An overview of the market for Pacific Island coconut products and the ability of industries to respond

by
Andrew McGregor with Mark Sheehy
Pacific Island Farmers Organisation Network

CIDP
COCONUT INDUSTRY DEVELOPMENT FOR THE PACIFIC

EUROPEAN UNION

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Pacific Community
Communauté du Pacifique

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Abbreviations

ACIAR	Australia Centre of International Agricultural Research
APCC	Asia Pacific Coconut Community
ASA	American Soybean Association
CIDP	Coconut Industry Development for the Pacific
CNO	crude oil from crushed copra
CRB	coconut rhinoceros beetle
DME	Direct Micro Expeller
ENSO	El Niño Southern Oscillation
FAS	Foreign Agriculture Service
FOSFA	Federation of Oil, Seed and Fatty Acids
MCFA	medium chain fatty acids
PICs	Pacific Island countries
RBD	refined, bleached and deodorized coconut oil
TFA	trans fatty acids
VCO	virgin coconut oil
WTO	World Trade Organization
USDA	United States Department for Agriculture

1 Summary

Traditional export markets for PIC coconut products

Copra oil and copra have been, and continue to be, the core export market for most Pacific Island coconut industries. Coconut oil is part of the 'vegoil' complex, which is made up of around 20 oils. Some are grown only in temperate climates (canola), others only in the tropics (oil palm and coconuts), with most grown in both temperate and tropical environments (soya bean, sunflower, corn, sesame and cotton). Coconut oil prices are determined by inter-relationships between all products within the 'vegoil' complex. The global vegetable oil market has seen substantial growth and structural change over the last two decades in both food and industrial uses. Food use per capita consumption has increased by some 13% and industrial (oleochemical) use of vegetable oil by over 110%.

The key vegetable oil market developments have been:

- the rapid technological development and demand growth in industrial use of vegetable oils, including biofuel;
- increasing income driving the demand for vegetable oil – particularly in China and India; and
- the growing relative importance of palm oil due to its competitive supply position.

Coconut oil's closest substitute is palm kernel oil – together they make up the 'lauric oil' sub-complex. Coconut oil accounts for 3% of both food and industrial vegetable oil use, while palm kernel oil accounts for 3% (food use) and 6% (industrial use). Lauric oils are defined as vegetable oils having a lauric acid content of approximately 50%. This high lauric acid characteristic affords particular advantages, particularly in food uses. Palm kernel oil and coconut oils are interchangeable in many applications because of their similar properties. The price of lauric oils tends to be significantly higher than the main vegetable oils (soya bean oil and palm oil).

Over the last 40 years, the prices of all vegetable oils have generally moved together – with prices of some vegetable oils more closely correlated than that of others. The estimated price correlation between coconut oil and palm kernel oil is 0.99. The last decade has seen a general upward trend in vegetable oil prices – with lauric oils being significantly higher.

The Philippines dominates the world coconut economy, accounting for about 40% of world copra production and 60% of exports of coconut oil. The PIC share of world coconut oil exports ranges from 3% to 6% annually, depending on the volume supplied by the Philippines. PICs make up around 5% of world copra production. While this share is relatively small, it is higher than that of any other Pacific Island major export commodity, other than palm oil (Papua New Guinea, Solomon Islands). PICs make up over 50% of world copra exports – with Papua New Guinea being the largest copra exporter.

Imports of copra oil are highly concentrated – Europe accounting for about 50%. China and India are minor importers of coconut oil. In 2015, China imported 95,500 tonnes of coconut oil, compared with a total of 8.5 million tonnes for all vegetable oils. India's coconut oil imports were 22,000 tonnes, compared with 15.1 million tonnes of total vegetable oil imports. India, however, has a large domestic coconut oil industry – producing 1.1 million tonnes in 2015. Unless this pattern of consumption changes, coconut oil and copra will not benefit directly from the vegetable oil demand growth in China and India. However, coconut oil prices are affected indirectly, due to the inter-relationship between all the oils within the 'vegoil' complex.

The crude copra oil and copra market is particularly narrow. It is traditionally characterised by little product differentiation and opportunities for niche marketing for PIC exporters. Crude oil is not an end-product in the coconut value chain. It is exported to a few large companies for manufacture into refined, bleached and deodorised (RBD) oil for consumption in importing countries or for re-export. These are large companies, mainly located in Europe (particularly Germany and the Netherlands) and some in Asia (particularly the Philippines).

Analysis of coconut oil prices over the last 20 years

The first decade was a period of unstable prices with a marked overall downward trend. The prices in the second decade were even more unstable but trended significantly upwards. Prices reached record levels exceeding USD 2,000 cif/tonne in 2011 and now stand at around USD 1,600/tonne.

The instability and upward trend in coconut oil prices over the last decade can be explained by a combination of factors:

- the expansion of the world trade in vegetable oils, following the closure of the Uruguay Round in 1996;
- China and India's income growth and high income elasticity of demand for vegetable oils;
- replacement of the negative health image of 'tropical oils' with a positive image, and the increasing awareness of health problems associated with trans fatty acids (TFAs) in some other vegetable oils;
- diversion of edible oils supplies (particularly palm oil and soya bean oil) for use as bio-fuel, followed more recently by the demand for biofuel declining with the falling of petroleum prices; and
- the continuing contraction in global coconut supply exacerbated by major cyclonic events in the Philippines – this decline has been even greater in PICs.

