Introducing the canarium package*

Slide 1

Slide 2

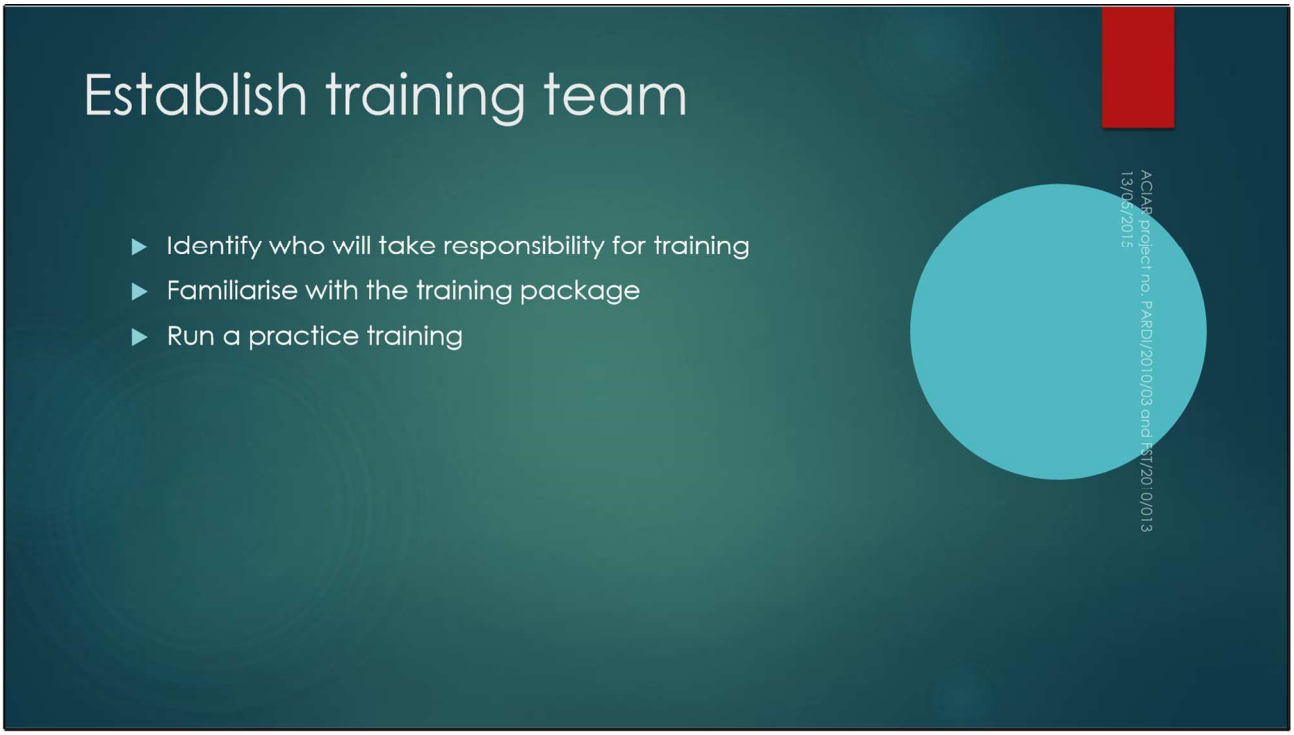
Slide 3

Slide 4

Slide 5

Slide 6

Slide 7



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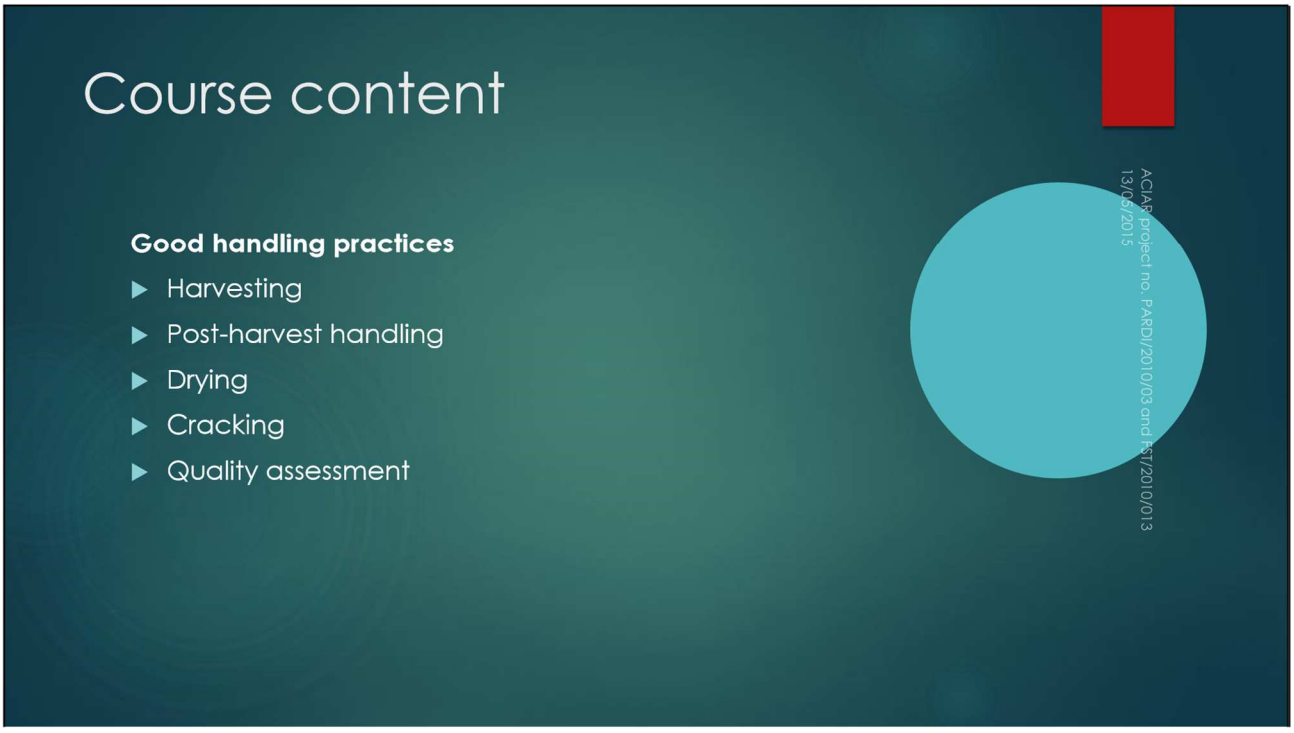

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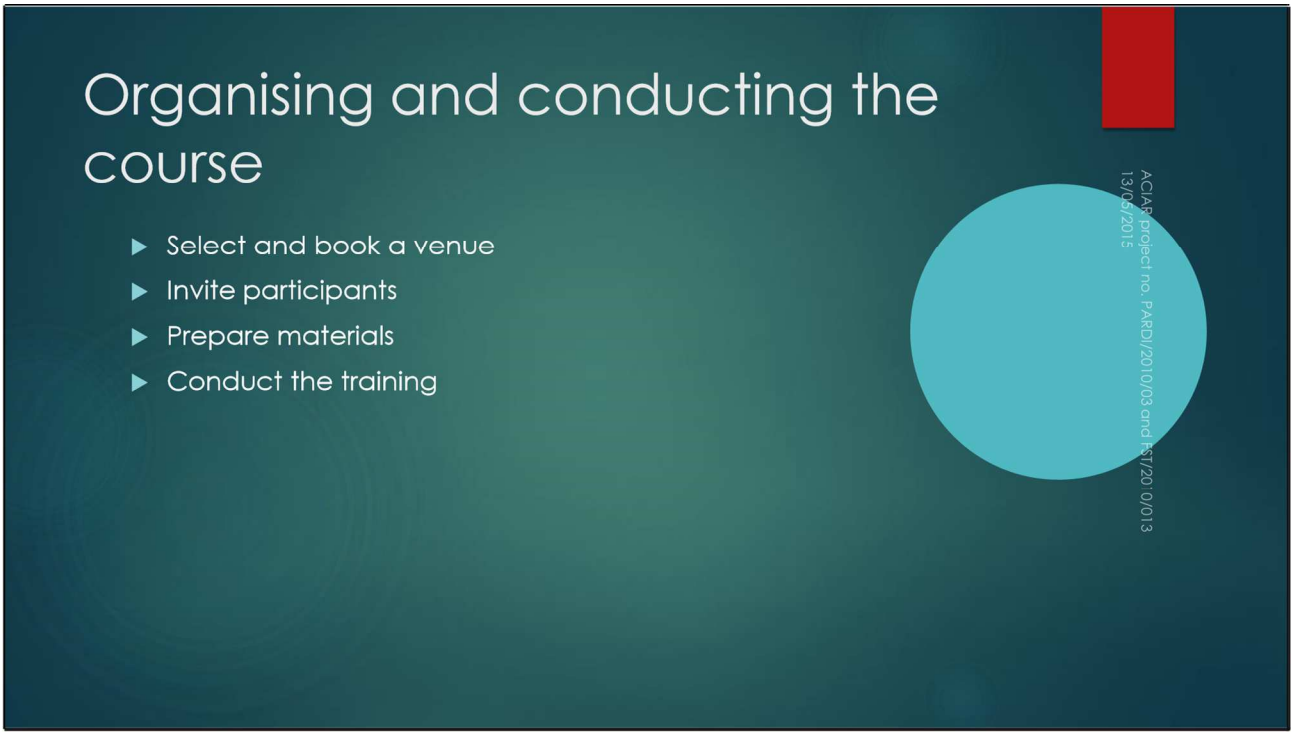


Slide 10

Appendix 11.12 *Trainer training presentation: Post harvest physiology*

Slide 1

Post-harvest Physiology

CANARIUM NUTS

1

Slide 2

Introduction

2

Post-harvest physiology

- To produce high quality canarium nuts and nut products, it is important to understand the processes that affect the quality

Slide 3

Introduction cont.

3

Quality and food safety of canarium nut is influenced by harvesting and post-harvest care

- Poor harvest and post harvest handling can result in nuts with a stale or rancid flavour
- Poor post harvest handling can result in contamination by human pathogens eg. Salmonella and E.coli or with aflatoxins

Slide 4

4

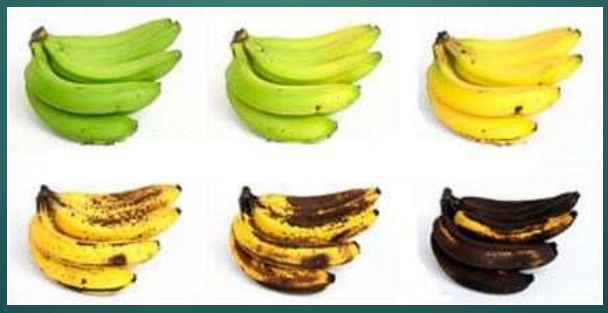
What should be done to produce good quality nuts that are safe to eat???

Slide 5

Nuts are a living organism

5

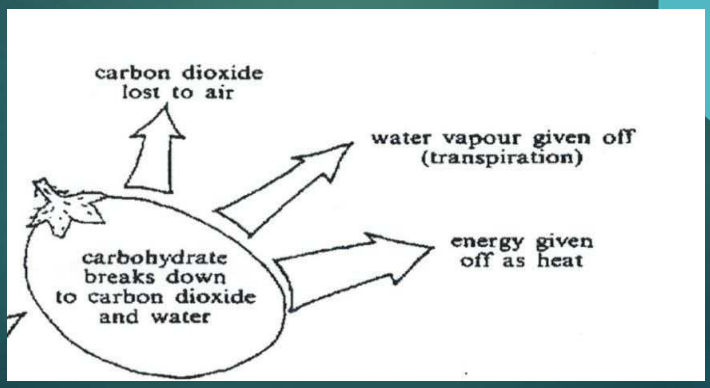
- All living organisms respire
- From the time the nut falls from the tree it starts to deteriorate through respiration
- Deterioration through respiration is more obvious in fruit like bananas but the same process occurs in canarium nuts



Nuts are a living organism

6

- Respiration is a process that converts nutrients (carbohydrates) that have been stored in the cell to energy (heat), giving off CO_2 and water

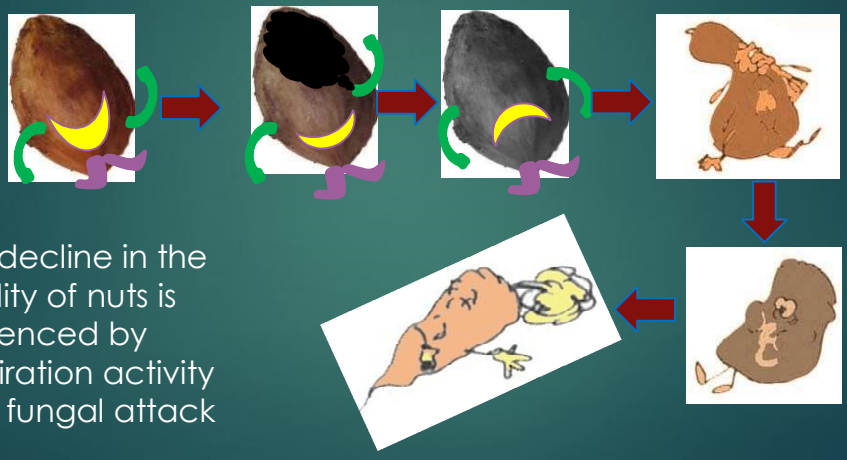


Slide 6

Slide 7

Nuts: after falling from the tree they begin to deteriorate

7



The decline in the quality of nuts is influenced by respiration activity and fungal attack

8

Respiration and deterioration can be increased by

Poor harvesting and handling practices:

- careless handling, such as dropping or throwing or walking on produce
- internal bruising, not visible externally, caused by impact;
- superficial grazing or scratches affecting the skins and outer layer of cells

Slide 8

Slide 9

Respiration and deterioration can be slowed by

9

Good post-harvest handling practices:

- Drying the nuts
- Cooling or freezing the nuts
- Remove oxygen by vacuum packing

Slide 10

Requirements for premium quality

10

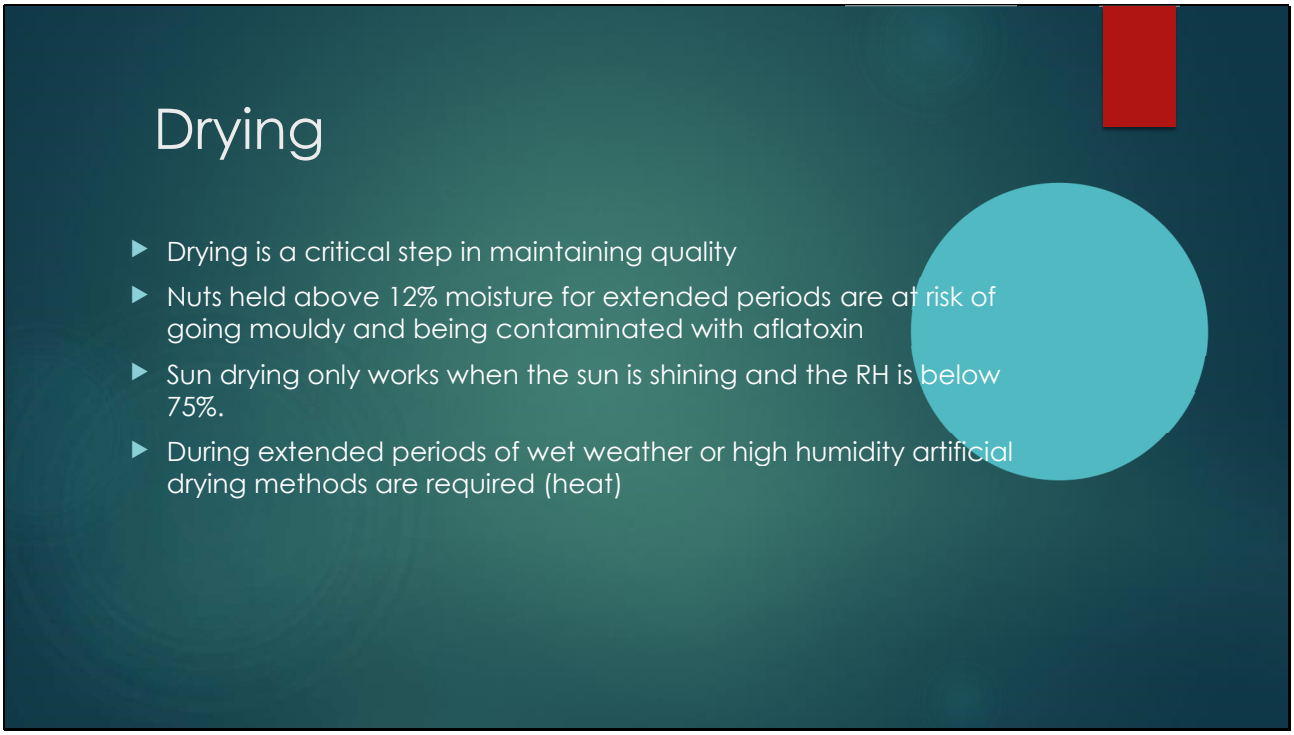
Good material

Good process
- Dry quickly
- Or Freeze
- Good hygiene

Good results
- Safe to eat
- Good flavour

Slide 11

Raised drying beds are more hygienic and efficient


Drying
Drying is a critical step in maintaining quality
Nuts held above 12% moisture for extended periods are at risk of going mouldy and being contaminated with aflatoxin
Sun drying only works when the sun is shining and the RH is below 75%.
During extended periods of wet weather or high humidity artificial drying methods are required (heat)

Slide 12

Slide 13

Cracking

- For food safety reasons it is best to deliver nutmeg in shell to the processor
- If cracking is to be carried out by the collector it must be done in hygienic conditions
- All tools and surfaces must be washed with soap before cracking

Cracking

Cracking must only take place in a clean and hygienic environment

Slide 14

Slide 15

Personal Hygiene

- Hand washing and personal hygiene is essential when cracking nuts or handling kernel.

Appendix 11.13 *Farmer training presentation: Good practices*

Slide 1

Canarium: Good practices

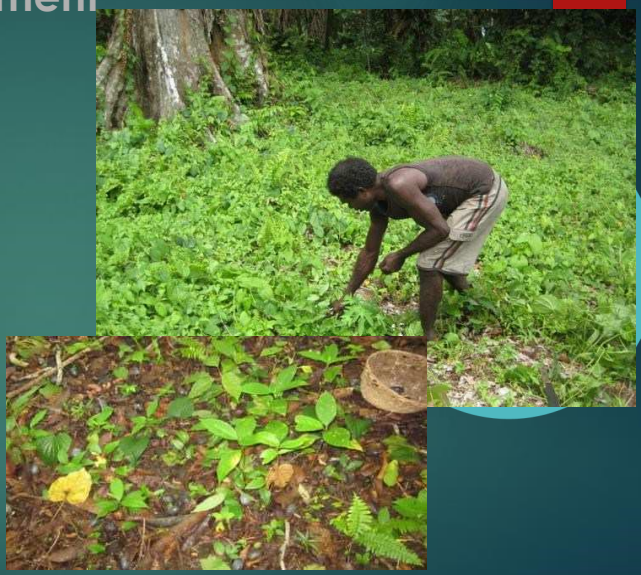
FROM TREE TO CONSUMER

Slide 2

Harvest management

Cleaning Around Trees

- Clean Land around and under the tree before the start of the harvest.
- Discard all nuts that have been on the ground for extended time



2

Slide 3

Harvesting

- Collect fallen fruit as often as possible from the ground.
- Fallen fruit should be collected each day if possible or at least on a weekly basis.
- Collect only fresh fallen nuts with a firm purple flesh

3

Slide 4

Postharvest handling

Depulping

- Remove the pulp within 24 hours of harvest
- Soak the fruit in hot water (40-50°C) for a few hours until the pulp becomes soft
- Wash away the slimy material adhering to the shell
- Discard all black nuts and nuts that float in water.

4

Slide 5

Hands on exercise: Quality grading

- Using nut in shell with a range of quality demonstrate to the participants the different grades.
  1. Nuts that are dry will rattle
  2. Black nuts should be rejected
  3. Nuts that float should be rejected
     - Demonstrate floating nuts to separate poor quality
     - Crack floaters and black nuts to show poor quality kernel

Slide 6

- Do not store fruits in a bag or in a pile, as the heat of respiration can adversely affect the kernel quality
- Soring in bags also increases the risk of contamination by mould and bacteria

6

Slide 7

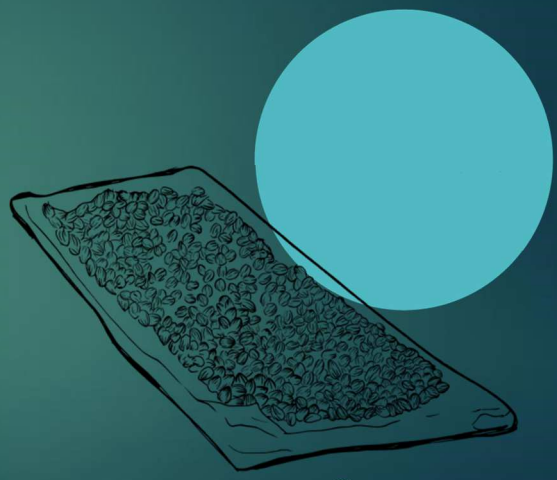
Drying

- Begin drying immediately after depulping
- Drying will be more efficient if drying racks are used
- Drying racks can be constructed from timber or bamboo.
- The bed of the rack can be made using a wire mesh, shade cloth or a loosely woven mat that will allow good air flow

7

Slide 8

- nuts can be dried on clean bags, or tarpaulins where there is no drying rack available.
  - Make sure the drying surface is clean before use
  - Dry in the sun
  - If rain occurs move the nuts under cover to prevent re-wetting.



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Slide 9

Cracking

- Cracking the nuts should only be done by instruction from the buyer
- The work area must be thoroughly cleaned before starting to cracking.
- All equipment and work surfaces must be washed with soap
- Kernel must only be stored in NEW bags or sterilized containers

9

Slide 10

Quality is paramount

Food Safety is Paramount

- High quality and food safe products rely on good handling practices from harvest to consumer

Appendix 11.14 *Trainer training presentation: The risk of aflatoxin in canarium nuts*

Slide 1

Slide 2

Slide 3

3

- Small quantities of aflatoxin in food may cause severe poisoning in humans characterized by:
  - Acute liver damage
  - Cancer (Carcinogenicity)
  - Fetal Malformation (teratogenecity)
  - Estrogenic effects (female hormones)
  - Nervous effects (hallucinations)
  - Vomiting (emetic)
  - Immunosuppresion

Slide 4

4

Factors that lead to Fungal Growth and Aflatoxins

- Aflatoxins are formed as a result of fungal growth in agricultural commodities.
- Contamination can occur in the field and/or during storage
- Once formed, they are extremely stable and persist long after the fungi has died.
- Once contaminated the commodity remains toxic and injurious to those who consume it.

Slide 5

Peanut

5

Slide 6

- Fungal growth and aflatoxins production is dependent on:
  - Presence of inoculums of a toxigenic fungal species.
  - A suitable substrate that may include agricultural commodities, processed foods, leather and wood.
  - Favourable environmental conditions
  - Moisture content of substrate
  - Temperature
  - Relative humidity
  - Oxygen / Carbon dioxide ratio
  - Time duration when all the above conditions are optimal

6

Slide 7

7

- Inoculums: The important producing fungi are Aspergillus, and are ubiquitous in occurrence and found in the air, soils, and vegetative materials.
- Substrates: Fungi are able to colonize and grow in a wide variety of substrates that include organic materials and most commodities. But some commodities depending on varieties, physical damage and other factors are more susceptible. These include:
- Maize, groundnuts, wheat and tree nuts.

8

Identification of Aflatoxin Contaminated Nuts

- Very small quantities are toxic
- You cannot see, smell, feel or taste Aflatoxins
- Laboratory testing is required
- But you can suspect contaminated nuts and avoid use or carry out tests

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Slide 9

Suspect Aflatoxins contamination in Nuts

9

- Nuts with slight to severe mould growth
- Nuts that are rotten, discoloured or diseased.
- Nuts with unusual or offensive smell, taste, flavour and aroma.
- Moist/wet and warm/hot nuts.

What to do with Aflatoxin Contaminated Nuts

10

- Aflatoxins in nuts are stable and not easily destroyed or removed by cooking, washing, milling or other common food treatment.
- Safest solution is destroy by burning or bury deep.

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Slide 11

Food safety and Aflatoxin

11

How do we minimize the risk for formation of aflatoxin?

- Minimize physical damage to nuts during harvesting and transportation
- Separate any mouldy and insect damaged nuts as soon as possible after harvest
- Dry to 10% moisture within nine days
- Ensure nuts are maintained at below 75% RH when in storage
- Use good hygiene practices to dry, store, and handle nuts

Good hygiene practices

12

- A food business must take all reasonable measures to process only safe food and to take all necessary steps to prevent the likelihood of food being contaminated.
- To produce safe nuts it is necessary to have good hygiene and suitable cleaning and sanitation programs in place
- The objectives of the cleaning and sanitation program are to ensure the establishment is maintained in a clean and tidy condition

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Slide 13

Good hygiene practices

13

- Moulds, bacteria and food pathogens can occur in dust, on unclean surfaces, be carried on clothing or by pests such as rats and insects.
- To avoid cross contamination from these sources every nut handling establishment should develop and maintain a cleaning and sanitation program
- The premises, all fixtures, fittings and equipment should be maintained to a standard of cleanliness where there is no accumulation of garbage, food waste, dirt, grease or other visible matter

Slide 14

Personal Hygiene

14

- Personal hygiene rules are needed to prevent contamination by human pathogens and other spoilage organisms
- Personal Hygiene Rules should be developed and clearly displayed in signs at the workplace
- All employees MUST wash their hands before commencing work and after using the rest rooms or taking a break.
- Facilities must be provided for hand washing

Slide 15

Appendix 11.15 *Results from risk of contamination and microbial testing of the supply chain*

A major goal of postharvest technologies is to reduce losses in quality and ensure safe food supply for the consumer (Kitinoja et al. 2011). Food manufacturers in particular need to have adequate sampling procedures to detect pathogenic bacteria and need to apply effective hygiene practices to prevent or minimise microbial contamination of food. The storage keeping ability of food also depends on storage conditions and the nature of any organisms present.

Food Standards Australia New Zealand monitor food supply to ensure it complies with international standards for microbial contamination, and to ensure that food is safe for human consumption. Common tests include standard plate count (SPC), and several bacterial, yeasts and mould contamination counts. The standard plate count (SPC), is one of the most common tests applied to indicate the microbiological quality of food. The significance of SPCs varies according to the type of food product and how it has been processed.

Total coliform bacteria indicate bacterial pollution associated with four genera of the family *Enterobacteriaceae (Escherichia, Klebsiella, Enterobacter* and *Citrobacter*). These

may be faecal or vegetative in origin. The presence of *E. coli* in ready-to-eat foods is undesirable because it indicates poor hygienic conditions which have led to contamination or inadequate heat treatment. Ideally *E. coli* should not be detected. Levels exceeding 100 per gram are unacceptable and indicate a level of contamination by introduced pathogens or that pathogens may have survived food processing.

Coagulase-positive *Staphylococci* contamination of ready-to-eat foods is largely as a result of human contact. Contamination should be minimised through good food handling practices and growth of the organism prevented through adequate temperature controls. Unsatisfactory levels of coagulase-positive *Staphylococci* indicate that time/temperature treatment of the food likely occurred following improper handling during food preparation. Levels of ≥104 colony forming units (cfu) in a food are considered potentially hazardous as foods with this level of contamination may cause food-borne illness if consumed.

Ready-to-eat foods should be free of *Salmonella* as consumption of food containing this pathogen may result in food-borne illness. The presence of this organism indicates poor food preparation and handling practices such as inadequate cooking or cross contamination.

Yeasts and moulds cause various degrees of deterioration and decomposition of foods. They affect grains, nuts, beans, and fruits in fields before harvesting and during storage. They also grow on processed foods and food mixtures. Detection depends on type of food, organisms involved, and degree of invasion. The actual growth may be visual and abnormal flavours and odours may also be produced. Even when a food appears mould-free mycological examination may find contamination. Several foodborne moulds, and possibly yeasts, may be hazardous to human health because of their ability to produce mycotoxins. Most mycotoxins are stable compounds that are not destroyed during food processing. Even when food preparation destroys the generating organisms, the resultant toxin may still be present. Contamination of foods by yeasts and moulds can cause substantial economic losses.

The aim of this project is to assess the risk of microbial contamination during processing of canarium nuts. Different processing methods and different phases in the food production chain were sampled.

Methods

Canarium indicum samples were taken from different methods of processing and different phases in the processing chain in Papua New Guinea, Solomon Islands and Vanuatu. Samples of nuts examined were fresh nuts, nuts dried in villages over hot stones heated in wood fired ovens, nuts dried using solar driers and nuts dried from two different commercial processors.

Three samples of nuts from each processing method were assessed by a registered food laboratory in Australia for microbial contamination and known pathogens. The results were compared to guideline levels for microorganism contamination from the NSW Food Authority (Food Authority NSW 2009).

Satisfactory results in these guidelines indicate good microbial quality, marginal results are within acceptable limits of microbial quality but may indicate possible hygiene problems during food preparation, while unsatisfactory results have unacceptable microbial contamination.

Statistical analysis

Results for the microbial tests were classified as (1) satisfactory, (2) marginal or (3) unsatisfactory when used as a ready to eat food and analysed using SPSS. Processed nuts were compared to fresh nuts as the control. Rank data were analysed with Kruskal-Wallis and Mann-Whitney U tests and a Bonferroni correction was applied to determine the appropriate level of significance.

Results

The standard plate count for commercial B, commercial A and village processed samples were either satisfactory or marginal when used as a ready to eat food (Table 1). The standard plate count for solar processed samples was unsatisfactory when used as a ready to eat food but satisfactory if the nuts were to be used in further processing foods. The standard plate count for fresh samples, although unsatisfactory for a ready to eat food, were marginal if used in further processing.

Coliforms (*Enterbacteriaceae*) results were marginal for all samples from all sources except from commercial B indicating a higher standard of hygiene (Table 1). *Escherichia coli* results were satisfactory in the processed samples and only marginal and unsatisfactory in the fresh and solar dried samples (Table 1).

Yeast Count and Mould Count were generally higher in the fresh samples than the more processed treatments. There is no standard for rejection, but yeast and mould growth will decrease storage capacity. *Staphylococcus* results and *Salmonella* results were satisfactory for all samples from all the sources tested.

	Fresh	**Village**	**Solar**	**Commercial A**	**Commercial B**
Standard Plate Count	Unsatisfactory (3)	Satisfactory (2) Marginal(1)	Unsatisfactory (3)	Marginal (3)	Satisfactory (2) Marginal (1)
Coliforms	Marginal (3)	Marginal (3)	Marginal (3)	Marginal (3)	Satisfactory (3)

E. Coli	Marginal (2) Unsatisfactory (1)	Satisfactory (3)	Marginal (2) Unsatisfactory (1)	Satisfactory (3)	Satisfactory (3)

Table 1. Microbial contamination of *Canarium indicum* samples collected from different processing methods. Standard Plate Count rated as satisfactory or unsatisfactory as a ready to eat (level 1) food; (number of samples each level).

Processed nuts contained significantly lower standard plate count and *E.coli* contamination to fresh nuts (Table 2). There were no significant differences in standard plate count and *E.coli* between commercial A and commercial B samples (Table 2).

	Fresh	**Village**	**Solar**	**Commercial A**	**Commercial B**
Standard Plate Count	12.50 (a)	4.00 (b)	12.50 (a)	7.00 (b)	4.00 (b)
Coliforms	10.50 (a)	5.50 (a)	10.50 (a)	10.50 (a)	3.00 (a)
E. coli	12.50 (a)	5.00 (b)	12.50 (a)	5.00 (b)	5.00 (b)
Yeast	14.00 (a)	5.00 (b)	9.50 (ab)	5.50 (b)	5.50 (b)
Mould	11.67 (a)	4.00 (a)	7.33 (a)	13.00 (a)	4.00 (a)

Table 2. Mean rank of microbial contamination of *Canarium indicum* samples from different processing methods. Means within the row with different letters are significantly different ($P < 0.05$).

Discussion

Fresh nuts were higher in all forms of contamination. The absence of *Staphylococcus* and *Salmonella* contamination indicates acceptable food handling procedures and low contamination. Coliforms (*Enterbacteriaceae*) results from all samples from all sources (except commercial B) indicate bacterial pollution, which may be vegetative or faecal in origin and may result from harvesting methods or contamination after cracking and removal from the shells. Low coliforms levels from commercial B indicate a higher standard of hygiene. Satisfactory levels of *Escherichia coli* in the processed samples demonstrates acceptable hygiene levels during processing, while the marginal and unsatisfactory *Escherichia coli* levels in the fresh and solar dried samples demonstrates unacceptable hygiene levels.

Variability in the standard plate counts between Commercial A, B, and the village processed samples shows different results for the different processing methods and lack of quality controls. Yeasts and Moulds, particularly in nut products are of concern because they can produce mycotoxins that are not destroyed during processing and may be harmful to human health.

Conclusion

This study assessed microbial contamination of *Canarium indicum* nut samples taken from different processing methods. Fresh nuts had higher standard plate counts and contamination by coliforms, *E. coli*, yeasts and moulds than processed nuts. *Enterbacteriaceae* results from most sources may result from harvesting methods or contamination after cracking and removal from the shells.

The absence of *Staphylococcus* and *Salmonella* and low levels of *Escherichia coli* in the samples tested demonstrates acceptable hygiene levels during processing. Variability between samples from different processing methods in standard plate counts shows inconsistency between processing methods, lack of quality controls and potentially hazardous problems. Improper handling during food preparation may lead to increased microbial contamination that may cause potentially hazardous results causing food borne illness.

These results highlight the need for establishing a Hazard Analysis Critical Control Points (HACCP) program and detailed procedures to improve food safety standards during processing need to be established and implemented.

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Appendix 11.16 *Best practices for canarium Harvest and Post-harvest care*

Guidelines for Farmers and Village Collectors

Harvest management

Poor harvest and post-harvest handling of canarium may result in low quality and can be contaminated with microbes that could be a health hazard for consumers. Human pathogens such as E.coli and Salmonella and aflatoxins are of particular concern and can contaminate the nuts through poor hygiene practices and poor post-harvest storage conditions. Aflatoxin is a toxin that is produced by Aspergillus fungi. Aspergillus occurs naturally in most agricultural environments, particularly in warm wet environments like those where canarium is grown.

Canarium that is not dried properly or handled with good hygiene practices is at high risk of being contaminated with aflatoxin or human pathogens. This document is developed to provide canarium nut growers and village collectors with a manual of Good Agricultural Practices for harvest and post-harvest care.

Cleaning under trees

Clean under trees before harvest begins. Remove all old fallen fruit and leaves and excessive vegetation to provide a clear ground for harvest. Old fruit and excessive ground cover create conditions that encourage infection by moulds and insects

Figure 1. Clean under trees before the start of harvest.

Harvesting fruit from the tree

If harvesting fruit from the tree only harvest mature fruit that has turned purple (Fig. 2). Avoid harvesting fruit before it is ripe as immature fruit will be shrivelled and classed as substandard and rejected by the buyer.

Figure 2. When harvesting from the tree harvest only ripe fruit that has a purple colour

Ground Harvesting

Collect fallen fruit as often as possible from the ground. Fallen fruit should be collected each day if possible or at least on a weekly basis. Collect only fresh fallen nuts with a firm purple flesh. Fallen nuts that have been on the ground for extended periods are at risk of being contaminated with mould and aflatoxin.

Post-harvest Management Removal of the flesh of the fruit (Depulping)

Fresh fruit should be processed as quickly as possible. Do not store fruits in a bag or in a pile, as the heat of respiration can adversely affect the kernel quality. It also increase the chances of contamination by mould. Remove the pulp within 24 hours of harvest, and start the drying process immediately. To remove the pulp soak the fruit in hot water (40-50°C) for a few hours until the pulp becomes soft. Rub the flesh from the nuts and thoroughly wash away the slimy material adhering to the shell. Discard all nuts that float in water.

Cleaning and grading the fresh nuts in shell

After removing the pulp the nuts should be sorted to remove any nuts with open cracks, surface mould, or nuts with visible insect damage. Discard any black (old) nuts. When sorting the nuts always use a clean surface (Fig 3) (hesian bags, tarpaulin, woven mat etc) to avoid contamination with fungi or bacteria.

Figure 3 Use a clean surface to sort and dry nuts.

Drying

Nuts must be dried to 10% moisture as soon as possible to prevent deterioration. Drying is recommended to reach 10% moisture content within seven days after harvest. As a guide 10% moisture is reached when the kernel rattles inside the shell. Reducing the moisture content to 10% moisture prevents mould and bacteria from growing. If farmers are unable to achieve dry nuts at 10% moisture within seven days then the nuts should be delivered to the processor as soon as possible. **Sun drying**

When drying the nuts spread the nuts in a single layer. Drying will be more efficient if drying racks are used (Figure 4). Drying racks can be constructed from timber or bamboo. The bed of the rack can be made using a wire mesh, shade cloth or a loosely woven mat that will allow air to pass through. Drying racks should be at least 20cm above the ground to improve airflow and increase drying rates. If the farmer does not have a drying rack the nuts can be dried on clean bags or mats.

Begin drying in the shade for the first 1-3 days and finish with sun drying. The drying rack is portable and will allow the nuts to be moved from shade to sun and under cover if it begins to rain. Once drying has begun do not allow the nuts to be re-wet. If rain occurs cover the nuts or move them under cover.

Figure 4. Drying of nuts should be done on raised drying racks.

Good hygiene practices for cleaning the sun drying area and surfaces are important. Make sure that any drying mats or racks are clean and free from dirt, mould and foreign matter.

Bagging

Use only clean plastic or hessian bags to store and deliver nuts in shell to the collector. Do not use bags that may be contaminated with chemicals or animal manures. The use of new bags is recommended as best practice. **Storage**

If nuts are to be sold for commercial use by a processor they should not be stored by the farmer. Deliver the nuts to the collector as soon as possible. If the nuts are for personal consumption they can be dried to 5% moisture and stored for up to 12 months. To dry the nuts to 5% the nuts may need to be dried near the cooking fires. Avoid hanging bags of nuts directly in the smoke as this may taint the flavour. Do not let stored nuts get wet or reabsorb moisture.

Transportation to the collector

Farmers should consult with their processor on the preferred way and time for delivery as each processor may have their own specific requirements. Transport only in clean containers or bags. Protect the nuts from rain during transportation.

Cracking Nuts

Cracking the nuts should only be done if the collector or processor demands kernel or kernel in testa. If cracking is done in the village good hygiene practices must be observed. The person doing the cracking must wash their hands before starting cracking. The work area must be thoroughly cleaned before cracking commences. All equipment and work surfaces must be washed with soap before commencing cracking. Kernel in testa or kernel must only be stored in NEW bags or sterilized containers.

Figure 5. Ensure you use a clean surface for cracking nuts. All surfaces and equipment must be washed with soap before commencing cracking.

Appendix 11.17 *Industry quality standards and product specifications*

When *canarium indicum* nuts are ripe they abscise (drop) from the tree. Nuts need to be collected from the ground regularly. Prior to the start of the season, old and immature nut-in-shell should be removed. The ground under the trees needs to be cleared of undergrowth and leaves to make collection of nuts easy and reduce the risk of mould etc.

The longer that nuts remain on the ground, the risk of mould, germination and rancidity increases. Consequently, nuts should be picked up as frequently as possible to maximise quality. Nuts can be checked for quality by immersion in water, with the nuts that float being rejected. Damaged nuts should also be rejected.

The fleshy mesocarp (flesh) should be removed as quickly as possible. Traditionally this was removed by rotting, but this increases the risk of microbial contamination. Mechanical removal of the flesh is much more preferable.

Food safety is extremely important in any post harvest treatment. It is important to minimise exposure to pathogens such as *Salmonella* and *E. coli*

Nut-in-shell should be dried in a single layer for approximately three days (dependent on weather conditions) to reduce the moisture content to approximately 10%. This will stabilise the nuts by reducing bacterial, yeast and mould growth and enzyme activity. The nut in shell can then be cracked and the kernel dried further to 2-3%. If the nuts cannot be dried to these levels using ambient air, heated air may need to be used.