Non-traditional markets for PIC coconut products: a focus on virgin coconut oil (VCO)

Recent years have seen copra oil and copra prices reach historic highs – yet PIC exporters have been unable to take full advantage of this situation. The main reason for this is that the large processors in Europe still remain the main end-users. The shipping of crude coconut oil to European buyers has become uneconomical for most PIC exporters, with decreasing volumes to ship and less Europe-bound shipping.

Coconut oil and copra are now largely shipped to Asian markets (Singapore, Malaysia and the Philippines) at lower prices than those available in Europe. The nearby markets of Australia and New Zealand have ample shipping available but their demand is mainly for RBD oil. The value added for RBD does not justify the investment required by the predominately small PIC copra mills. PIC industry attention, as a consequence, has turned to niche products that can be differentiated in terms of specific quality attributes (various types of certification such as origin, organic and fair trade). The particular niche market focus for PIC producers has been on virgin coconut oil (VCO). Fiji, Samoa and Solomon Islands were amongst the earliest global entrants into VCO export markets.

VCO is a product ready for consumption without further processing. It is produced directly from fresh mature coconut kernel, and is regarded as the purest form of coconut oil. As VCO is further down the coconut value chain it is viable to send to the market in relatively small quantities. RBD and VCO oil have the same physical and chemical characteristics but different sensory attributes. The Philippines were the first to enter the VCO market in the early 1990s on a very small scale (only two tonnes exported in 2001). For the first decade or so the price premiums paid for VCO were very substantial – averaging around five times the RBD price. Not surprisingly, the growth in global exports of VCO has been exponential, with Philippines exports exceeding 25,000 tonnes in 2015 (exporting to 38 countries). Sri Lanka has also become a major player, exporting 16,000 tonnes in 2016, up from 5,000 tonnes in 2013. Australia has become a major buyer of VCO, purchasing 1,750 tonnes from Sri Lanka in 2015.

This rapid increase in supply has transformed VCO from an exceptionally high-priced niche product, to a commodity that can secure a significant price premium, provided quality and other certification requirements are met. To remain competitive, PIC VCO producers need to produce a premium quality product that can be differentiated in the market through organic and other certification. Certification brings with it substantial overhead costs. The experience with VCO in the Pacific has shown that larger, more centralised processing entities are likely to be more viable than small, village-based units. These larger units have been better able to satisfy demanding quality standards. The larger units have also been better able to 'pull' the product through the VCO value chain and link with markets.

PICs adjusting to the changing VCO market situation: market considerations

The focus of VCO development in PICs has been almost entirely on export markets. In the Philippines, VCO is now a common product found in most supermarkets and pharmacies – this is not the case in PICs, which are large importers of vegetable oil. (In 2015, Fiji imported 16,675 tonnes of vegetable oil – landed value USD 20.7 million; and, Papua New Guinea 46,758 tonnes – landed value USD 43.1 million). These imports are almost entirely for food use. By comparison, the domestic consumption of coconut oil for food use is miniscule. and other food grade coconut oil, a combination of measures needs to be taken. There would need to be significant reduction in the price at which VCO is sold locally – however, not exporting would bring with it large marketing cost savings. In many PICs the prevailing image of coconut oil for cooking is that of an 'inferior' product. A concerted effort needs to be made to reverse this image for VCO and for food grade, high quality copra oil. Local regulatory requirements (including labelling) need to be reformed, together with the structure of tariffs for vegetable oil.

Investigating PIC domestic VCO (together with high grade, food quality copra oil) value chains is recommended as a priority for the Coconut Industry Development Project (CIDP).

Approximately half the VCO produced globally is used in a range of non-food products (hair and skin care products, massage oils, etc.). For most non-food uses, high quality copra oil is a suitable substitute for VCO. Small-scale cold press copra mills have been utilised in Fiji, Solomon Islands and Vanuatu to produce high quality copra oil (well dried and stored copra without smoke contamination). Niche markets have been identified in Australia and New Zealand for high quality copra oil outside the traditional bulk crude copra oil markets. With the prevailing VCO price environment, high quality copra oil is identified as an alternative to VCO for small scale producers. While the price for high grade copra oil is still significantly lower than that for VCO, small-scale high quality copra production offers some significant advantages for producers. These include: low capital cost, significantly lower labour input requirements, and less difficult in meeting quality requirements.

Investigating small-scale, high quality copra value chains is recommended as a priority for the CIDP.

Coconut water

Globally, coconut water (UHT bottled or packaged) has emerged as the fastest coconut product market and is part of what has become known as the 'sport-drink' value chain. In 2014, the global coconut water market was estimated at USD 1.36 billion and is projected to increase to USD 4 billion by 2019. The Philippines the largest supplier – notably for PICs, Australia is the third biggest buyer after USA. However, PICs have not shared in this market development. The main reasons for this are:

- the perishability of coconut water once removed from the coconut;
- the high capital investment required to preserve coconut water in a way that maintains flavour and nutritional value; and
- the throughput requirements to make this investment viable – there are just not sufficient coconuts available in the right location.

This situation is unlikely to change, unless there is a large increase in the ready availability of coconuts.

Coconut cream and milk products

Coconut milk and cream products have also experienced rapid growth in demand – driven by new alternative dairy food and beverage products to cater for the increasing awareness of lactose intolerance and other health issues. Samoa was an early pioneer in the export of coconut cream. The Samoan product was considered to be of superior quality but Samoa found it difficult to compete with the cheaper alternative produced by the Philippines.