Care is required when using heated air and requires adequate airflows to ensure that the moisture is carried away from the nuts. Excessive temperatures during drying with nuts at high moisture content are detrimental. Providing sufficient air is flowed through the nuts, the recommendation for drying nut-in-shell is three days at 35^{o}C followed by four days at 38^{o}C. This will decrease the moisture content to approximately 6% however the kernel will require further drying for long term storage. If the moisture content of the nut-in-shell has been reduced to 10%, drying the kernel with heated air and sufficient air flow may be achieved at 60^{o}C in 1-2 hours. When storing dried kernels, the kernel should be stored in airtight containers to prevent rehydration. This is particularly important in high relative humidity environments. Refrigeration also increases shelf life, but may be uneconomical in developing countries.

Kernels may be stored in-testa as this protects the kernel from physical damage during storage. The testa is easily removed when at field moisture content but adheres to the kernel and becomes increasingly difficult to remove as the kernel dries. The testa is more easily removed from the kernel if rehydrated by immersion in near boiling water for 90 seconds. Steam may also be used commercially. Water absorbed during testa removal will need to be removed prior to packaging or value adding.

Cracking the nut-in-shell exposes the kernel to contamination and hygiene is important during this and future processing. While blanching or steaming is a critical control point in the processing chain, to destroy pathogens such as Salmonella and E. coli, it will not remove aflatoxins and microbial re-contamination may occur through manual handling, particularly if moisture content is not reduced to safe levels quickly.

Factory hygiene protocols need to be developed, with appropriate training to ensure general principals of food hygiene are observed. Critical control points such as blanching the kernels

need to be monitored to ensure the temperature is sufficient to achieve sanitising the kernel. Monitoring and laboratory testing of moisture content, microbial and aflatoxin loads to ensure levels of these pose a nil safety risk for human consumption.

Prepared kernel for retail sale should be packaged in moisture proof sealed bags under partial vacuum. Shelf life studies with nuts that have been dried to less than 2.0% moisture content, have shown that canarium indicum will keep for 9-12 months. The product needs to be appropriately labelled. The labels need to include the product name, country of origin, weight, date of packaging and nutritional analysis.

Appendix 11.18 *Selection of the best trees for early yield and nut characters*

Selection of the Tropical Nut C*anarium indicum* for Early Fruiting, Nut-in-shell Size and Kernel Size

B.W. Randall, D.A. Walton, E.L. Grant and H.M. Wallace
Genecology Research Centre
University of the Sunshine Coast
Maroochydore
Australia

P. Zekele
Ministry of Forests
Munda
East New Georgia
Solomon Islands

B.Gua
Secretariat of the Pacific Community
Honiara
Solomon Islands

R. Pauku
Maraghoto Holdings
Honiara
Solomon Islands

Keywords: Forest products, Galip nut, Ngali nut, Nangainut, tree selection

Abstract

Indigenous nut crops have great potential to improve the livelihood of rural populations in developing countries. *canarium indicum* (Burseraceae) is an indigenous species of the lowlands of Pacific Islands with great potential for developing a commercial nut industry. We examined a plantation of 50 families of 6year old *canarium indicum* trees to determine whether some families displayed early fruiting and desirable nut characteristics. One thousand seedlings from 50 known parent trees (20 seedlings for each parent) were planted in 2005. Trees were assessed in 2011 for early flowering and fruiting. Of 693 surviving trees 189 trees were flowering and 155 trees bore fruit after 6 years. Nuts were sampled from 25 trees to assess nut-in-shell and kernel weights.There were significant differences in mean nut-in-shell weight between trees. Nut-in-shell from the best selections weighed nearly twice as much as those from the poorest selections. Similarly kernel weights for the best selections were more than twice the weight of those from the poorest selections. However, the best selections for nut-in-shell weight were not the same as the best selections for kernel weight, highlighting the importance of assessing a range of characteristics. The highest mean kernel-recovery (kernel to nut-in-shell ratio) for the best tree was nearly twice that of the tree with the lowest kernel-recovery. These results highlight the benefits of early evaluation programs to identify superior selections that will increase yield and quality of *canarium indicum* kernels in Pacific Island countries.

INTRODUCTION

The world trade in tree nuts is in excess of $US 2 billion and just four species, walnuts, hazelnuts, pistachios, and almonds, make up more than 80 % of this trade (USDA 2008). Many other indigenous nut species have been traditionally used by subsistence farmers and have great commercial potential. Commercialisation of indigenous tree nuts could enable rural communities to reduce poverty (Garrity, 2006; Leakey et al., 2005).

Commercial nut industries rely on consistent high yielding cultivars, appropriate growing conditions and postharvest systems (Kazantzis et al., 2003; Wallace and Walton, 2011). In many undomesticated trees differences between individuals results in large variability in fruit and nut-in-shell size, quantity of fruit and timing of fruiting production (Leakey et al., 2005). Tree selection and domestication programs can greatly increase production (Nichols and Vanclay, 2012).Trees that produce a large fruit yield within a few years of planting will maximise the early return on investment. Maximum fruit (or nut) production may be pivotal to commercial success and traits with economic importance can be improved with selection (Nichols and Vanclay, 2012; Leakey et al., 2002).

Canarium indicum is an indigenous tree in Eastern Indonesia, Papua New Guinea, Vanuatu, and the Solomon Islands that occurs in the lowlands up to 600m (Thomson and Evans, 2006). It is a traditional food source and a valuable commercial timber species (Nevenimo et al., 2007). The fruit contains an edible kernel with a high oil content and has traditionally been important for food security (Nevenimo et al., 2007; Leakey et al., 2008).

The *canarium* nut industry in the Pacific is in its infancy and although unknown on the international markets, has great potential for expansion (Wallace et al. 2010). The *canarium* nut industry is limited by the variability in size and quality of processed kernel and reliability of supply (Bunt and Leakey, 2008; Nevenimo et al., 2008). The size of some nut-in-shell has been increased through informal tree domestication over generations by indigenous farmers (Nevenimo et al., 2007). Growing trees with improved quality and yield (particularly larger kernel size), that produce fruit earlier and more regularly, have been identified as research and development priorities by farmers in Papua New Guinea (Nevenimo et al., 2008). Currently there are no trials that have assessed genetic differences in yield and nut-in-shell characteristics of *C. indicum* in a replicated trial.

The aim of this study was to examine the variability in fruiting and nut characteristics of six year old seedlings from known *canarium* families. In particular; (1) Which families had a high proportion of trees that bore fruit when trees are six year old? (2) Which families (if any) produced significantly more fruit at six years old? (3) What are the differences in weight of nut-in- shell, weight of kernels and kernel recovery between individual trees?

MATERIALS AND METHODS

Experimental site

A *canarium indicum* progeny trial was established in the Solomon Islands under the South Pacific Regional Initiative on Genetic Resources (SPRIG) program in 2005. Seedlings from 50 selected mother trees from 5 provenances were planted near Poitette, Kolumbungara Island, Solomon Islands (07º55'S-157º10'E). Individual trees in the same family are half or full siblings. The trial consisted of 20 plots of 50 families (single trees from each family in each plot) in a randomised block design (1000 trees in total).

Early fruiting

We counted the number of fruit bunches on all surviving trees and estimated the number of fruit in each bunch in 2011 when trees were 6 years old. Trees were assessed halfway

through the fruiting season, when the majority of flowers had set fruit and very few ripe fruit had abscised.

Variation in nut characteristics

We collected 20-30 ripe fruit from each of 25 trees to determine nut-in-shell and kernel characteristics. The pulp was removed and the nut-in-shell were individually weighed at field moisture content. Nuts-in-shell were cracked, the testa removed and each kernel was weighed. The kernel recovery ratio ((weight of kernel / weight of wet nut-in-shell) x 100) was calculated. **Statistical analysis**

All data were analysed using SPSS version 17(IBM Corp. Chicago). We compared the number of fruits between trees. Trees that did not bear fruits were excluded from the analysis as C*anarium indicum* is dioecious and non-fruiting trees were likely to be males. Data for number of fruits did not meet assumptions for parametric testing so data were analysed by a Kruskal-Wallis test (Sokal and Rohlf 1995). We compared differences in nut characteristics trees using a general linear model. Duncan's Multiple Range test was used for comparison of means.

RESULTS

Early fruiting

Representatives of all families survived the first six years. Of the 693 surviving trees in 2011, 27.3% trees were flowering and 22.4% trees were bearing fruit with a total of 40% either flowering or fruiting. The best performing families (families 11, 26 and 29) had over 50 % of individuals bearing fruit at 6 years, whereas the worst performing families (families 6 and 16) had none. Mean number of fruit per family was 32.81 (SE 4.11) and there was no significant difference between families (P=0.617). Only 12 trees were observed bearing more than 100 fruit each, while 79 trees (50% of the trees that bore fruit) produced less than 15 fruit each.

Nut sizes

Differences in nut-in-shell weight, kernel weight and kernel recovery between trees were all highly significant (P <0.001).The tree with the heaviest nut-in-shell weight did not produce the heaviest kernel or the best kernel recovery ratio. Trees 19.02, 13.01 and 11.04 produced nut-in-shell that was 1.8 times heavier than nut-in-shell from tree 39.17 (Fig. 1). Trees 22.06, 30.11 and 19.02 produced kernels that were 1.7 times heavier than kernels from tree 45.04 (Fig 2). The highest kernel recovery from trees 22.06 and 39.17 was 1.8 times heavier than kernel recovery from tree 11.04 (Fig 3).

DISCUSSION

Several families had a high proportion of trees that bore fruit, while two families had surviving trees that produced no fruit when trees were six year old, confirming that selecting better families will increase yield (Nichols and Vanclay 2012). Our results indicated that there was no significant difference in total fruit yield between families, however yield was highly variable. The majority of trees bore few fruit, but fruit yield, and the number of trees bearing fruit should increase with age. Fruit yields require further research.

Differences between undomesticated trees results in large variability in fruit and nut-in-shell size (Leakey et al., 2005). To identify elite trees, trees with heavier kernels need to be identified (Leakey et al., 2008). These results show that the best *C. indicum* trees produce kernels that weigh nearly twice as much as the poorest trees. Significant variability in weight of nut-in-shell, weight of kernel and kernel:nut ratio between *C. indicum* has also been

reported in Papua New Guinea (Nevenimo et al., 2007; Leakey et al., 2008). Selecting the right trees could lead to nearly double the production of kernels by weight.

Transport, labour and production costs may indicate an economic reason for including kernel recovery ratio in the selection process (Evans 1996). Our results show that heavier nut-inshell may be least desirable criteria for selection and confirm that kernel weight and kernel recovery ratio need to be considered as selection criteria (Leakey et al., 2008).

We recommend that the best material with the largest kernels be selected and distributed to smallholders as this will improve volume of kernel produced and return for effort for *C. indicum* producers. Appropriate harvesting and postharvest systems are also needed to ensure quality (Walton and Wallace, 2008; 2010; Walton et al., 2013). A strong industry based on processed *C. indicum* nuts will improve livelihoods, especially of women smallholders in Pacific countries.

Acknowledgements

Funding for this project was provided by ACIAR PARDI/2010/no and FST/2010/013.

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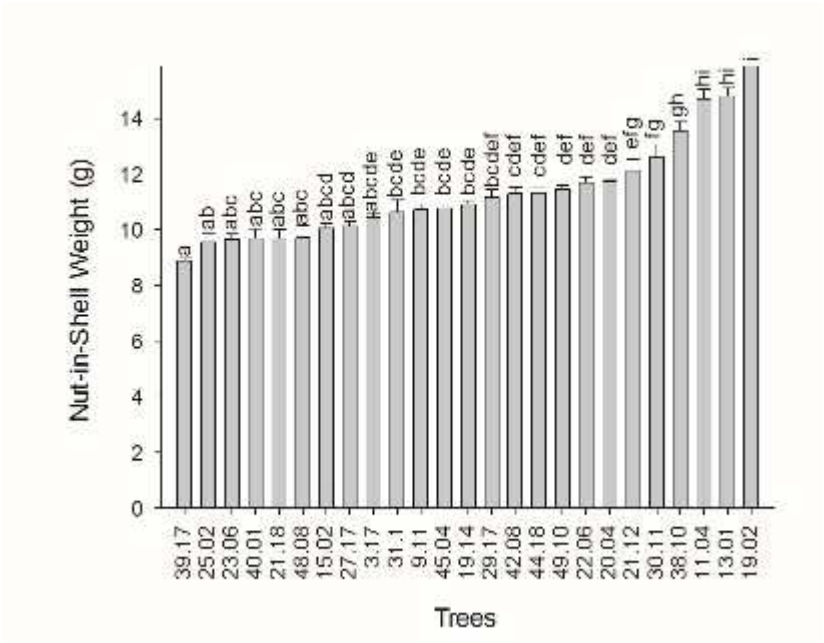

Fig.1. Differences in nut-in-shell weight between 6 year old *Canarium indicum* trees in Kolumbungara Island, Solomon Islands. Trees indicates the identity of individual trees sampled. N=25-30 nuts per tree.

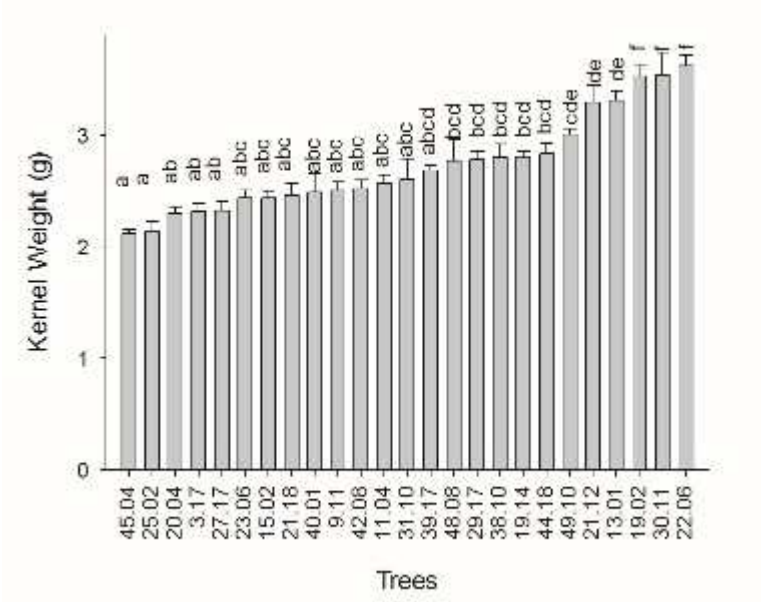

Fig. 2. Differences in kernel weight from 5 year old *Canarium indicum* trees in Kolumbungara Island, Solomon Islands. Trees indicates the identity of individual trees sampled. N=25-30 nuts per tree.

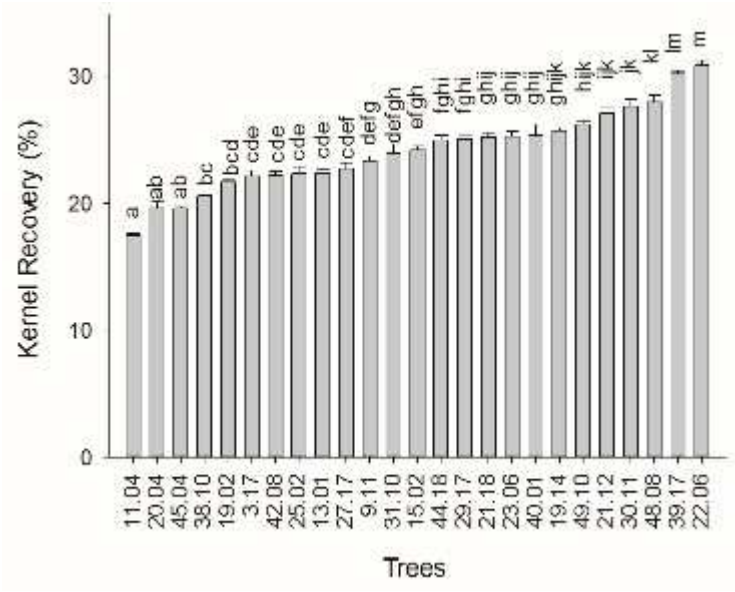

Fig.3. Differences in kernel recovery ratio from 5 year old *canarium indicum* trees in Kolumbungara Island, Solomon Islands. Trees indicates the identity of individual trees sampled. N=25-30 nuts per tree.

Appendix 11.19 *Three year study on early fruiting and nut characteristics of the Tropical Nut, Canarium indicum*

Selection of *Canarium indicum trees* to improve nut production: Tree yield and nut size *Randall, BW*[1], Walton, DA[1], Grant, E[1], Gua, B[2], Wallace, HM[1]. author's email: brandall@usc.edu.au

[1] *University of the Sunshine Coast, Maroochydore, Australia* [2]*SPC, Honiara, Solomon Islands*

Abstract

Promotion of new and underutilised crops provides developing countries new agricultural products to increase productivity within traditional agricultural systems. Nut-bearing trees provide non-timber forest products, increase food security and provide a saleable commodity. Indigenous nut crops have great potential to improve the livelihood of rural populations in developing countries. However, information about productivity of indigenous nuts is limited. *Canarium indicum* (Burseraceae) is an indigenous agroforestry species of the lowlands of Melanesia that produces edible nuts with the potential to be the basis of a commercial nut industry. We examined a plantation of six to eight year old *Canarium indicum* trees for three seasons to determine which families were early-bearing and/or more productive. One thousand seedlings from 50 known parent trees (20 seedlings for each parent) were planted in 2005 with 693 trees surviving after 6 years. Tree growth was measured in 2011 when the canopy was beginning to close. Yield and early bearing of trees were assessed in 2011, 2012 and 2013. We also measured nut-in-shell and kernel weights from 25 to 30 trees each year, during 2011, 2012 and 2013, to determine which trees produced large kernels. Yield between families for each season was not significantly different, with variable yield within families because of differences between half siblings. There were significant differences in kernel weights between trees that produced the heaviest kernels and trees that produced the lightest kernels. There is a need to identify and propagate trees with superior yield and nut size to increase yield and quality of *Canarium indicum* kernels in Pacific Island countries.

Key words: agroforestry; tree selection; indigenous nuts; Burseraceae; traditional foods.

INTRODUCTION

Agroforestry systems as practiced by subsistence and market farmers in developing countries, uses land for trees, crop and animal production. Trees are selected to provide useful non-timber tree products such as fruit, nuts, firewood and medicines (Simons and Leakey 2004). Agroforestry helps to preserve important ecosystem services and improve food security of developing countries (Simons and Leakey 2004; Jose 2009). Agroforestry also has the benefits of carbon sequestration, biodiversity improvement, soil conservation and enrichment and improved air and water quality (Jose 2009).

More than 50% of the population in developing countries lives in rural areas (Pimentel et al. 1997a). In developing countries people in rural areas are dependent on non-timber forest products such as fruit and nuts to alleviate poverty and improve food security (Combe 1982; Simons and Leakey 2004; Leakey et al. 2005; Pauku 2005; Garrity 2006). Nuts in particular

often have high protein and oil content and thus have high nutritional value and are recommended for healthy diets (Griel et al. 2008; Orem et al. 2013).

Tree improvement by selection of elite tree material has great potential to improve profitability of tree crops (Simons and Leakey 2004; Goldschmidt 2013). Tree selection can result in increases in timber yields of 20% in Australian *Corymbia* hybrids, 20-25% in Australian pines and 10-25% in European conifers (Lee 2007; Wu et al. 2007; Ruotsalainen 2015). In addition, for non-timber products like walnuts, high nut and kernel weight are economically desirable qualities that can be improved through breeding programs (KhadiviKhub and Ebrahimi 2015). Selection of elite trees as planting material may produce improvements in the size and quantity of fruit or nuts, thus increasing yields and improving food security (Simon and Leakey 2004; Brauer et al. 2009). Improving these qualities may be critical factors for profitability and sustainable commercial success (Kainer et al. 2007). Improving the quality of kernels will improve livelihoods of indigenous people and promote the success of the Canarium nut industry (Nevenimo et al. 2007; Nyoka et al. 2015)

Canarium indicum is an indigenous lowland tree in Eastern Indonesia, Papua New Guinea, Vanuatu, and the Solomon Islands, and is valued as a commercial timber species as well as for its edible nuts (Thomson and Evans 2006). The edible kernel which has a high oil content of 67 – 75 % is enclosed in a tough endocarp (Nevenimo et al. 2007; Leakey et al. 2008). *Canarium* is used as a shade tree for cocoa and has potential to improve financial return for small-holders as well as increase food security (Combe 1982; Nevenimo et al. 2007).

The *Canarium* nut industry is in its infancy and has great potential for expansion (Bunt and Leakey 2008; Nevenimo et al. 2008; Wallace et al. 2010). Processed nuts have a high value in export markets, they can be transported, and stored without cold-storage challenges (Nevenimo et al. 2007; Bunt and Leakey 2008). Lessons learned from commercialization of *Canarium indicum* may be useful as a model for other agroforestry tree species (Nevenimo et al. 2007).

One of the current limitations of the *Canarium* nut industry is variability in the size and quality of kernels (Bunt and Leakey 2008). Selection of elite trees for clonal propagation should consider desirable nut characteristics. Research and development priorities identified by farmers in Papua New Guinea include smaller trees (for ease of harvest), larger kernel size, extended fruiting season, improved regularity of fruiting and thinner shells (Nevenimo et al. 2008). Increased kernel yield per tree is influenced by nut size, kernel size, kernel recovery (ratio of kernel weight to total nut weight) and total nut yield per tree.

Formal selection of elite trees has been undertaken in East New Britain, Papua New Guinea and the Solomon Islands. High yielding trees that produce heavier nuts have been identified and seedlings from these elite parent trees have been established in plantations (Nevenimo et al. 2007). Environmental, site-specific factors such as soil fertility and climatic conditions may also impact tree growth and fruit yield and often several year's data are needed to measure performance (Matheson and Cotterill 1990; Huett 2004; Goldschmidt 2013; Makungwa et al. 2013).

The aims of this study were to 1) examine differences in tree growth, measured by height and diameter at breast height (DBH), 2) compare yield of fruit between families and provenance, 3) assess morphological variability in nut characteristics of young bearing trees in an established *Canarium* plantation. In particular, the objective is to identify promising trees in terms of nuts in shell weight, kernel weight and kernel recovery. This information can be used to guide selection of elite propagation material to improve productivity of the emerging *Canarium* industry.

MATERIALS AND METHODS

Experimental site

A *Canarium indicum* progeny trial was established in the Solomon Islands under the South Pacific Regional Initiative on Genetic Resources (SPRIG) programme in 2005. Twenty seedlings from 50 selected mother trees (families) from 5 provenances were planted near Poitette, Kolumbungara Island, Solomon Islands (07º55'S; 157º10'E). Individual trees in the same family are half or full siblings. The initial trial consisted of 20 plots of 50 families (single trees from each family in each plot) in a randomised block design (1000 trees in total).

Tree Growth, flowering and fruiting

We measured height (metres) using a HaglöfECi II inclinometer (Haglöf Sweden) and tape measure and circumference at breast height (1.3m above ground) when the trees were six year old, in 2011. We counted the number of inflorescences and fruit bunches on all 693 surviving trees and estimated the number of flowers and fruit in each inflorescence and bunch on all surviving trees between 2011 and 2013. Trees were assessed halfway through the fruiting season, when most flowers had set fruit and very few ripe fruit had abscised.

Nut and kernel weight characteristics

We collected 20-30 ripe fruit from each of 25 trees (2011), 33 trees (2012) and 34 trees (2013) to determine nut-in-shell (kernel-in-endocarp) and kernel characteristics. The pulp was removed and the nut-in-shell were individually weighed at field moisture content (≅ 30%). Nut-in-shell were cracked, the testa removed and each kernel was weighed. The kernel recovery ratio at field moisture content (weight of kernel / weight of wet nut-in-shell) x 100) was calculated.

Statistical analysis

All data were analysed using SPSS version 17 (IBM Corp. Chicago). Data for height and diameter at breast height of trees in 2011 met the assumptions for parametric testing. Data were analysed by a nested ANOVA examining differences in height and DBH between provenances and families nested within provenances, using missing neighbours as a covariate.

Data for number of fruit per tree were analysed using a general linear mixed model (repeated measures). Trees that did not bear fruit were excluded from the analysis as *Canarium indicum* is dioecious and non-fruiting trees were likely to be males. The terms in the initial model were provenance, family nested within provenance and number of fruit per tree for each year as a repeated measure, with missing neighbours and DBH as covariates. The terms provenance and family nested within provenance were not significant and were removed. The final model included the terms diameter at breast height and missing neighbour.

We compared differences in nut characteristics such as nut-in-shell weight, kernel weight and kernel recovery using a one way ANOVA with year, provenance and family (nested within provenance). Since different trees were sampled each year, years were also analysed separately. Where differences were significant, Duncan's Multiple Range test was used for comparison of means.

RESULTS

Tree Growth within the first five years

The mean height of the 693 surviving trees was 12.42 metres (SE 0.1484) and the mean DBH was 0.1781m (SE 0.0023). No significant differences were detected for any terms in the model for both height and DBH.

Number of trees flowering

Trees from all families flowered during 2011 when the trees were only six years old. During the entire three year observation period, 28% of trees flowered, 20% of trees bore fruit, 19% flowered but produced no fruit and 60% neither flowered nor produced fruit (Table 1). Of the trees that flowered but produced no fruit, 55 trees flowered in each of the three years, 55 trees flowered in two of the three years and 117 trees flowered in one year only. All of these 227 trees were probably male and were excluded from data analysis on that basis. During the same period 274 trees bore no flowers and produced no fruit for the entire three year period.

Fruit yield from younger trees.

Of the 693 surviving trees, in 2011 155 trees bore fruit, in 2012 137 trees bore fruit, and in 2013 135 trees bore fruit. During the period 2011-2013, 243 trees (35% of surviving trees) produced fruit. Of the early-fruiting families with more than 13 individual trees fruiting between 2011 and 2013, families 11, 26 and 29 each contained three trees that bore fruit each year (Table 2).

Fruit yield from younger trees - General Linear Repeat Measures Model

The general linear model showed that effects of provenance and family nested within provenance were not significant while the effect of DBH and missing neighbour were significant ($P = 0.001$ and $P < 0.001$) (Table 3). Under the final parsimonious general linear model, the factors of provenance and family nested within provenance were eliminated and the factors DBH and missing neighbour were both highly significant ($P < 0.001$) (Table 4).

Families 15 and 20 produced more fruit than the remainder (Fig. 1). Trees with less than 33.3% missing neighbours produced fewer fruit per tree than trees with more missing neighbours (Fig. 2).

Six families were present among the top ten highest yielding families each year. Of these, two families (9 and 23) produced high yields each year and four families (3, 15, 38 and 42) produced high yields in two of the three years. Similarly seven families were present among the ten lowest yielding families each year. Of these, one family (family 37) produced low yields each year and six families (families 1, 10, 14, 29, 43 and 46) produced low yields in two of the three years.

Variability in nut and kernel weight

Annual effects

The effect of year on the nuts sampled from the same trees in separate years was not significant while the effect of family was significant ($P = 0.034$).

Nut-in-shell weight

There were highly significant differences in nut-in-shell weight between trees each year ($P < 0.001$). In 2011, tree 19.02 (family 19, plot 02) produced nut-in-shell weight nearly twice that from the tree with the smallest nut-in-shell weight (tree 39.17) (Fig. 3). In 2012, nut-inshell weight from trees 28.16, 13.05 and 29.06 was more than twice the weight from the tree with the lowest nut-in-shell weight (29.12) (Fig. 4). In 2013, nut-in-shell from tree 28.03 was more than twice the weight from the tree with the lowest nut-in-shell weight (tree 32.20) (Fig.5).

Kernel weight

There were highly significant differences in kernel weight between trees each year ($P < 0.001$). In 2011, trees 22.06, 30.11 and 19.02 produced the heaviest kernels (Fig. 6). Similarly in 2012, the heaviest kernel from tree 28.16 was more than twice the weight of the

smallest kernel from tree 22.03 (Fig. 7). In 2013, the heaviest kernel from tree 28.03 was more than twice the weight of the smallest kernel from tree 10.12 (Fig. 8).

Kernel Recovery

There were highly significant differences in kernel recovery between trees each year ($P < 0.001$). In 2011, trees 22.06 and 39.17 produced the highest kernel recovery ratio (Fig. 9). In 2012, tree 22.06 again produced the highest kernel recovery ratio (Fig. 10). In 2013, tree 7.09 produced the highest kernel recovery ratio (Fig. 11).

DISCUSSION

Provenance and family had no effect on tree height, diameter at breast height (DBH) and yield of fruit, however, there were large differences in nut-in-shell weight, kernel weight and kernel recovery between trees. Each year the heaviest kernels were more than twice the weight of the smallest kernels. While the effect of family was significant, this may be attributed to superior performance of individual trees. For example, for nut-in-shell, family 21 in 2011, families 13 and 29 in 2012 and families 36 and 41 in 2013 were represented in the largest quartile and the smallest quartile. The mean nut-in-shell weight, kernel weight and kernel recovery ratio were 11.79g, 2.74g and 23.2%. This compares favourably with previous findings of kernel mass from 1.38 to 3.65g and kernel to nut-in-shell ratio from 14 to 26% (Nevenimo et al. 2007).

Trees in this trial had been grown from seed selected from elite trees identified by farmers in various regions. Informal tree domestication within the local areas has been undertaken by indigenous farmers wishing to grow trees with larger nuts (Leakey et al. 2008). Surprisingly, during the first six years of growth, there was no significant difference in height or DBH between provenances or families. Diversity between the trees could be the result of sexual propagation between the known maternal trees and the unknown paternal trees.

Trees from all provenances flowered within the first 5 years. During the period, 37.5% of trees bore no flowers for the entire period and apparently were still immature. *Canarium* is generally believed to be dioecious with male and female on separate trees (Nevenimo *et al*. 2007). Trees with no flowers may be either female or male. Among the mature trees (those that flowered) 19% produced no fruit and were probably male. It is also believed that some populations may have a considerable percentage with hermaphrodite flowers (Moxon pers. comm., 2014).

Crop size is influenced by weather (Kainer et al. 2007). Annual variability and irregular and biennial bearing resulting from genotype x environmental interactions is expected, but reduces average annual yield (Goldschmidt 2013). Several year's data are needed to measure tree growth and fruit yield (Matheson and Cotterill 1990; Huett 2004; Goldschmidt 2013; Makungwa et al. 2013).

Among the trees that bore fruit, yield difference for provenances and families were not significant. Some individual trees appear to have higher yields. Differences in yield between individual trees may result from variability between half siblings resulting from open pollination. For example family 15 with the highest mean fruit yield for the combined period also contained trees with very low fruit yield. Variation in yield between fruit trees provides an opportunity for selecting cultivars based on these variations and presents a strong argument for using clonal propagation (Leakey et al. 2002).

The process of tree domestication needs to be reported in such a way as to identify reasons for selection, not just the results (Simons and Leakey 2004). Total tree height and DBH are used as measures of tree productivity for timber species, with DBH the best measure of timber production (Kuyah and Rosenstock 2015). Growing for timber or nut production requires different management strategies. In forestry plantations, tall trees which are more valued for timber production are promoted by planting trees closer together to produce

straight trunks with fewer branches. Wide spacing promotes a larger branching canopy that produces heavier fruit yield.

Taller tree height and larger diameter at breast height have been correlated to increased nut production (Ares and Brauer 2004; Layne and Abramson 2004). Only increased DBH was found to explain differences in nut production in this study. This may reflect how differences in tree and crown structure impact nut yield.

The effect of tree spacing appears to be very important for nut production of *C. indicum*, as trees with fewer neighbours and more surrounding space produced more fruit. Yield in macadamia nuts increases with increased light interception, with some cultivars tending to bear the crop towards the end of the branch, while others bear closer to the trunk (Huett 2004). In macadamia nuts, yield is also greater on the northern aspect (Boyton and Hardner 2002). Accessing light resources is important in determining fruit production (Huett 2004; Kainer et al. 2007; He et al. 2008). Differences in yield within the plantation may reflect differences in availability of light to some individuals following death of surrounding trees.

Originally, trees had been planted 5.0 meters apart with 8.0 metres between rows. When assessing tree growth during 2011, when trees were six years old, it was noted that in some areas, the canopy was already closing. In subsequent years the canopy became denser except where tree mortality of surrounding neighbours maintained light availability. Trees with less than 33.3% missing neighbours produced fewer fruit per tree indicating that the initial spacing was too close for maximum nut production even when the trees are only 6 to 8 years old. Spacing of trees needs to ensure that the availability of light is adequate to promote flowering and seed set. Nevenimo et al. (2007) recommended that an initial spacing for fruit production be 10m x10m. With older trees, even this spacing may be insufficient for maximum nut production.

Seed availability is often a bottleneck to tree planting (Simons and Leakey 2004). Growing trees using seed from elite phenotypes is the common method and can avoid poor seed sources, but due to variability between half siblings, is not always reliable (Nichols and Vanclay 2012). To promote the development of a fledgling industry, improved seedlings or vegetative or clonal promulgates are needed and their supply to farmers should be subsidised (Simons and Leakey 2004).

In determining the desirable characteristics for trees to be selected, we need to consider the total kernel mass per tree. The best selection would be trees that produce the highest yield with the heaviest mean kernel mass. Heavy fruit yield often results in smaller individual fruit (Goldschmidt 2013). Consequently neither individual kernel size nor tree yield can be considered separately as a measure of productivity. Difference in kernel size between trees indicates a significant opportunity to increase kernel size by selecting elite trees from superior producing mother trees. Variation in yield between fruit trees presents a strong argument for using clonal propagation.

There is considerable benefit to be gained in a selection program in increasing the productivity of *Canarium indicum* trees in the Solomon Islands. This analysis is from one progeny trial in New Georgia. Other sources of elite trees with a much wider provenance base were established in the Solomon Islands, however these are on traditional land (R Pakau pers com). Any future evaluation of nut yield should include these additional sources if possible.

Acknowledgements

The authors would like to thank Richard Pakau from Maraghoto Holdings, Honiara, Solomon Islands for his assistance with organising field work. We also gratefully acknowledge Philip Zekele and the staff from the Ministry of Forests, Munda, Solomon Islands for their

assistance with field work and data collection. This study was supported by funding from ACIAR PARDI/2010/no and FST/2010/013.

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Table 1. Percentage of *Canarium indicum* trees that flowered and produced fruit in a 6-8 year old plantation in Solomon Islands

	2011	**2012**	**2013**	**Combined years**
Flowering	27.3	33.7	24.1	28.3
Fruiting	22.4	19.8	19.9	20.5
Flowering, no fruit	17.6	21.4	17.9	19.0
Neither flowering nor fruiting	60.0	58.6	62.0	60.2

Table 2. Identity of high performing, early-fruiting families with more than 13 individual trees that fruited between 2011 and 2013

Family Identity	**Trees fruiting in family (%)**			**Individual trees fruiting in each year (%)**			**Number trees surviving / 20**
	All years	2 years	Only one year	2011	2012	2013	
11	23.1	23.1	15.4	53.8	30.8	46.2	13
29	21.4	14.3	21.4	50.0	28.6	35.7	14
26	20.0	33.3	0.0	46.6	33.3	46.6	15
12	14.3	21.4	7.1	28.6	42.9	21.4	14
40	13.3	20.0	13.3	33.3	33.3	33.3	15
10	7.1	21.4	28.6	21.4	42.9	28.6	14
13	6.7	20.0	26.7	33.3	20.0	33.3	15

Table 3. Initial analysis indicated that the effect of missing neighbour and diameter at breast height were significant while the effect of tree height, provenance and family nested within provenance were not significant. Tests of between-Subjects Effects
Transformed Variable: Average

Source	**Type III Sum of Squares**	**df**	**Mean Square**	**F**	**Sig**
Intercept	20231.743	1	20231.743	13.534	0.000
Provenance	6423.263	4	1605.816	1.074	0.371
Family (Provenance)	86309.959	45	1917.999	1.283	0.128

Missing Neighbours	38125.104	1	38125.104	25.503	0.000
Diameter at Breast Height	17589.407	1	17589.407	11.766	0.001
Height	898.189	1	898.189	0.601	0.439
Error	284035.493	190	1494.924		

Table 4. The final model included the significant factors of family, missing neighbour and diameter at breast height. Tests of between-Subjects Effects.
Transformed Variable: Average

Source	**Type III Sum of Squares**	**df**	**Mean Square**	**F**	**Sig**
Intercept	22534.108	1	22534.108	15.105	0.000
Family	92235.240	49	1882.352	1.262	0.137
Missing Neighbours	37454.639	1	37454.639	25.107	0.000
Diameter at Breast Height	32301.052	1	32301.052	21.652	0.000
Error	284933.682	191	1491.799		

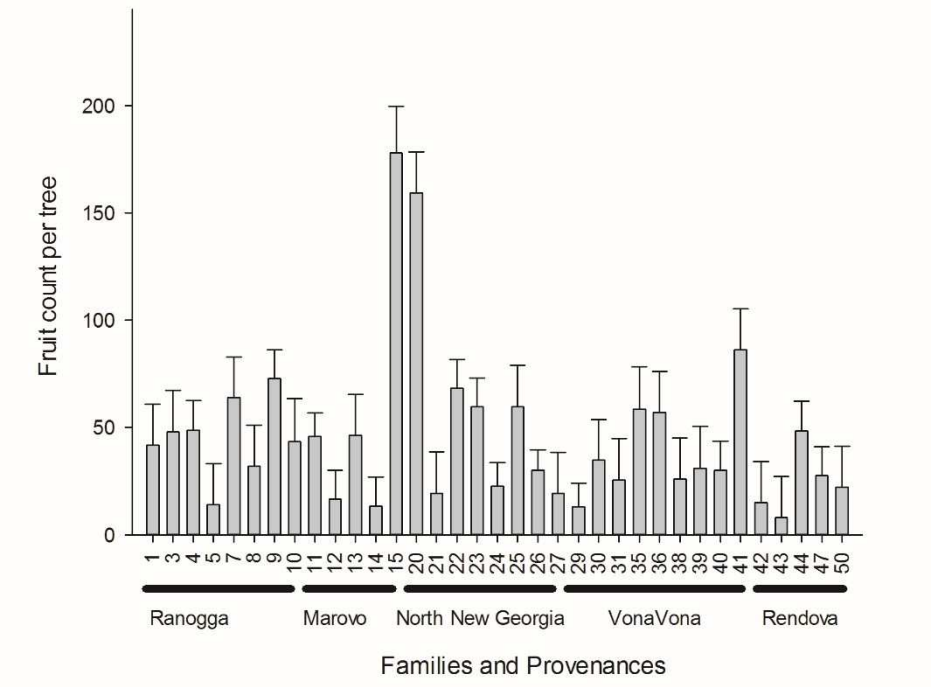

Fig. 1. Fruit count per tree from families clustered within the respective provenances.

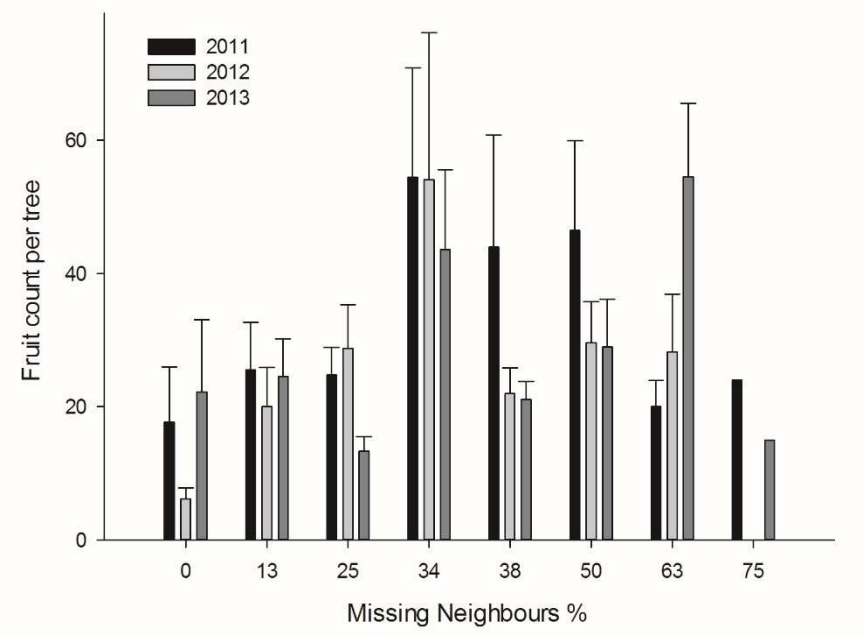

Fig. 2. Fruit count per tree per year with relative surrounding space as indicated by the percentage of neighbours that were missing.

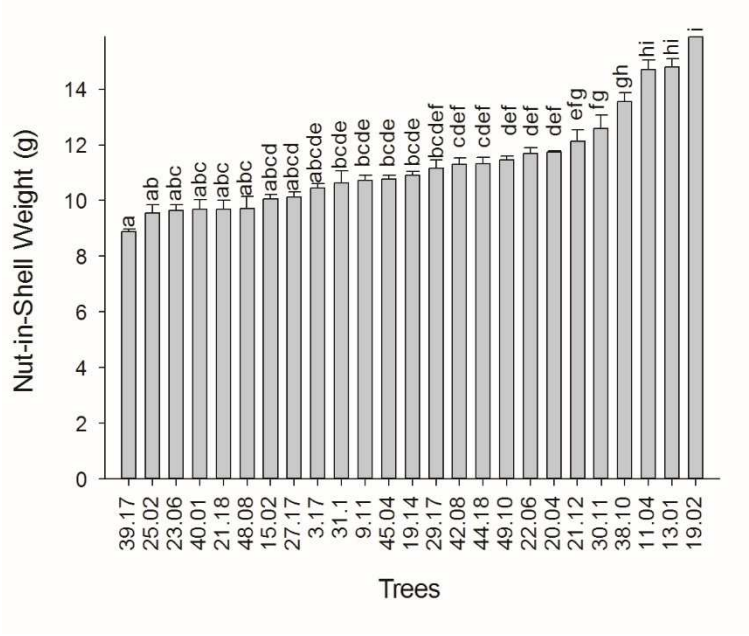

Fig. 3. Nut-in-shell weight (g) from six year old *Canarium indicum* trees in 2011 from the Solomon Islands. Tree notation is Family.Plot, e.g., 39.17

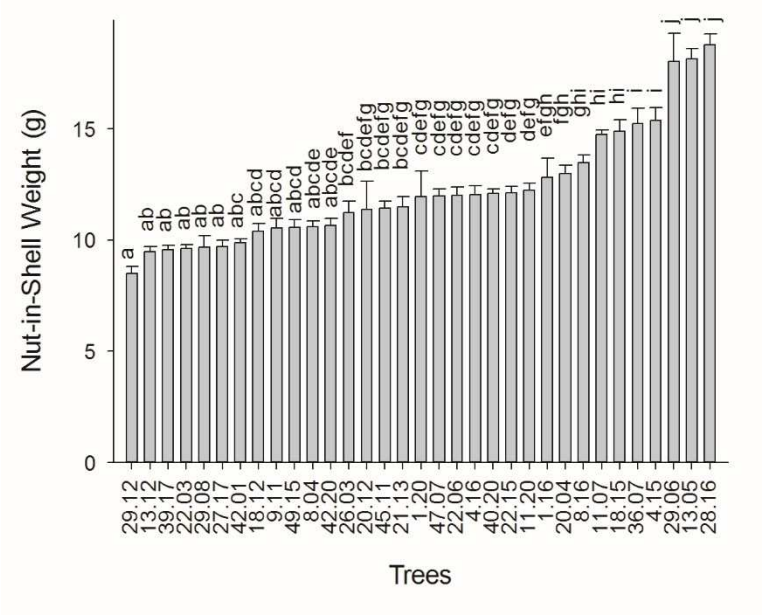

Fig. 4. Nut-in-shell weight (g) from seven year old *Canarium indicum* trees in 2012 from the Solomon Islands. Tree notation is Family.Plot, e.g., 29.12

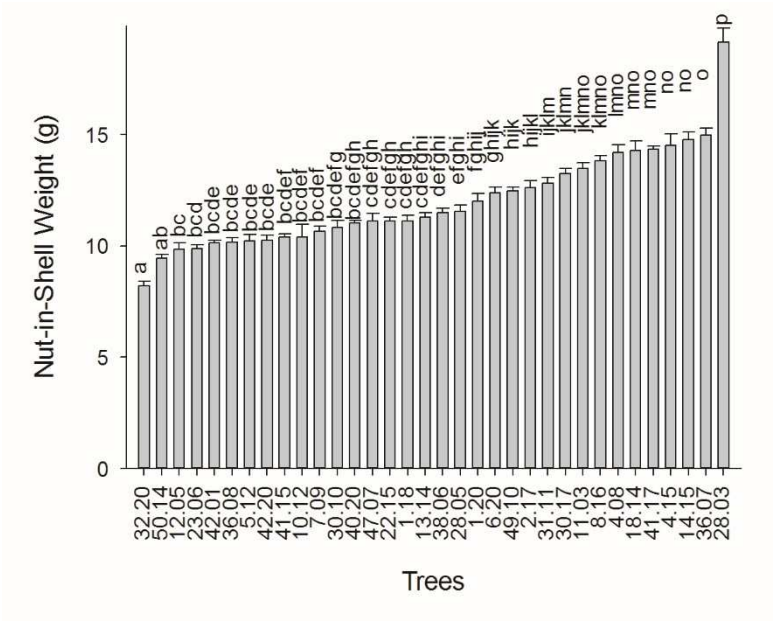

Fig. 5. Nut-in-shell weight (g) from eight year old *Canarium indicum* trees in 2013 from the Solomon Islands. Tree notation is Family.Plot, e.g., 32.20

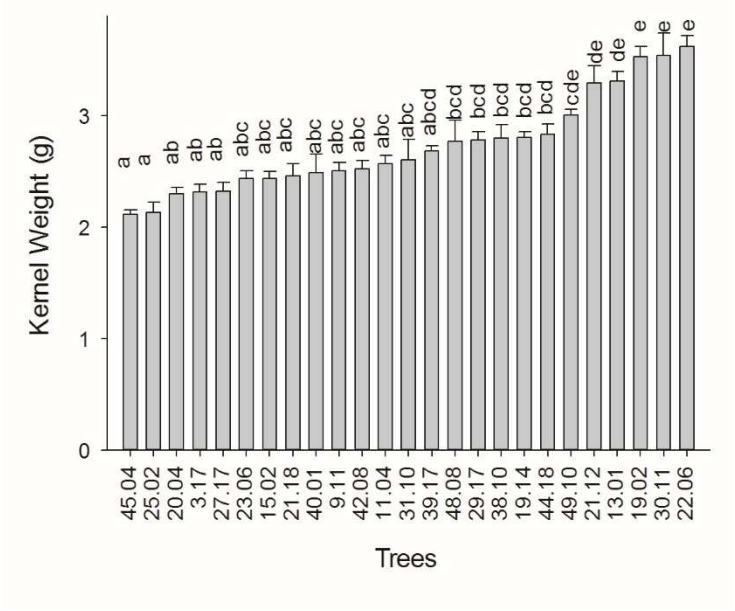

Fig. 6. Kernel weight (g) of *Canarium indicum* from early flowering trees in 2011 from the Solomon Islands. Tree notation is Family.Plot, e.g., 45.04

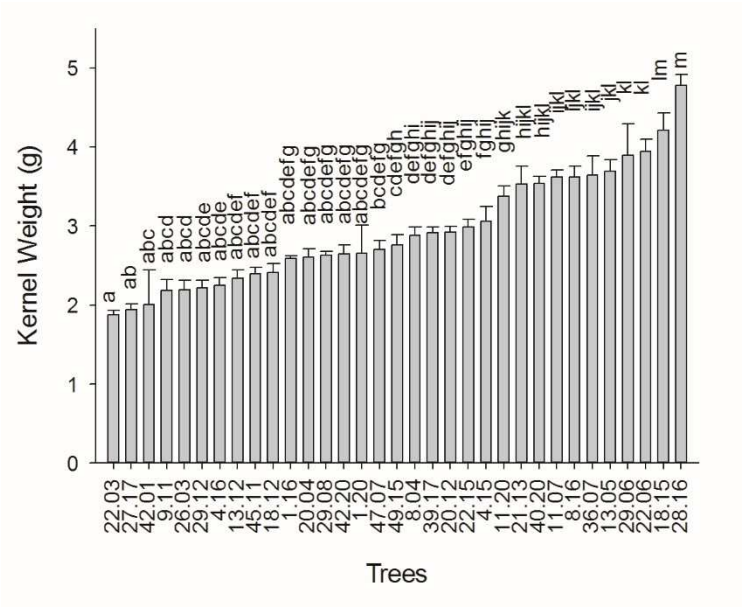

Fig. 7. Kernel weight (g) of *Canarium indicum* from early flowering trees in 2012 from the Solomon Islands. Tree notation is Family.Plot, e.g., 22.03

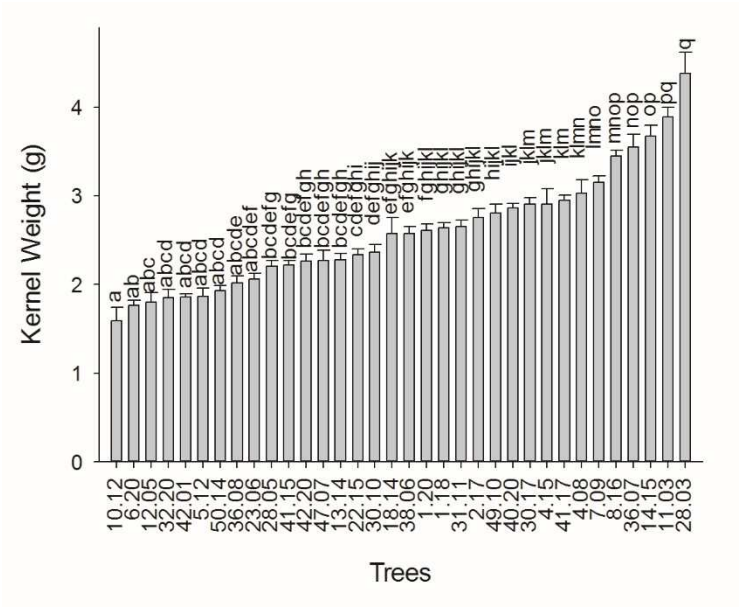

Fig. 8. Kernel weight (g) of *Canarium indicum* from early flowering trees in 2013 from the Solomon Islands. Tree notation is Family.Plot, e.g., 10.12

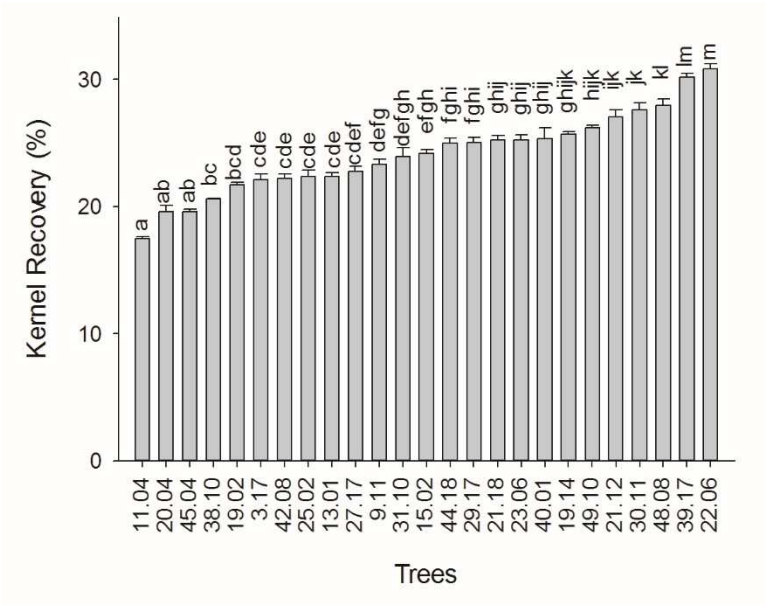

Fig. 9. Kernel recovery (%) of *Canarium indicum* from early flowering trees in 2011 from the Solomon Islands. Tree notation is Family.Plot, e.g., 11.04

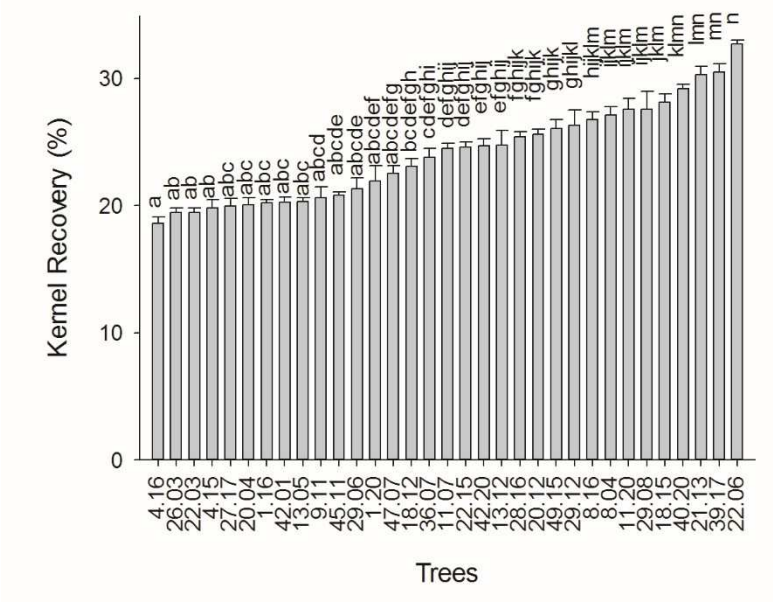

Fig. 10. Kernel recovery (%) of *Canarium indicum* from early flowering trees in 2012 from the Solomon Islands. Tree notation is Family.Plot, e.g., 4.16

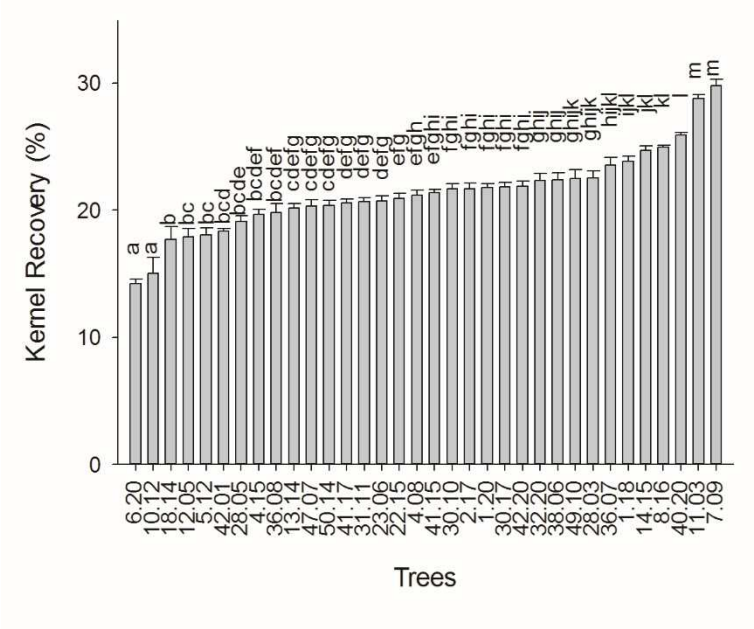

Fig. 11. Kernel recovery (%) of *Canarium indicum* from early flowering trees in 2013 from the Solomon Islands. Tree notation is Family.Plot, e.g., 6.20

THE UNIVERSITY OF ADELAIDE

Tourism Research Insights

Canarium tourism exposure in Vanuatu

Pacific Agribusiness Research for Development Initiative

2013

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Background

Canarium indicum is indigenous to Melanesia (including Vanuatu, Solomon Islands and PNG) and produces edible fruit, nuts and timber. Traditionally, the nuts are traded fresh in roadside and village markets, either as nut-in-shell or as dried kernels. However, each countries 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.

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.

Currently, the industry suffers from several negative impacts on market and product development. This includes the lack of capacity to supply product, maintain a consistent quality and quantity supply, and need for product specifications, all of which currently impact people's desire and capacity to be involved in the industry[1].

The above factors emphasize the market potential currently present for producers of canarium in Vanuatu. With international nut consumption expected to increase in coming years there is market demand to support growth. However it is crucial that the canarium market grow in a sustainable way; market development will need to focus on satisfying domestic and regional markets before expanding internationally.

A core component of this development will be expanding the engagement of the tourist population that consistently visit Vanuatu. This unfilled domestic demand represents a significant market opportunity for canarium producers and the Vanuatu economy. Not only will in-coming tourist dollars 'top up' domestic sales but the exposure to international customers will bridge the gap between domestic suppliers and international market preferences.

In an effort to understand the experience of tourists in Vanuatu with canarium nuts the Pacific Agricultural Research for Development Initiative (in association with the University of Adelaide and the University of the Sunshine Coast) instigated a survey based review of tourists leaving Vanuatu. PARDI are interested in the development of the canarium nut industry and the possibility of engaging tourists to assist market development. This survey represents the first step in understanding the engagement requirements and interests of tourists in Vanuatu.

[1] *Pacific Agribusiness Research Development Initiative 2012, South Pacific Canarium poised to become more than just nuts, PARDI fact sheet, Canberra*

Methodology

In October 2012 a collaborative team of researchers from the University of the Sunshine Coast and the University of Adelaide conducted a consumer survey of tourists leaving Vanuatu. The survey was carried out in the city of Port Vila, targeting areas tourists frequented as survey conduction points. These included hotels and resorts, the airport, ocean front and local cafes.

The survey (*see Appendix A*) was designed to understand the local food and indigenous nut consumption. It included questions that would establish both the consumption preferences of tourists, the market exposure of tourists, and their preference of experiences. The end of the survey integrated these themes to allow respondents to provide recommendations and insight into the development of canarium products.

In order to objectively obtain information in regards to consumer reactions to canarium products parameters were placed upon the survey sample demographic. To answer the survey respondents were required to:

- be over the age of seventeen
- a tourist leaving Vanuatu
- buy/ consume nuts or nut products.

These survey sample constraints ensured that respondents would be suitable target consumers and would have had exposure to local food and the indigenous Vanuatu culture.

Results

The following chapter provides a summary of the collated survey results provided by respondents in Vanuatu. While there is some scope from the survey parameters the results still provide both broad macro and micro views of tourism experiences. Importantly this research gathers several key areas that can be effectively used as core elements within domestic tourism. These are:

- respondent demographics
- consumption patterns in Vanuatu
  - nut consumption

Respondent demographics

The resulting respondent demographics are scoped by the parameters that were placed upon the survey. As discussed previously, survey respondents were required to be over the age of seventeen and ready or about to leave Vanuatu. As the survey was concerned with nut consumption, survey respondents were also required to be consumers of some form of nut product. This included consumption of nuts individually or nut products such as biscuits or cereals that contain nuts.

The gender divide of respondents was comparatively even with just under half (49 per cent) being male and the remaining percentage (51 per cent) being female. Approximately half of the respondents were between 18 and 34 years old and the other half between 34 and older. It is positive to see the survey respondent group spread across a wide age gamut as the resulting results will represent a range of consumer brackets.

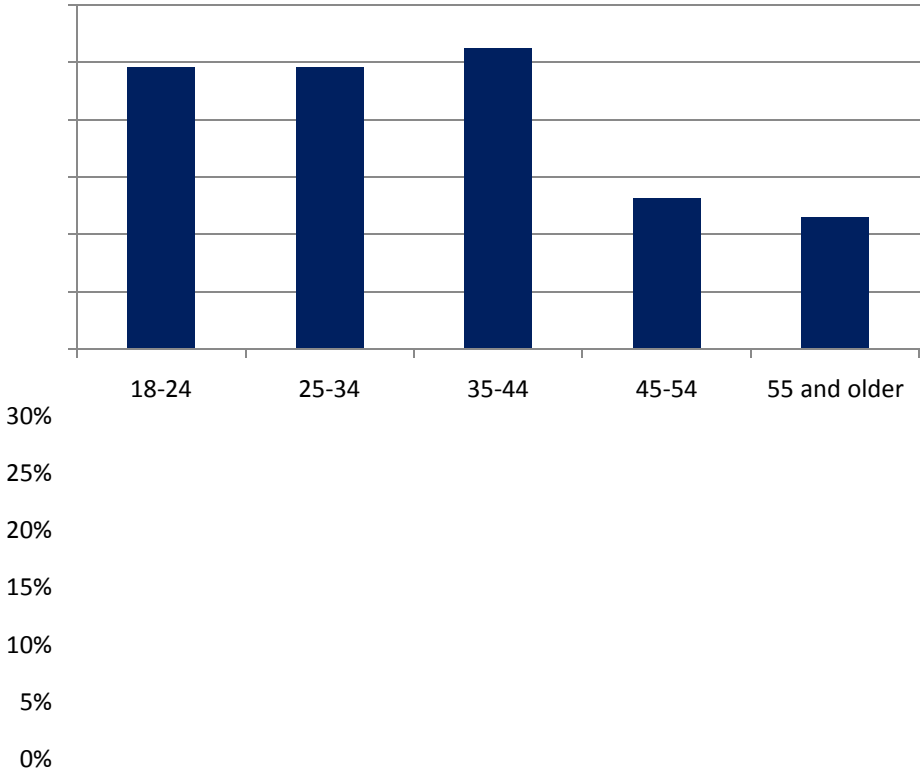


Figure 9 Age demographic of survey respondents

As Vanuatu is an 83 island archipelago access is only available through ocean or air travel. The clear preference is via plane travel (80 per cent) with the remaining visitors arriving by sea vessel. Ocean travel is predominately through cruise ships but some respondents did arrive by means of sailing themselves (albeit only five per cent).

The majority of respondents were visiting Vanuatu for a holiday (85 per cent) with many experiencing their first trip to the region (61 per cent). Of the remaining group that were revisiting seven percent had visited Vanuatu four or more times in the past. It is interesting that (with exception to a single conference attendant) all of these frequent visitors were on holiday. This is an encouraging sign for the local tourism industry. As Figure 2 shows, the majority of respondents spent between two and seven days holidaying in Vanuatu.

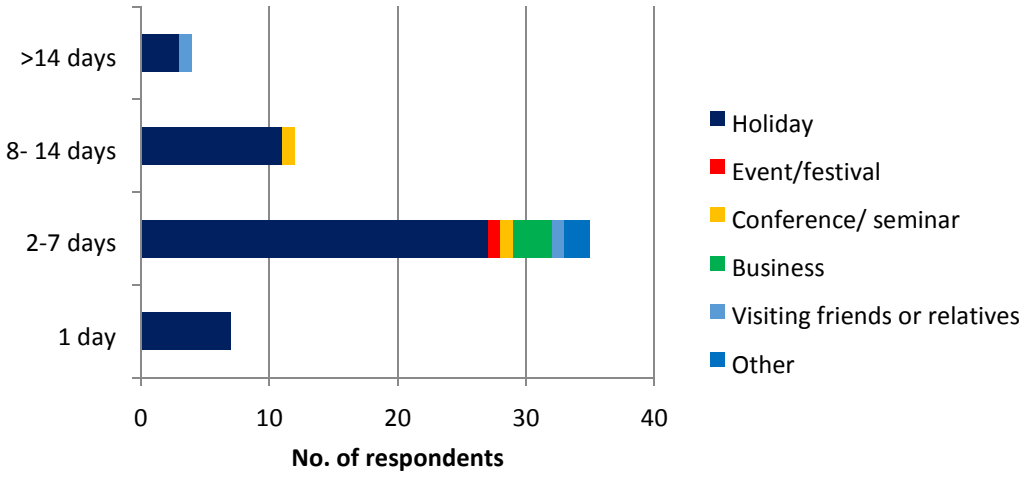


Figure 10 Duration and nature of time in Vanuatu

Few respondents were travelling alone with many visiting Vanuatu with others, such as friends or family. The predominant group size respondents reported was two (31 per cent), with the largest group size sitting at 48 (albeit an interesting outlier). It is worth noting that of the 61 surveys collected 14 respondents were members of a group of 48 and another four were travelling in a group of 34. While smaller groups of two and three still lie in majority normative judgement would suggest that typically these numbers would be higher.

As shown in Figure 3, respondents responded positively when asked if they thought they would return to Vanuatu. According to the data 50 per cent of visitors will contemplate returning to Vanuatu in the future while less than 10 per cent are unlikely to return.

A large percentage (42 per cent) surveyed stated they were unsure if they would return. However, this should not be weighed as a negative. Modern travel behaviour suggests that tourists are keen to frequent new destinations as travel is as much about adventure as it is about new experiences. While not all of these tourists will return to Vanuatu it can be expected that they will advertise their travel experience, especially through word of mouth and social media outlets. Consequently, while Vanuatu may not get every tourist to return it can expect new tourists via recommendations.

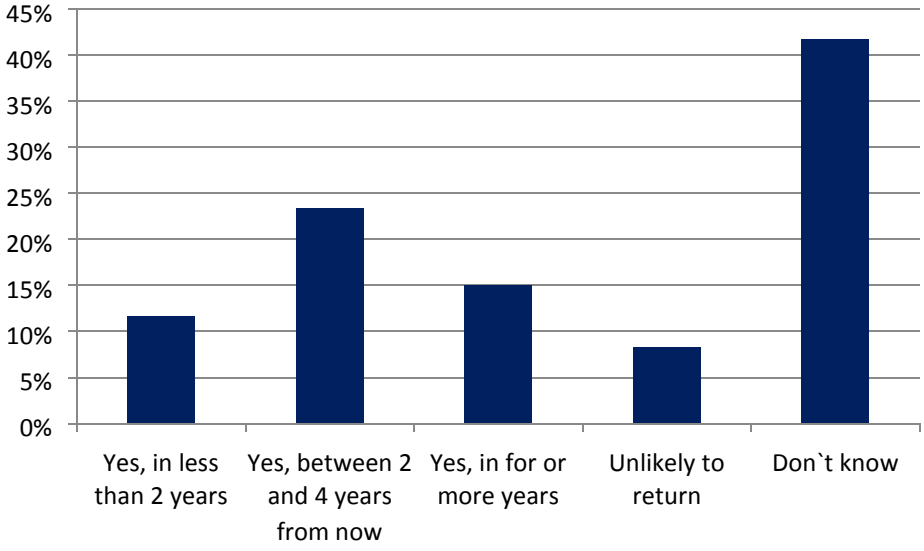


Figure 11 Expected return frequency

Consumption patterns in Vanuatu

In order to understand the perception and motivations of consumers the survey asked respondents about their consumption habits and preferences. The majority of respondents were either the main food purchaser or shared purchasing tasks with another while staying in Vanuatu. As primary food decision makers the respondents represent the target group that any domestic food markets would be interested in engaging with.

The purchasing frequency data, shown in Figure 4, suggests that tourists visiting Vanuatu are exposed to local products on a regular basis. From the data we can see that nearly 50 percent of respondents were purchasing local food at least once a day. Furthermore, over 80 percent of respondents at some point during their visit to Vanuatu purchased local food. This result reflects strongly on the Vanuatu domestic food market and suggests that tourists visiting the area are willing to engage with local food. It is also reassuring to see that so few respondents were unsure of the origin of the food they were consuming (< five per cent).

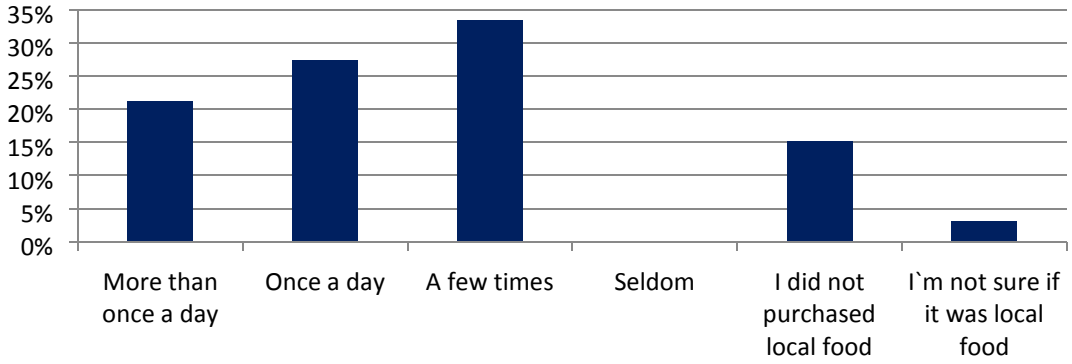


Figure 12 Local Vanuatu food purchasing frequency

Local food purchasing locations follow an expected pattern. As shown in Figure 5, fine dining restaurants and cafes dominate the market with regard to tourist frequency. This is not surprising as these locations are designed to attract the tourism market and engage with those visiting Vanuatu. However, it is reassuring to see those visiting Vanuatu are also providing support to domestic business. These highly frequented locations will be ideal areas to promote and advertise local food to those travelling to the region.

It is encouraging to see both supermarkets and central markets being used (especially as central markets are frequented more). Again, this represents willingness from tourists to explore local food markets and engage with the domestic market. This is further supported by the low numbers that frequented either a hotel or bistro locations.

There may be merit in further analysis with regard to consumer values and market preferences in reference to choosing food locations. With such a sizeable proportion of tourists purchasing local food and using local outlets, this market knowledge will demonstrate the opportunities available to domestic Vanuatu producers. Qualifying these purchasing habits and preferences will isolate consumer behaviour and assist venues in developing strategies that will target tourists.

A positive market trend is again seen when observing the purchasing frequency of gifts or souvenirs by tourists in Vanuatu. The majority of respondents (92 per cent) purchased gifts or souvenirs, of which 65 per cent were food products or snacks. Not only does this represent a strong market opportunity for domestic suppliers it also translates to further market exposure by tourists as they return home.

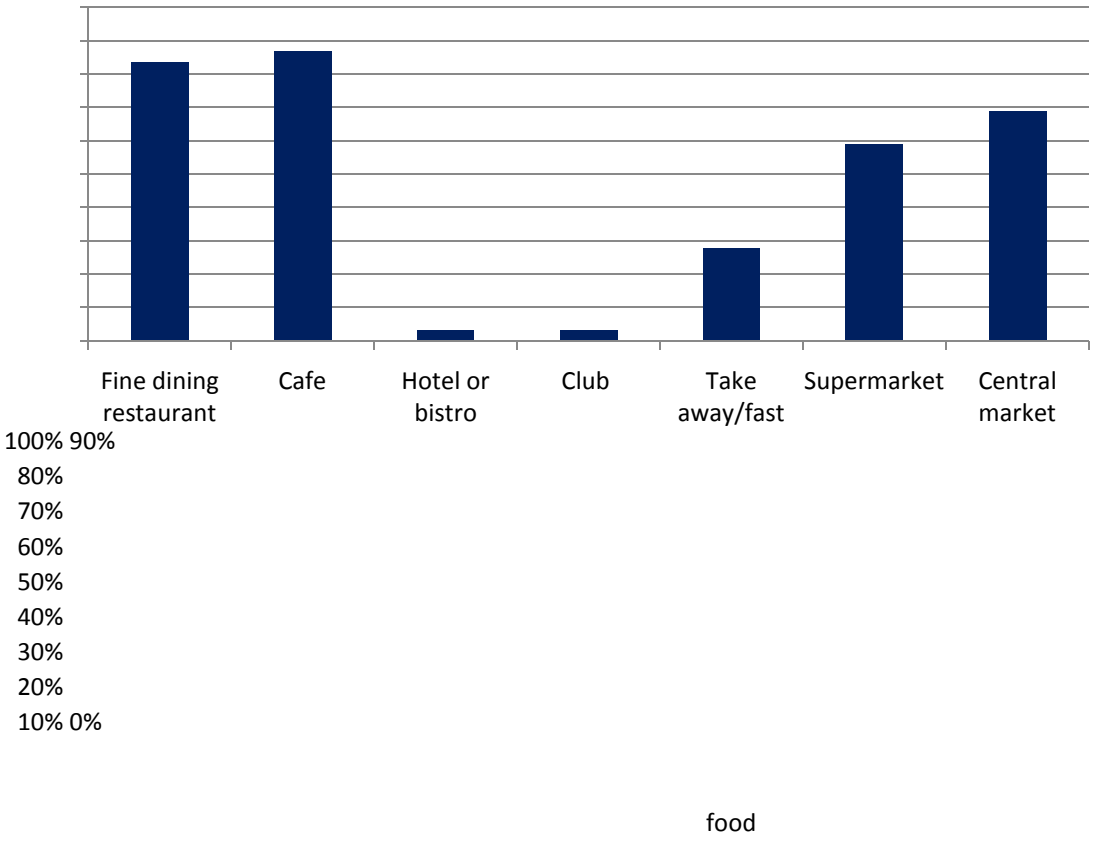


Figure 13 Frequency of food outlets used for eating out

In an effort to understand the mind set of respondents towards local food statements were asked to establish their level of agreement. The results of these inquiries are shown in Figure 6. Respondents responded extremely positive (>50 per cent) with respect to specifically looking for local food and the positive impact it had upon their trip.

It is interesting to see that respondents did not feel that local food was branded and easily recognisable. This may be linked to why local foods inclusion on local menus scored poorer than other statements and why respondents appear to not have commonly looked for local food on menus.

It is encouraging that the issue seems to be a lack of information and engagement rather than disinterest from those visiting Vanuatu. Respondents showed strong interest in knowing both the food location and production techniques of products. Furthermore, availability and promotion of local products within restaurants is proposed as a point of influence for customers.

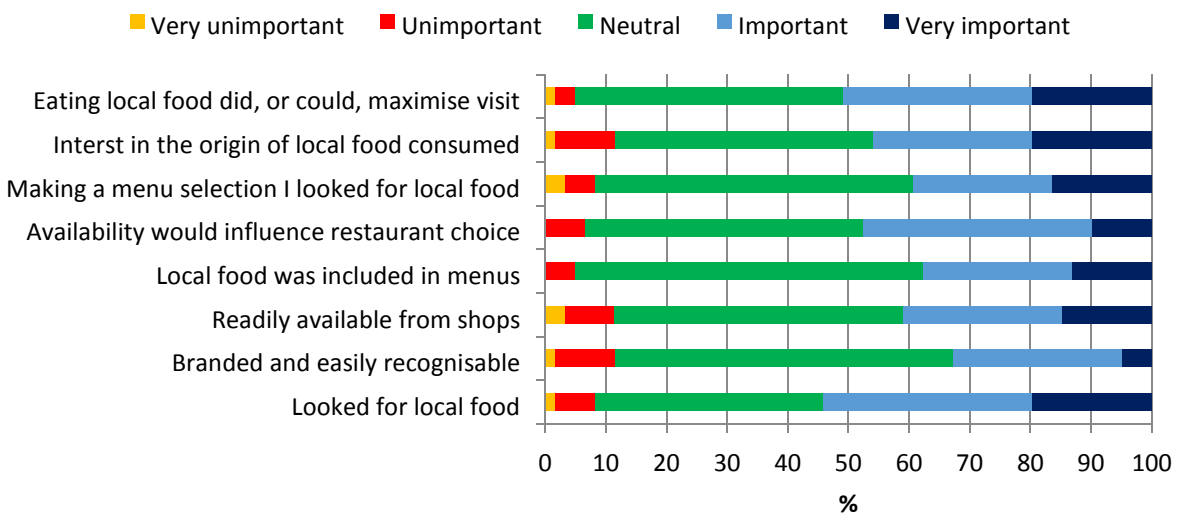


Figure 14 Consumer interest statements

Nut consumption

To assist the future development of the canarium nut market the core of the survey asked respondents about their nut experiences and preferences. All respondents were consumers of nuts (as required by the survey scope) with the majority having nuts either a few times a year (38 per cent) or more than once per week (30 per cent). This u-shaped frequency suggests that nuts and nut products are not a universally frequented food source. Rather they are targeted by consumers to satisfy their specific taste or dietary need. This is a welcoming result as it demonstrates that there is room within consumer nut consumption for producers to pursue and market towards.

Respondents were also asked about their purchasing habits in regard to certified food products. Certified products were defined as food products made by developing economies to improve their future- examples such as Fair Trade, Organic, Rainforest, and UTZ were given. Consumption, while not rapid, was promising with high results for monthly and yearly purchases. As discussed later, this is linked to customers seeking organic, local products that are nutritional and fresh. Further analysis will illustrate the market development opportunities in the certification niche- including areas of growth and specific competitive advantages within Vanuatu.

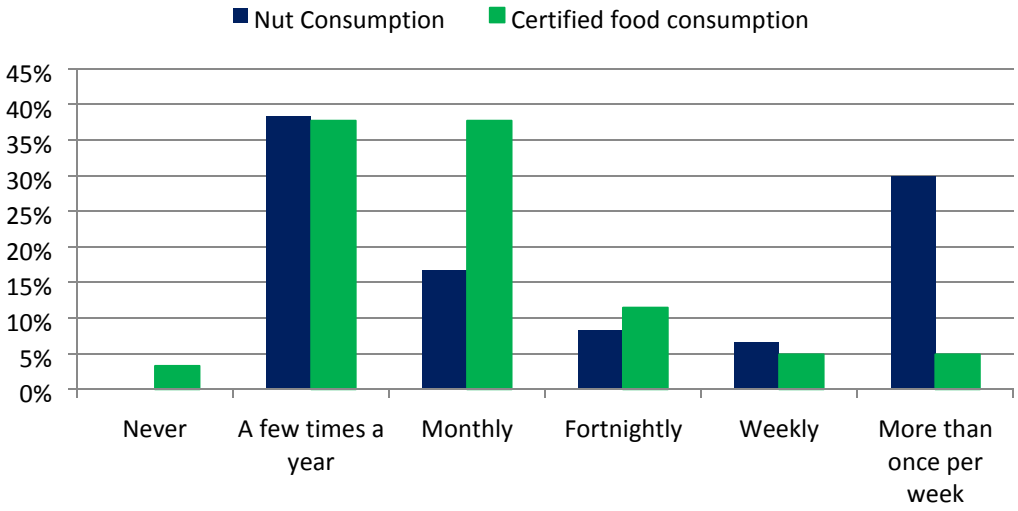


Figure 15 Consumption rates of consumers

As Figure 8 shows, the nut purchasing frequency shifted slightly when tourists were in Vanuatu in comparison to their home consumption. Of the respondents who purchased local food 90% purchased nuts and just below 35 percent were frequent purchasers (at least once a day). This is an interesting response as it reflects an upward purchasing shift, suggesting that nut consumption is either preferred while on holiday or nut products are substituted for a home product that is not available in Vanuatu.

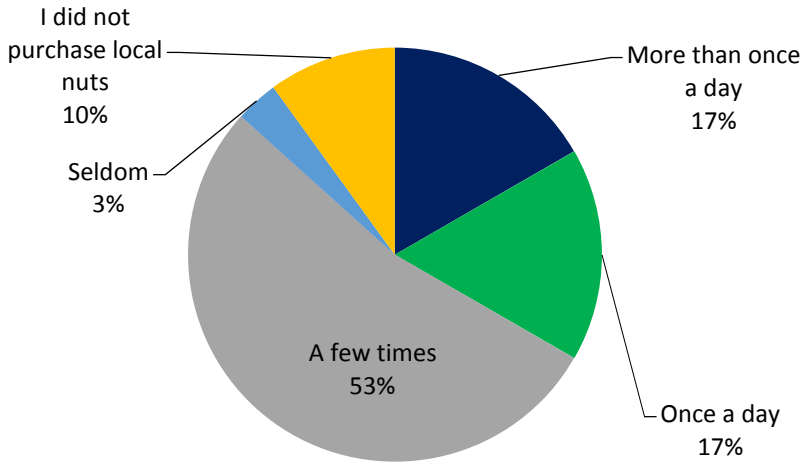


Figure 16 Nut purchasing frequency during time in Vanuatu

Of the four names the nut exists under the most common (74 per cent) name known was canarium. However of the four names the variety exists as, Nangai was the most preferred (albeit that the survey was conducted in Vanuatu and is the local name). Moving forward, as the canarium nut market expands and develops, it will be critical that a set name is decided upon and promoted. This will define the product within the market and maximise consumer engagement.

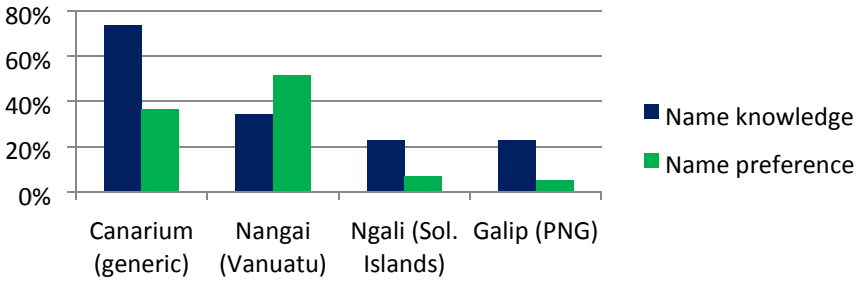
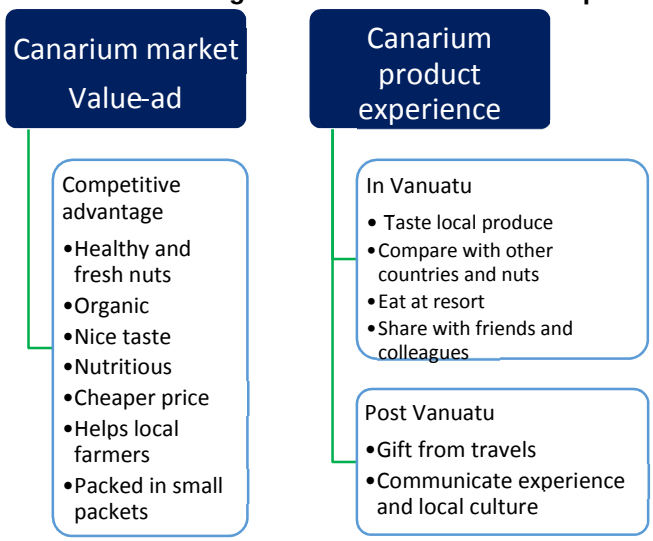


Figure 17 Name knowledge and preference

The driving motive for the purchase of nuts by tourists can be split in to two groups; social experience drivers and market response drivers (see Table 1). The majority of respondents chose canarium nuts because they were healthy and fresh, organic, local and they were cheaper than other nut varieties (many compared the price to that in New Caledonia). When the nuts were consumed in Vanuatu it was usually as snacks to eat with friends or when back at the resort. The nut was also purchased frequently as a gift to take back home to give to friends and family.