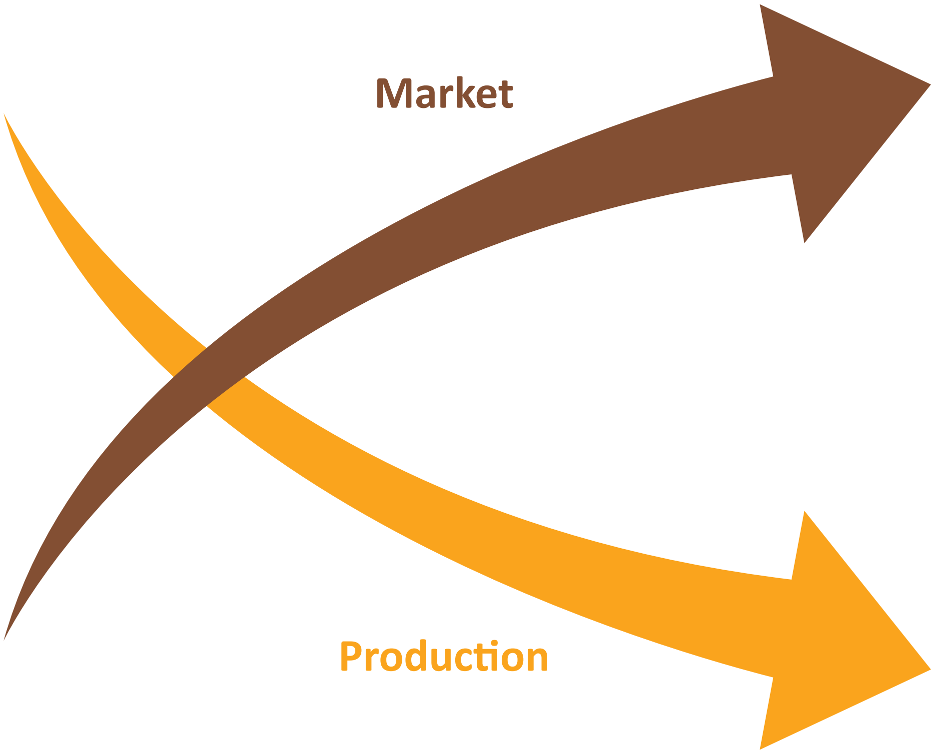
Coconut milk/cream products are seen to offer one of the best niche market opportunities for PIC coconut industries. Existing processing technologies allow for competiveness on a small to medium scale – provided adequate attention is given to quality standards and workforce skills to control the risk of contamination. A number of potential coconut milk/cream products have been identified where PIC processors could be competitive on local and regional markets. These include coconut cream freeze and coconut yogurt.

Investigating the coconut cream freeze and coconut yogurt value chains is recommended as a priority for the CIDP.

Coconut timber

Globally, since the turn of the century, and particularly over the last decade, there has been a massive increase in the demand for coconut products. Ironically, this has come at a time when coconut production capacity has been in marked decline and nowhere more so than in PICs. In the Pacific, well over 50% of the 1.3 million coconut trees that remain standing can be regarded as senile and unproductive. The last forty years has seen very little replanting; a situation that urgently needs to be reversed if rural communities are to take anywhere near full advantage of the growing market opportunities that are now on offer.

Coconut Market vs Production



APCC reports indicate >50% of trees are senile with declining yield

Asia and Pacific Coconut Community

A critical incentive for farmers to replant is to receive worthwhile return for the removal of their old palms. For several decades, the expectation has been that coconut timber would provide such an incentive. However, despite the emergence of high-end niche coconut furniture companies, such as Pacific Green in Fiji, the overall level of demand for coconut timber has been disappointing and has had little impact on the propensity of PIC farmers to replant. Encouragingly, the last few years have seen the emergence of more appropriate technology that should allow for the commercially viable use of coconut timber in much wider markets, such as for veneer products.

A detailed value chains analysis for coconut timber in the manufacture of veneer products is recommended as a priority for the CIDP.

2 The core value chains for coconut products

In Pacific Island countries (PICs), coconuts have been a fundamental food security crop for centuries, well before coconut plantations were first established in coastal areas to produce copra for export to Europe more than a century ago. Even though copra and copra oil exports to Europe have largely ceased, coconuts remain an important crop for food security and livelihoods in the region[1] and remain an export earner for most countries.

2.1 Four broad markets and core value chains for coconut products

There are essentially four broad markets for coconut products, based on four core coconut value chain strands. Three of these value chain strands involve products derived from the coconut kernel.

- **Coconut food**, which predominately has involved oil traditionally extracted from copra (dried coconut kernel) but has increasingly involved virgin coconut oil (VCO) extracted directly from the kernel. Other coconut food products made directly from the kernel are coconut cream/milk and desiccated coconut.
- **Coconut oleo chemical**, which includes products such as soaps, personal care products and cosmetics. Both copra oil and VCO are used for these products. Over the last two decades, copra oil has also been increasingly used for bio fuel – although this has declined in recent years with falling petroleum prices.
- **Coconut water**, which includes the newly emerging 'sports drink' market. Until very recently, the coconut water market was relatively trivial compared with the food and oleo chemical markets for coconut products. The last few years, however, has seen rapid growth in coconut water consumption outside coconut producing countries. This has been driven by a processing technological change and consumer demand driven by health and well-being concerns.

The fourth value chain strand is not directly derived from the coconut kernel.

- **Bi-products**, which comprise a range of products derived from the husks, shells, timber and leaves of the coconut tree.

Coconut oil still remains overwhelmingly the main coconut product entering international trade, with its use being shared approximately equally between the food and chemical product uses. The input/output structure for these four broad value chains is presented in more detail in Annex 1 of this report. The last 20 years has seen an explosion of products within these coconut value chains. This is reflected below in the extract from the presentation of the APCC Director at the Coconut Industry Development Project (CIDP) Value Chain Workshop held in Nadi, Fiji, July 2017 (APCC 2017).