Both driver groups highlight competitive advantages that canarium nut producers can target to promote their product to tourists. These drivers suggest that the canarium nut can be a vehicle for tourists to experience local food while in Vanuatu. The regular purchase of gifts suggests that many tourists wish to share their travel experience with friends and family. For growing market this may be one avenue to slowly advertise the products to a more international consumer base.

Table 6 The driving factors behind tourist nut purchases



Tourists gave a variety of reasons in relation to the purpose behind their purchase/s of canarium nuts in Vanuatu. The most popular factor for tourists to purchase the nuts for was to consume as a snack while relaxing at their hotel/accommodation (79.3 per cent of nut consumers did this), followed by purchasing as a gift (68.9 per cent), and for socialising during the trip (62.1 per cent). Eating out and for a special occasion rated less in comparison to the other responses. No respondents purchased nuts as a grocery item.

A variety of outlets were used by tourists to buy canarium nuts during their stay in Vanuatu (Figure 10). Often a variety of options were used, illustrating that purchases occurred on more than one occasion. A strong majority of purchases occurred at the central market or supermarket followed by a small amount having canarium nut or nut products at a restaurant/café. It is possible that restaurant consumption is low because consumers might not be aware canarium is in or on the food they have consumed.

Only a few times were the nuts purchased from accommodation sources or roadside stalls. However, this may reflect a lower level of exposure in these locations rather than a consumer purchase location preference.

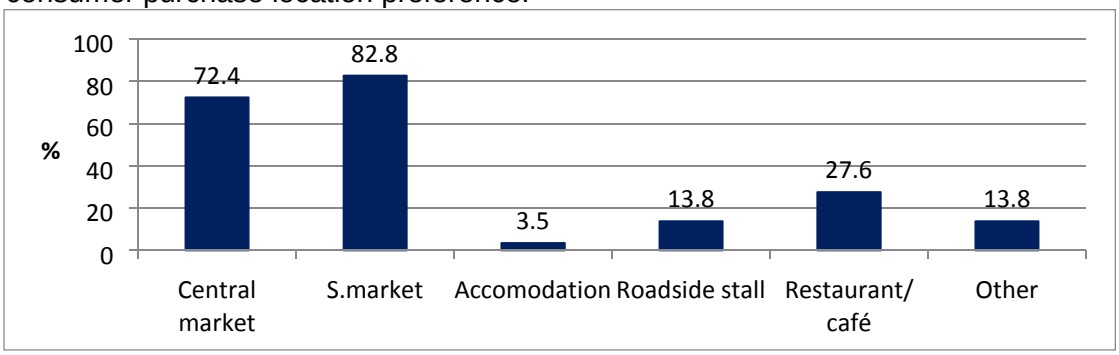


Figure 18 Frequency of location use by canarium nut purchases

Currently in Vanuatu canarium nuts are available in a variety of forms; still in the shell, as fresh kernels, as dried kernels, with value added, or as an ingredient. The majority of tourists reported purchasing canarium in the first four forms. Canarium still in the shell or with value added were the most popular options (75.9 per cent and 72.4 per cent respectively). Both fresh and dried kernels were also popular with 68.9/65.5 per cent of consumers purchasing the nuts in this form. A small percentage (24.1 per cent) of consumers of the nut purchased the nut as an ingredient.

The nut purchasing profile says more about the availability of canarium than the preference of tourists. Due to the infant nature of the canarium nut industry the nut is not yet a predominant product within restaurants and hotels/accommodation. Naturally then, the predominant access point for tourists is to purchase canarium at local markets and Supermarkets. It is positive to see that consumers are willing to consume canarium in the many forms that it is available is. This gives producers a large market to work with when developing their product.

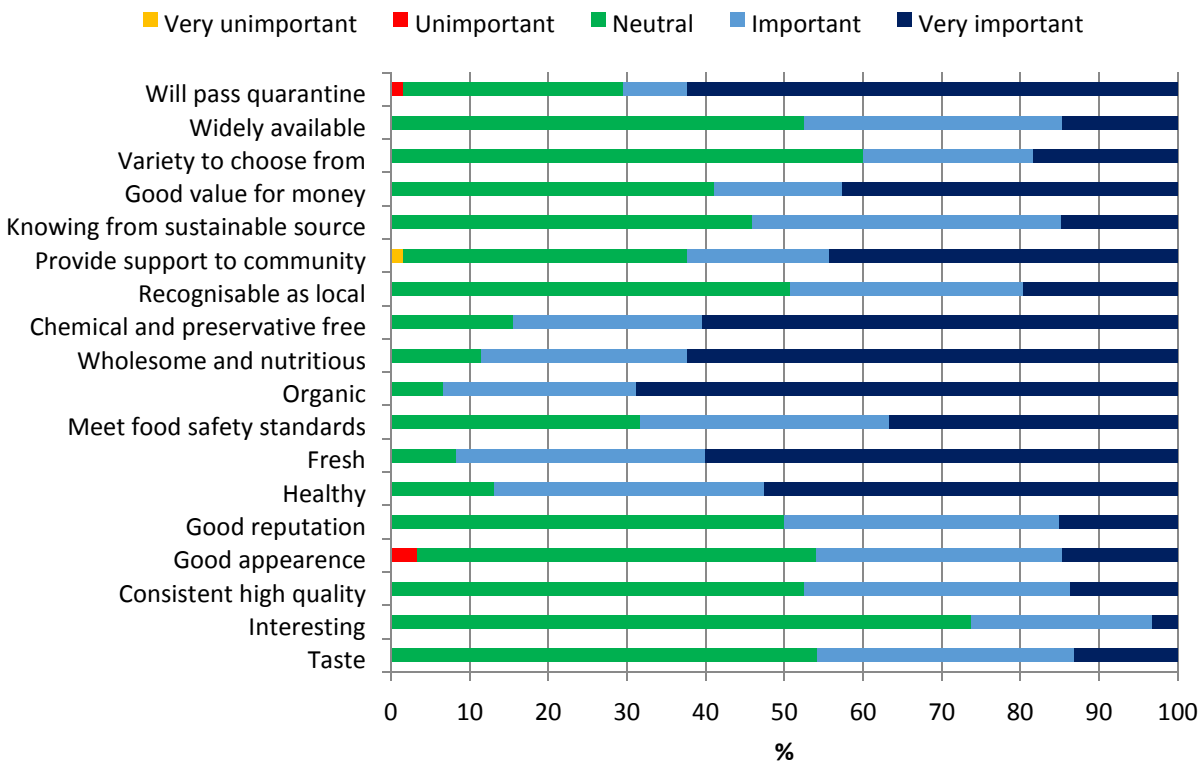


Figure 19 Tourists value of attributes

The attributes consumers value (Figure 11) builds on the purchasing drivers that consumers responded to. Production methods (for example, chemical and preservative free and organic) and nutritional value are of high importance. Product quality including freshness, healthiness, and an ability to pass through quarantine were also of prominent value. Of less importance is the availability of nuts, product variety, or that the nuts are 'interesting'. Valued attributes signify methods that will encourage tourists to purchase more local nut or local nut products while in Vanuatu. Matching these values with the previously discussed drivers will create a more valued product for tourism.

Moving forward

The survey shows respondents would be willing to pay a higher price for nuts that were clearly branded as being local to Vanuatu. The majority of respondents were prepared to pay an increase of 10-30 per cent with the maximum sitting at 70 per cent (for full spectrum see *Appendix B*). This is encouraging for all links of the chain including retailers, processors and farmers.

As shown in Figure 12, many of the suggested possible influences did, or could have, influenced the tourists that visited Vanuatu to purchase nuts. Exposure to advertising, a price promotion, accommodation/supermarket staff endorsed nuts, or samples were available in the stores would provide the greater influence on customers. Recipe cards, use by celebrity chefs, and local staff endorsement proved less popular. Though they still would provide some influence as very few respondents disagreed (or strongly disagreed) with any of the suggestions. Moving forward it will worth exploring the use of these influences as a strategy to engage with tourists staying in Vanuatu.

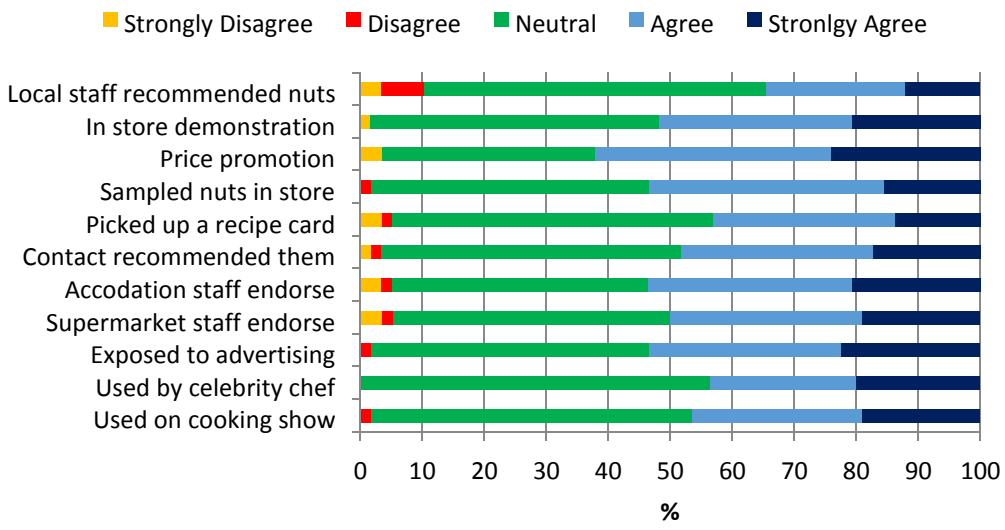


Figure 20 Influencing factors

Respondents were also asked if they would be engaged by a promotion of Vanuatu as a food destination and the growth area for food tourism. This could include festivals, tours, and domestic cooking schools that focus on local nuts. This received mixed results with around 60 per cent suggesting this option lacked appeal, 17 per cent staying neutral, and 22 per cent being attracted to the idea.

This survey suggests there is a demand from tourists in Vanuatu and that moving forward the canarium industry can increase its influence through a variety of strategies. Also, as illustrated in Table 2, engagement with the tourist population should provide a link between the domestic market and international market. This can assist both the development of the domestic market and the entry into the international market space.

Further analysis would be interesting to link if tourists do have preferences linked to the purchasing purpose. For example, if a particular nut form is preferred as a gift, or as a snack etc. Producers could then link these preferences to locations so that gift locations could house a certain variety while markets and more accessible ‘snack’ sites may keep another, more preferable, product. It is interesting to note that the respondents that did not consumer any canarium products mentioned a lack of access to products as their main reason, not a dislike of the products themselves.

The industry appears to have a lot of development potential. Initially the canarium industry needs to focus on the quality and quantity issues that it currently has. That said, engagement with tourists should be promoted, especially as a method to increase the cash flow in to the industry. All these approaches require appropriate strategies. The information from these tourist results should be used as a scoping manual when developing strategies, especially with regard to incoming visitors to Vanuatu.

Table 7 Suggested future path for canarium producers

Conclusion

These results demonstrate that tourist consumers see value in the canarium nut and there is room in the market for canarium producers to engage. They also highlight the points of difference that producers should focus on. Focus should be placed on the access of the product to tourists, the connection of the product to the location and community, and the quality and freshness of the product.

As discussed the future development of the industry could be a staged approach. The quality and quantity issues the industry will need to be dealt with. The industry will also have to maintain consistency and define a niche that targets tourists. Further economic analysis could be done to highlight the economic potential of tourist dollars to the canarium industry and sustainable paths that can be followed to provide positive growth.

In terms of next steps, these insights only reinforce the existing plans to focus on the value adding, packaging and branding opportunities for the industry in different market segments. Once these new products are developed further understanding will be needed to observe consumer preferences and willingness to pay.

Appendix A

Canarium Tourist Survey

SCREENING QUESTIONS

I would like to ask you a few questions first to determine if you qualify for the study.

S1. Are you a tourist leaving Vanuatu?
A ☐ Yes
B ☐ No THANK THEM FOR THEIR PARTICIPATION, HOWEVER THE SURVEY IS SEEKING THE OPINIONS OF TOURISTS LEAVING VANUATU

S2. Which one of the following age groups do you fall into?
A ☐ Under 18 years →THANK YOU FOR YOUR PARTICIPATION, HOWEVER THE SURVEY REQUIRES PEOPLE TO BE OVER 18 YEARS OF AGE OR HAVE PARENTAL CONSENT
B ☐ 18-24
C ☐ 25-34
D ☐ 35-44
E ☐ 45-54
F ☐ 55 years or older

S3. How often do you BUY/CONSUME nuts or nut products such as biscuits or cereals that contain nuts?
A ☐ Never →THANK YOU FOR YOUR PARTICIPATION, HOWEVER THE SURVEY IS SEEKING PEOPLE WHO BUY OR CONSUME NUTS OR NUT PRODUCTS
B ☐ A few times a year
C ☐ Monthly
D ☐ Fortnightly
E ☐ Weekly
F ☐ More than once per week

QUESTIONNAIRE

Let's commence the survey now.

1. What was the primary nature of your visit to Vanuatu? PLEASE SELECT ONE ONLY
A. ☐ Holiday
B. ☐ Event/festival
C. ☐ Conference/seminar
D. ☐ Business
E. ☐ Visiting friends or relatives
F. ☐ Other, _____

2. How many times have you visited Vanuatu in the last 5 years? PLEASE SELECT ONE ONLY
A. ☐ Never, this is your first visit
B. ☐ 2 to 3 times
C. ☐ 4 or more times

3. Do you think you will return to Vanuatu? PLEASE SELECT ONE ONLY
A. ☐ Yes, in less than 2 years
B. ☐ Yes, between 2 and up to 4 years from now
C. ☐ Yes, in 4 years or more
D. ☐ Unlikely to return
E. ☐ Don't know

4. How did you enter/arrive in Vanuatu? PLEASE SELECT ONE ONLY
A. ☐ Airplane
B. ☐ Cruise ship
C. ☐ Other, _____

5. Did you purchase any souvenirs or gifts from Vanuatu?
A. ☐ Yes → were any of these local food products or snacks? ☐ Yes → and what are they _____
B. ☐ No

6. How long was your visit on this occasion?
A. ☐ 1 day
B. ☐ 2 to 7 days
C. ☐ 8 to 14 days
D. ☐ More than 14 days

7. Are you visiting Vanuatu with others, such as friends or family?
A. ☐ Yes → how many? _____
B. ☐ No

8. Which of the following best describes your role in buying food, including selecting restaurant meals, while visiting Vanuatu? PLEASE SELECT ONE ONLY

A. ☐ I was the main food buyer
B. ☐ I shared the food buying with others
C. ☐ I occasionally did some food buying
D. ☐ I never did any food buying

9. What food outlets did you mainly frequent when eating out in Vanuatu? PLEASE SELECT ALL THAT APPLY

A. ☐ Fine dining restaurant
B. ☐ Cafe
C. ☐ Hotel or bistro
D. ☐ Club
E. ☐ Take away shop/fast food store
F. ☐ Supermarket
G. ☐ Central Market (Port Vila Market House)
H. ☐ Other, please specify_____

10. How often do you purchase certified food products like Fair Trade, Organic, Rainforest, UTZ etc? (i.e. food products, like coffee, made by developing economies to improve their future)? PLEASE SELECT ONE ONLY

A. ☐ Never
B. ☐ A few times a year
C. ☐ Monthly
D. ☐ Fortnightly
E. ☐ Weekly
F. ☐ More than once per week

11. To what extent do you agree with the following statements concerning local food from Vanuatu? 1 = strongly disagree to 5 = strongly agree

	Strongly Disagree				Strongly Agree
A. When purchasing food during my visit to Vanuatu, I specifically looked for local food to try.	1	2	3	4	5
B. Local food from Vanuatu was branded and easily recognisable.	1	2	3	4	5
C. Local food from Vanuatu was readily available at the places where I shopped.	1	2	3	4	5
D. Local food from Vanuatu was frequently included on the menus at eating out places on the island.	1	2	3	4	5
E. If local food had been promoted at Vanuatu restaurants; that would have positively influenced me to choose those restaurants.	1	2	3	4	5
F. When selecting from a menu during my visit to Vanuatu, I specifically looked for local food to order.	1	2	3	4	5
G. I am interested in learning about where the local food I eat comes from and how it is grown and/or produced.	1	2	3	4	5
H. Eating local food from Vanuatu did, or could have, made my visit more enjoyable.	1	2	3	4	5

12. This survey concerns a local nut grown and processed in Vanuatu. The nut is known by different names. Have you heard of any of the following?

A. Canarium nuts (Generic) ☐Yes ☐No
B. Nangai nuts (Vanuatu) ☐Yes ☐No
C. Ngali nuts (Sol. Islands) ☐Yes ☐No
D. Galip nuts (PNG) ☐Yes ☐No

13. Of the different names for the local nuts, which name do you prefer? PLEASE SELECT ONE ONLY

A. ☐ Canarium nuts
B. ☐ Nangai nuts
C. ☐ Ngali nuts
D. ☐ Galip nuts
E. ☐ Other suggestion_____

14. When you hear the term 'Vanuatu local nuts', what three main things come to mind?

A.
B.
C.

15. Have you tasted the local nut? A. ☐Yes B. ☐No

16. Would you like to?

A. ☐No → Why?_____ GO TO Q23

B. ☐Yes (provide sample) → What are your first impressions?_____

_____

17. During your visit to Vanuatu, please indicate how often you purchased local food (e.g. fruit, meat or seafood)?

A. ☐ More than once a day
B. ☐ Once a day
C. ☐ A few times
D. ☐ Seldom
E. ☐ I did not purchase local food (GO TO Q23)
F. ☐ I'm not sure if it was local food

18. During your visit to Vanuatu, please indicate how often you purchased local nuts or local nut products?

A. ☐ More than once a day
B. ☐ Once a day
C. ☐ A few times
D. ☐ Seldom
E. ☐ I did not purchase local nuts ↓

18a. Why did you NOT buy local nuts or nut products during your visit to Vanuatu?
PLEASE SELECT ALL THAT APPLY (THEN GO TO Q23)

A. ☐ Personal Dislike
B. ☐ Not aware of them
C. ☐ Advised not to eat local food
D. ☐ Not available where I shopped
E. ☐ Too expensive
F. ☐ Health safety concerns
G. ☐ Concerns about quality
H. ☐ No particular reason
I. ☐ Other reason_____

19. Please provide the three main reasons why you purchased local nuts or local nut products during your visit.

A.
B.
C.

20. Did you purchase local nuts or local nut products during your visit to Vanuatu for any of the following occasions?
PLEASE SELECT ALL THAT APPLY

A. ☐ As part of a holiday grocery shop
B. ☐ For special occasion
C. ☐ When socialising with others
D. ☐ When eating out
E. ☐ When relaxing at your holiday accommodation
F. ☐ For a gift
E. ☐ Other_____

21. Where did you purchase the local nuts or local nut products from during your visit to Vanuatu? SELECT ALL THAT APPLY

A. ☐ Central market (Farmer's market)
B. ☐ Supermarket
C. ☐ Hotel/resort accommodation
D. ☐ Roadside stall
E. ☐ Restaurant or cafe
F. ☐ Other: _____

22. In what form/s did you purchase the local nut or local nut products? SELECT ALL THAT APPLY

A. ☐ Nut in shell
B. ☐ Fresh kernel
C. ☐ Dried kernel
D. ☐ Value added (e.g. packaged, salted, sugar or chocolate coated, flavoured)
E. ☐ As an ingredient in another product (e.g. biscuits)
F. ☐ Other: _____

23. We would like to find ways to encourage tourists to purchase more of the local nut or local nut products when visiting Vanuatu. The next series of questions are to assist us in understanding attributes that are important to you.

On a scale of 1 'not important at all' to 5 'very important', please rate the following attributes of local nut or local nut products that would encourage you to purchase or purchase more?

	Not important at all				Very important
A. They taste good	1	2	3	4	5
B. They are interesting and/or novel	1	2	3	4	5
C. They are of consistent high quality	1	2	3	4	5
D. They have a good appearance	1	2	3	4	5
E. They have a good reputation	1	2	3	4	5
F. They are healthy	1	2	3	4	5
G. They are fresh	1	2	3	4	5
H. They meet food safety standards	1	2	3	4	5
I. They are organic	1	2	3	4	5
J. They are wholesome and nutritious	1	2	3	4	5
K. They are free from chemicals and preservatives	1	2	3	4	5
L. They are easily recognisable as local Vanuatu food	1	2	3	4	5
M. Knowing that purchasing them was supporting the local community, local retailers and local producers	1	2	3	4	5
N. Knowing they are indigenous to the region	1	2	3	4	5
O. Knowing they are an authentic Vanuatu product	1	2	3	4	5
P. Knowing they are from a sustainable source	1	2	3	4	5
Q. That they are good value for money	1	2	3	4	5
R. There was a variety to choose from	1	2	3	4	5
S. They were widely available	1	2	3	4	5
T. An assurance that they would pass quarantine	1	2	3	4	5

24. Would you be prepared to pay more for nuts that were clearly branded as being local to Vanuatu?

A. ☐ No

B. ☐ Yes → How much more, expressed as a percentage, would you be prepared to pay (e.g. 10% more)?

_____%

25. The next series of questions is about what may influence people to purchase or purchase more local nuts while visiting Vanuatu. Please indicate to what extent do you agree with the following statements on a scale of 1 'strongly disagree' to 5 = 'strongly agree'

I was or could have been influenced to purchase or purchase more local nuts while visiting Vanuatu if....

	Strongly Disagree				Strongly Agree
A. I saw Vanuatu local nuts prepared and served on a cooking show, such as Master Chef, or at a local tour	1	2	3	4	5
B. I saw Vanuatu local nuts prepared and served by a celebrity chef	1	2	3	4	5
C. I saw or heard an advertisement for Vanuatu local nuts while on holiday	1	2	3	4	5
D. The staff at the supermarket recommended Vanuatu local nuts to me	1	2	3	4	5
E. Staff at my holiday accommodation recommended Vanuatu local nuts	1	2	3	4	5
F. A friend, family member or colleague recommended Vanuatu local nuts to me	1	2	3	4	5
G. I picked up a recipe card using Vanuatu local nuts at the store/market/tour	1	2	3	4	5
H. I sampled Vanuatu local nuts at the store/market/accommodation	1	2	3	4	5
I. There was a special price promotion on Vanuatu local nuts	1	2	3	4	5
J. There was a demonstration on how to use the Vanuatu local food at the store/market/holiday accommodation/tour	1	2	3	4	5
K. A staff member at a local restaurant recommended local nuts to me	1	2	3	4	5

26. How appealing to you is a Vanuatu food tourism event such as a festival, tours or cooking schools that focused upon local nuts? PLEASE SELECT ONE ONLY

A. ☐ Not at all appealing
B. ☐ Not very appealing
C. ☐ Neutral
D. ☐ Somewhat appealing
E. ☐ Very appealing

27. Which of the following statements best describes the highest level of education which you have completed?

A. ☐ Primary School
B. ☐ Secondary school
C. ☐ Technical training (e.g. TAFE)
D. ☐ Tertiary education / University

28. Which of the following best describes your household's income?

A. ☐ Low income household
B. ☐ Medium income household
C. ☐ High income household
D. ☐ Very high income household

29. Are you an Australian resident?

A. ☐ No → What is your country of residence? _____
B. ☐ Yes → What is your postcode? _____

30. What is your current occupation? _____

31. Do you have any comments you would like to add?

Appendix B

% cost increase of nuts willing to be added by consumers

Price increase (%)	Percentage of respondents (%)
0	19.67
5	3.28
8	1.64
10	11.48
12	1.64
15	11.48
18	1.64
20	4.92
25	16.39
30	8.20
40	4.92
50	8.20
60	1.64
70	1.64

THE UNIVERSITY OF ADELAIDE

Tourism Research Insights

Canarium in the Solomon Islands

Pacific Agribusiness Research for Development Initiative

2014

Contents

Background

Canarium indicum is indigenous to Melanesia (including Vanuatu, Solomon Islands and PNG) and produces edible fruit, nuts and timber. Traditionally, the nuts are traded fresh in roadside and village markets, either as nut-in-shell, raw kernels or as dried kernels. However, each countries industry is quite different and is at different stages of development. 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.

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.

In the Solomon Islands, the canarium nut industry is constrained by the lack of capacity to supply product and maintain a consistent quality and quantity of supply. Logistics and challenges in sourcing product packaging currently limit growth of the value adding arm of the industry.

Despite the range of market challenges currently present for producers of canarium (or Ngali nuts as they are known by locals) in Solomon Islands, with international nut consumption expected to increase in coming years, there is market demand to support growth of the canarium industry. However, it is crucial that the canarium market grow in a sustainable way; therefore market development will need to focus on building capacity at home and satisfying domestic and regional markets before expanding internationally.

This research will investigate the habits and preferences of local consumers, ensuring that market development efforts are targeted in a way that meets existing consumer demand and tastes. This is one of the objectives of this research, with the information collected able to directly inform strategic development of the canarium industry.

The other component to this research is to improve the engagement with, and better understand the tastes and preferences of the tourist population that visit Solomon Islands. At present, with relatively low tourist numbers each year –around 20,000 visitors, the tourist market is small, and as such should not be the sole focus of product development and market efforts but rather 'top up' domestic sales. Results from the tourist survey can shed light into international market preferences and help bridge the gap between domestic suppliers and international markets.

In an effort to understand the experience of locals and tourists in Solomon Islands with canarium nuts the Pacific Agricultural Research for Development Initiative (PARDI) (in association with the University of Adelaide and the University of the Sunshine Coast) instigated two surveys, one targeting local consumers and another targeting tourists leaving the Solomon Islands. PARDI are interested in the development of the canarium nut industry and this research represents a significant step in understanding the potential to develop the canarium market in the Solomon Islands.

Methodology

In February 2014 the University of Adelaide in collaboration with the University of the Sunshine Coast and Maraghoto Consultancy services designed and conducted a consumer survey of 50 tourists leaving Solomon Islands and 400 locals. The tourist component of the survey was carried out in the city of Honiara across five of the main hotels. The local survey component sampled 200 people from Honiara, 100 in Auki and 100 in Gizo.

The tourist survey (*see Appendix A*) was designed to understand the local food and indigenous nut consumption. It included questions that would establish both the consumption preferences of tourists, the market exposure of tourists, and their preference of experiences. The end of the survey integrated these themes to allow respondents to provide recommendations and insight into the development of canarium products. The local consumer survey *(see Appendix B)* was designed to understand nut consumption and purchasing habits, consumer perceptions and preferences. The survey finished by eliciting information on the attributes and influencing factors local consumers thought were important when purchasing canarium nuts.

In order to objectively obtain information in regards to consumer reactions to canarium products parameters were placed upon the survey sample demographic. To answer the survey respondents were required to:

- be over the age of seventeen buy/ consume nuts or nut products.

And for the tourist survey

- be a tourist leaving Solomon Islands

And for the local consumer survey

- be a local or expat living in the Solomon Islands
- have heard of or tried canarium nuts

These survey sample constraints ensured that respondents would be suitable target consumers.

Results: Tourists

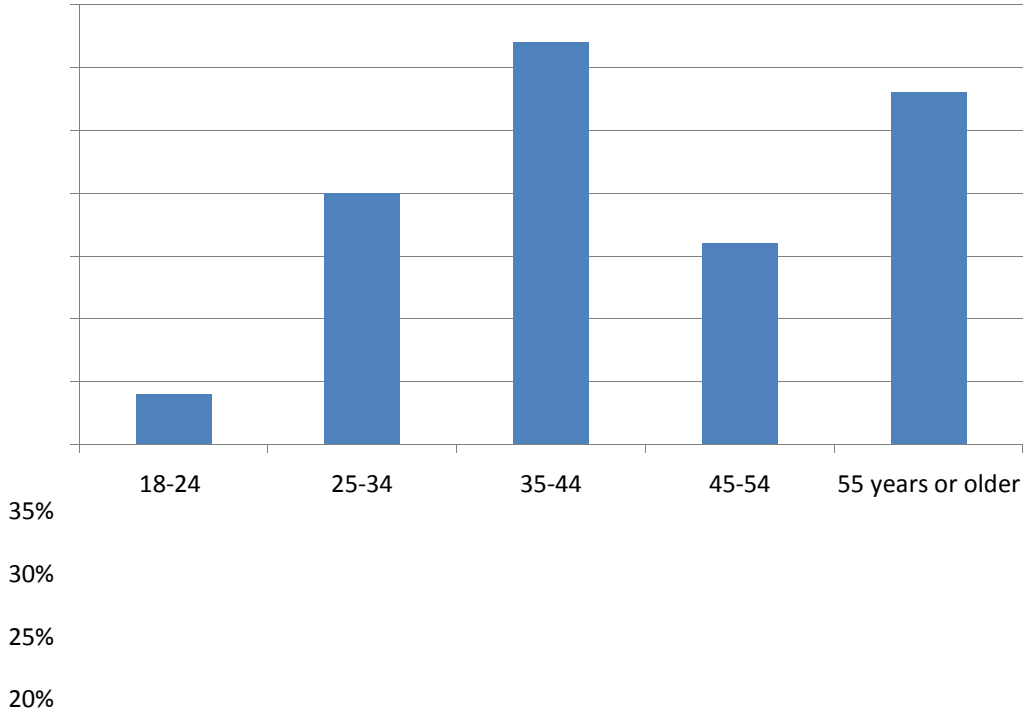
The following chapter provides a summary of the collated survey results provided by 50 survey respondents in Solomon Islands. The sample size is small given so few tourists visit the Solomon Islands, however the results still provide an overview of visitor experiences. Importantly this research gathers several key areas that can be effectively used as core elements to help develop the canarium market. These are:

- respondent demographics
- consumption patterns in Solomon Islands
- nut consumption

Respondent demographics

The resulting respondent demographics are scoped by the parameters that were placed upon the survey. As discussed previously, survey respondents were required to be over the age of seventeen and ready or about to leave Solomon Islands. As the survey was concerned with nut consumption, survey respondents were also required to be consumers of some form of nut product. This included consumption of nuts individually or nut products such as biscuits or cereals that contain nuts.

The gender divide of respondents was comparatively even with just over half (52 per cent) being male and the remaining percentage (48 per cent) being female. As shows in Figure 1, 24 per cent of the respondents were between 18 and 34 years old, 48 per cent between 35 and 55, and 28 per cent 55 years and older. The survey respondent group spread represents a range of consumer brackets, and is skewed towards the older demographic. All respondents arrived by airplane.



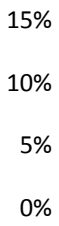


FIGURE 21: AGE DEMOGRAPHIC OF SURVEY RESPONDENTS

Figure 2 highlights that amongst the survey respondents the most common country of origin was Australia (30 per cent), followed by New Zealand (18 per cent), Europe (12 per cent), Pacific countries (10 per cent) and other Asia (10 per cent).

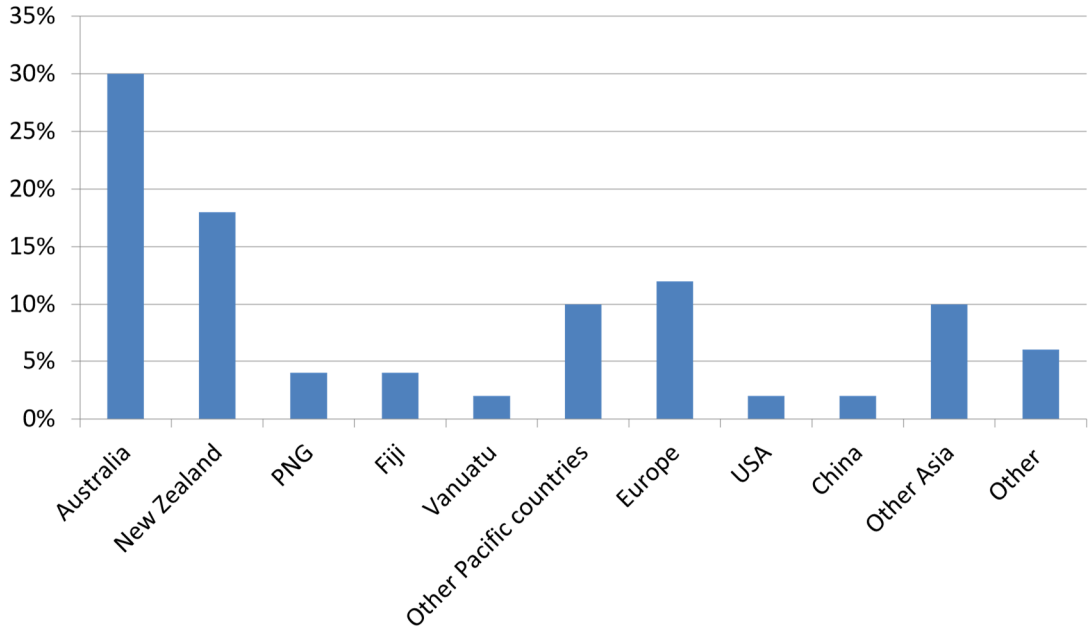


FIGURE 2: COUNTRY OF ORIGIN

The majority of respondents were visiting Solomon Islands for a business (56 per cent), with others visiting to attend a conference of seminar (16 per cent) or visit friends or relatives (14 per cent). Only two per cent were on vacation, highlighting how underdeveloped the tourism industry is. For all respondents, it was their first trip to the region. As Figure 3 shows, the majority of respondents stayed more than 14 days in Solomon Islands.

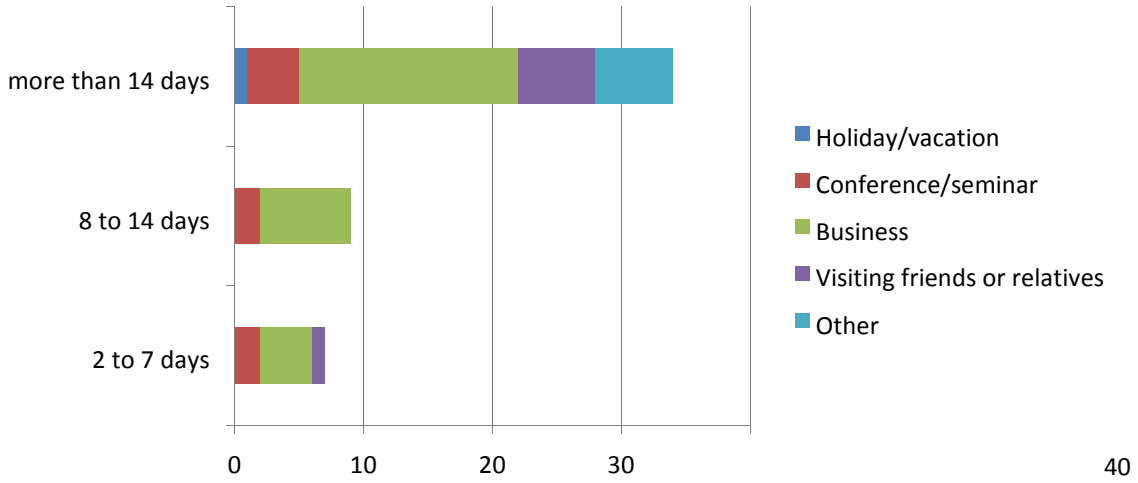


FIGURE 3: DURATION AND NATURE OF TIME IN SOLOMONS

Over half (58 per cent) of respondents were travelling alone. This is in line with the high proportion of visitors travelling for business or a conference/seminar. Of those travelling with others, they were in small groups of between two to 5 persons.

As shown in Figure 4, respondents responded positively when asked if they thought they would return to Solomon Islands with 59 per cent expending to return within two years. This figure is in line with the nature of the visitors to the Solomon Islands- with over half visiting on business, which would likely require them to visit semi-frequently. A further 16 per cent said they would return at some time in the future. 22 per cent of those surveyed stated they were unsure if they would return and two per cent stated they were unlikely to return.

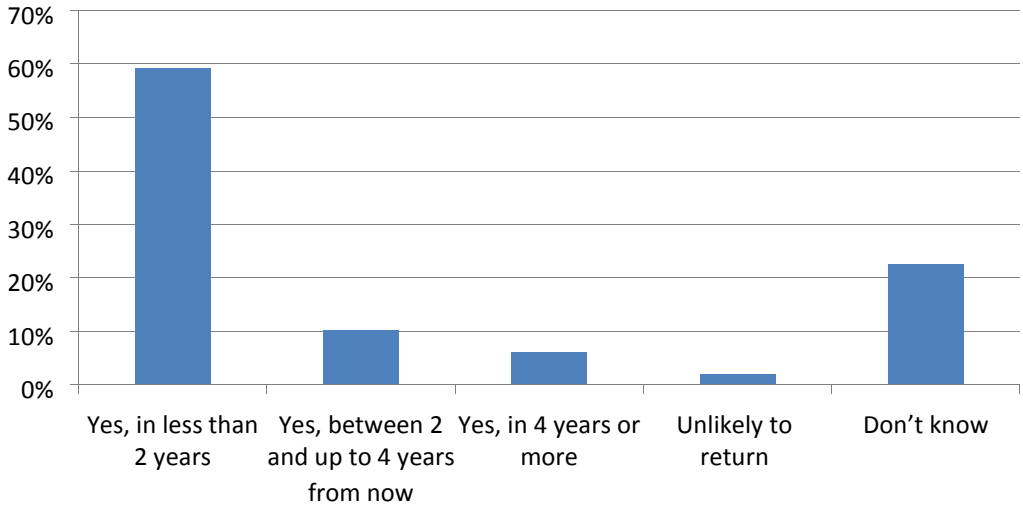


FIGURE 4: EXPECTED RETURN FREQUENCY

Consumption patterns in Solomon Islands

In order to understand the perception and motivations of consumers the survey asked respondents about their consumption habits and preferences. The majority of respondents were either the main food purchaser or shared purchasing tasks with another while staying

in Solomon Islands. As primary food decision makers the respondents represent the target group that any domestic food markets would be interested in engaging with.

Local food purchasing locations follow an expected pattern. As shown in Figure 5, fine dining restaurants, cafes and hotel or bistro's dominate the market with regard to tourist frequency. This is not surprising as these locations are designed to attract the tourism market and engage with those visiting Solomon Islands.

It is encouraging that tourists also frequent supermarkets, central markets and roadside stalls. This represents willingness from tourists to explore local food markets and engage with the domestic market. These highly frequented locations will be ideal areas to promote and advertise local food to those travelling to the region.

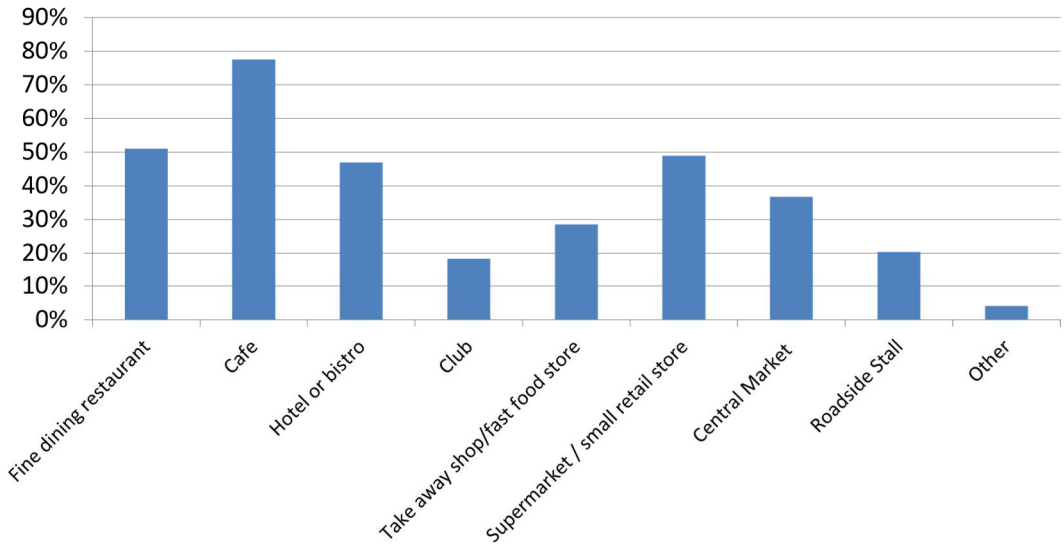


FIGURE 5: OUTLET CHOICE FOR PURCHASING FOOD OR EATING

As Figure 6 shows, the majority of respondents are interested in (55 per cent) purchasing souvenirs or handicrafts from the islands, however only 8 per cent were interested in purchasing edible gifts to take home. This low figure may be influenced by customs/quarantine restrictions and the perception that some products may be difficult to get through. In a related survey - the Vanuatu canarium Tourist Survey, passing quarantine was viewed as a very important desirable attribute for a local nut by 62 per cent of respondents. Packaged canarium nuts are able to pass through Australian customs, therefore any future efforts targeted at tourists should clearly advertise that this fact.

A positive trend is that 49 per cent of tourists are interested in experiencing traditional culture in rural areas where local products are made. This, coupled with the fact 53 per cent of tourists are interested in trying new dishes/foods typical to the islands suggests that this interest would likely extend to purchasing local food products to try.

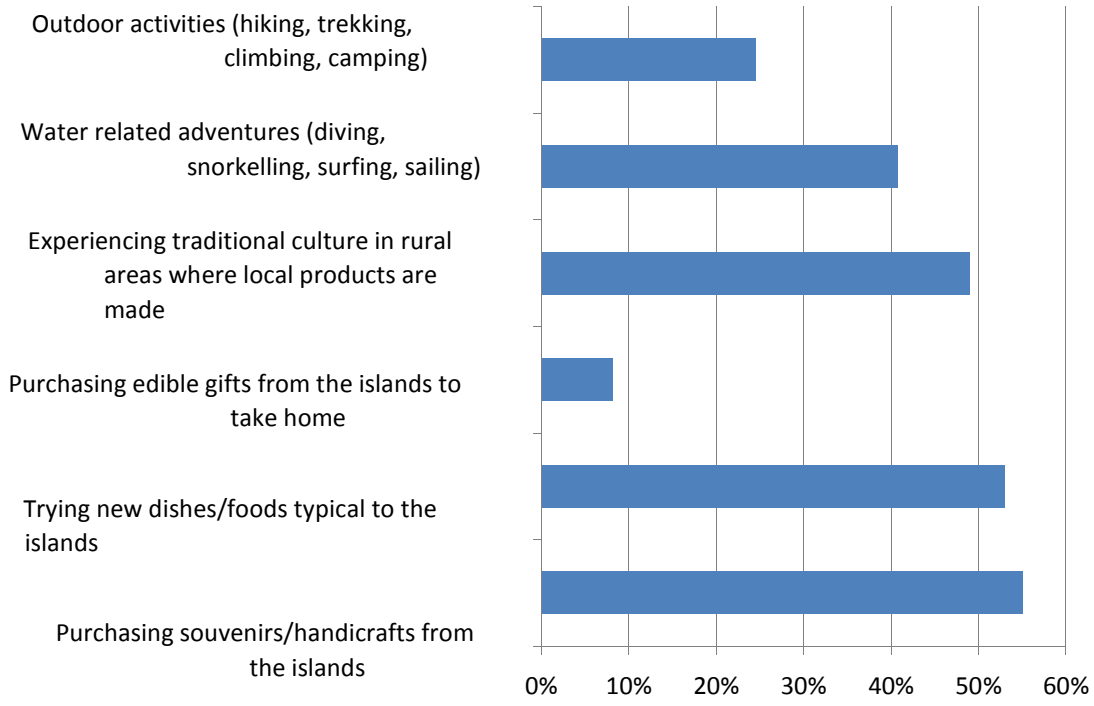
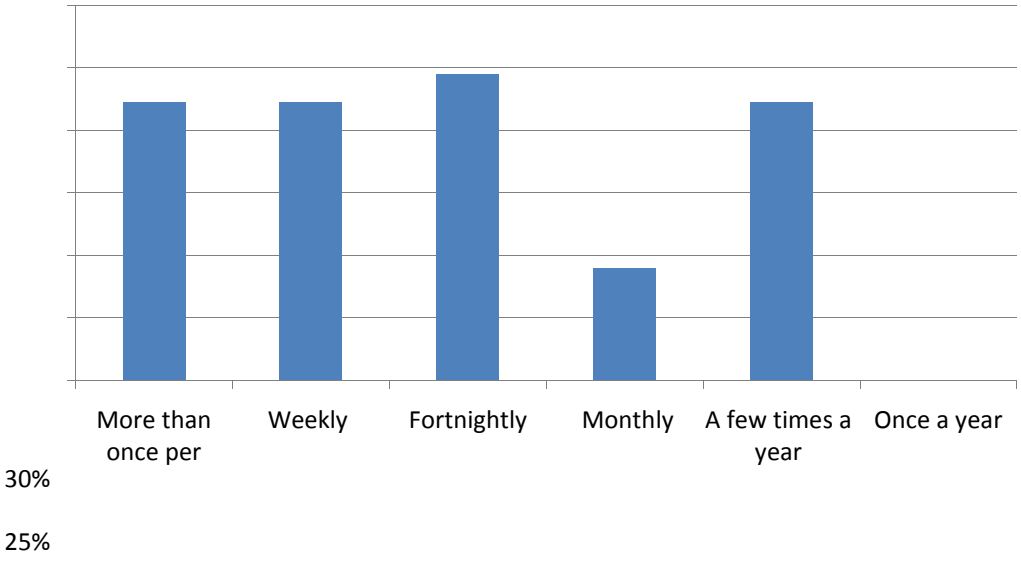


FIGURE 6: ACTIVITIES OF INTEREST IN THE SOLOMON ISLANDS

Nut consumption

To assist the future development of the canarium nut market the core of the survey asked respondents about their nut experiences and preferences. Figure 7 below shows that all respondents were consumers of nuts (as required by the survey scope) with the majority having nuts more than once a week (22 per cent) weekly (22 per cent) or fortnightly (24 per cent). These consumption trends highlight that the respondents are regular nut consumers. This is a welcoming result as it demonstrates that these consumers would be open to trying canarium, providing a potential market to which local producers could pursue and market towards.



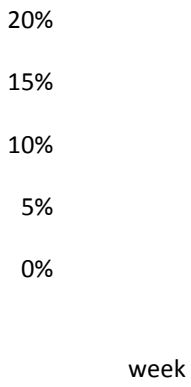


FIGURE 7: NUT CONSUMPTION RATES

Just over half of respondents knew of or had tried canarium (or Ngali as they are known in the Solomon Islands) nuts before. When asked if they had tried any of the other indigenous nuts- Terminalia/Beach almond, Cutnut, Tahitian chestnut, or Tulip – 64 per cent of visitors surveyed stated that they had not heard of any of these nuts. For the 36 per cent of visitors that had tried other indigenous nuts, the most common was Cutnut (20 per cent) followed by Terminalia/Beach almond (14 per cent). These figures suggest that visitors to the Solomon Islands have limited knowledge of local nuts.

This limited awareness was reflected in nut consumption patterns during their time in the Solomon Islands. As Figure 8 shows, while in Solomon Islands, nuts were purchased infrequently if at all, with 14 per cent of respondents purchasing one time, 16 per cent purchasing twice and 27 per cent purchasing nuts a few times during their stay. A large portion of respondents (47 per cent) did not purchase any local nuts. Given that 44 per cent of respondents eat nuts at least once a week when at home, this shift in nut consumption frequency whilst in Solomon Islands is significant, reflective of the underdeveloped local nut market in Solomon Islands, a general lack of awareness of local nuts by tourists and a potential niche market opportunity.

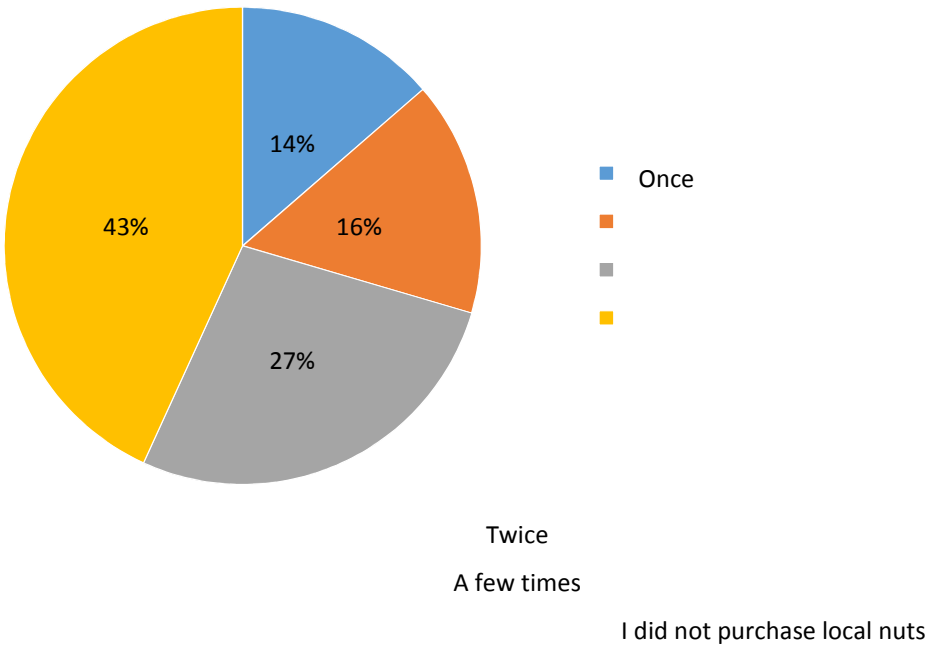


FIGURE 8: NUT PURCHASING FREQUENCY DURING TIME IN SOLOMON ISLANDS

This lack of awareness of local nuts is highlighted in Figure 9, which shows that when asked why they did not purchase local nuts, most respondents stated that they were not aware of local nuts, did not see them where they shopped and otherwise that there was no particular reason why they didn't purchase them. Only a few respondents suggested that they were concerned about quality or health and safety issues. It is noteworthy that price and personal preferences were not an identified as issues. These factors suggest that with stronger marketing to increase tourist's awareness of local nuts, and provide information over quality and health standards, that tourists would be open to purchasing local nuts.

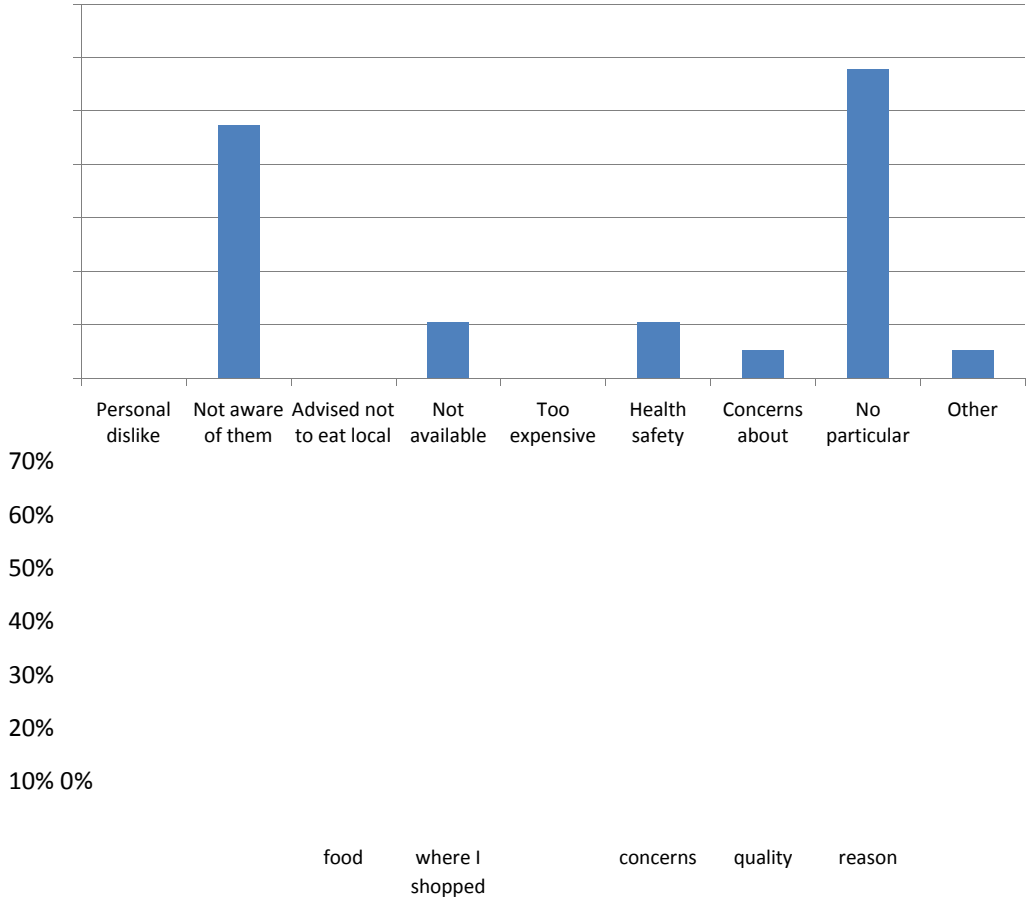


FIGURE 9: REASON DID NOT BUY NUTS IN SOLOMON ISLAND

As Figure 10 shows, the majority (76 per cent) of nuts were purchased at the local, central or main market, with smaller amounts purchased at the super market (24 per cent) and small retail store (12 per cent. The nut purchasing profile says more about the availability of canarium than the preference of tourists. Due to the infant nature of the canarium nut industry, the nut is not regularly found in restaurants and hotels/accommodation. Naturally then, the main access point for tourists is to purchase canarium at local markets and Supermarkets.

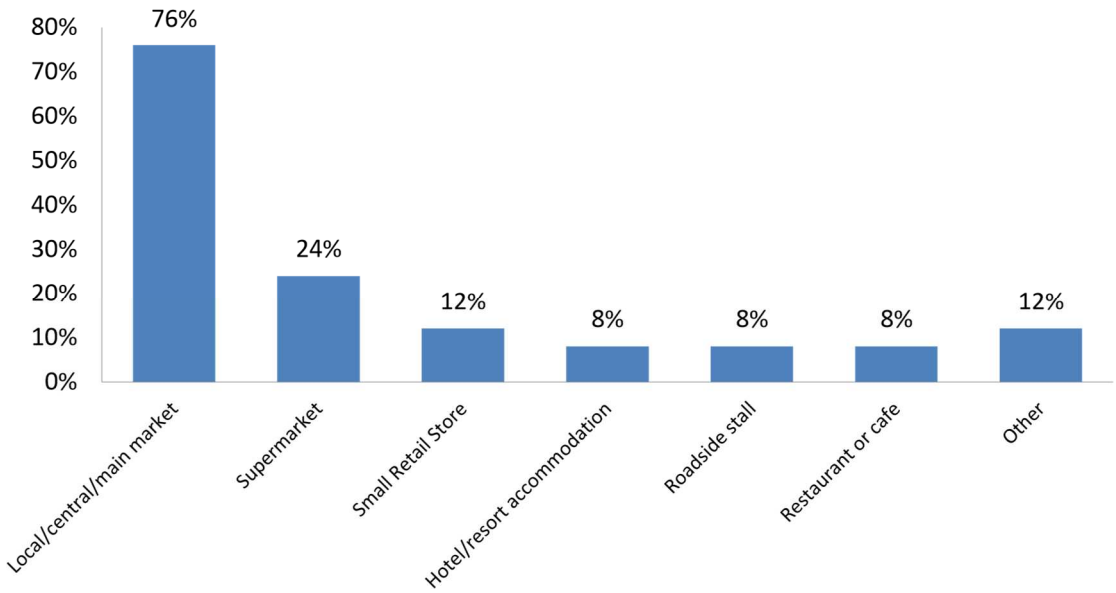


FIGURE 10: FREQUENCY OF RETAIL OUTLET USED WHEN PURCHASING LOCAL NUTS

As highlighted in Figure 11, local nuts were more commonly purchased as a fresh kernel (64 per cent) in the shell (48 per cent) and as a dried kernel (32 per cent). Other forms which nuts were purchased in included as an ingredient as another product (20 per cent) or value added in some way (16 per cent). It is positive to see that consumers are willing to consume canarium in the many forms that it is available. This gives producers a large market to work with when developing their product.

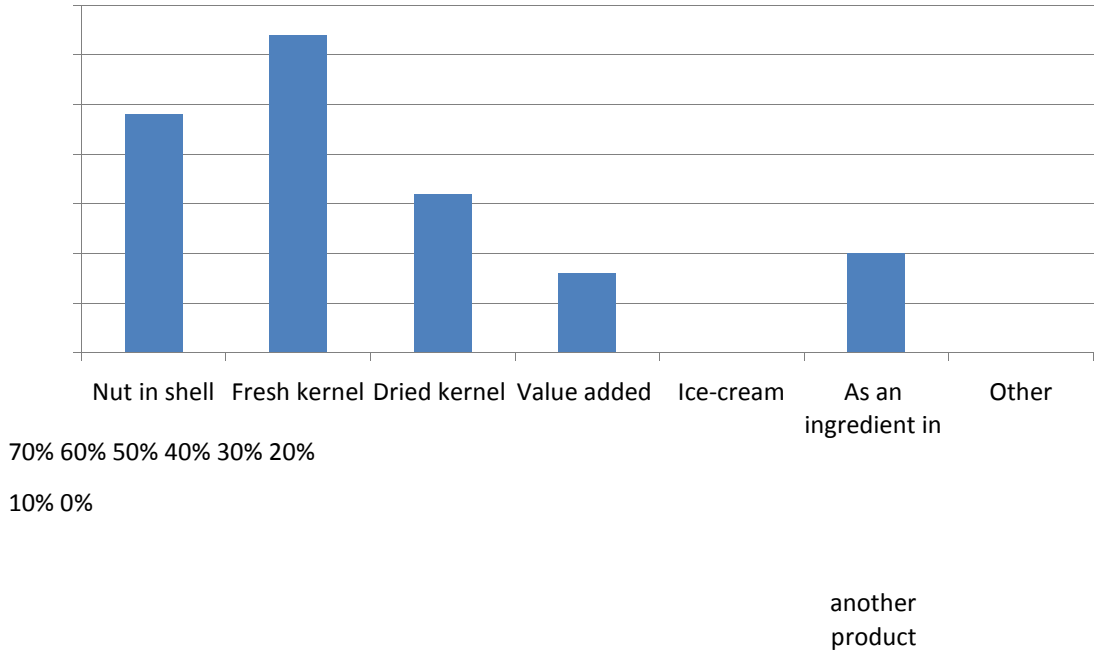


FIGURE 11: THE FORM THE NUT WAS IN WHEN PURCHASED

There is significant opportunity for value adding from canarium nuts. Figure 12 highlights the range of value added canarium nut products that survey respondents indicated an interest in purchasing. The greatest interest was for canarium as a snack nut (67 per cent) or roasted

and salted (61 per cent). Other popular options included canarium nut coated in honey (35 per cent) or chocolate (20 per cent), as a cooking or body oil (31 per cent) a nut brittle (18 per cent) or made into a local dish called Masi Masi (16 per cent).

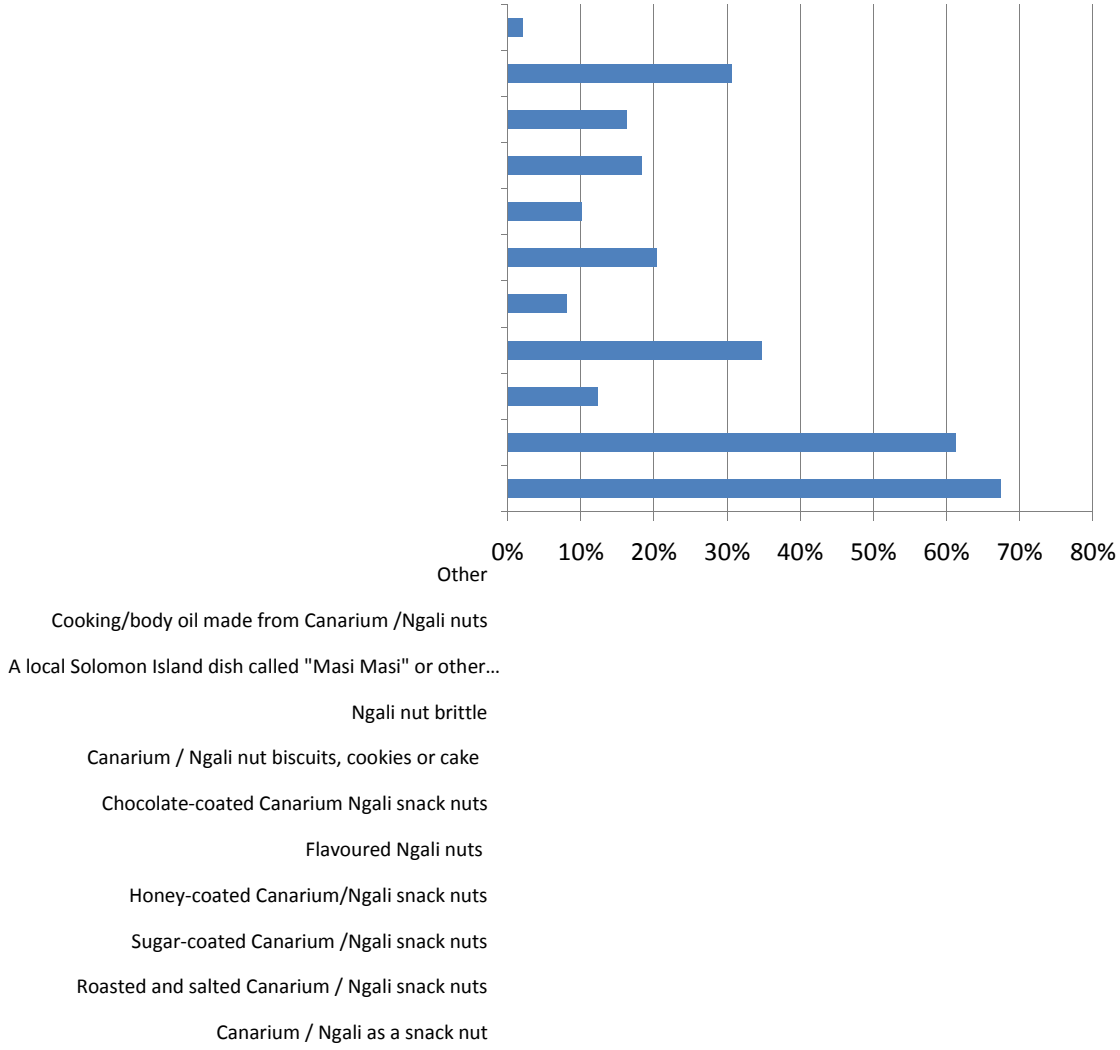


FIGURE 12: PREFERRED CANARIUM NUT PRODUCTS TO PURCHASE

Survey respondents were asked how much they would be willing to pay for a 100 gram package of dried canarium nuts. As illustrated in Figure 13, over half of respondents were willing to pay between 11 and 15 Solomon Island Dollars (SBD) (equivalent to between AUD $1.50 and $2.25). Nearly a quarter of respondents were willing to pay between SBD 16 and 20 (equivalent to between AUD $2.25 and $3.00). Conversely, 12 per cent were only willing to pay less than SBD 10 (Less than AUD $1.50).

Over SBD 31

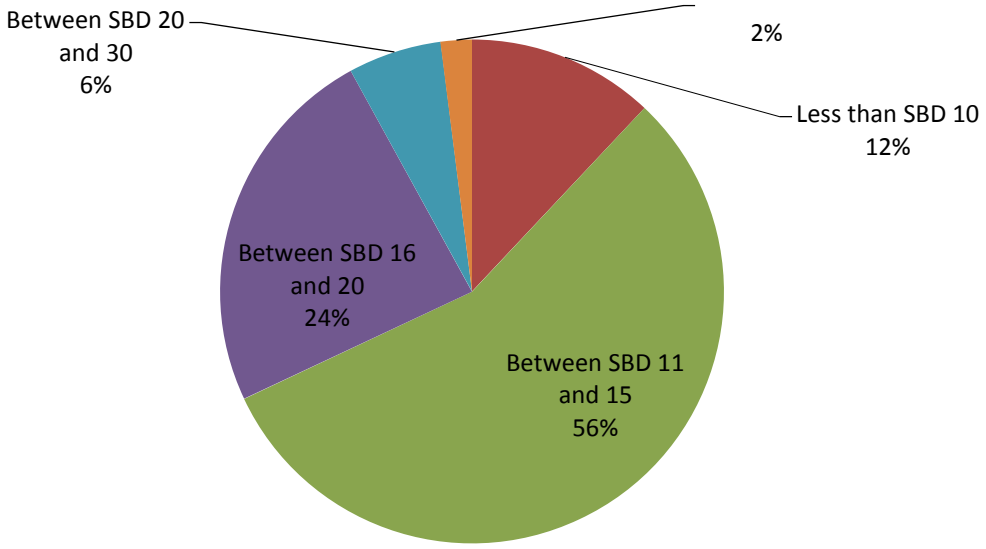


FIGURE 13: WILLINGNESS TO PAY FOR A 100G PACK OF DRIED CANARIUM NUTS

Figure 14 shows that when it came to name knowledge and preference, the traditional Solomon Island name – Ngali nuts, was the most commonly known (92 per cent) and the most preferred (51 per cent). The second most preferred name was Pacific nuts (29 per cent).

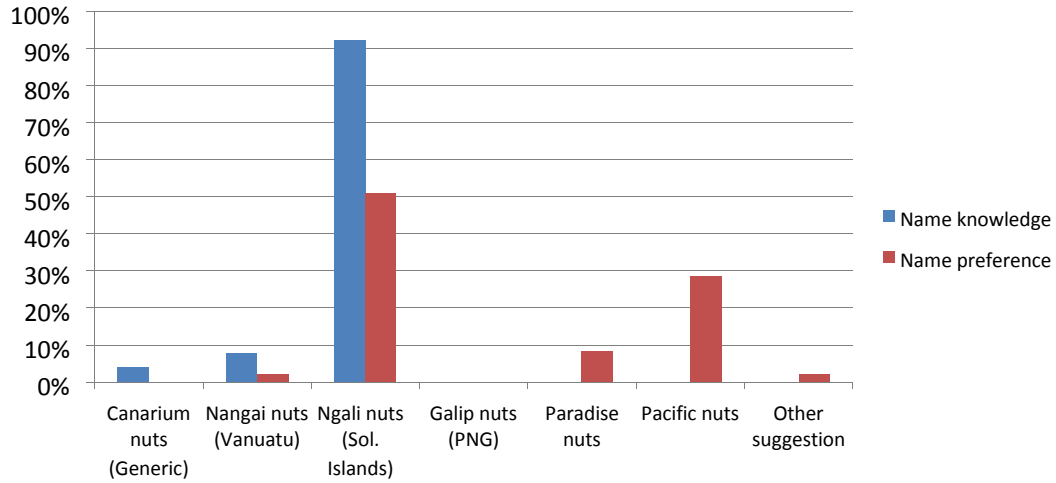


FIGURE 14: NAME KNOWLEDGE AND PREFERENCE

The survey respondents were asked to rank the importance of various attributes of local nuts or nut products. Figure 15 shows that unsurprisingly, taste/flavour was the most important attribute (84 per cent), after this the following were also listed as very important- being free from chemicals and preservatives (68 per cent), nutritional characteristics (63 per cent), freshness (59 per cent) and organic certification (51 per cent). It is clear that health concerns are a priority for consumers and an important selling point for local nuts. Knowing that their consumption also helps the local community was also very important for 48 per cent of respondents, interestingly more so than price (41 per cent).

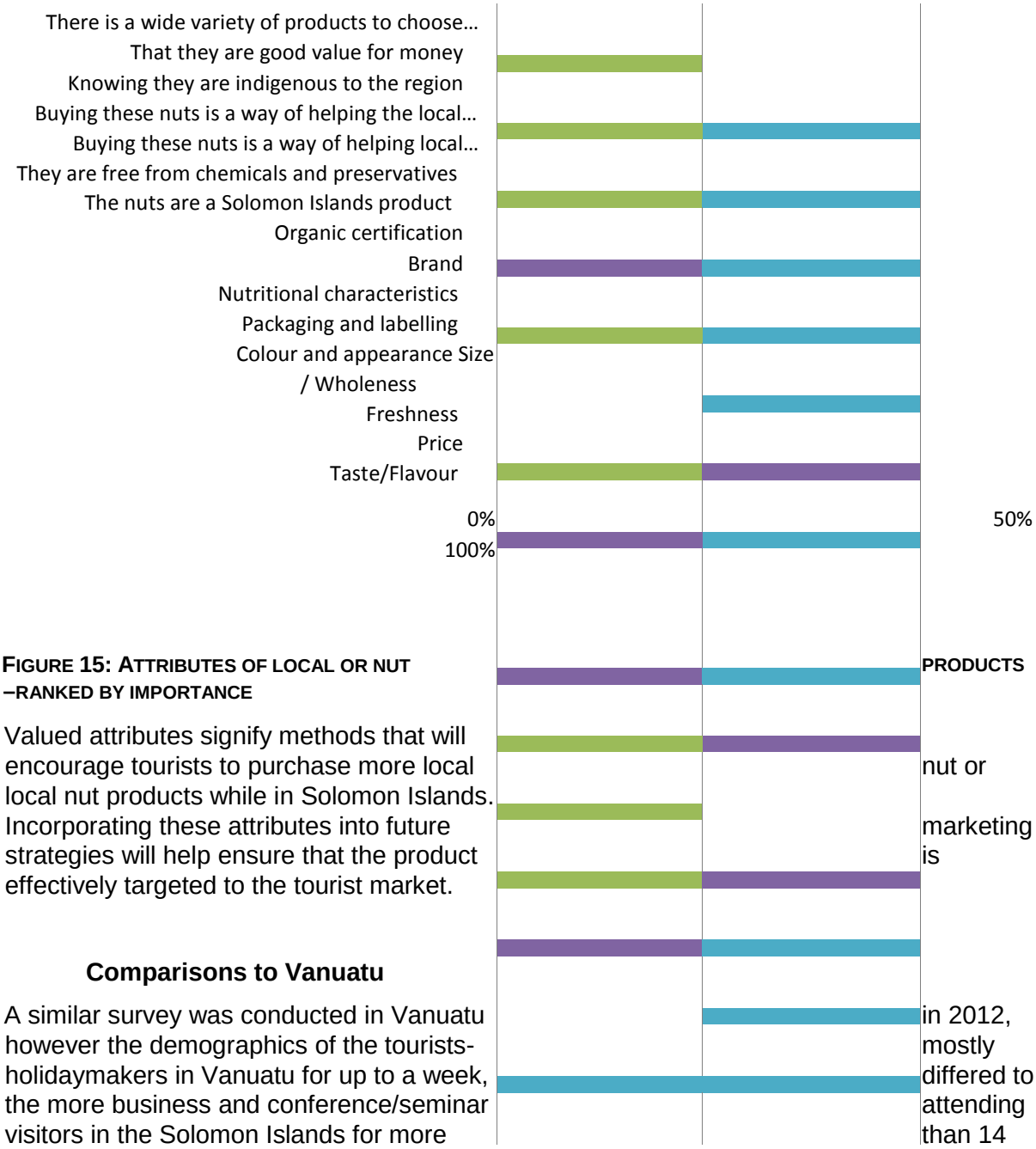


FIGURE 15: ATTRIBUTES OF LOCAL OR NUT PRODUCTS –RANKED BY IMPORTANCE

Valued attributes signify methods that will encourage tourists to purchase more local nut or local nut products while in Solomon Islands. Incorporating these attributes into future marketing strategies will help ensure that the product is effectively targeted to the tourist market.

Comparisons to Vanuatu

A similar survey was conducted in Vanuatu in 2012, however the demographics of the tourists- mostly holidaymakers in Vanuatu for up to a week, differed to the more business and conference/seminar attending visitors in the Solomon Islands for more than 14 days. The survey respondents in Vanuatu were also skewed more towards the younger age distribution.

When compared to home consumption, nut-purchasing frequency by tourists was higher in Vanuatu than in Solomon Islands. In Vanuatu the nuts were purchased to eat with friends or when back at the resort, often also as a gift to take back home for friends and family. The greater nut purchasing frequency could be partly attributed to the greater availability of processed nuts for purchase and marketing of local nuts.

The supermarket was the most popular location to purchase canarium nuts in Vanuatu, compared to the local/central/main market in the Solomon Islands. This may be reflective of the differences in the value chain, where in the Solomon Islands the primary processing occurs in existing village systems, which are not fully integrated into supermarket value chain as in Vanuatu.

Nearly three quarters of tourists reported purchasing canarium in its value-added form in Vanuatu, as compared to 16 per cent in the Solomon Islands. Once again, this is indicative of the more advanced value adding that has been occurring in Vanuatu in recent years and highlights the opportunity for Solomon Islands to capitalise on the consumer interest in value added products, guided by tourist preferences for a snack nut, roasted and salted or honey coated.

Alike the tourists in Solomon Islands, tourists in Vanuatu place great value on production methods (chemical, preservative free and organic), nutritional characteristics and knowing that the nut provides support to the community. Passing quarantine restrictions was very important to 62 per cent of respondents in Vanuatu. Whilst this wasn't included in the Solomon Islands survey, it is likely that this would also be an important attribute, and could be included in promotional material to quash any concerns tourists may have.

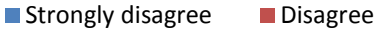
Moving forward – tourist market

The survey shows that nearly 70 per cent of respondents would be willing to pay a higher price for nuts that were clearly branded as being local to Solomon Islands. The majority of respondents were prepared to pay an increase of 5-30 per cent with the maximum sitting at 40 per cent. This willingness to pay a premium for locally branded nuts is encouraging for all links of the chain including retailers, processors and farmers, and should be capitalised on.

As part of any future development of the tourism sector, opportunities to tie canarium nuts to an authentic experience of local culture should be explored, whether it be incorporating a tasting of canarium nuts into tours which showcase traditional culture in the rural areas, or going one step further and through cooking schools or cooking demonstrations, demonstrate the use of canarium nuts in traditional dishes such as Masi Masi. When asked about what did or could have influenced them to purchase local nuts (see Figure 16), 49 per cent of respondents either agreed or strongly agreed that a demonstration on how to use local food at the store, market, accommodation or on a tour could have influenced them to purchase more nuts. Seeing local nuts prepared on a cooking show or by a celebrity chef were found to be less influential, with only 34 per cent and 23 per cent of respondents indicating that this could have influenced their purchasing decision.

Cooking schools and cooking demonstrations are a popular activity with tourists around the world, and given that trying new dishes/foods typical to the islands is something that 53 per cent of respondents indicated they were interested in; this might be an opportunity worth exploring. This would have the added benefit of providing tourists the opportunity to experience the traditional culture where local products are made, something which 49 per cent of respondents indicated they would be interested in. Being able to link canarium nuts to an experience had while visiting the Solomon Islands would be a valuable way to build the brand and encourage tourists to take nuts back home as gifts, or to re-create a new dish they have learnt.

Moreover, simply offering tastings of canarium nuts at retail outlets or at their accommodation would help influence tourists to purchase more nuts (as indicated by 49 per cent of respondents). This would be a relatively inexpensive form of marketing, which could have big payoffs. Targeting marketing efforts to the hotels or restaurants would also be effective, as just over half of respondents agreed or strongly agreed that a recommendation from the hotel or local restaurant would influence them to buy more canarium nuts. Recommendations from these venues were more influential than a recommendation from the supermarket. A display at hotels and restaurants showcasing local products and offering tastings could be a useful marketing tool.



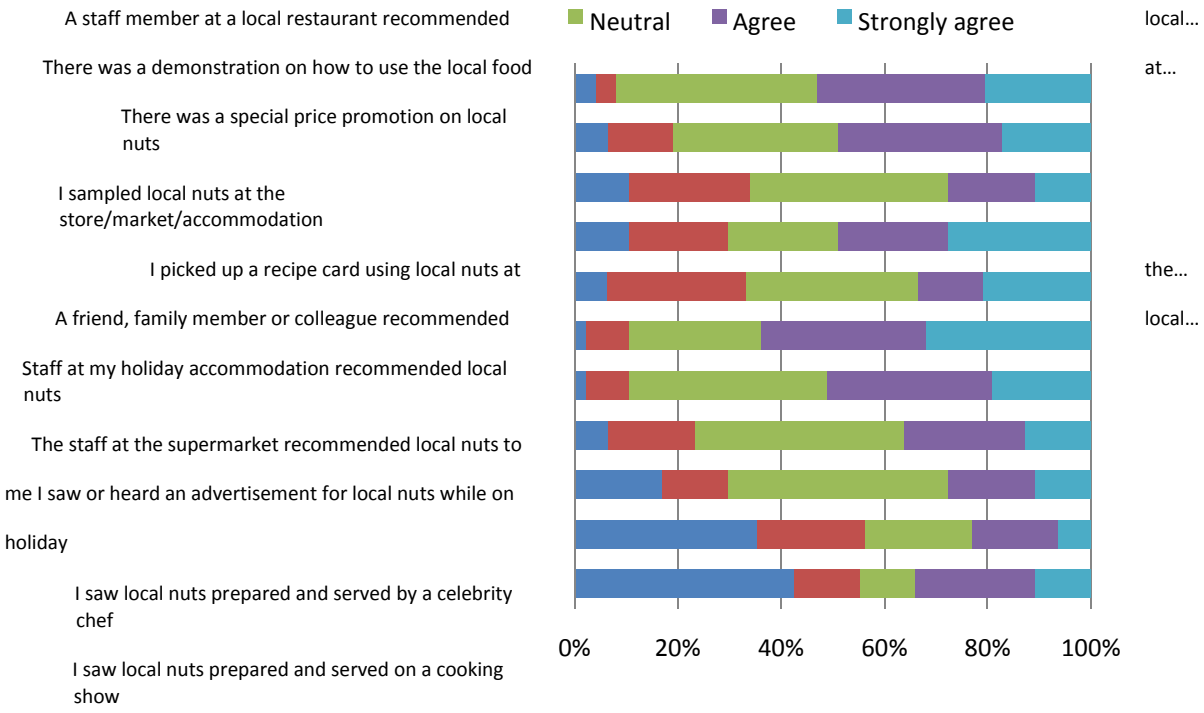


FIGURE 16: INFLUENCING FACTORS

These findings must be considered against the backdrop of the struggling tourist sector. Cruise ships are not common to the Solomon Islands and Honiara is not as attractive as other Pacific destinations. Tourists are discouraged by political unrest and the Island isn't marketed very effectively. While the survey results suggest there is potential to grow tourist's consumption of canarium, the low number of tourists visiting the Island means that it is not practical to solely target product development or marketing efforts towards the tourist market at this stage. Until tourism numbers pick up, it would be best to focus efforts on the local consumers or products that can be bought by both locals and tourists.

Results: Local consumers

The following chapter provides a summary of the collated survey results provided by 400 local survey respondents in Solomon Islands. This research captures several key areas that can be effectively used as core elements to help develop the canarium market. These are:

- respondent demographics
- nut purchasing patterns
- nut consumption patterns
- important attributes and consumer preferences

Respondent demographics

The survey of local consumers had a sample size of 400 respondents, comprising of 100 respondents from Glizo, 100 from Auko, and 200 from Honiara. Of these respondents, 97 per cent were local to the Solomon Islands and three per cent were expats, living in Solomon Islands. The age of the respondents varied, with one quarter aged between 18-24, 28 per cent between 25-34, 27 per cent between 35-44, 13 per cent between 45-54 and 8 per cent 55 years and older. These age demographics are representative of the Solomon Island population.