1 For example, the smallholder study in Solomon Islands estimated that around 110 million coconuts are grown and consumed annually (Bourke et al. 2006). This equates to around 20,000 tonnes of copra. In 2015 Solomon Islands produced 17,746 tonnes of copra (APCC Coconut Statistics Year Book 2015: 215). This domestic demand can be expected to have increased significantly over the intervening decade in the face of high population and urbanisation growth rates.

Emergence of Products

1993

1. *Oleo chemicals*
2. *Glycerine*
3. *Fresh coconuts*
4. *Matured coconuts*
5. *Coconut Seedlings*
6. *Bukayo*
7. *Coco Cream Powder*
8. *Coconut Milk*
9. *Frozen coco meat*
10. *Kopyar/Makapuno*
11. *Coconut Vinegar*
12. *Nata de coco*
13. *Ubod*
14. *Coco acid oil*
15. *Alkanolamide*
16. *Paring oil*
17. *Coco coir waste*
18. *Coco coir fiber*
19. *Coconut water*
20. *Coco husk*
21. *Coco husk chips*
22. *Coco chips*
23. *Coco lumber*
24. *Coconut shell*
25. *Coconut shell charcoal powder*
26. *Toilet/Bath soaps*
27. *Husk nuts*
28. *Laundry soap*
29. *Shortening*

2016

1. *Oleo chemicals*
2. *Glycerine*
3. *Fresh coconuts*
4. *Matured coconuts*
5. *Coconut Seedlings*
6. *Bukayo*
7. *Coco Cream Powder*
8. *Coconut Milk*
9. *Frozen coco meat*
10. *Kopyar/Makapuno*
11. *Coconut Vinegar*
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17. *Coco coir waste*
18. *Coco coir fiber*
19. *Coconut water*
20. *Coco husk*
21. *Coco husk chips*
22. *Coco chips*
23. *Coco lumber*
24. *Coconut shell*
25. *Coconut shell charcoal powder*
26. *Toilet/Bath soaps*
27. *Husk nuts*
28. *Laundry soap*
29. *Shortening*
30. *Coco jam*
31. *Special Creamed Coconut*
32. *Coconut Water Concentrate*
33. *Coco Soy Sauce*
34. *Coco Fiber Dust*
35. *Coco Shell Powder*
36. *Shampoo*
37. *Coco Wood Pallett*
38. *Margarine*
39. *Coconut Flour*
40. *Coconut Milk Powder*
41. *Coconut Liquor*
42. *Coco Handicrafts*
43. *Grated Coconut Milk*
44. *Coconut Honey*
45. *Coir Net*
46. *Soap Chips*
47. *Virgin Coconut Oil*
48. *Coconut Sugar*
49. *Neera fresh*

3 Core market developments since the turn of the century

3.1 Global vegetable oil markets

Copra oil and copra has been, and continues to be, the core export market for most PIC coconut industries. Coconut oil and copra, as part of vegetable oil complex, are pulled through the value chains of food and oleo chemical industries. Recent decades have seen substantial growth and structural change in global consumption of vegetable oils in both food and oleo chemical (industrial) uses.

Global annual per capita consumption of vegetable oil for food use has increased significantly over the last two decades – increasing from 9.5 kg for the period 1991–2000 to 10.7 kg for the period 2001–2011 (a 13% increase) (Table 1). The increase in per capita consumption for industrial uses has been even greater, increasing from 3.7 kg (average 1991–2000) to 7.9 kg (average 2001–2011 (a 113% increase).

Coconut oil consumption, in contrast to the overall growth in vegetable oil consumption, has been lower over the same period. It has increased by only 4% in food use (0.30 kgs to 0.31 kgs/capita) and fell by 11% in the industrial sector (0.23 kg to 0.20 kgs/capita) (Table 1).

Table 1: Global per capita consumption of main vegoil complex products

	Food Use					Industrial Use				
	Consumption (kg/cap/year)			Share of global consumption (%)		Consumption (kg/cap/year)			Share of global consumption (%)	
	1991–2000	2001–2011	Rate of change	1991–2000	2001–2011	1991–2000	2001–2011	Rate of change	1991–2000	2001–2011
Soya bean oil	2.85	3.37	19%	30%	31%	0.58	1.57	171%	16%	20%
Palm oil	1.29	1.84	42%	14%	17%	1.28	3.09	142%	35%	39%
Rape seed oil	1.39	1.37	–1%	15%	13%	0.43	1.15	167%	12%	15%
Coconut oil	0.30	0.31	4%	3%	3%	0.23	0.20	–11%	6%	3%
Palm kernel oil	0.12	0.24	1%	1%	2%	0.20	0.46	129%	5%	6%
Sunflower oil	1.27	1.25	–2%	13%	12%	0.16	0.33	106%	4%	4%
Total	**9.47**	**10.71**	**13%**	**100%**	**100%**	**3.70**	**7.88**	**113%**	**100%**	**100%**

Source: Kojima et al. (2016) derived from FAOSTAT data

3.1.1 Coconut oil in the vegoil complex

Coconuts are classified as an oil seed, with most coconut products being part of the vegoil complex. The markets and prices for most coconut products are directly affected by interactions within the complex. To comprehend developments in coconut product markets, it is necessary to understand the interrelationship between the prices and demand for all the vegetable oils within the vegoil complex. Even the few coconut products that are not part of the vegoil complex are indirectly affected through competing demand for inputs along their value chains.