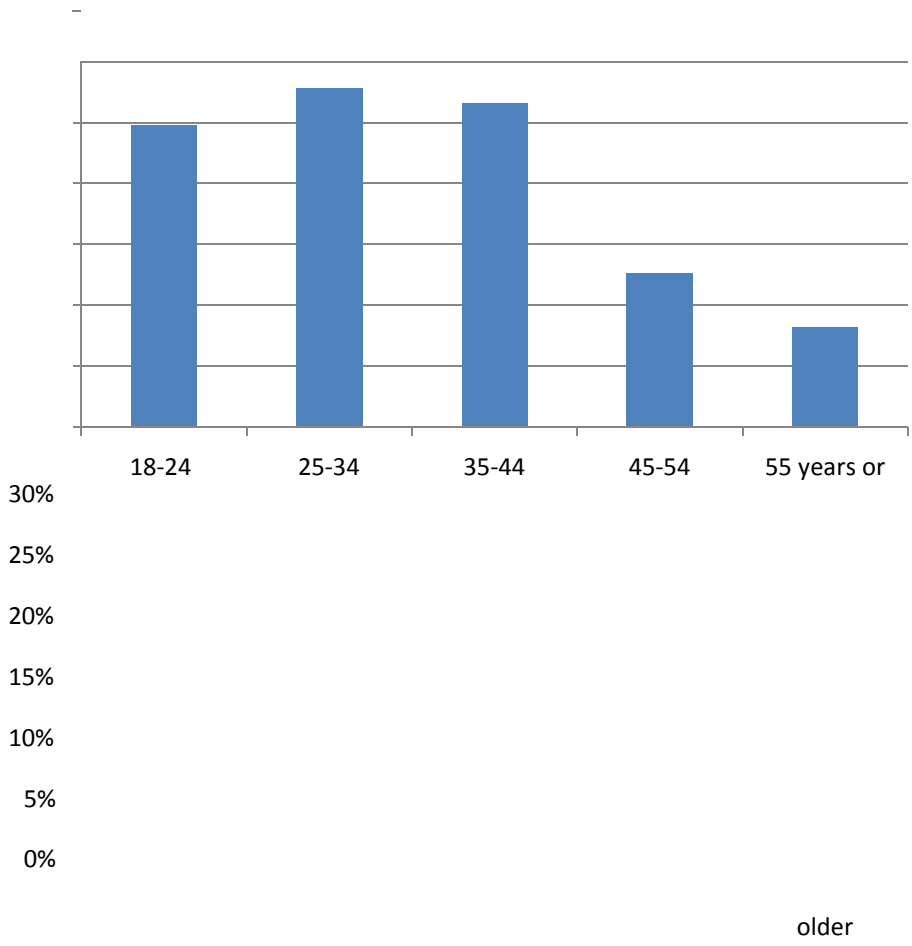


FIGURE 17: AGE DEMOGRAPHIC OF SURVEY RESPONDENTS

The majority of local nut consumers (39 per cent) consume nuts only a few times a year. A relatively small amount of respondents consume nuts more often – monthly (18 per cent), fortnightly (13 per cent) or weekly (16 per cent). Only ten per cent of respondents reported consuming nuts more than once a week. The low rate of nut consumption is reflective of the seasonality of local nuts, which are only available when in season, limiting opportunities for all year round consumption. Nuts are typically purchased raw, with processed and packaged nuts only becoming available in the last five or so years.

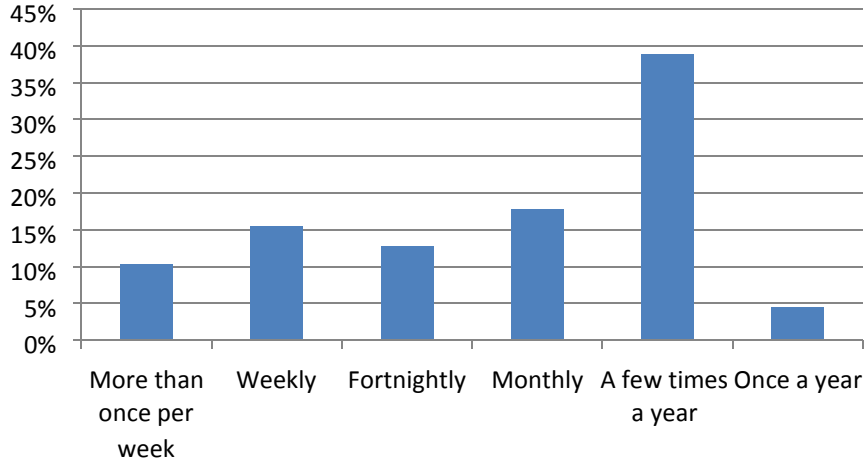


FIGURE 18: FREQUENCY OF NUT CONSUMPTION

For local consumers, 75 per cent purchase the majority of their fruits, vegetables and nuts from the wet market. The remainder of respondents purchase from road side market (nine per cent), grow most of their own food (13 per cent), or for small minority, purchase from the supermarket or directly from growers.

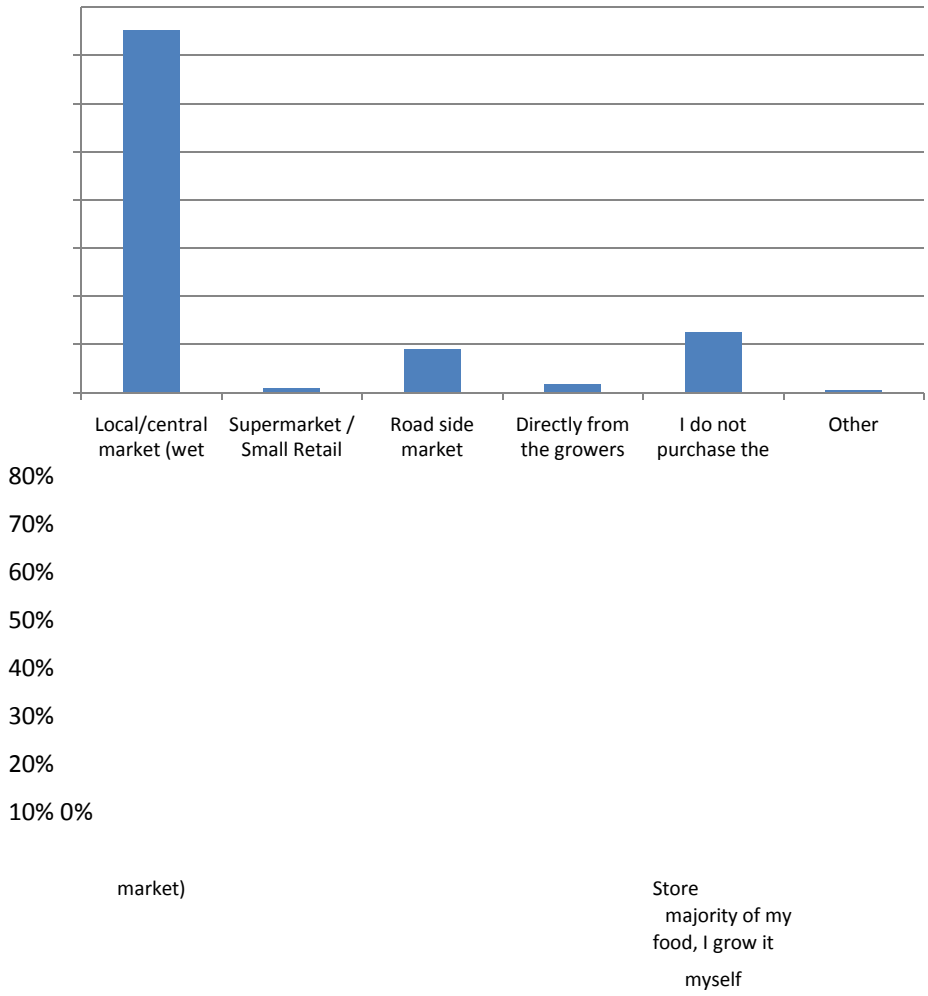


FIGURE 19: FRUIT, VEGETABLE AND NUT PURCHASE LOCATION

Consumption of canarium Nuts

Canarium nuts were used as a food source by 07 per cent of respondents, with alternative uses including medicinal/traditional or cultural purposes (36 per cent), as a gift (18 per cent) or for bartering (12 per cent). A minority of respondents used canarium oil as a body lotion or for cooking.

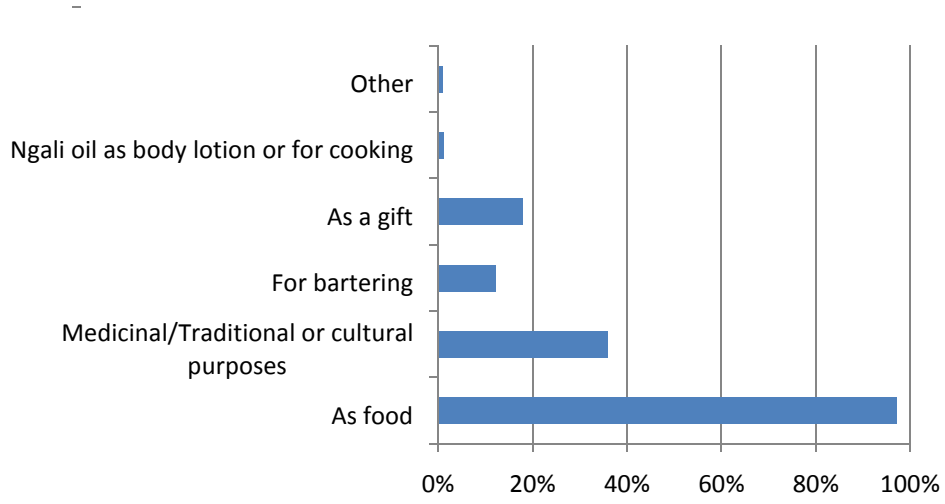


FIGURE 20: USES OF CANARIUM NUTS

The consumption patterns of canarium nuts vary from consuming only when in season (36 per cent) to weekly (22 per cent), fortnightly (9 per cent), monthly (18 per cent), quarterly (10 per cent) or yearly (five per cent). In most the respondents households, everyone consumes canarium nuts.

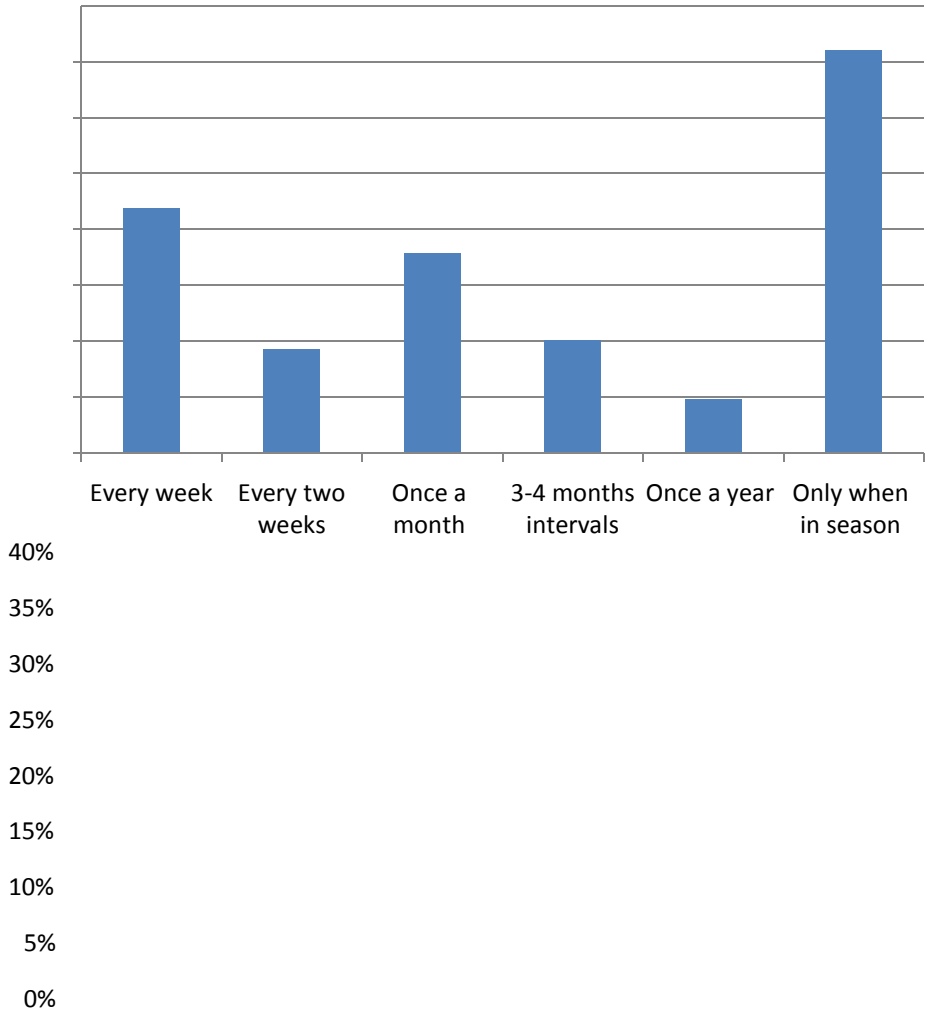


FIGURE 21: FREQUENCY OF CANARIUM NUT CONSUMPTION

Canarium nuts are most often consumed as a raw nut (93 per cent), in Masi Masi or other traditional recipes (68 per cent), as a roasted nut (46 per cent) or mixed with other nuts or foods (41 per cent). Canarium nuts are considered to be a healthy snack and a good nutritious food by 80 per cent of respondents. The remainder were largely unsure, with a few disagreeing with this statement. Approximately one quarter of respondents had experienced quality problems with the nut, complaining that at times the nut is tasteless or has a bad taste (potentially due to poor handling or drying techniques), and that if too many nuts are consumed it can cause stomach upsets.

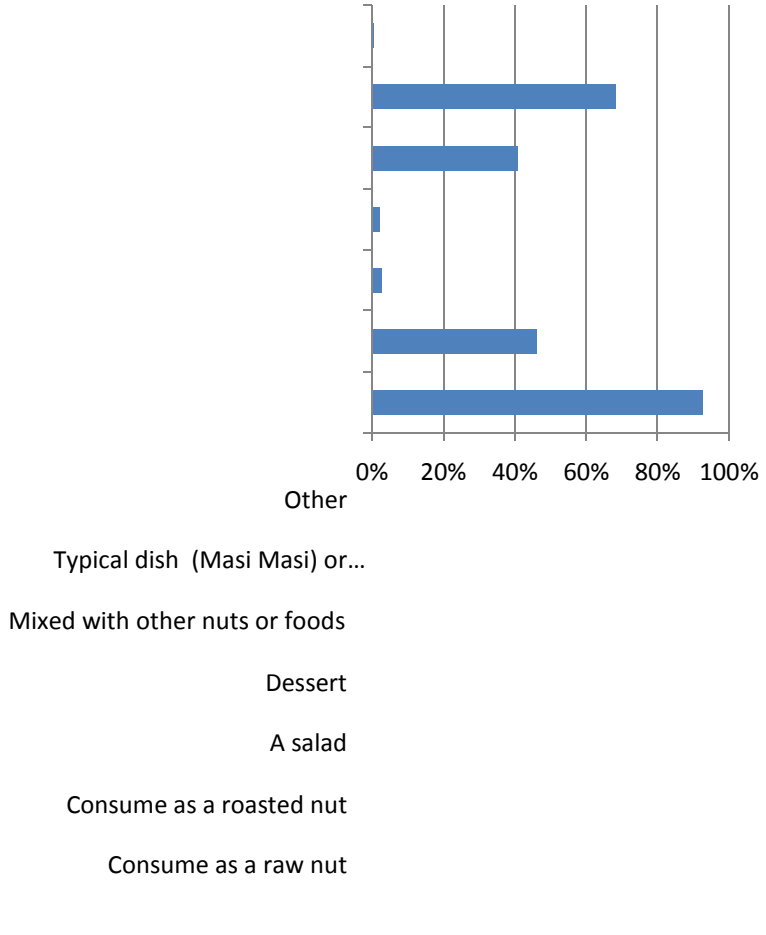


FIGURE 22: WAYS THE CANARIUM NUT IS CONSUMED

Purchasing of canarium nuts

Canarium nuts are most typically purchased when in season (32 per cent). Unsurprisingly, the canarium nut purchasing frequency closely resembles the consumption frequency, with

a similar pattern of monthly (15 per cent), fortnightly (10 per cent) and weekly (16 per cent) purchases.

Canarium nuts are most often purchased from the wet market (89 per cent) or a roadside stall (20 per cent. Around three quarters of respondents stated that they can only buy canarium nuts when they are in season, however a smaller amount (around 20 per cent) of respondent were able to find canarium nuts easily all year round. Approximately 60 per cent of respondents stated that they would buy more canarium nuts if they were available all year round.

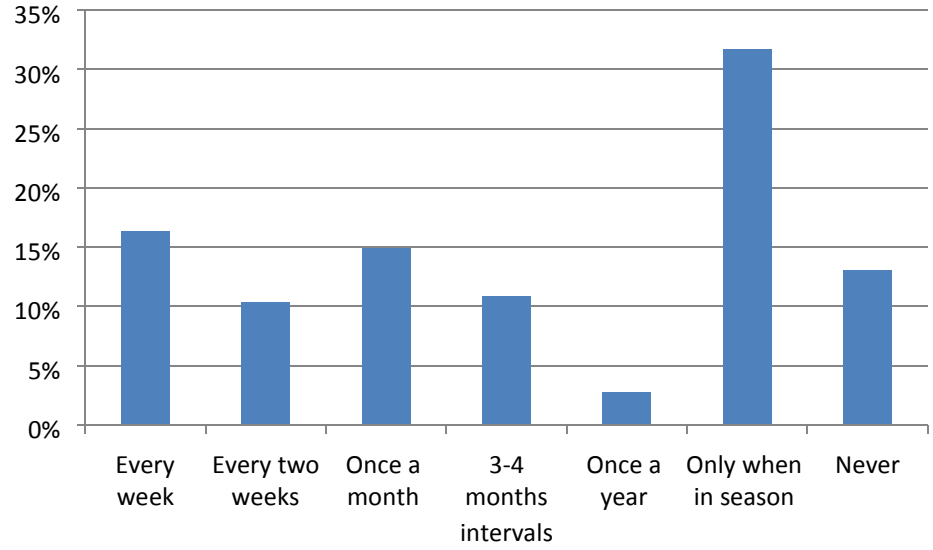


FIGURE 23: CANARIUM NUT PURCHASING FREQUENCY

Of the canarium nuts purchased, just over half of respondents buy canarium nuts as an occasional snack food. Just over a third buys the nuts as both a snack and for traditional uses, with 11 per cent buying canarium nuts purely to uses in traditional dishes and for events.

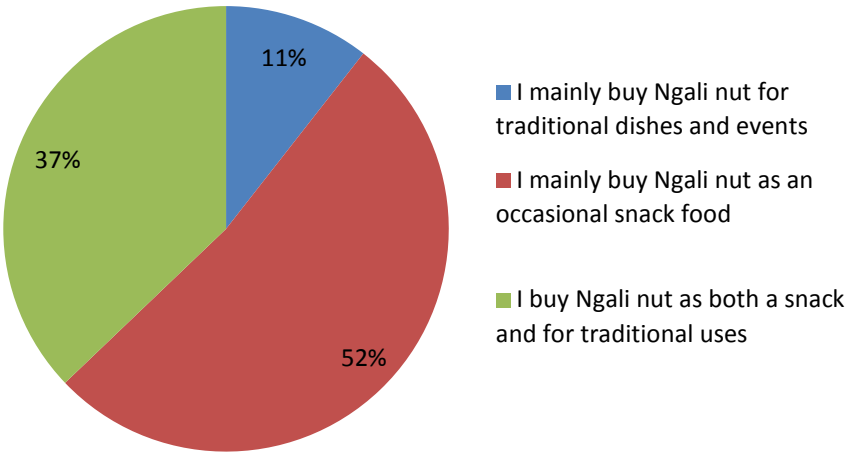


FIGURE 24: CANARIUM NUT PURCHASING HABITS

Comparisons between the different ways which canarium nuts are purchased versus how local consumers would prefer to buy them indicate that there is unmet demand for dried and packaged canarium nut as well as for canarium nut which has been value added, including roasted, salted, sugar coated, flavoured or in traditional recipes such as Masi Masi. At present 80 per cent of all canarium nuts are purchased as a fresh kernel, yet 51 per cent would prefer to purchase canarium in one of the value added forms outlined. This suggests

that if the value chain was further developed to include processing of the nut into various value added forms, that there would be a strong support from local consumers.

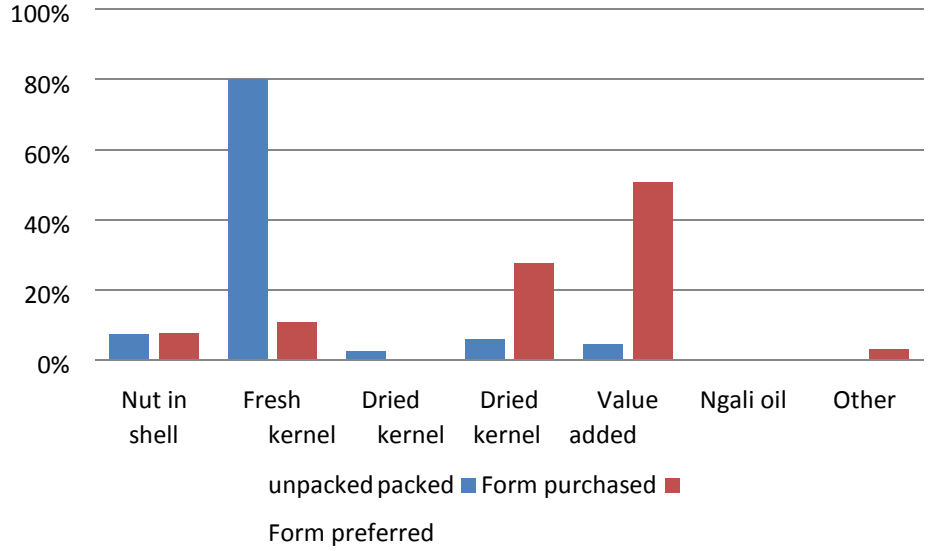


FIGURE 25: CANARIUM NUT PURCHASING –ACTUAL VS PREFERRED FORM

Delving deeper into the explicit preferences for canarium nut in different value added forms (selecting up to three options), respondents showed the strongest preference for roasted and salted canarium nuts (65 per cent), biscuits, cookies or cakes containing canarium nuts (51 per cent), traditional recipes containing canarium nut (46 per cent), ice-cream containing canarium nut (37 per cent), canarium as a snack nut (37 per cent) and cooking/body oil made from canarium nuts. Respondent's views of the commercial potential of the various forms of canarium nut largely mirrored their purchasing preferences, with roasted and salted canarium nuts viewed as having the greatest commercial potential by 20 per cent of respondents, followed by ice cream (18 per cent) cooking/body oil (16 per cent) and canarium in traditional recipes such as Masi Masi (15 per cent).

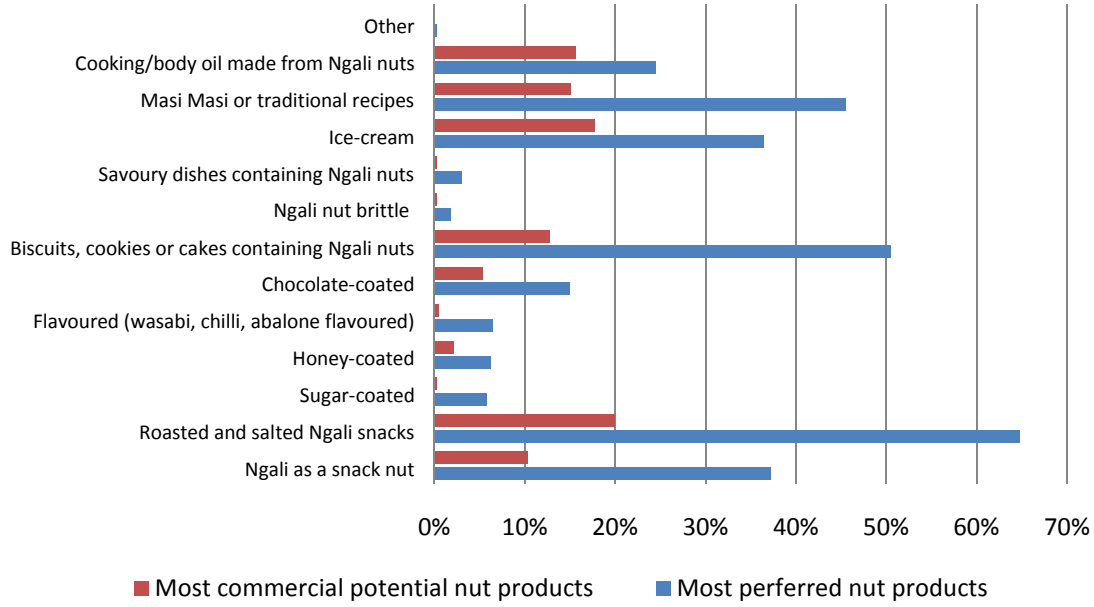


FIGURE 26: VALUE ADDED CANARIUM PURCHASING PREFERENCES

These insights into local consumer preferences and views towards what would have the most commercial potential will prove valuable in guiding future value chain development and commercialisation efforts for the canarium nut industry.

Local respondents indicated that they usually pay around SBD 7.10 per 100 gram canarium nuts in the form of fresh kernel. For dried canarium nut kernels, 89 per cent of respondents indicated that would be willing to spend less than 10 SBD for 100 grams. Respondents also indicated that they would not be willing to pay any more than this for canarium nut in their preferred form of value added canarium. This suggests that there is limited scope for price premiums for processing and value adding of canarium nuts. However, given that this is a hypothetical question, and that consumers may not have extensive knowledge of the quality attributes of these potential products, these responses should not be given too much weight. Further consumer research should be undertaken in the early stages of product development to showcase product attributes through marketing and tastings. This would allow for more accurate willingness to pay information to be elicited from potential consumers.

Attributes and consumer perception

Respondents were asked to rank which attributes were the most important in their canarium nut purchasing decision. Local consumers ranked taste (93 per cent), freshness (87 per cent) price (73 per cent) and nutritional characteristics (68 per cent) as very important attributes. Health attributes were very important for many respondents, including that they are free from chemicals and preservatives (55 per cent) and had organic certification (50 per cent). Supporting the local economy (83 per cent), helping local communities (82 per cent) and knowing that the nuts are a Solomon Islands product (77 per cent), were ranked by most respondents are either important or very important.

This responses to this question support further developing the value chain, with 86 per cent of respondents stating that having a wide variety of products to choose from was important or very important to them.

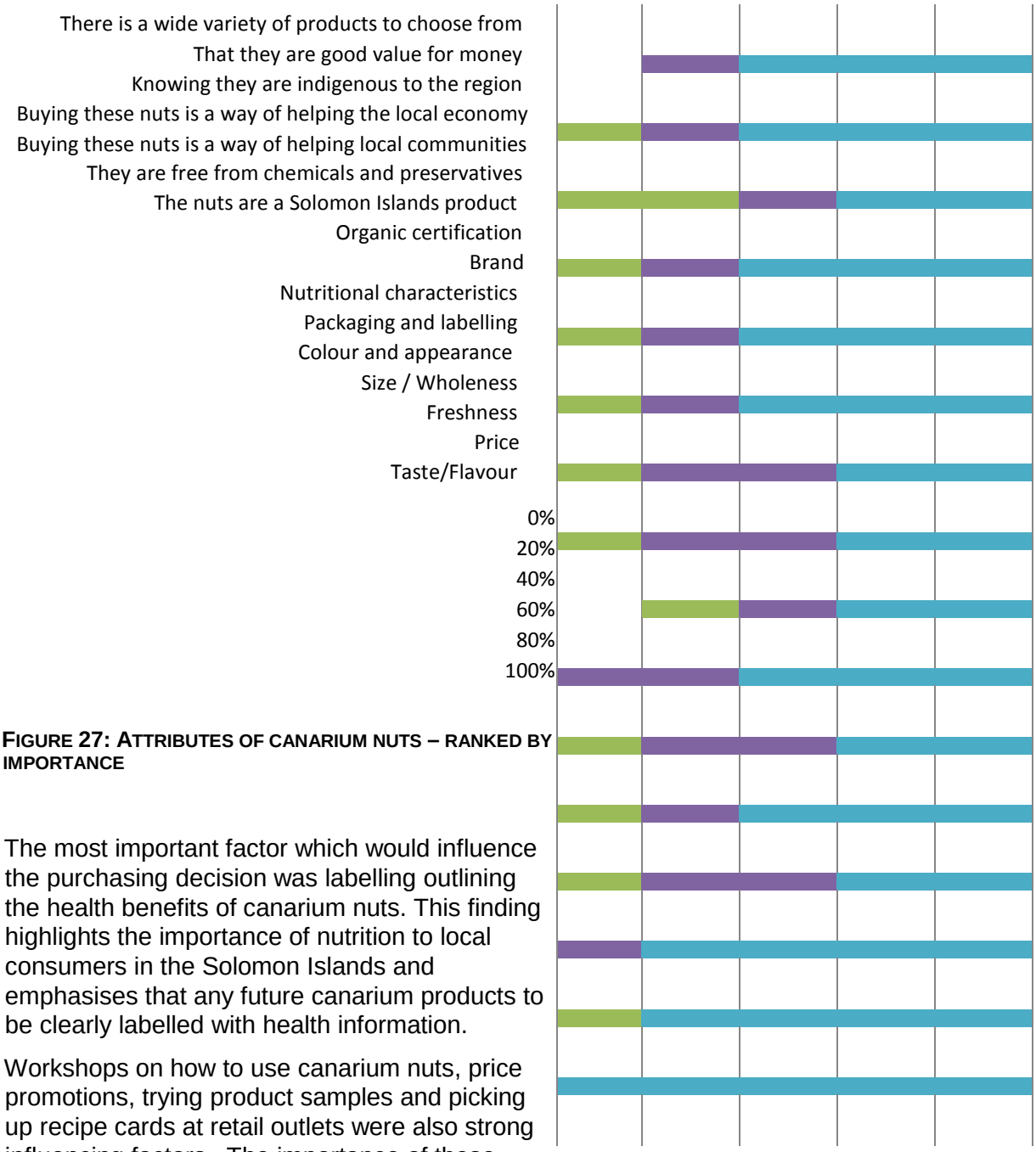


FIGURE 27: ATTRIBUTES OF CANARIUM NUTS – RANKED BY IMPORTANCE

The most important factor which would influence the purchasing decision was labelling outlining the health benefits of canarium nuts. This finding highlights the importance of nutrition to local consumers in the Solomon Islands and emphasises that any future canarium products to be clearly labelled with health information.

Workshops on how to use canarium nuts, price promotions, trying product samples and picking up recipe cards at retail outlets were also strong influencing factors. The importance of these influencing factors provide a useful guide of what would be expected to be the most effective marketing strategies for canarium nuts to local consumers in the Solomon Islands.

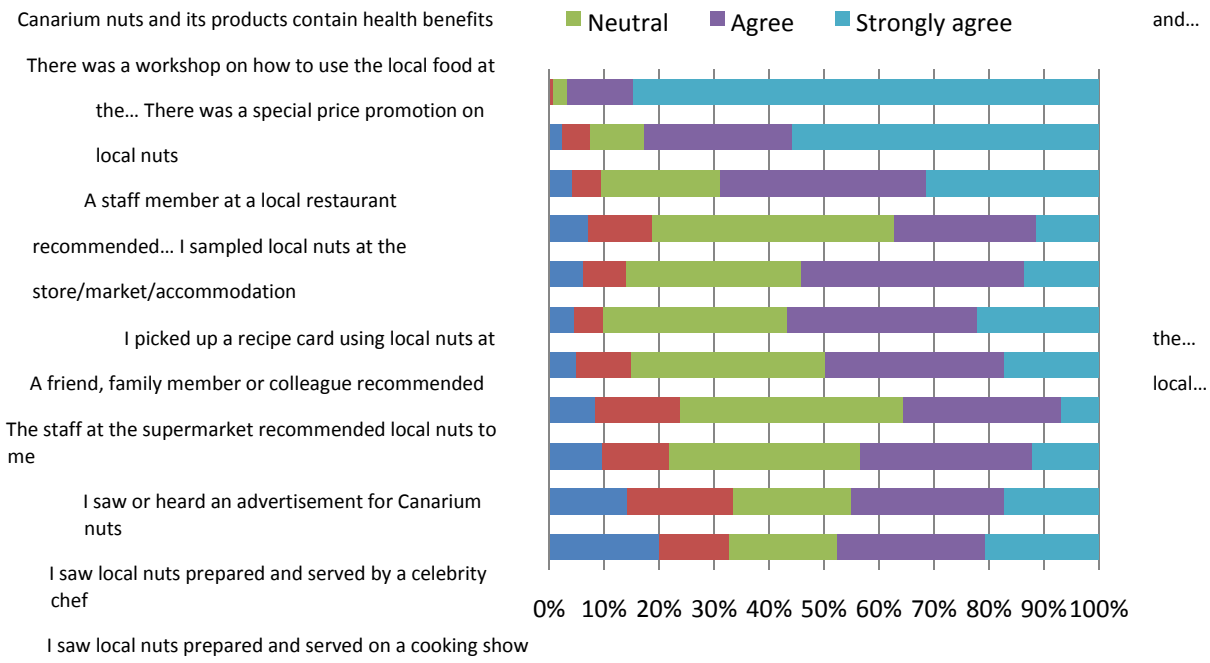
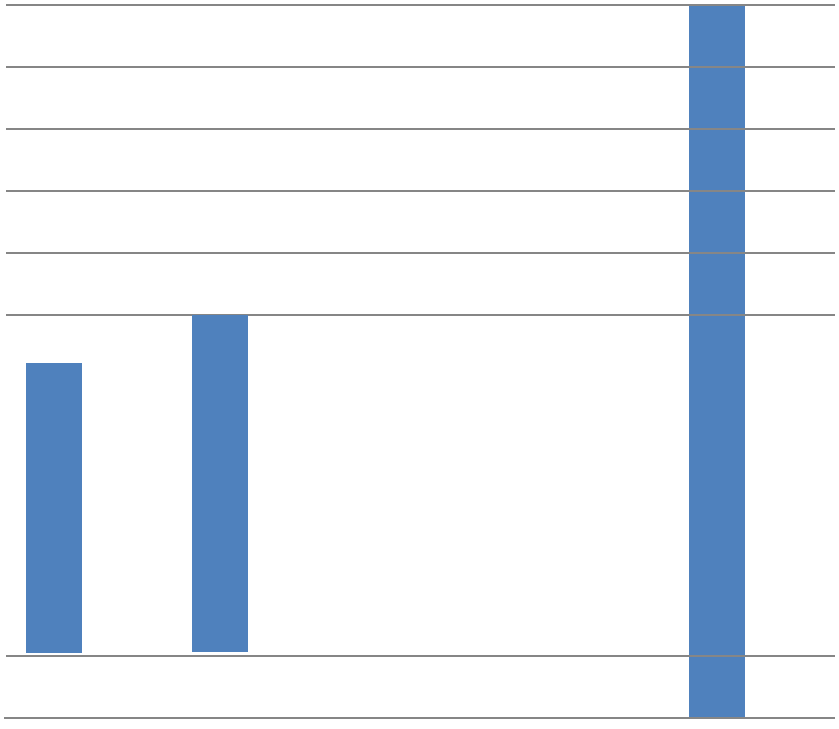


FIGURE 28: INFLUENCING FACTORS

Nut preferences

The highest number of respondents had tried canarium nut (100 per cent-as required to be eligible to participate in the survey), closely followed by Cut nut (96 per cent) and Terminalia/Beach Almond (83 per cent). The local respondents however preferred Cut nut (38 per cent) and Terminalia (37 per cent) over canarium nut, which only 16 per cent of respondents preferred.



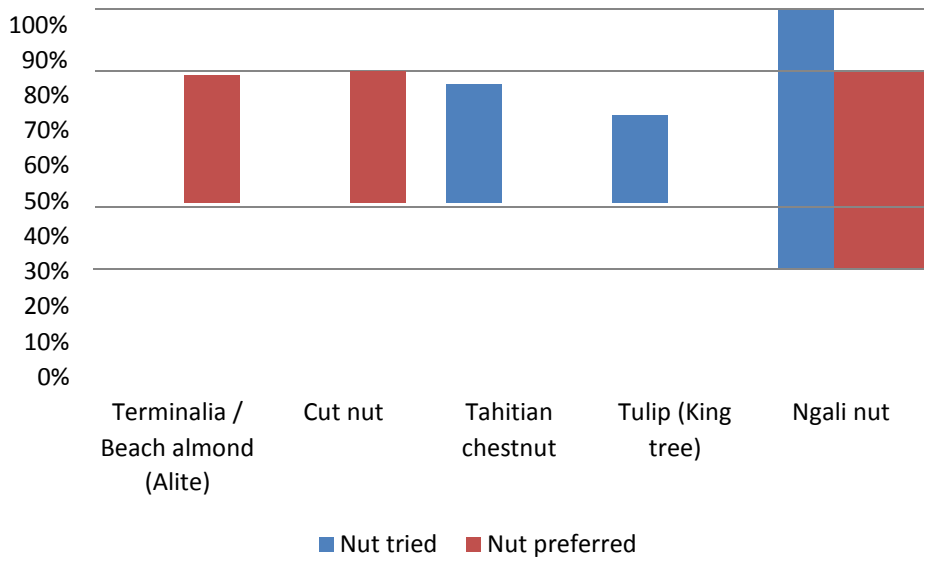


FIGURE 29: INDIGENOUS NUT CONSUMPTION AND PREFERENCES

Ngali nuts was the most appealing name for canarium nuts by 74 per cent of local respondents, unsurprising, given that this is the local Solomon Islands name for the nuts. Canarium nuts were the favoured name by 16 per cent of respondents, with the other potential names receiving little support.

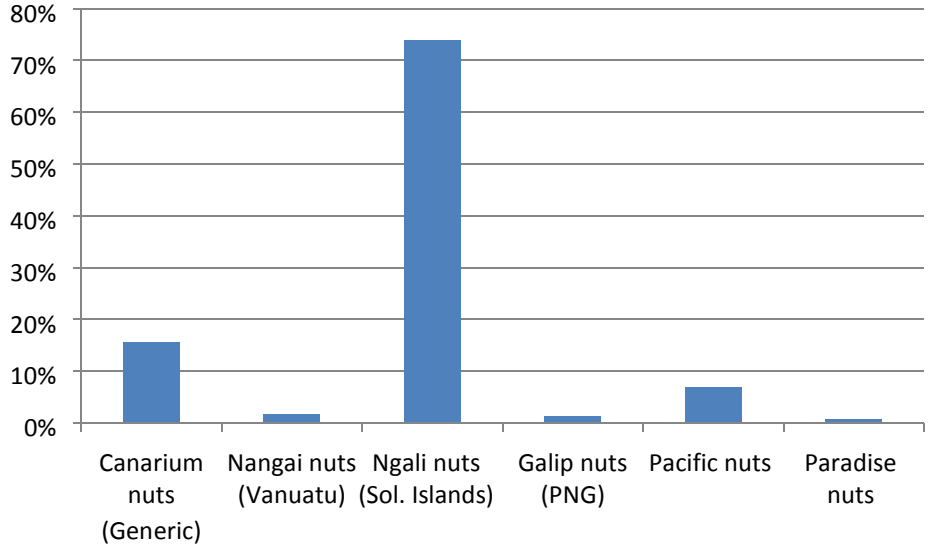


FIGURE 30: CANARIUM NUT NAME PREFERENCES

Moving Forward: the local market

The focus of market development efforts should be directed mainly towards the domestic market, given that this is where the greatest demand rests at present. However, product development and marketing strategies will benefit both current and future markets.

Organic certification, despite being ranked as either very important or important by 83 per cent of local respondents and 78 per cent of tourist respondents, may not be a viable option for producers. The current production methods are organic by default, however achieving certification may be cost prohibitive for local producers, with no guarantee that the benefits will flow down to producers. Potentially, in the future once the local industry is more developed and if the product is exported in larger quantities, it may be worth revisiting organic certification. Certifying the nuts as organic could provide further opportunities to not only boost sales but also potentially command a price premium from tourists or future export markets.

Local and tourist consumer preferences clearly highlighted a desire for labelling and branding that highlight that the nuts are local to the Solomon Islands and advertise the fact that they support the local community. Labelling and branding should be explored in the short term, as fair trade, sustainable sourcing and community development are becoming increasingly desirable attributes for consumers.

The current trend towards coconut oil as a cooking or body oil is part of a broader shift by consumers towards healthy alternatives to cook with and use for personal care. For 25 per cent of local and 31 per cent of tourist respondents, canarium cooking oil/body oil was a product preference. Canarium nuts are rich in oil, between 67 and 73 per cent, and this oil is commonly used as a medicinal product, for cooking, and in cosmetics and skin care products (Leakey et al., 2008). The literature suggests that canarium oil could be a natural anti-microbial and antioxidant agent (Obame et al., 2007), that it has medicinal traits, including anti-oxidant activity, anti-inflammatory activity and phenolic content (Leakey et al., 2008) and that its antioxidant status could have many health benefits (Shakirin et al., 2012). Local processors could produce canarium oil products and support further research into its many benefits.