The vegoil complex is made up of around 20 oil seeds. These include grains (soya bean, sunflower, canola [rape seed]), ground nuts (peanuts) and tree crops (oil palm and coconuts). Some are grown only in temperate climates (canola), others only in the tropics (oil palm and coconuts), while most are grown in both temperate and tropical environments (soya bean, sunflower, corn, sesame and cotton). Soya bean and palm oil are dominant oil seeds in the vegoil complex. Between 2001 and 2011, soya bean accounted for around 30% of vegetable oil consumption globally, and palm oil around 17% (Table 1). In the industrial sector, palm oil was much more important, accounting for nearly 40%, compared with around 20% for soya bean oil. The primary product made from soya beans is cake for the supply of proteins in the manufacture of animal feed. This is not part of the vegoil complex. Soya bean oil, the bi-product from soybean cake, is the product that enters the vegoil complex.

Particular oil seeds have different characteristics, due to their oils having different attributes. These substitute for each other in the production of a wide and increasing variety of final products. The price of a particular vegetable oil reflects its own demand and supply situation, together with its competitive position relative to other oils and, now, other liquid energy products. As a result of this inter-relationship, price formation of vegetable oils tends to be more complex than for most other agricultural commodities. Superimposed on market forces are the intervention measures taken by national governments in each country by way of subsidies, tariffs, quotas and export taxes. The situation is summarised by ITC (2012).

> *The major characteristics of the vegetable oils markets, palm oil included, are the overwhelming weight of governmental policies on the sector development; the volatility of prices and the impact of speculation; and the correlations between the consumption and prices of several oils due to their substitutability for major uses (p 16).*

Coconut oil's market share in the vegoil complex is small, accounting for around 3% of oil consumption in both food and industrial uses. Palm kernel oil, coconut oil's closest substitute, accounts for about 1% of vegetable food use and 6% of industrial use. Coconut oil and palm kernel oil together make up the lauric oil sub-complex. This sub-complex complex is discussed in some detail below, due to its importance for coconut products markets.

Palm oil's growing dominance in the global supply of vegetable oils is due to its competitive position in comparison to other oil seeds. The yield per hectare of oil palms is five to ten times higher than that of other oil-bearing crops – particularly coconuts (ITC 2012). Compared with grain crops, oil palms have much lower requirements in terms of fuel, fertilisers and pesticides. Palm oil's competitive production advantage is expected to increase further as, of all the oil seed crops, it is expected to be the least adversely effected by climate change (Taylor et al. 2016: 261). The most adversely affected by climate change are the vegetable oils derived from grain crops. Mature coconut palms (five to 50 years), like oil palm, are also expected to fare relatively well in the face of climate change and the comparative advantage of the oil produced is likely to improve. Unfortunately for PICs, however, an increasing number of coconut trees are regarded as senile. These senile trees will be particularly vulnerable to the expected increasing intensity of cyclones (Taylor et al. 2016: 257).

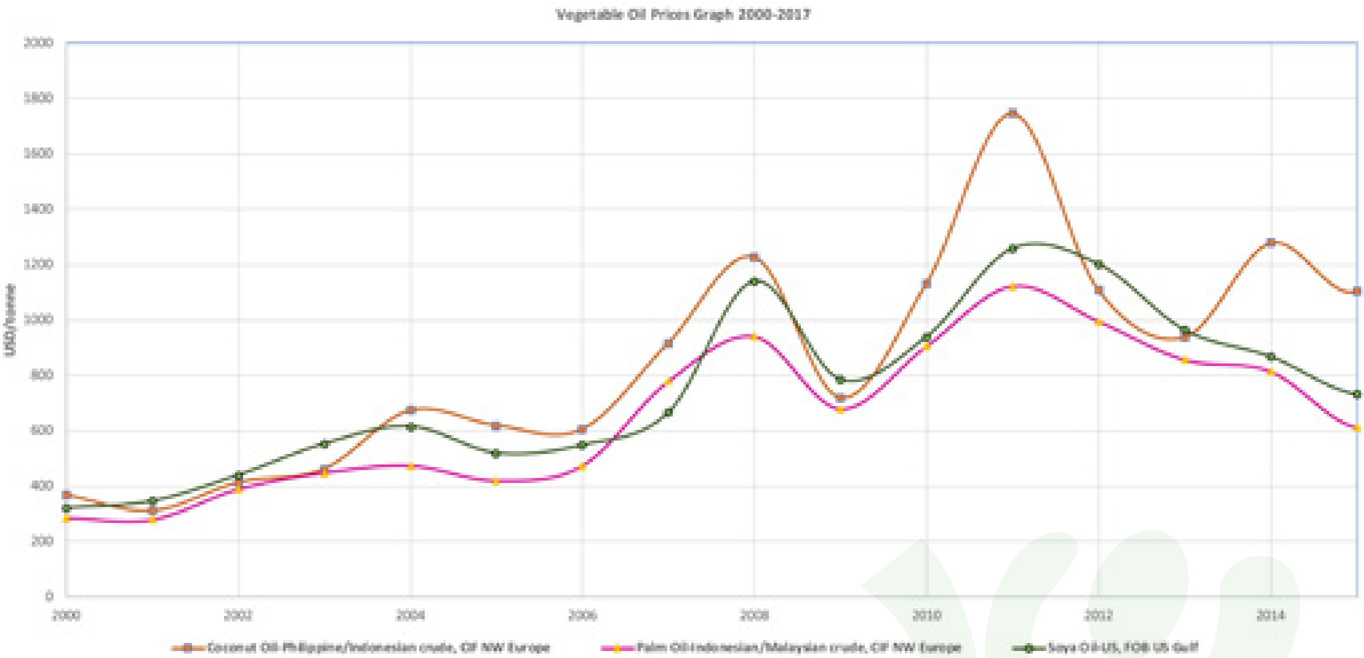
The lauric oil sub-complex: coconut and palm kernel