The broader nutritional and health characteristics of canarium nuts could be further promoted and researched, given that this is viewed by 87 per cent of local respondents as either very important or important. This research could feed into educating the local and tourist market of the nutritional and health benefits as well as traditional uses of canarium and could be used as a key marketing tool in product and market development. The Pure Fiji brand is an example of how the Pacific Island location can be successfully used as a selling point to market local body oil products. Given strong consumer preferences for healthy alternatives to vegetable oils, further research could be conducted into the viability of a canarium oil product.

Conclusion

The industry appears to have a lot of development potential; however future development of the industry could take a staged approach, as initially the canarium industry needs to focus on its the quality and quantity issues. Existing processing firms need to build capacity, and new processing firms must start before the industry can become more commercialised. At the present, nuts are only available when in season; however there is unmet domestic demand for the product all year round. For canarium to be available year round, processing and packaging challenges must first be addressed so that canarium in its value added form, can be available year round for local consumption.

Both locals and tourists had a strong preference for roasted or salted canarium, canarium as a snack nut, canarium in traditional dishes and canarium oil. Given the common interest in these products, market and product development should first focus on rolling out these preferred products. The survey results can help to inform value adding efforts by the processing firms, so that they can better target future efforts towards the local market. Once these new products are developed, further research will be required to elicit more detailed information on consumer preferences and willingness to pay.

In order to commercialise these products, the capacity of existing processors needs to be increased and new firms need to enter the market to expand the processing capacity of the industry. The traditional nut drying techniques used in the villages is able to successfully stabilise the nut so that it won't go off, providing an excellent starting point for further processing improvements and processors value adding options.

Community based organisations (CBO's) have also been a valid option for linking producers to processors to overcome economies of scale and logistic constraints. This also allows villages to sell excess canarium stock for a commercial return while still using canarium for its traditional uses. Moving forward, these industry structures can be modified slightly as the industry grows and becomes more commercial. Canarium trees could be planted around the villages to boost supply and feed into the CBO model and plantations could be established as long as ownership and land tenure issues can be dealt with. Either way, there is an opportunity to increase the production of canarium while supporting local community livelihoods.

Once the industry is able to maintain consistent quality supply, potential export markets in the region could be explored. This stage of development would be more likely to succeed when the industry has matured to a point where multiple processors have built up their capabilities to handle the quantity and quality required to make exports viable. This staged approach can help ensure that the industry develops in a sustainable manner, which respects the local environment and culture, such that the livelihood benefits can be enjoyed for years to come.

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Appendix A: Canarium Tourist Survey

TOURIST QUESTIONNAIRE CANARIUM NUTS

SOLOMON ISLANDS FEB 2014

THE UNIVERSITY OF ADELAIDE

PARDI

The University of Adelaide is utilising the services of Maraghoto Consultancy Services to conduct a number of consumer surveys to help direct the development of the local Ngali nut industry. The project is part of the wider PARDI initiative, which stands for Pacific Agribusiness Research for Development Initiative, a project funded by the Australian Government focused on developing opportunities for high-value agriculture, forestry and fisheries products in the Pacific island countries.

The data collected as part of this survey is confidential and for research purposes ONLY. Only summary results will be included in published reports.

This Survey should take between 15 to 20 minutes to answer.

Enumerator to complete:

Date: _____

Time: _____

Location: _____

Gender of respondent: ☐Male ☐Female

SCREENING QUESTIONS

S1. Are you a tourist, business traveller or temporary visitor to the Solomon Islands?

A ☐ No → *THANK YOU FOR YOUR PARTICIPATION, HOWEVER THIS SURVEY IS FOR TOURISTS ONLY*

B ☐ Yes

S2. Which one of the following age groups do you fall into?

A ☐ Under 18 years →*THANK YOU FOR YOUR PARTICIPATION, HOWEVER THE SURVEY REQUIRES PEOPLE TO BE OVER 18 YEARS OF AGE*

B ☐ 18-24

C ☐ 25-34

D ☐ 35-44

E ☐ 45-54

F ☐ 55 years or older

S3. How often do you BUY/CONSUME nuts or nut products such as biscuits or cereals that contain nuts?

A ☐ Never→*THANK YOU FOR YOUR PARTICIPATION, HOWEVER THE SURVEY IS SEEKING PEOPLE WHO BUY OR CONSUME NUTS OR NUT PRODUCTS*

B ☐ More than once per week

C ☐ Weekly

D ☐ Fortnightly

E ☐ Monthly

F ☐ A few times a year

G ☐ Once a year

---

1. What country are you visiting from? A. ☐ Australia
   - B. ☐ New Zealand
   - C. ☐ PNG
   - D. ☐ Fiji
   - E. ☐ Vanuatu
   - F. ☐ Other Pacific countries
   - G. ☐ Europe
   - H. ☐ USA
   - I. ☐ China
   - J. ☐ Other Asia
   - K. ☐ Other: _____

2. What was the primary nature of your visit to Solomon Islands? *PLEASE SELECT **ONE** ONLY*
   - A. ☐ Holiday / Vacation
   - B. ☐ Event/festival
   - C. ☐ Conference/seminar
   - D. ☐ Business
   - E. ☐ Visiting friends or relatives
   - F. ☐ Transit or stop over
   - G. ☐ Other, _____

3. How many times have you visited Solomon Islands in the last 5 years? *PLEASE SELECT **ONE** ONLY*
   - A. ☐ Never, this is your first visit
   - B. ☐ 2 to 3 times
   - C. ☐ 4 or more times

4. Do you think you will return to Solomon Islands? *PLEASE SELECT **ONE** ONLY*
   - A. ☐ Yes, in less than 2 years
   - B. ☐ Yes, between 2 and up to 4 years from now
   - C. ☐ Yes, in 4 years or more
   - D. ☐ Unlikely to return
   - E. ☐ Don't know

5. How did you enter/arrive in Solomon Islands? *PLEASE SELECT **ONE** ONLY*
   - A. ☐ Airplane
   - B. ☐ Cruise ship / sailed in
   - C. ☐ Other, _____

6. How long is your visit on this occasion?
   - A. ☐ 1 day
   - B. ☐ 2 to 7 days

C. ☐ 8 to 14 days

D. ☐ More than 14 days

7. Did you or are you planning to purchase any souvenirs or gifts from Solomon Islands?

   A. ☐ Yes → were any of these local food products or snacks? ☐ Yes → and what are they _____

   B. ☐ No

8. What activities are you interested in/have participated in while in The Solomon Islands? *PLEASE SELECT **MAX 3***
   A. ☐ Purchasing souvenirs/handicrafts from the islands
   B. ☐ Trying new dishes/foods typical to the islands
   C. ☐ Purchasing edible gifts from the islands to take home
   D. ☐ Experiencing traditional culture in rural areas where local products are made
   E. ☐ Water related adventures (diving, snorkelling, surfing, sailing)
   F. ☐ Outdoor activities (hiking, trekking, climbing, camping)
   G. ☐ Other, please explain: _____

9. Are you visiting Solomon Islands with others, such as friends or family?

   A. ☐ Yes → how many? _____

   B. ☐ No

10. Which of the following best describes your role in buying food, including selecting restaurant venues and meals, while visiting Solomon Islands? *PLEASE SELECT **ONE** ONLY*

    A. ☐ I was the main food buyer/decision maker

    B. ☐ I shared the food buying/ decision making with others

    C. ☐ I occasionally did some food buying/decision making

    D. ☐ I never did any food buying or decision making at all during this trip

11. What food outlets did you mainly frequent when eating out or purchasing food in Solomon Islands? *PLEASE SELECT **ALL** THAT APPLY*

    A. ☐ Fine dining restaurant

    B. ☐ Cafe

    C. ☐ Hotel or bistro

    D. ☐ Club

    E. ☐ Take away shop/fast food store

    F. ☐ Supermarket / small retail store

    G. ☐ Central Market

    H. ☐ Roadside Stall

    I. ☐ Other, please specify_____

12. Have you ever heard or tried canarium/Ngali nuts before? A. ☐ Yes (Go to Q13)
    B. ☐ No (Please read below) ***PROVIDE SAMPLE NOW!***

Only if the answer to Q12 is No:

Ngali nuts (*canarium indicum*) are harvested from indigenous trees throughout the South Pacific (particularly Solomon Islands, Vanuatu and Papua New Guinea). They are a traditional food with a naturally soft texture and pleasant mild flavour. **(Skip to Q14)**

13. This survey concerns a local nut grown and processed in the Solomon Islands. The nut is known by different names. Have you heard of any of the following?

A. canarium nuts (Generic) ☐Yes ☐No

B. Nangai nuts (Vanuatu) ☐Yes ☐No

C. Ngali nuts (Sol. Islands) ☐Yes ☐No

D. Galip nuts (PNG) ☐Yes ☐No

14. Of the different names for the local nuts, which name do you prefer for these nuts? *PLEASE SELECT **ONE** ONLY* A. ☐ canarium nuts

B. ☐ Nangai nuts

C. ☐ Ngali nuts

D. ☐ Galip nuts

E. ☐ Paradise nuts

F. ☐ Pacific nuts

G. ☐ Other suggestion_____

15. During your visit to the Solomon Islands did you purchase local nuts or local nut products?

A. ☐ YES, once (continue to Q16)

B. ☐ Twice (continue to Q16)

C. ☐ A few times (continue to Q16)

D. ☐ NO, I did not purchase any local nuts or local nut products *(Please continue with Q15a **BELOW)*** ↓

15a. Why did you **NOT** buy local nuts or nut products during your visit to Solomon Islands?
*PLEASE SELECT **ALL** THAT APPLY, THEN SKIP TO **Q 18***

A. ☐ Personal Dislike
B. ☐ Not aware of them
C. ☐ Advised not to eat local food
D. ☐ Not available where I shopped
E. ☐ Too expensive
F. ☐ Health safety concerns
G. ☐ Concerns about quality
H. ☐ No particular reason
I. ☐ Other reason_____

16. Where did you purchase the local nuts or local nut products from? *PLEASE SELECT **ALL** THAT APPLY*

A. ☐ Local/central/main market
B. ☐ Supermarket
C. ☐ Small Retail Store
D. ☐ Hotel/resort accommodation
E. ☐ Roadside stall
F. ☐ Restaurant or cafe
G. ☐ Other: _____

17. In what form/s did you purchase the local nut or local nut products? *PLEASE SELECT **ALL** THAT APPLY* A. ☐ Nut in shell

B. ☐ Fresh kernel
C. ☐ Dried kernel
D. ☐ Value added (e.g. packaged, salted, sugar or chocolate coated, flavoured)
E. ☐ Ice-cream
F. ☐ As an ingredient in another product (e.g. biscuits, muesli, Masi Masi, traditional recipes etc) G. ☐ Other: _____

18. Would you be interested in purchasing any of the following canarium /Ngali nut products? (Either for personal consumption or for a gift?) ***(Select Max 3 options)***
    - A. ☐ canarium / Ngali as a snack nut - just plain roasted nuts with no flavours?
    - B. ☐ Roasted and salted canarium / Ngali snack nuts?
    - C. ☐ Sugar-coated canarium /Ngali Snack nuts?
    - D. ☐ Honey-coated canarium/Ngali Snack nuts?
    - E. ☐ Flavoured Ngali nuts
    - F. ☐ Chocolate-coated canarium Ngali Snack nuts? G. ☐ canarium / Ngali nut biscuits, cookies or cake?
    - H. ☐ Ngali nut brittle (a confectionary made with hard sugar embedded with nuts)
    - I. ☐ A local Solomon Island dish called "Masi Masi" or other traditional canarium / Ngali dishes?
    - J. ☐ Cooking/body oil made from canarium /Ngali nuts?
    - K. ☐ Other: _____

19. Which of the above mentioned products do you think has the most potential and why? _

20. How much would you be willing to pay for a **100 grams** package of dried Ngali nut kernels?

(Show the respondent a 100g sample pack if they are not sure on the size SBD: Solomon Islands dollars)

- A. ☐ I am not willing to spend anything on nuts while on the Solomon Islands
- B. ☐ Less than SBD 10 (Less than AUD $1.50)
- C. ☐ Between SBD 11 and 15 (Between AUD $1.50 and $2.25) D. ☐ Between SBD 16 and 20 (Between AUD $2.25 and $3.00)
- E. ☐ Between SBD 20 and 30 (Between AUD $3.00 and $4.50)
- F. ☐ Over SBD 31 (Over AUD $4.50)

We would like to find ways to encourage tourists to purchase more of the local nut or local nut products when visiting Solomon Islands. The next series of questions are to assist us in understanding attributes that are important to you.

21. *On a scale of 1 'not important at all' to 5 'very important', please rate the following attributes of local nut or local nut products that would encourage you to purchase or purchase more?*

		Not important at all				***Very important***
A.	Taste/Flavour	1	2	3	4	5
B.	Price	1	2	3	4	5
C.	Freshness	1	2	3	4	5
D.	Size / Wholeness	1	2	3	4	5
E.	Colour and appearance	1	2	3	4	5
F.	Packaging and labelling	1	2	3	4	5
G.	Nutritional characteristics	1	2	3	4	5
H.	Brand	1	2	3	4	5
I.	Organic certification	1	2	3	4	5
J.	The Nuts are a Solomon Islands product	1	2	3	4	5
K.	They are free from chemicals and preservatives	1	2	3	4	5
L.	Buying these nuts is a way of helping local communities	1	2	3	4	5
M.	Buying these nuts is a way of helping the local economy (e.g. retailers, processors, etc.)	1	2	3	4	5
N.	Knowing they are indigenous to the region	1	2	3	4	5
O.	That they are good value for money	1	2	3	4	5
P.	There is a wide variety of products to choose from	1	2	3	4	5

The next series of questions is about what may influence people to purchase or purchase more local nuts while visiting Solomon Islands. Please indicate to what extent do you agree with the following statements on a scale of 1 'strongly disagree' to 5 = 'strongly agree'

22. I was or could have been influenced to purchase or purchase more local nuts while visiting Solomon Islands if....

	Strongly Disagree				***Strongly Agree***
A. I saw local nuts prepared and served on a cooking show, such as Master Chef, or at a local tour	1	2	3	4	5
B. I saw local nuts prepared and served by a celebrity chef	1	2	3	4	5
C. I saw or heard an advertisement for local nuts while on holiday	1	2	3	4	5
D. The staff at the supermarket recommended local nuts to me	1	2	3	4	5
E. Staff at my holiday accommodation recommended local nuts	1	2	3	4	5
F. A friend, family member or colleague recommended local nuts to me	1	2	3	4	5
G. I picked up a recipe card using local nuts at the store/market/tour	1	2	3	4	5
H. I sampled local nuts at the store/market/accommodation	1	2	3	4	5
I. There was a special price promotion on local nuts	1	2	3	4	5
J. There was a demonstration on how to use the local food at the store/market/holiday accommodation/tour	1	2	3	4	5
K. A staff member at a local restaurant recommended local nuts to me	1	2	3	4	5

23. Would you be prepared to pay more for nuts that were clearly branded as being local to the Solomon Islands?
    - A. ☐ No
    - B. ☐ Yes -> How much more, expressed as a percentage, would you be prepared to pay (eg 10% more)

_____%

24. Have you ever tried any of the following indigenous nuts? Please select all that apply. C. ☐ Terminalia / Beach almond (Alite)
    - D. ☐ Cutnut
    - E. ☐ Tahitian chestnut
    - F. ☐ Tulip (King tree)
    - G. ☐ No, I have not heard of any of these (Please skip to ***DEMOGRAPHICS***)

25. Including Ngali nuts on the previous list of indigenous nuts, is there a nut you prefer among these 5 nuts? Why? (Make sure you don't just show them the list of 4 nuts above. They need to choose from all 5 nuts including Ngali nut) A. ☐ Yes, I prefer _____
    - B. ☐ No

Why: _____

DEMOGRAPHICS

26. Please indicate the category that best describes the highest level of education that you have achieved
    A. ☐ Some primary school
    B. ☐ Primary school
    C. ☐ Secondary School
    D. ☐ Diploma (Technical School, TAFE)
    E. ☐ Bachelor's degree from University
    F. ☐ Masters, PhD,
    G. ☐ Other:_____

27. What is your usual occupation? _____

28. What is your marital status?
    A. ☐ Single, never been married
    B. ☐ Married
    C. ☐ De Facto
    D. ☐ Divorced
    E. ☐ Widow

29. How many people are living in your household back home? _____

30. How many of them are children under 18 years?_____

31. How many of them are children under 5 years?_____

32. Is there any piece of advice or suggestion you can think of regarding the Ngali nuts that might be useful for us?

_____
_____
_____

Thank you for your participation!!!

Appendix B: Local Consumer Survey

CONSUMER SURVEY CANARIUM/NGALI NUTS SOLOMON ISLANDS FEBRUARY 2014 THE UNIVERSITY OF ADELAIDE PARDI

The University of Adelaide is utilising the services of Maraghoto Consultancy Services to conduct a number of consumer surveys to help direct the development of the local Ngali nut industry. The project is part of the wider PARDI initiative, which stands for Pacific Agribusiness Research for Development Initiative, a project funded by the Australian Government focused on developing opportunities for high-value agriculture, forestry and fisheries products in the Pacific island countries.

The data collected as part of this survey is confidential and for research purposes ONLY. Only summary results will be included in published reports.

This Survey should take between 15 to 20 minutes to answer.

Enumerator to complete:

Date: _____

Time: _____

Location: _____ Gender

of respondent: ☐Male ☐Female

SCREENING QUESTIONS

S1. Which one of the following age groups do you fall into?

A ☐ Under 18 years →*THANK YOU FOR YOUR PARTICIPATION, HOWEVER THE SURVEY REQUIRES PEOPLE TO BE OVER 18 YEARS OF AGE*

B ☐ 18-24

C ☐ 25-34

D ☐ 35-44

E ☐ 45-54

F ☐ 55 years or older

S2. How often do you BUY/CONSUME nuts or nut products such as biscuits or cereals that contain nuts?

A ☐ Never→*THANK YOU FOR YOUR PARTICIPATION, HOWEVER THE SURVEY IS SEEKING PEOPLE WHO BUY OR CONSUME NUTS OR NUT PRODUCTS*

B ☐ More than once per week

C ☐ Weekly

D ☐ Fortnightly

E ☐ Monthly

F ☐ A few times a year

G ☐ Once a year

S3. Which of the following options describes you best?

A ☐ I'm a Local living in Solomon Islands

B ☐ I'm an Expat living in Solomon Islands

C ☐ I'm a tourist in Solomon Islands → PLEASE REFER TO THE TOURIST QUESTIONNAIRE.

S4. Are you aware/have you heard of Ngali nuts (Nangai nuts/canarium nuts/Galip nuts)

A ☐ Yes, I'm aware of these nuts and have tried them in the past

B ☐ I've heard of the nuts but have not tried them before ***(PROVIDE SAMPLES NOW)***

C ☐ No, I never heard nor have tried these nuts → *THANK YOU FOR YOUR PARTICIPATION, HOWEVER THE SURVEY IS SEEKING PEOPLE WHO ARE AWARE, BUY OR CONSUME NGALI NUTS*

QUESTIONNAIRE

1. Who makes the majority of food purchasing decisions for your household?
   - A. ☐ Myself
   - B. ☐ My spouse or partner
   - C. ☐ A relative of mine (brother, sister, cousin)
   - D. ☐ A non-relative (friend, flatmate, partner's relative) E. ☐ Other:_____

2. Where do you purchase the majority of your Fruits, Vegetables and Nuts?
   - A. ☐ Local/central market (wet market)
   - B. ☐ Supermarket / Small Retail Store
   - C. ☐ Road side market
   - D. ☐ Directly from the growers
   - E. ☐ I do not purchase the majority of my food, I grow it myself
   - F. ☐ Other: _____

The following questions relate to the canarium/Ngali nuts as part of a study to understand the consumer insight and preferences on the nuts.

3. Do you use Ngali nuts for any of the following options? (Select all that apply)
   - A. ☐ As food
   - B. ☐ Medicinal/Traditional or cultural purposes
   - C. ☐ For bartering
   - D. ☐ As a gift
   - E. ☐ Ngali oil as body lotion or for cooking
   - F. ☐ Other, please explain: _____

4. On average, how frequently do people in your household CONSUME Ngali nuts
   - A. ☐ Every week
   - B. ☐ Every two weeks
   - C. ☐ Once a Month
   - D. ☐ 3-4 months intervals
   - E. ☐ Once a year
   - F. ☐ Only when in season (please indicate approximate month _____)

5. Who in your household CONSUMES Ngali nuts? (Mark all that apply)
   - A. ☐ Everyone
   - B. ☐ Men
   - C. ☐ Women
   - D. ☐ Children

6. If you consume the nut as food or use it in a dish, what is the most common way you would use it? (Select Max 3 options)
   - A. ☐ Consume as a raw nut
   - B. ☐ Consume as a roasted nut
   - C. ☐ A salad
   - D. ☐ Dessert
   - E. ☐ Mixed with other nuts or foods
   - F. ☐ Typical dish (Masi Masi) or other traditional recipes
   - G. ☐ Other, please explain: _____

7. Do you consider Ngali nuts to be a healthy snack and a good nutritious food?
   - A. ☐ Yes
   - B. ☐ No
   - C. ☐ Unsure

8. Have you experienced any quality problems when consuming/purchasing Ngali nuts?
   - A. ☐ Yes
   - B. ☐ No
   - C. ☐ If yes, please describe: _____

PURCHASING OF NGALI NUTS

9. How frequently do you BUY Ngali nuts (only want one answer)
   - A. ☐ Every week
   - B. ☐ Every two weeks
   - C. ☐ Once a Month
   - D. ☐ 3-4 months intervals
   - E. ☐ Once a year
   - F. ☐ Only when in season (please indicate approximate weeks per year_____)
   - G. ☐ Never, I do not buy the nuts as I either grow them or have access to them for no cost (SKIP TO QUESTION 16)

10. Where do you usually BUY the Ngali nuts from:
    - A. ☐ Local/central/main market
    - B. ☐ Supermarket
    - C. ☐ Small Retail Store
    - D. ☐ Road side market
    - E. ☐ Restaurant or Cafe
    - F. ☐ Directly from the growers

G. ☐ Other: _____

11. Which of the following applies when BUYING Ngali nuts:
    A. ☐ I can easily find themd all year round
    B. ☐ I can only buy them when in season
    C. ☐ It is difficult to find Ngali nuts even when they are in season
    D. ☐ I can never find Ngali nuts to buy

12. How best describes your Ngali nut purchasing habits?
    A. ☐ I mainly buy Ngali nut for traditional dishes and events
    B. ☐ I mainly buy Ngali nut as an occasional snack food
    C. ☐ I buy Ngali nut as both a snack and for traditional uses

13. Would you buy more nuts if they were available all year round?
    A. ☐ Yes
    B. ☐ Maybe
    C. ☐ No

14. How do you usually buy Ngali nuts? (only want one answer)
    A. ☐ Nut in shell
    B. ☐ Fresh kernel
    C. ☐ Dried kernel unpacked
    D. ☐ Dried kernel packed
    E. ☐ Value added, e.g. roasted, salted, sugar coated, flavoured, Masi Masi, traditional recipes etc.
    F. ☐ Ngali oil
    G. ☐ Other: _____

15. Considering your answer in the question above (Q14) what is the amount (e.g. grams, Kg, ml or number of kernels) that you generally buy and how much do you usually pay? (Av dry kernel weight is 2.8g)
    A. The price I usually pay for the amount listed is: SBD$: _____ for (Size/amount) _____

16. Is this how you **PREFER** to purchase the nut (in Q14)?
    A. ☐ Yes (Skip to Q19)
    B. ☐ No (go to Q17)

17. How would you **PREFER** to purchase the nut?
    A. ☐ Nut in shell
    B. ☐ Fresh kernel
    C. ☐ Dried kernel unpacked
    D. ☐ Dried kernel packed
    E. ☐ Value added, e.g. roasted, salted, sugar coated, flavoured, etc.
    F. ☐ Ngali oil
    G. ☐ Other: _____

18. Considering the type of Ngali nut you indicated you **PREFER** to purchase in Q17, what is the amount (e.g. grams, Kg,ml or number of kernels) that you would buy and how much would you be willing to pay for this product? (Av dry kernel weight is 2.8g)
    A. The price I would be willing to pay is: SBD$: _____ for (Size/amount) _____
19. Would you be interested in purchasing any of the following Ngali nut products? (Either for personal consumption or as a gift?) (**Select Max 3 options**)

    A. ☐ Ngali as a snack nut - just plain roasted nuts with no flavours?
    B. ☐ Roasted and salted Ngali snacks?
    C. ☐ Sugar-coated?
    D. ☐ Honey-coated?
    E. ☐ Flavoured (wasabi, chilli, abalone flavoured)
    F. ☐ Chocolate-coated?

G. ☐ Biscuits, cookies or cakes containing Ngali nuts?
H. ☐ Ngali nut brittle (a confectionary made with hard sugar embedded with nuts)
I. ☐ Savoury dishes containing Ngali nuts?
J. ☐ Ice-cream
K. ☐ Masi Masi or traditional recipes
L. ☐ Cooking/body oil made from Ngali nuts?
M. ☐ Other: _____

20. Which of the above do you think has the most commercial potential and why?

_____

_____

21. How much would you be willing to pay for a 100 grams package of dried Ngali nut kernels? (Show the respondent a 100g sample pack if they are not sure on the size SBD: Solomon Islands dollars)
    A. ☐ I would not spend anything on Ngali nuts
    B. ☐ Less than 10 SBD
    C. ☐ Between 11-15 SBD
    D. ☐ Between 16-20 SBD
    E. ☐ Between 21-30 SBD
    F. ☐ Over 30 SBD

ATTRIBUTES AND CONSUMER PERCEPTION

22. When purchasing Ngali nuts for personal consumption or as a gift, how important are the following attributes?

Please rate the importance of each attribute using the scale 1 to 5 being 1 not important at all and 5 very important.

		Not important at all				Very important
A.	Taste/Flavour	1	2	3	4	5
B.	Price	1	2	3	4	5
C.	Freshness	1	2	3	4	5
D.	Size / Wholeness	1	2	3	4	5
E.	Colour and appearance	1	2	3	4	5
F.	Packaging and labelling	1	2	3	4	5
G.	Nutritional characteristics	1	2	3	4	5
H.	Brand	1	2	3	4	5
I.	Organic certification	1	2	3	4	5
J.	The Nuts are a Solomon Islands product	1	2	3	4	5
K.	They are free from chemicals and preservatives	1	2	3	4	5
L.	Buying these nuts is a way of helping local communities	1	2	3	4	5
M.	Buying these nuts is a way of helping the local economy (e.g. retailers, processors, etc.)	1	2	3	4	5
N.	Knowing they are indigenous to the region	1	2	3	4	5
O.	That they are good value for money	1	2	3	4	5
P.	There is a wide variety of products to choose from	1	2	3	4	5

23. What sort of attributes or characteristics not mentioned before are you interested/concerned regarding the consumption/purchase of the Ngali nuts?

_____
_ _____

24. The next series of questions are about what may influence people to purchase or purchase more Ngali nuts. Please indicate to what extent do you agree or disagree with the following statements on a scale of 1 ‘strongly disagree’ to 5 = ‘strongly agree’

I can be influenced to purchase or purchase more Ngali nuts if....

	Strongly Disagree				Strongly Agree
A. I saw local nuts prepared and served on a TV, radio, cooking show, or at a					

	1	2	3	4	5
local tour…..					
B. I saw Ngali nuts prepared and served by a local celebrity/chef	1	2	3	4	5
C. I saw or heard an advertisement with Ngali nuts	1	2	3	4	5
D. The staff at the supermarket recommended Ngali nuts to me	1	2	3	4	5
E. A friend/family member/colleague recommended Ngali nuts to me	1	2	3	4	5
F. I picked up a recipe card using Ngali nuts at the store/market/tour	1	2	3	4	5
G. I sampled Ngali nuts at the store/market/accommodation	1	2	3	4	5
H. A staff member at a local restaurant recommended Ngali nuts	1	2	3	4	5
I. There was a special price promotion on Ngali nuts	1	2	3	4	5
J. There was a workshop on how to use local food at the store/market/holiday accommodation/tour	1	2	3	4	5
K. The Ngali nuts and its products contain health benefits and these are explained in the label	1	2	3	4	5

25. Have you ever tried any of the following indigenous nuts? Please select all that apply.

A. ☐ Terminalia / Beach almond (Alite)
B. ☐ Cut nut
C. ☐ Tahitian chestnut
D. ☐ Tulip (King tree)
E. ☐ No, I have not heard of any of these (Please skip to Q27)

26. Including Ngali nuts on the previous list of indigenous nuts, is there a nut you prefer among these 5 nuts? Why? (Make sure you don't just show them the list of 4 nuts above. They need to choose from all 5 nuts including Ngali nut)

A. ☐ Yes, I prefer _____ B. ☐ No
Why: _____

27. Ngali nuts are known by different names. Which of the following appeals more to you?

A. ☐ canarium nuts (Generic)
B. ☐ Nangai nuts (Vanuatu)
C. ☐ Ngali nuts (Sol. Islands)
D. ☐ Galip nuts (PNG)
E. ☐ Pacific Nuts
F. ☐ Paradise Nuts

DEMOGRAPHICS

28. Please indicate the category that best describes the highest level of education that you have fully completed:

A. ☐ Some primary school
B. ☐ Primary school
C. ☐ Secondary School
D. ☐ Diploma (Technical School, TAFE)
E. ☐ Bachelor's degree from University
F. ☐ Masters, PhD

G. ☐ Other:_____

29. What is your usual occupation? _____

30. What is your marital status?
    A. ☐ Single, never been married
    B. ☐ Married
    C. ☐ De Facto
    D. ☐ Divorced
    E. ☐ Widow
31. How many people live in your household? _____
32. How many of them are children under 18 years? _____ 33. How many of them are children under 5 years? _____
34. Is there any piece of advice or suggestion you can think of regarding the Ngali nuts that might be useful for us?

_____
_
_____
_ _____

Thank you for your participation!!!

THE UNIVERSITY OF ADELAIDE

Australian Nut Processor Research Insights

Canarium nut enterprise survey

Pacific Agribusiness Research for Development Initiative

2013

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Table of Figures

1.0 Background

*Canarium indicum*is indigenous to Melanesia (including Vanuatu, Solomon Islands and PNG) and produces edible fruit, nuts and timber. Traditionally, the nuts are mostly traded fresh in roadside and village markets, either as nut-in-shell or as dried kernels. Each countries 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[2].

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. This in turn could improve the livelihoods of smallholders and business operators across the three countries[3]. This project adds to this focus through emphasising developing opportunities for high-value agriculture, forestry and fisheries products in Pacific island countries.

In an effort to understand the potential value of canarium to international nut enterprises the Pacific Agricultural Research for Development Initiative (in association with the University of Adelaide and the University of the Sunshine Coast) instigated a survey based review of a group of Australian nut enterprises. PARDI are interested in the development of the canarium nut industry and the possibility of future export opportunities into Australia and abroad. This survey represents the first step in understanding the requirements and possible interests of commercial nut entities outside of Vanuatu.

Composition of 100g of Canarium kernel in dry basis

	Average	Min	Max
Protein	13.60%	12.70%	14.40%
Calories	703.5	680	727
Total fat	68.87%	66.30%	75.40%
Oleic*	44.77%		
Palmitic*	25.90%		
Carbohydrate	11.32%	11.04%	11.60%
Fibre	10.25%	4.10%	16.40%
Calcium (mg/100g)	70	68	72
Iron (mg/100g)	4.15	2.9	5.4
Vit. C (mg/100g)	12.38		

* As a percentage of the total fat

Sources: Eulensen 1994; English 1996; Leakey 2007; Suhartati 2011

[2] *Pacific Agribusiness Research Development Initiative 2012, South Pacific Canarium poised to become more than just nuts, PARDI fact sheet, Canberra*

[3] *Pacific Agribusiness Research Development Initiative 2012, Canarium nut value chain review, Canberra*

2.0 Methodology

50 companies from all over Australia were approached and invited to take part in the research trial. A brief explanation of the project was given, followed by a brochure containing the most relevant information about the canarium nuts'. CEOs of each company were contacted to approach company leadership about the trial and the concept of assessing a new nut variety.

The companies were sourced from the internet using Google as a search engine and from a database provided by the project partner at the University of the Sunshine Coast. Also, the director of one of the websites promoting nuts in the Australian market place spread the word about the trial amongst its members which established more valuable participants[4]. Of the 50 companies approached, 34 replied back and 21 were willing to take part of the trial.

The companies interested received a box with instructions, a value chain review document with the latest information about the canarium nuts, four questionnaires, and a selfaddressed envelope. They were also provided with two 250 gram packets containing dried canarium nuts sourced from Vanuatu. These nuts were dried in Vanuatu using a coal drier and then packaged in a sealed transparent plastic bag.

The questionnaires (*see Appendix A)* included a brief introductory paragraph and a composition table describing the nutritional value of the nuts (as shown in 1.0). This introduction was followed by 16 questions designed to obtain information about the companies, their impression of the nut, and the value they saw in the product.

The nut samples were sent to the companies in December 2012. After, emails and phone calls were made to ensure the companies had received the samples and were still keen to participate in the trial. Nuts were also sent to be analysed in two separate laboratories to get a more accurate and clear idea of the quality and characteristics of the nut variety (*see Appendix B*).

After four months, 16 companies sent back 25 completed questionnaires (shown in Figure.1). One of the companies withdrew from the trial explaining they were too busy to take part in the trial while another four said they would send the questionnaires back but these never reached our facilities.

Figure 22: Locations of the 16 companies involved in the trial

[4] *http://www.nutsforlife.com.au/index.php*

3.0 Results

The following chapter provides a summary of the collated survey results provided by nut producers. While there is some scope from the survey parameters, the results still provide a strong indication of the value canarium nuts could provide nut enterprises in Australia. Importantly this research illustrates several key areas that can be effectively utilized by both nut enterprises and canarium producers. These are:

- Processor companies
- Consumption preference
- Characteristics and strengths
- Nut attributes

3.1 Processor companies

The participant companies consisted of nut importers, exporters, processors, distributors, retailers, growers and marketers. Some companies were involved in more than one of these activities. However, the majority of the companies' core business was processing and to a lesser extent growers and importers of nuts.

When asked who their main customers were, the most common reply was wholesalers. This was followed by food processors, and on equal proportions supermarkets, specialist nut stores, and their own stores. Interestingly, none of the companies had online sales as their main customer, but this market may develop more in the future with technological advances.

The responses varied when the nut companies were asked what type of nuts they generally work with. The majority of companies, excluding a few specialists, were trading with more than one variety of nut. This trend was also shown with product volumes which also varied greatly. The most traded nut was macadamia closely followed by almonds, pecans and cashews. Only a few companies were also dealing with Brazil nuts, peanuts, beer nuts, pistachios, pine nuts and hazelnuts.

3.2 Consumption preference

After the introductory questions, company representatives were asked to try the nuts and then complete the rest of the questionnaire. We made sure to send samples from the same season to ensure freshness and commonality. We also reduced consumer bias via distraction by keeping the nuts in plain, non-descript packaging.

When we asked the respondents to write their first impression after trying the nuts, a wide variety of comments were documented. In order to summarize the comments and highlight the words that were used the most in the responses we designed a word cloud (Figure 2). This word cloud brings together the most relevant and important key words from the answers and creates a map that highlights the common words from the sample.

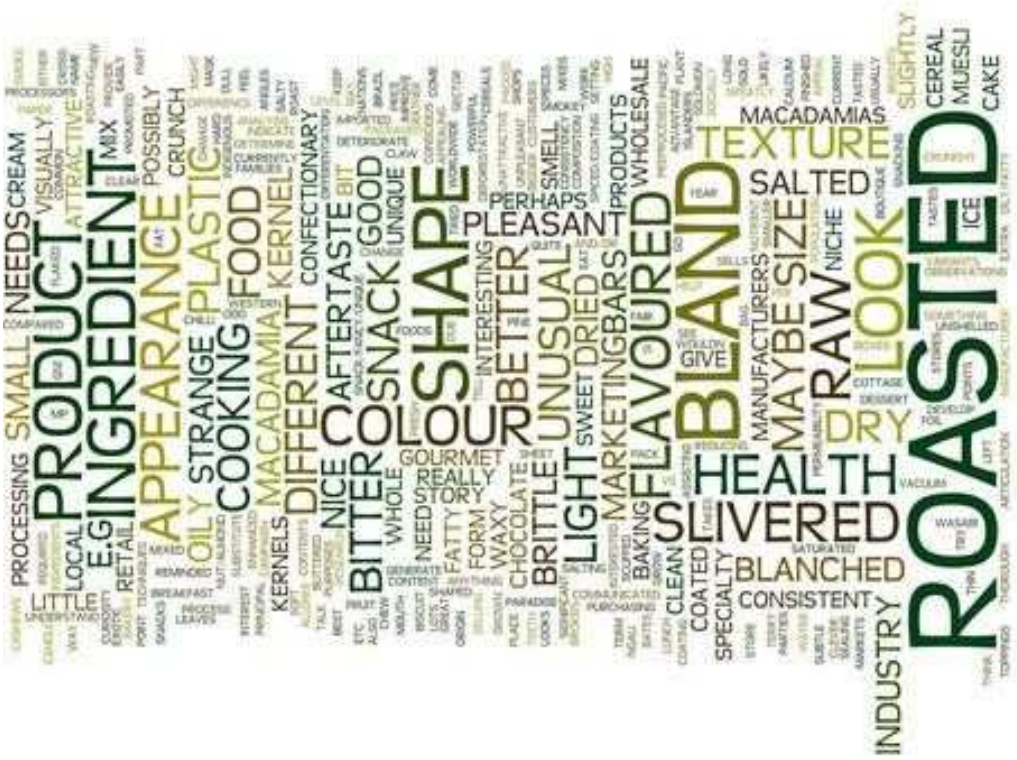

Figure 23: Word cloud

From the word cloud we can see that terms such as bland flavour, distinctive, shape, slivered, almonds, different, unique, cooking ingredient, bitter, smoky, strange, aftertaste, broken, pieces, oily, fatty, waxy, soft, subtle, flavour, macadamias, roasting and flavouring were considerably dominant. The biggest word given was 'Roasted'. These suggestions reflect the common value-ad suggested for the processing of nuts. Moving forward roasting may be a key process for canarium nut product development.

We suggested that the companies perform any type of processes or tests that they would consider appropriate to evaluate the nuts. A couple of companies roasted the nuts and provided us with very good feedback. These companies suggested this process improved the flavour significantly as well as the colour and the texture characteristics.

Other words that resonated with the respondents were shape, ingredient, product, bland and appearance. This could be interpreted as a nut with an unusual shape with bland flavour and with potential to be used as a cooking ingredient. However, it may be a result of the canarium used being untreated and in its simplest form.

When we asked the companies to tell us what the main characteristics that set canarium nuts apart from other nuts the answers given reflected previous literature knowledge. Six respondents didn't have anything to say about any characteristic in particular, seven mentioned shape and appearance factors, and five wrote about the particular taste of the nuts. The raw nuts by themselves did not expose a remarkable response among the respondents which, again, suggests roasting and further processing may be required in order to improve the organoleptic characteristics e.g. flavour, odour, colour, texture, appearance and taste.

3.3 Organoleptic characteristics

Describing the organoleptic characteristics of the nuts is paramount in order to line up the strategies in which processing can be improved when developing a market ready product.

Nut processors were asked to rate the following organoleptic characteristics of the nuts from the samples sent: appearance of the nuts, taste, texture, nutritional content, colour and odour. To gauge answers we used a Likert scale without numbers, just a plain horizontal line with the extreme rating categories at each end. On the left, extremely bad/poor, and on the right end extremely good/excellent. Respondents had to draw a vertical line across the horizontal line to reflect the value they felt fitted to the particular characteristic. This rating gave us a measure from 0-10 which we were able to use numerically for analysis. This method endeavours to avoid biases as often respondents can tend to use neutral or middle answers when there is a point of reference (for example a number or a predetermined scale).

In Figure 3 the average of the rating values is displayed. The minimum possible value was 0.1 (extremely bad/poor/low) and the maximum 10 (extremely good/excellent). The recorded answers were mostly around 5, sitting in the middle of the scale. This suggests that the respondents rated the organoleptic characteristics of the nuts neutrally, neither too bad or too good.

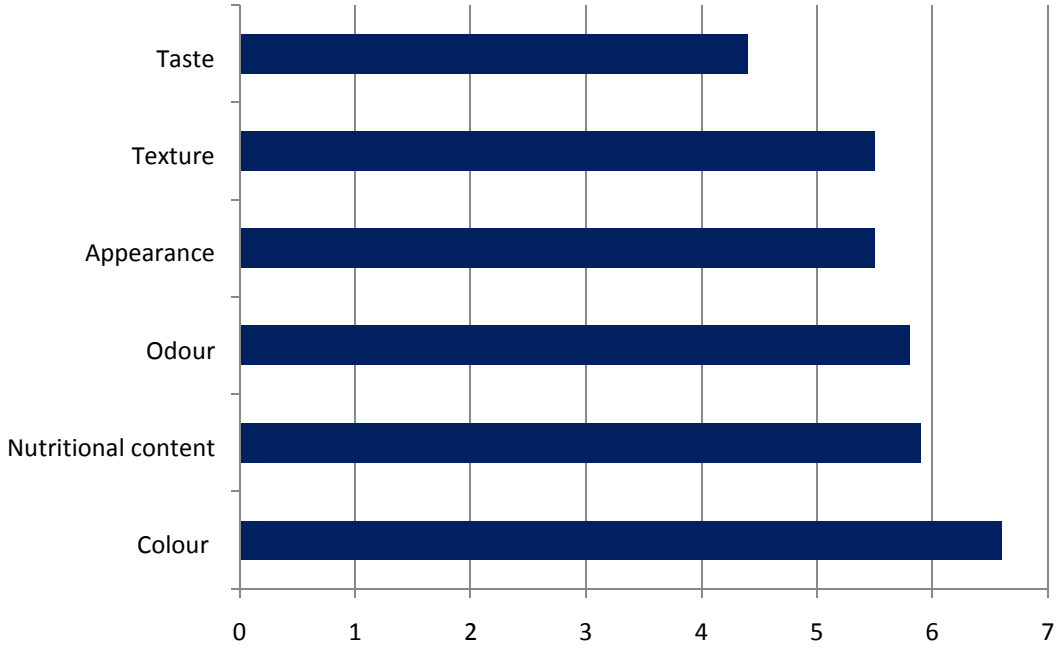

Figure 24: Average rating values on organoleptic characteristics of canarium nuts

The characteristic that was rated highest was the colour of the nuts; a white ivory found very appealing by the majority of respondents. The variables nutritional content and odour were very close to each other and slightly above appearance and texture. Texture and appearance have exactly the same average rating and are not too far from the middle of the rating scale. The variable with the lowest value among the five categories was taste, a few respondents pointed out a very particular strange/weird/bitter/smoked/bad aftertaste. But this may have more to do with the nut sample being a blander, rawer form of the nut (that is, neither roasted nor salted).

The rating of the organoleptic characteristics presented variability among respondents. In figure 4 we can see the density and distribution of the rating values for this case. This allows us to observe where the majority of responses sat on the Likert scale. It is clear that most of the rating values peak within the middle of the scale around five. This illustrates that there is some variation in the data. This is always expected and reflects different opinions from different people on the same product attribute.

From this rating exercise, it can be inferred that great importance has to be placed on the development of the canarium nut product itself. The organoleptic ratings give us a good idea

of where these efforts should be aimed. Taste is paramount in the success of any food product. Obviously, if it doesn't taste great then it's going to be very difficult to sell or it will require another competitive (such as healthy components or nutritional value).

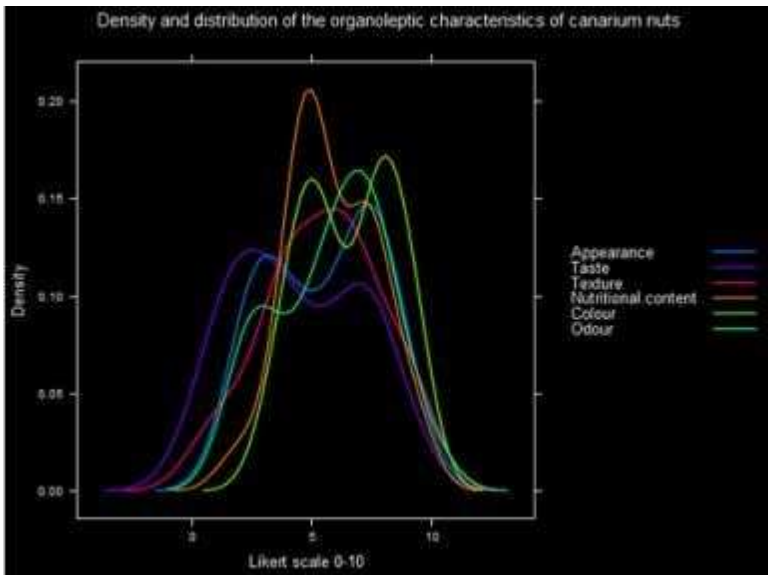

Figure 25: Density and distribution when rating organoleptic characteristics of canarium nuts

3.3 Nut attributes

The data collected during this trial aimed to identify and quantify the five most important attributes related to the canarium nuts. We asked companies to identify preferred attributes from a list of 17 different food related characteristics (for example, freshness, wholeness, size, and colour). This exercise included the attributes from their own perception as a company and asked their opinion on what final consumer's perceptions may be in relation to the nut type.

When we analysed these results the most important attributes were found to be price and flavour. These were followed by freshness, nutritional characteristics, packaging and the nut colour. The respondents were then asked to rank these attributes in order to identify which ones were the most important from their own point of view and from the final consumer perspective.

A scale from one to five was used, with one being the most important and five the least important attributes. These responses are summarised in figure 5.

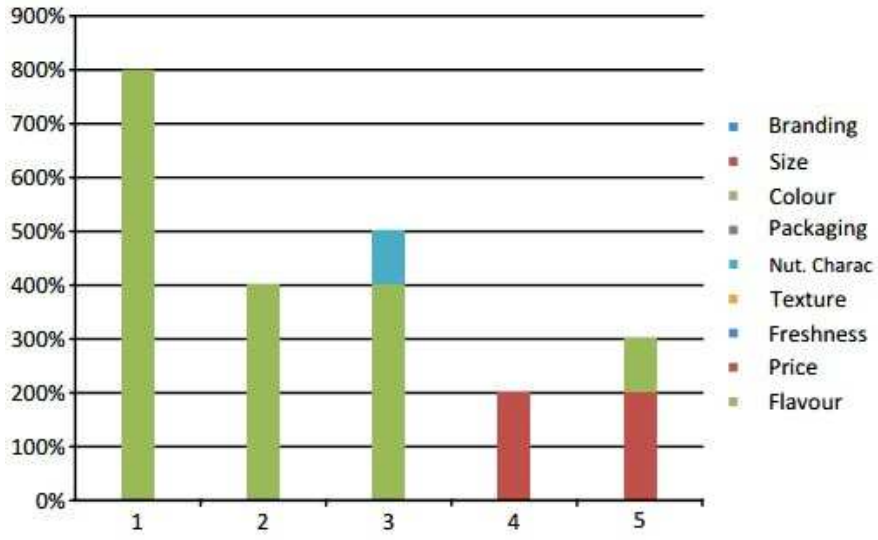

Figure 26: Most significant attributes to processors

Respondents rated flavour, price and freshness as the most important attributes among the list of 17 different qualities. These three attributes represent the key factors companies would assess when they were considering the purchasing of canarium nuts. Consequently it is crucial that canarium producers develop these areas to meet the standards of quality required by such buyers.

Participants were also asked them to rate the same 17 attributes from a final consumers point of view. In their opinion the individuals who purchase nuts value flavour, price, and organic certification as the three most important attributes (as shown in figure 6).

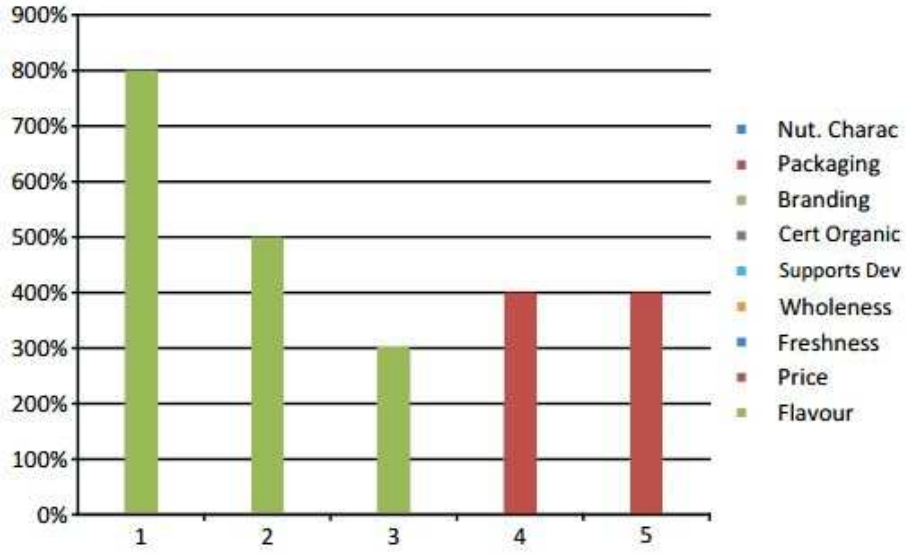

Figure 27: Most significant attributes to consumers

For both profiles, nut buyer and consumer, the branding, size, and colour of the nut obtained lower scores. While this emphasizes that producers should focus on the other, stronger, attributes more, it no way concludes that they should be ignored. Moving forward canarium producers must not only establish a unique product that attracts customers but also place emphasis on meeting the standards required by international buyers.

4.0 The Australian Market

One of the main objectives of this trial was to identify and research export opportunities for canarium nuts in the Australian market. When we asked the respondents to give us their opinion on the potential that canarium nuts have in the Australian market, 67 per cent of the respondents believed that canarium nuts would have commercial appeal in the Australian market. Furthermore, they suggested different market segments which would provide the best opportunities. For example:

- health stores
- gourmet food and small boutique stores
- bakery and confectionary products
- as a cooking ingredient

At this stage of the research plan we tried to manage the commercial expectations of the Australian nut companies by playing down the prospect of quick exports and instead explained about how the industry is still developing and focusing on domestic tourists in the short term. However, we did ask them if they would consider using canarium nuts as part of their product mix and 58 per cent of the respondents stated they would be interested. This result shows there are opportunities which can be explored further.

In order to gain a better understanding of what the best processing opportunities for the nuts were, we asked the nut companies what were the most suited products for the canarium nuts. The roasted and salted processes were the most common answers. Additional ideas for future product development included, as a dessert or cooking ingredient, as part of a nut brittle, in confectionary, baking, snacks, biscuits, chocolate coating, flavoured, mixed with other nuts, with dried fruits, etc.

Continuing with the exercise of exploring the different products we can create with the nuts, we asked the processors how they would prefer to buy the nuts. Several options were offered including: dried, roasted, salted, flavoured, coated, packaged, etc. Most of the respondents replied raw, which probably fits their existing production processes. This was expected as nut enterprises typically like to control the value adding aspects themselves. On the other hand, the companies that specialize in packaging and distributing were more interested in the development of value added canarium products such as roasted, salted, flavoured and coated nuts. This poses an interesting differentiation in the types of companies that may be targeted for canarium export and the level of value adding needed for both. It also shows significant links that could be made, not only in the product development, but the overall supply chain of canarium products.

4.1 Respondent suggestions

Since most of the respondents have a great deal of experience in the nut industry we put aside room at the end of the questionnaire to ask for any comments or suggestions to make sure we weren't missing anything important. As a result, we received quite a few interesting responses, some of which are detailed below:

- *'This product needs to be promoted as assisting the local population and reducing deforestation. It needs to tell a story, it is this story which sells the product, rather than the product itself'*
- *'We did dry roast them nice flavour texture would go very nice in mixes and cake toppings a substitute for almonds and macadamias'*
- *'The nuts were in a clear plastic bag - this allows nuts to deteriorate from the light and the plastic permeability. Keep them fresh by vacuum sealing in foil'*

- *'Need to determine what the selling points of these nuts are vs. other nuts currently in the market place. Provide other variants e.g. flavoured etc, which might mask the taste, which I don't think it has western appeal'*
- *'Flavour would be greatly enhanced with roasting and salting like macadamia nuts'*
- *'A common name for the nut is required for marketing purposes perhaps Pacific nut or paradise nut something exotic that will generate interest'*

A number of these respondents see some real potential in canarium nuts and think they should be developed and taken to the next level.

5.0 Conclusion

These results demonstrate that nut buyers see value in the canarium nut and there is room in the market for canarium producers to work with. They also highlight the points of difference that producers should focus on. Clearly focus should be placed on the unique origin and story of the nuts, the interesting texture, and the uniqueness of flavour.

Nonetheless, the profile of canarium did lack slightly, especially when compared to the other nuts that the companies are used to dealing with. Consequently, further work must be done to follow up on flavour additions, such as salt and roasting, to maximize the marketability of canarium. Such efforts will raise the organoleptic characteristics and increase the nuts competitiveness.

On a positive note, the majority of companies saw potential for canarium products in the Australian market. Even though we played down the opportunities in the short term, several of the company's surveyed asked for prices, logistic costs and available volumes. Such inquiries can only reflect positively for canarium producers and illustrate future opportunity.

In terms of next steps, these insights only reinforce the existing plans to focus on the value adding, packaging and branding opportunities for the industry in different market segments. Once these new products are developed further understanding will be needed to observe consumer preferences and willingness to pay.

Appendix A

Canarium Nut Survey

1. Who makes the purchasing decisions for the company regarding new products?
   (Please select one of the following options)
   F. General Manager / Owner
   G. Purchasing Officer
   H. Product Development Manager
   I. Other, please explain:_____

2. Which of the following is the main activity of your company?

		2.1What is your core Business
	(Please circle all that apply)	*(Please tick only one)*
Nut importation	a. Yes/No	□
Nut processing	b. Yes/No	□
Nut packaging	c. Yes/No	□
Nut distribution	d. Yes/No	□

Nut retailing e. Yes/No □

Other, please explain: _____ f. Yes/No □

3. Who are your main customers?
   (Please circle only one)
   a. Wholesalers
   b. Food Processors
   c. Supermarkets
   d. Specialist Nut Stores
   e. Your own stores / Factory sales
   f. Online retail sales
   g. Other, please explain:_____

4. What type of nuts / nut products do you currently purchase/process?
   4.1 What volumes do you buy/manage/process?

	(Please circle all that apply)	*(Please quote in Kg/month)*
a.	Almonds	a. _____
b.	Brazil nuts	b._____
c.	Macadamia	c. _____
d.	Cashews	d._____
e.	Peanuts	e._____
f.	Beer nuts	f._____
g.	Pecans	g._____
h.	Other, please explain: _____	h._____

The next set of questions are to be answered after sampling the canarium nuts sample attached to this questionnaire. Please put the nuts in a separate container so the packaging is not interfering with the answers:

5. What is your first impression of canarium nut? *(Please describe below)*

   _____

   _____

   5.1 Is there any particular characteristic that sets in apart from other nuts?

   _____

6. Please rate the following attributes in the scale provided by placing **a vertical line** in the **most likely place**. *Keep in mind that we are interested in determining the commercial potential of the nuts in the Australian market.*

   (Please follow the example below as how to place the mark across the line):

Example: please rate the following statement 'Eating nuts is good for your health'

strongly disagree ——————————|—————— ***strongly agree***

6.1 How would you rate the appearance of the nuts?

extremely bad _____ ***extremely good***

6.2 How would you rate the taste of the nuts?

extremely bad _____ ***extremely good***

6.3 How would you rate the texture of the nuts?

extremely poor _____ ***excellent***

6.4 How would you rate the Nutritional content of the nuts?

extremely poor _____ ***extremely good***

6.5 How would you rate the colour of the nuts?

extremely bad _____ ***extremely good***

6.6 How would you rate the odour of the nuts?

extremely bad _____ ***extremely good***

7. Do you think canarium nuts would have commercial appeal in the Australian market? *(Please circle only one)*
    a. Yes
    b. No (Skip to question 8)

    7.1 Which market segment would provide the best opportunity?
    _____

8. Do you require HACCP certification from all of your raw material suppliers *(Please circle only one)*
    a. Yes
    b. No
    c. Sometimes (please explain) _____

9. Would you consider using this nut in your business? *(Please circle only one)*
    a. Yes (Skip to question 11)
    b. No
    c. Maybe (Skip to question 11)

10. If you are not interested then can you recommend anyone else that might be interested?_____(*End of the Survey*)

11. If you were to consider using this nut what consumer product do you think it would be most suited to? *(Please describe below)*
    _____
12. How would you prefer to buy the nuts? *(Please circle all that apply)* a. dried
    b. roasted
    c. salted
    d. flavoured
    e. coated (sugar, chocolate)
    f. consumer packaged
    g. Other? Please explain:_____

13. From the following list of food attributes and from **your company's perceptions** on the canarium nuts, please rank them on a scale 1 to 5 being 1 the most important and 5 the least important.

    (Place the letter next to the number)

    a. Price 1. (most important)
    b. Flavour 2.
    c. Texture 3.
    d. Colour 4.

e. Size
f. Wholeness
g. Freshness
h. Packaging
i. Branding
j. Nutritional characteristics
k. Certified Organic
l. Certified Fair Trade
m. Other certification (Rainforest Alliance, Utz, etc)
n. Environmentally friendly
o. Country of origin
p. Supports development of local communities in the Pacific islands
q. Proceeds go back to smallholder farmers

5. (least important)

14. Again, from the list above, please rank the attributes based on what you think the **final consumer** might value when thinking about purchasing the canarium nuts?
(Place the letter next to the number)

1. (most important)
2. 3.
4.
5. (least important)

15. If you do have any interest in this product, can we contact you again for further research?
(Please circle only one)

a. Yes
b. Maybe
c. Not interested, thank you.

16. Is there any piece of advice or suggestion you can think of regarding canarium nuts that might be useful to us? *(Please describe below)*

_____
_____
_____
_____
_____
_____
_____

THANK YOU FOR YOUR HELP FILLING OUT THIS SURVEY!!

Appendix B

Composition of 100g of Canarium nuts in dry basis comparison table									
	Sources				Samples Sent DEC 2012				
Analysis	Eulensen 1994	English 1996	Suhartati 2011	Leakey 2007	SAALS 2013	Waite Analytical Services 2013	Average	Min	Max
Protein	14.4%	12.70%	13.70%		16.30%	15%	14.4%	12.7%	16.3%
Kilojules	3042	2845			3070		2986	2845	3070
Total fat	69.3%	71%	66.30%	67.3-75.4%	74.10%	72.70%	70.7%	66.3%	75.4%
Saturates	33.7%				33.60%	46.00%	37.8%	33.6%	46.0%
Oleic*			44.77%				44.8%		
Palmitic*			25.90%				25.9%		
Mono unsaturated Fat					30.10%	40.10%	35.1%	30.1%	40.1%
Poly Unsaturated Fat					10.40%		10.4%		
Trans Fat					<0.1%	0%	0.0%		
Carbohydrate	11.6%		11.04%		3.10%		8.6%	3.1%	11.6%
Fibre	4.1%	16.40%					10.3%	4.1%	16.4%
Calcium (mg/100g)	72	68			120	89.2	87.3	68	120
Sodium (mg/100g)		27.8			3.9	3.5	11.7	3.5	27.8
Iron (mg/100g)	2.9	5.4				3.3	4.15	2.9	5.4
E.Coli (cfu/gm)					<10		<10		
Total Bacteria Count (cfu/gm)					6400		6400		
Yeast (cfu/gm)					90		90		
Mould (cfu/gm)					110		110		
Vit. C (mg/100g)		12.38					12.38		

Appendix 11.23 *Information Brochure for communities in the Western Province, Solomon Islands*

Ngali News

If you have any comments about local needs or problems in using the methods developed by the scientists please tell Allen Tippet from the TDA so he can pass the information on to one of the project team or contact one of the team below. Discussing these methods with you can help them sort out problems along the way, or to hear about other suggestions and ideas. It will also help to make sure that the researchers work in a way that suits your business, local village or culture.

If you want to learn more about the research findings, researchers and partner organisation staff are available to speak with you and can be contacted at:

Project team in the Solomon Islands:

In-country co-ordinator: Dr Richard Pauku,
Maraghoto Holdings Company Limited
Tel: (677) 23190 / 20252

Project team at the University of the Sunshine Coast, Australia:

Project Leader: Dr Helen Wallace,
Tel: +61 7 5430 1228

Principal Researcher: Dr Jen Carter, Tel: +61 7 5459 4496

Cracking Ngali

We found that some women were very good and fast at cracking the shells by hand. There is a hand operated nutcracker but it only cracks the nuts one at a time and some women would be quicker using their hands! A mechanical cracking device is faster, but the nuts break very easily and distant markets sometimes prefer to eat whole nuts. So the different ways to crack nuts all have problems at the moment.

Appendix 11.24 *Canarium Industry Development Workshop*

Date: October 22nd – 23rd 2013

Venue: King Solomon Hotel, Honiara, Solomon Islands

Chaired by: Richard Pauku

Canarium industry development workshop - Minutes

Tuesday 22nd October: Presentation sessions

Session 1: Welcome and introductory remarks

9:00 am Arrival and Welcome, Richard Pauku

- Welcome to all the attendees including a visitors from other countries as well as a special welcome to the minister of Agriculture and Livestock for accepting the invitation to open the canarium industry development workshop.

9:30 am PARDI project overview, Helen Wallace (Project Leader)

- Gave thanks for attending the workshop.
- Explained that the outcome of the workshop is to share information across the pacific between partner and donor countries; discuss the problems and solutions that each country faces; grow the network between countries; and plan for the future and a new phase of the industry.
- The first project focused on processing and the final report is publically available on the ACIAR website or contact Helen to email a copy directly.
- The current project has focused on moving canarium from market based selling to value adding and selling at a processed product.
- Processing methods in PNG, Vanuatu and the Solomon Islands are different.
- The PARDI project adopts a value chain approach that focuses on the market – who will pay and what will they pay for. From there, how we process and how we get it there can be determined.
- Speakers from Australia were introduced. The purpose of the workshop was reiterated.

9:50am Opening of the Workshop by the Minister of Agriculture and Livestock

- Thank you to all attendees.
- Background of the ngali nut industry in SI – it is an indigenous nut with important cultural values that are significant in culture and still relevant today.
- There are a number of contemporary factors that the industry faces and little progress has been made towards creating a commercially viable industry.
- Generally the market chains are weak and many nuts are left in the wild.
- The government is committed to developing an industry and thanks the Australian Government that has sort to enhance livelihoods in SI.
- States that he would like to see more involvement of the ministry in future projects.
- Declared the canarium workshop officially open.

10:00 am Introduction of participants

- All workshop participants introduced themselves to the room
- Richard explained that a workshop like this is a good opportunity to strengthen the good work that has been occurring and that canarium requires collective effort from NGO's, government, private, and other countries

10:15 am Tea Break

Session 2: Government Perspectives

10:45am Ministry of Agriculture and Livestock, Noel Roposi

- Overview of CEMAs involvement with ngali processing and marketing in the early 1990s.
- In 1988 superior varieties were collected, disseminated and planted by farmers. Buying points of NIS were established across the country. Once collected the NIS was transported to Honiara where workers were paid to crack the nuts.
- End product was primarily oil which was sold to the Body Shop. Markets in Korea for charcoal made from the shell were explored. Some snack nuts were also produced.
- Extracting the oil is a physically demanding task, even lifting the cake from the basin requires great strength.
- Not easy to propagate by grafting but eventually was successful
- Manual cracking is too slow *Questions:*
- Kim jones commented that he would like a copy of the value chain report.
- Helen Tsatsia asked 'where does MAL fit in now'? The question was not answered.
- Comment – the fruit and nut policy is an issue that also needs to be discussed.

Ministry of Forests and Research

Did not attend

CEMA, General Manager Alfred Ramo

- The role of CEMA changed in 1996, the organisation now is solely a regulatory faction and does not participate in marketing commodities.
- Canarium is a prescribed commodity under CEMA.
- Someone needs to re-ignite bulk collection of canarium like what CEMA did in the provinces in the past.
- MAL has an important role to play through extension to farmers and they have the officers stationed in the provinces to assist with this.
- It is important to look at product ventures like canarium, especially when the government is supporting the industry. We do not know what will happen with cocoa and copra and an industry like canarium can lessen the economic risk of farmers.

Ministry of Commerce, Industry, Labour and Immigration, Cornelius Donga, Director International Trade Division

- The ministry has not been involved in ngali in the past.
- The department took the owner of the small business, Varivo, to japan to promote ngali and the response was very good
- Make sure business environment is conducive of the private sector
- The department could not assist Maraghoto this year, maybe next year

- One of the reasons why the industry failed in the past was because CEMA and the dodo research station was operated by the government, the private sector has to pick it up
  We have the facilities to help move forward. We need to know where MAL and the Ministry of Forests fit in so that we can move forward

Questions

Did the patent hamper the industry?

- Richard replied that the patent is still current

Session 3: Research and Development

11:15am Processing Research, Bruce Randall (USC)

- Described the processing research undertaken in PNG, Vanuatu and SI.
- Described the current results of the FACT trial on Kolumbangara Is.
- The kernel weight of the largest nuts was almost three times greater than the smallest nuts. This gives an indication that a selection programme is important.
- Drying small amounts of kernel at 60C for 1 hour in an oven with good airflow is sufficient to 'snap dry' kernel to below 5% moisture. Using the same ovens with 2kg of kernel could take longer than 10 hours. **Stakeholder Analysis, Kim Jones (USC)**
- PNG has an active planting programme. Extension networks will be run by commercial operators in the long run at a ratio of one extension officer per 250 farms.
- Small holders have planted canarium in conjunction with cocoa. Canarium provides shade for the cocoa. The established cocoa supply chains can be used by canarium. This means that transport is less of an issue. Large volumes of NIS owned by single operators give them the power to seek markets.
- There are no organised markets in PNG yet.
- There is a need to develop safety and quality guidelines. There is an urgency to develop systems and markets as volumes increase and product starts coming on line, otherwise farmers will become disillusioned.
- Buckets are an advantage because it protects the kernel from breakage
- Quality management – training, documentation is required, it is a very perishable nut
- The crackers that we have been focusing on have been maintaining whole kernel, looking at different markets – oil and biscuits – don't need whole kernel, should revisit mechanical crackers

Market Research, Craig Johns (UofA)

- Provided an overview of the marketing research conducted so far
- Staged research throughout the project
- In 2011, early research was targeted
- In 2012 Australian nut companies were sent samples of dried canarium nuts

12:30pm Lunch

Session 4: Industry Perspectives

1:30pm Vanuatu Department of Forests, Joseph Tungon

- Presented in Bislama
- Described the cultural and economic importance of canarium nut in Vanuatu

Questions

What is the value of the industry on an annual basis?

- Answer – Do not know. In the last three years the industry has grown really fast. Votausi explained that a consumer preference to move away from palm oil has also encouraged the canarium oil industry.

Lapita Café, Vanuatu, Votausi Mackensie-Reur, owner

- Thanked Craig – gives a lot of confidence to me in the industry
- Involvement food industry over 20 years and canarium since 1999
- 99% products made locally
- In 1999 – started making biscuits and putting nuts in them, kava store was the only one selling dried nuts and so they were purchased from there
- Went to the airline and they were interested on putting on planes which was a break thorough. It made me aware that there was a market, it took me 5 years before I got into that market
- We do other products – chips , manioc flour
- 2008 began sourcing my own supply– went to my island and they produce nuts for me – they crack, remove testa and I freeze them
- 2009 – kava store stopped supplying supermarkets
- 2010 – started supplying dried snack nuts to supermarkets, by April we sold everything
- 2011 – 750kg NIT were sold out by May/ June
- This time the projection is that we need 2tonnes of NIT to meet demand for the whole year
- It has moved so fast since 2010 when we started drying
- Asked by Volcanic Earth if we could produce oil – Lapita dries the nuts and gives it to them used coconut press. They give the cake back to make biscuits. Volcanic Earth want 300l for the next season, they developed a special product especially for the canarium oil
- It is not going to get smaller, we need to move away from small production My products do not have good packaging.
- Sell biscuits in major supermarkets, use our own gluten free flour – twin packs are sold to hotels and lounges at the airport
- Now looking at fruit and nut mix
- Trying to get into the hotels – difficult because of the supply of the nuts – developing a menu – sauce, pesto, etc. – if the nuts are not there they have to change the menu – need to be available all year round. Not a quick solution, need to make sure of quality and supply.
- Challenges – one big one with a small cottage industry – seasonal; money is sitting there no cash flow, farmers deliver today and want the money today. If we want the farmers to supply on time the answer is pay on delivery, we have managed to get the trust of the farmers
- 2nd challenge – cost of supply – to save money on transport buy NIT need to crack on the same day that is picked up, freezer costs a lot of money but at the moment this is the best way
- How do we know the farmers crack on the same day? – it is difficult for me to monitor, I rely on my agent to make sure they get the farmers to crack on the same day and not cheat – at the moment if it is off we can make oil

3rd challenge – with increasing demand the current production is not enough , we are at a cross roads, we have no choice but to expand operation at some level to cater for demand – need more efficient equipment , packaging, quality control – either I go ahead or I walk away like they did in 1994. I don't want to produce and inferior product – we want some help working on a project proposal, need some capital investment – it is time for us to be serious in a smart way – need a financial analysis of viability of what we want to do. *Questions*

- Cornelius Donga, Director International Trade Division – what government support do you receive? Votausi – the government does not always have money, they do provide

support, they make sure policies are made. The Department of Industry is facilitating with value adding products, supporting us.

- Kim Jones – as a quality control strategy, will it work if you take a small sample at your first point of buying and from that assess how much the farmer is paid? Votausi - That is possible for us to do, I think that would work.
- Participant – Apart form capital what are other challenges in the long run? Votausi – We are not getting enough nuts to us. I believe the nuts are there, we can meet the demand, and the challenge is having cheap access to the nuts. Buying near airstrips, the challenge is transportation of nuts, finding a way of doing some pre-processing on site.
- Participant – Do you have formal arrangement with suppliers, for example, supply three times a week and pay them fortnightly? Votausi – someone before me was buying cash on delivery, that was kava store and I was expected to do the same thing. We bulk up in Santo but we cannot do that with our other small farmers – some come with 1 kg, 500g…it's a bit hard to pay them in 30 days.

Varivo Holdings, Duddley

Did not attend

Jedon Organic Food Ltd, Doni Keli

- Muesli is the number one product
- Started in 2004
- Issues – expanding shelf life of our products; capital is an issue – how do I store at home; packaging presentation is not good, we are not selling; lack of transport, the weather coast of Guadalcanal has no wharf, they are at the mercy of the sea and the weather
- Chinese product competition, peanuts from china cost SBD$3
- It is the market that we are working for
- personal commitment and hard work is one of the resources I have because we receive no assistance form the government
- Commercial banks rarely provide loans to small business
- with our rural farmers I pay COD
- farmers need training
- lots of fruit is thrown away at the market – waste of resource
- Hopefully next year my commercial kitchen will be ready so I can comply with government standards as well export markets that require a clean and healthy environment
- Work towards strengthening that link between farmers in the rural community and our business – win win , there is no losing
- Solar drying is a solution to the high cost of electricity – to run one 600W dehydrator for 8h cost SBD$50

Questions

- Helen Wallace – How much ngali do you sell per year? Don – 5kg to the supermarket, sourced from farmers down the road and the central market
- Comment – the bank is no longer offering subsidy support

Maraghoto Holdings Company Ltd, Richard Pauku, owner

- The traditional method from west is the only acceptable method of drying for us, we buy through the TDA and one day we hope to cover the whole nation like CEMA
- At SBD $20/kg farmers go off and look for better price
- Local packaging not available – packets, bottles – this is frustrating
- Limited exposure to learning opportunities

- We need some proactive programmes form the ministry
- Need to compete with local market prices which are 10-15 raw kernels for SBD$2
- SBD$400/bucket is too much for Maraghoto because they sell kernel, for Lime Lounge (Café) that is ok because they add it to other foods
- No supply this season from the TDA
- Some of the companies print outside, they do not print here
- The cost of individual farmers to transport to Honiara is too much, they do not come back to sell because they do not get a good price to make it worth while
- I don't know what strategies to follow at the moment, we need to strategise *Questions*
- Helen Wallace comment – they are pulling away from export market in PNG, need to get domestic first, how would it work for SI? Richard – I agree, strengthen domestic market, sort out processing, production issues, climate change issues there, need to make sure our market is resilient to climate change
- Votausi – I was kicked out too (as well as Maraghoto) of the project because I wanted to focus on the domestic market, I think they need to re-think that
- Kim Jones – Is there wastage of ngali? Richard – not kernel, shells yes. Those packets sometimes taste stale, they were cracked yesterday
- Votausi – better for farmers to sell to me because I buy everything they crack, I stay away from Efate because they prefer to sell at the market, where I buy the market is saturated during the season.
- Cornelieus – we need to define the roles of the stakeholders so that we can take the industry forward. Access to finances is a big issue in SI. My ministry is trying to get the government to assist small business with finance. Ngali has been here for many years in the traditional sector. The SI government has not taken on the private sector, this is where it has failed. The issue of selection, mum knew this one is good for pudding, this one is good fresh that knowledge has been there for quite some time. We have trees bearing good fruit after 3 years. I am optimistic this time round with the sunshine university.

Session 5: Discussion

- Votausi – I faced some challenges of pricing from the farmers – so what we did was I went with my agent and we developed a spread sheet and went to cooperatives and asked what they offered for other commodities – compare with copra and cocoa, this showed the farmers that I was offering a good price for the nuts, it took us a while to visit all the farmers. They see you and think you have a lot of money so want more money from you, communication with them is the key. I just wanted to share that with you.

  Richard – group them into networks, rather than just talk to one farmer at a time. I just received news from the TDA that the farmers want SBD$30-40/kg. I don't know how to go around that. I offered 30 for this season and we will see how we go.
- Craig – How do you structure your price negotiation with your farmers? Votausi – that brings you to the issue that we really need to work with farmers about price, and also what product I want, understand how it is going to work. It is important that we standardise the pricing.
- Don – I am curious about a test that will at some stage compare taste of nuts between trees? Helen – no, different countries have different taste preferences, too hard for us.
- Helen Wallace – vote of thanks to Richard for organising the workshop – presented him with a pack of maccas

4:30 Finish

Wednesday 23rd October

9:00am Discussion and Planning for Future Direction

Way forward for the industry: Key issues/ possible solutions and planned actions

- Keshav (PARDI project – training people in agricultural research) – I have no experience in canarium, there are several issues that need to be discussed – way forward? Short or long term? Development is important, how to find agronomic based solutions, not solved in shorter period , substitution of products is not easy, what can the government do? Credit policies to support the local businesses is a very important issue. There are also issues with access to export markets and certification.
- Helen (MAL) – we need to put someone in charge of these issues because they are very important – the attorney general's office – we don't have any policy around these issues.
- Mark Johnston – transfer arrangement with PNG policy to share materials in general/ principle
- Helen (MAL) –and SPC
- Helen Wallace – are there province to province issues?
- Richard – the KGA has an exchange of materials between farmers, the NGASI association is there to facilitate

- Keshav – A workshop in NARI on material exchange between the three countries - agreement has not been signed
- Noel – don't worry about that
- Joseph – selection has been done on sandalwood and whitewood not canarium

- Participant – What are the limiting factors, the big blocks?
- Richard – we need a planting program
- Votausi – in the short term we need good packaging
- Kim Jones – production is a long term thing, there are lots of nuts out there, and why is it not being harvested? How do we set a fair price when transport costs are so high? Solutions are buying more buckets and creating buying points in the provinces to reduce shipping costs. Then we can work on product development once it is here (in Honiara)
- Helen Wallace – there is strong evidence for strong demand in Vanuatu, do you have that here?
- Don – first one is use of traditional method second one is the dehydrator. Yes there is demand for it. It has to be packaged, it sells out before the next season. The middle class group are buying his product.
- Cornelius (from Rendova Is) – sells his bucket for SBD$500. We should approach this strategically. Identify the different value chains. We have a commodity that can be an alternative to the logging industry. Copra has a lot of value chains in the industry. Can I suggest that we outline what needs to be done? If we look at everything then we will never finish. What is the key challenge for oil? What is the key challenge for processing?
- Richard – I do not believe there is plenty of supply – there is limited supply
- Improved variety
- Keshav – there needs to be a standard info on how to harvest – a small booklet on how to harvest, store, - it will be really good to have one of these.
- Votausi – with post harvesting , with us, the Forestry department are helping us to ensure that the post-harvest harvesting is done properly, they have done this with other products, that's a cost that is out of our hands, so long as that they know what we want, that cost is out of our hands.
- Richard – product development is an issue
- Mark Johnston - Up scaling is an issue that I heard come up yesterday
- Votausi – yesterday or last week I wanted to start doing new products. We need help from the government to put together project proposals to access government funding.

- Don – needs nutritional information on the product
- Votausi – packaging need to be standardized

- Keshav – is there standard equipment for the processing that is available now? Does something need to be developed? Without the availability of equipment it will be very difficult to achieve scale. There needs to be some development of specific equipment for this specific nut
- Cornelius – There must be some trade fairs or something that we can access that have been developed for other nuts
- Mark Johnston – cracking is the main thing that is really needed
- Cornelius – manually processed! In Malaita cracking is ceremonious, if we take this away from people, from what they normally do… but that is a way we can brand this thing. That is one of the issues here, we are going against tradition.
- Helen (MAL) – ask the farmers about the cracking, what about PNG?
- Keshav – it will be a learning kind of process with all countries
- Votausi – I want to continue with cracking with the mothers. Maybe we can use a mechanical cracker for the oil.
- It can be marketed as manually cracked.

- Richard – buying points by private will not cover the whole country. NGASI can organise/ facilitate buying in coordination with the private sector.
- Don – I go to the farmer, talk with them, if they are willing to sell I buy if not I go to the next farmer. They need money too.
- Noel Roposi –With cocoa we have a quality management system from farmer to exporter and we have control points
- Kim – need a HACCP and we have a draft one
- Kim – can value add other crackers fairly easily
- Mark Johnston - long term you will need to look at mechanical cracking
- Richard – there are no readily available materials for packaging

- Helen Wallace – one name for all 3 countries? Name/ brand?
- Richard – *Melanesian nuts*
- Moses – we need a common name but we also need to allow for branding. A Melanesian name, a common name and then ngali, ngangai etc.

- Mark Johnston – don't rely on MAL
- Cornelius – we have assisted a pineapple jam manufacturer with equipment
- Helen (MAL) – we have a food technologist there, you can make use of him as well
- Don – often we think of money as the key but it is not always we need training as well

- Freight is a government problem to forget

List of attendees

- Professor Helen Wallace, University of the Sunshine Coast, PRA Leader
- Dr Richard Pauku, Director Maraghoto Holdings Company, Project coordinator Solomon Islands – maraghoto@solomon.com.sb
- Craig Johns, University of Adelaide, project officer (Objective 1) – craig.johns@adelaide.edu.au
- Kim Jones, University of the Sunshine Coast, Nut industry advisor (Objective 2 & 3) – kim.jones@westnet.com.au
- Bruce Randall, University of the Sunshine Coast, project officer (Objective 2) – brandall@usc.edu.au
- Elektra Grant, USC, project officer (Objective 2 & 3) – egrant@usc.edu.au
- Dr Keshav Kshirsagar – NARI, PNG – keshav.kshiragar@nari.org.pg
- Cornelius Donga - Director International Trade Division, Ministry of Commerce, Industry, Labour, Immigration – Cornelius.donga@commerce.gov.sb
- Lawrence Atu – Development and Research Officer, NGASI
- Patterson Siliota – Chief Produce Director, CEMA – siliotapatterson@yahoo.com
- Billy-Klyvston Maehia – Research Assistant, NGASI – billyK.maehia2013@gmail.com
- Doni Keli – Jedom Organic Friuts, P.O Box 1667, Honiara; Tel 677 7569052; jedom.organicfruits@gmail.com
- Votausi Mackenszee-Reur – Lapita Café Ltd – P.O Box 1131, Port Vila; munch@lapitavanuatu.vu
- Moses Pelomo – Director AGRIBIZ Ltd – P.O. Box 1034 Honiara; mosses.pelomo@gmail.com
- Noel Roposi – Principle Marketing Officer, Ministry of Agriculture and Livestock - p.o Box 413, Honiara; noel2008@gmail.com
- Mark Johnston – RDP team leader – m.johnston@solomon.com.sb
- Helen Tsatsia – Research office – MAL po Box G13 Honiara
- Helen.tsatsia@yahoo.com
- Titus Sura – Dept. director Planning, MAL
- Jimmy Saelea – Under secretary, MAL

Alfred Ramo, General Manager, CEMA