Lauric oils are defined as vegetable oils having a lauric acid content of approximately 50%. The lauric oil sub-complex is made up almost entirely of coconut oil and palm kernel oil.[2] This high lauric acid characteristic affords particular advantages, particularly in food uses, compared with other vegetable oils and justifies the designation as a vegetable oil sub-complex. The medium chain fatty acids (MCFA), or medium chain triglycerides, that make up lauric oils are believed to have particular digestive health advantages (Bawalan 2011: 11). The main food uses for lauric oils are in ice cream, margarine, chocolate and confectionary products. Sodium laurate (the sodium salt from lauric acid) is considered to produce the finest soaps and detergents. Palm kernel oil and coconut oils are interchangeable in many applications because of their similar properties.

2 Oil palm planting is done primarily for the oil derived from the mesocarp of the palm fruits. However, palm kernel oil is a valuable bi-product derived from the palm kernels. For every tonne of palm oil produced, around 130 kgs of palm kernel oil is obtained. This high lauric acid product is almost technically identical to coconut oil; it enters the same marketing channels and commands approximately the same price.

It is only in recent years that the health value of lauric oils has been recognised and promoted. This has been able to offset the consumer resistance to tropical oil generated by the American Soybean Association (ASA) in the 1980s.[3] Klurfeld (1991) notes that changes in the dietary intake of fats and oils that occurred over the past century comprised an increasing consumption of saturated and partially hydrogenated trans-fats, which can increase the risk of coronary heart disease by raising levels of 'bad' cholesterol and lowering levels of 'good' cholesterol. It was on this basis the claim was made that tropical oils (palm oil and coconut oil) were harmful to public health and such erroneous claims continue to be made. Yet the chemical composition of lauric oil is neutral in terms of cholesterol.[4] Therefore, it is now widely accepted that the consumption of palm oil and coconut oil as a source of dietary fat does not pose any additional risks for coronary artery disease when consumed in realistic amounts as part of a healthy diet (Klurfeld 1991).

The average price of lauric oils tends to be significantly higher than that of the main vegetable oils (soya bean oil and palm oil) (Figure 1). Lauric oil prices also tend to more unstable due to their more specialised uses and thus their more price inelastic (demand tends to be relatively unresponsive to price). A comprehensive model of the world lauric oil economy built in the 1970s estimated the own short run price elasticity of demand for lauric oil in the US to be –0.16 (Labys 1975: 222).[5] More inelastic demand, combined with greater production variability, explains the greater price instability of coconut oil and palm kernel oil compared with other vegetable oils. Thus, lauric oils are perhaps the most price unstable of any major internationally traded commodity (Warr and Wolmer 1996) – something PIC copra growers have long lived with.



Source: Data provided by the Public Ledger

Figure 1: Soya bean oil, palm oil and coconut oil prices 2000–2017

The privileged position of lauric oils in the market place has been under some threat with the emergence of genetically modified rape seed oil that has a high lauric content (Becker and Rohde 2001). This competition is likely to affect the demand for coconut oil in its industrial uses – although it does not yet seem to be reflected in price premiums received for coconut oil.

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3 By the mid-1980s, soybean oil accounted for more than 70% of all edible oils in the United States; palm and coconut oils, only 4%. However, the domestic oil industry viewed with alarm the competing interest of the imported oils. In 1986, with endorsements from other farm groups, the American Soybean Association (ASA) launched a series of attacks that became known as the "tropical grease campaign." The campaign created a new term, "tropical oils," and used the phrase derisively. ASA convinced many consumers that tropical oils were unhealthy, and consumers should be warned on product labels (Klurfeld 1991).

4 Specifically the hypercholesterolemic effect caused by the less than 1.5% of lauric and myristic saturated fatty acids contained in the oil are compensated for by the moderate amounts of monounsaturated oleic acid and linoleic fatty acids, which are hypocholesterolaemic, as well as by the presence of vitamin E, which are natural inhibitors of cholesterol synthesis (Klurfeld 1991).

5 A 1% increase in the lauric oil price leads to a 0.16% decrease in demand, all other variables (price of substitutes, income) remaining constant.

3.1.2
The inter-relationship between prices within in the vegoil complex

A chart showing vegetable oil prices over the last 40 years reveals two broad conclusions.

- The prices of all vegetable oils generally move together – with the prices of some more closely correlated than the prices of others.
- Over the last decade there has been a general upward trend in vegetable oil prices.

Table 2 shows the estimated correlations between prices (average annual) of the various oils in the vegoil complex. The table is divided in two time periods: Period A (1977 to 2003) and Period B (2000 to 2016).

Table 2: The correlation between prices of various vegetable oils: 1977 to 2003 and 2000 to 2016

						Period A: 1977–2003*
	coconut oil	palm oil	palm kernel oil	soya bean oil	sunflower oil	rapeseed oil
coconut oil	1	0.89	0.99	0.80	0.71	0.76
palm oil	0.89	1	0.89	0.94	0.92	0.92
palm kernel oil	0.99	0.94	1	0.83	0.74	0.80
soya bean oil	0.80	0.94	0.83	1	0.95	0.97
sunflower oil	0.71	0.92	0.74	0.95	1	0.96
rapeseed oil	0.76	0.92	0.80	0.97	0.96	1

***McGregor (2003: 4)**

						Period B: 2000–2016**
	coconut oil	palm oil	palm kernel oil	soya bean oil	sunflower oil	rapeseed oil
coconut oil	1	0.86	0.98	0.83	0.79	0.39
palm oil	0.86	1	0.96	0.96	0.95	0.24
palm kernel oil	0.98	0.96	1	0.95	0.92	0.49
soya bean oil	0.83	0.96	0.95	1	0.95	0.37
sunflower oil	0.79	0.95	0.92	0.95	1	0.16
rapeseed oil	0.39	0.24	0.49	0.36	0.16	1

**** Calculated from data provided by the Public Ledger**

The correlation between coconut oil and palm kernel oil prices is the highest amongst all the vegetable oils, being 0.99 for the period 1997 to 2003 and 0.98 for the period 2000 to 2016. This compares with the correlation between coconut oil and palm oil prices of 0.89 and 0.86 respectively over the same periods. It is notable that price correlations between the oils within the vegoil complex have fallen somewhat, indicating decline, but still high substitutability between most vegetable oils.

3.1.3
Increasing income driving the increased demand for vegetable oil

The income elasticity of a product measures the change in the consumption in response to changing income, controlling the other main factors affecting demand (the price of the product, prices of substitutes, population growth, etc.). At low income levels, the income elasticity of demand for vegetable oils is high – demand is highly responsive to changes in income. At higher income levels, the income elasticity is lower (demand is less responsive to changes in income) until, at a certain level, response ceases and the market reaches saturation.

China

An econometric study by Fang and Beghin (2000) for China estimated the income elasticity for soya bean oil to be 0.27.[6] The rapid growth in per capita income in China has been a major contributing factor in the substantial expansion of vegetable oil consumption in recent decades. In addition, in the lead-up to China's accession to the World Trade Organization (WTO), there was a partial dismantling of the restrictions on edible oil imports and a reduction in domestic prices towards international prices. The consequence of these combined factors is that China's vegetable oil consumption increased from 10.3 million tonnes in 1997 to 35.7 million tonnes in 2016 (266% increase), with imports increasing from 3.5 million tonnes to 8.2 million tonnes (134% increase) over the same period (Figure 2). China has become the largest consumer of vegetable oil and the second largest importer after India (USDA FAS).

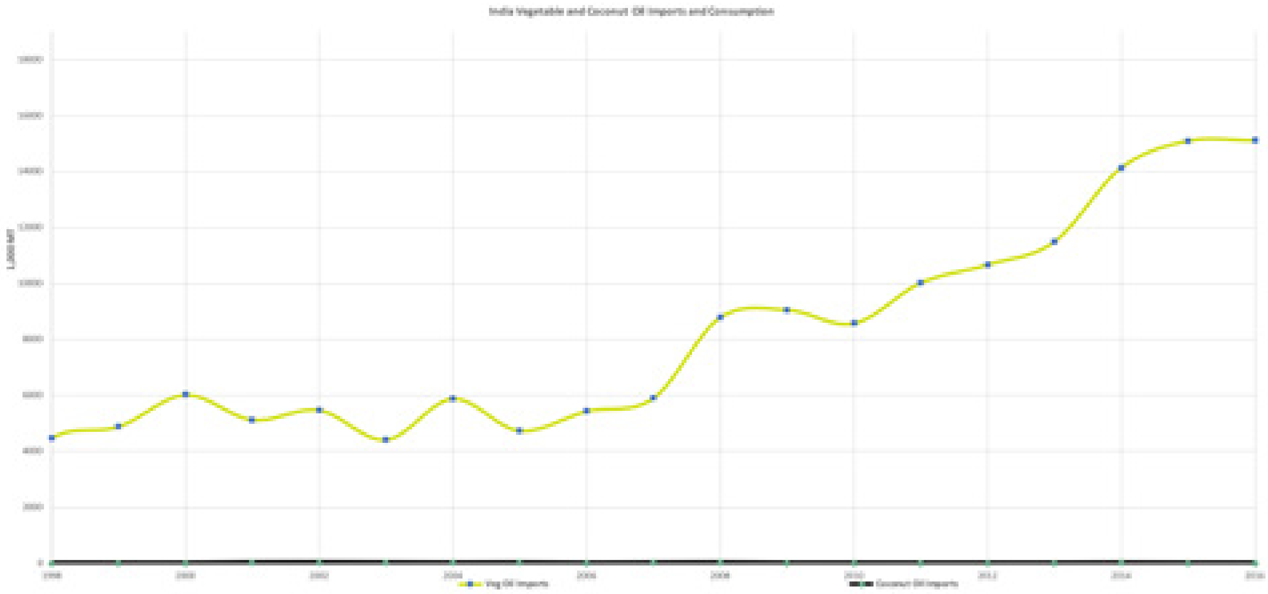
Source: USDA, Foreign Agriculture Service

Figure 2: China's vegetable consumption, imports and coconut oil imports

India

Similar results are found for India, the other rapidly growing vegetable oil market. Pan et al. (2008), estimated the income elasticity for vegetable oil used in food to be 0.57 and in industrial use to be 0.64. Vegetable oil imports to India are around 15 million tonnes. A large population, steady economic growth, trade policy reforms in the early 1990s, and domestic programmes that favoured the production of cereals have contributed to a three-fold increase in vegetable oil imports in the last few decades (Figure 3). There still remains considerable scope for expanding Indian consumption of vegetable oil as, per capita, edible oil consumption remains relatively low – 19 kgs in 2016/2017 compared to 26.3 kg for China, 39.9 kg for USA and 21.5 kg for the European Union (USDA FAS). Most of the increase in domestic demand has been met by rising imports, rather than increased domestic production.

6 A 1% increase in per capita income in China leads to 0.27% increase in soya bean oil consumption, controlling for the influence of other factors.



Source: USDA, Foreign Agriculture Service

Figure 3: India's vegetable oil imports

Europe, North America and Japan

In Europe, North America and Japan, average per capita income is still significantly higher than that of China and India, and total vegetable oil consumption reflects this. However, growth has been low to stagnant. For USA, Kojima et al. (2016) estimated, the income elasticities for soya bean oil to be 0.11 in food use and 0.08 in industrial use. Income levels in China and India and in some other developing countries can be expected to continue to grow faster than in North America, Europe and Japan. It will thus be these countries, with their higher income elasticity, that will continue to drive the demand for vegetable oils, including coconut oil.

3.1.4
The changing structure of vegetable oil consumption for non-food uses

At the beginning of the 21st century, around 94% of the world output of vegetable oils was used in the food sector. The development of oleo chemical industries and biofuel drastically changed the structure of vegetable oil consumption. By 2010/2011, 72% of the world production of vegetable oils was used in the food sector – with the industrial and biofuel uses accounting for 18% and 15% respectively. It was palm oil that led the charge on non-food uses of vegetable oil (ITC 2012 and Fry (2010).

3.1.5
Summary

Since the turn of century there has been a large increase in global consumption of vegetable oil and a change in the structure of the market. The key causal factors can be summarised as:

- population and income growth in some developing countries, with high-income elasticities of demand for vegetable oils;
- India becoming a major importer of vegetable oil – although coconut oil imports remain insignificant;
- China's more than threefold increase in vegetable consumption and a doubling of vegetable oil imports (coconut oil imports remain relatively small);
- the accelerated technological development in the use of vegetable oils in non-food products;

- a rapid increase in demand for biofuels (now subsided somewhat), particularly for products with a lot of oil and minimal amounts of meal (particularly palm oil);
- palm oil, with production efficiency and relatively high oil content, being consistently able to achieve the fastest production growth among the major vegetable oils, so increasing comparative advantage is expected for palm oil in the face of climate change; and
- health concerns and labelling requirements regarding the trans-fatty acid (TFA) content of foods having an increasing effect on consumer decisions in favour of particular vegetable oils (particularly coconut and palm kernel oil).

3.2
Coconut oil and copra as commodities in international trade and the performance of PIC exporters

3.2.1
Current trade in coconut oil and copra

While all vegetable oil markets are inter-related, it is the lauric oil complex that is of most importance to coconut oil. World trade in lauric oils is shared approximately equally between coconut oil and palm kernel oil.

The Philippines dominates the world coconut economy, accounting for about 40% of world copra production (Table 3) and 60% of world exports of coconut oil (Table 34). Indonesia and India are also substantial producers – with Indonesia being a significant exporter. PIC's share of world coconut oil exports ranges from 3% to 6% annually, depending on the volume supplied by the Philippines in that year. PICs make up around 5% of world copra production. While this share is relatively small, it is higher than that of any other major PIC export commodity, other than oil palm in Papua New Guinea and Solomon Islands. When it comes to trade in copra, PICs are in the unique position of being the most important supplier, with a market share of over 50% (Table 5). Papua New Guinea has the distinction of being the world's largest copra exporter, followed by Vanuatu. The Philippines exports insignificant amounts of copra.

Table 3: PIC and world copra production (tonnes) 2011–2015

	2011	2012	2013	2014	2015
PIC Production					
FSM	265	1224	1224	76	76
Fiji	17,000	16,111	12,088	18,776	3,807
Kiribati	8,729	8,832	8,938	8,111	7,349
PNG	146,526	88,555	61,536	85,281	86,873
Samoa	20,000	14363	5,000	5,000	5,000
Solomon Islands	6,600	26,610	14,066	19,101	17,746
Tonga	6,000	10,333	10,303	9,459	9,030
Vanuatu	25,500	36,068	24,576	39,807	36,274
Palau	8600	8420	8420	8252	8200
Total PIC	**239,220**	**2,105,516**	**146,151**	**193,863**	**174,355**
Philippines	1,869,000	2,633,000	2,578,000	1,887,000	1,934,000
Indonesia	1,358,000	1,491,750	1,481,174	1,461,919	1,315,727
India	975,000	1,234,000	1,289,000	1,16,5000	1,072,000
Rest of world	523,550	511,178	525,804	457,266	460,143
Total world production	**4,964,770**	**6,080,444**	**6,020,129**	**4,000,048**	**4,956,255**
PIC share (%)	**4.82%**	**3.46%**	**2.43%**	**4.85%**	**3.52%**

Source: Asia Pacific Coconut Community Year Book 20015

Table 4: PIC and world coconut oil exports (tonnes): 2011–2015

	2011	2012	2013	2014	2015
PIC Production					
Fiji	1,328	3,794	1,494	1,630	1,794
PNG	54,349	19,847	13,466	11,068	18,467
Samoa	2,509	3,935	1,633	1,428	1,020
Solomon Islands	470	172	196	238	1,163
Tonga	2531	3961	1428	1452	0
Vanuatu	12000	10011	5535	9,208	6,570
Total PIC	**73,187**	**41,720**	**23,752**	**25,024**	**29,014**
Philippines	781,411	852,236	1,080,836	815,018	765,558
Indonesia	540,050	799,973	630,568	771,419	760,072
Malaysia	143,611	136,783	131,068	187,665	152,091
Rest of World	316,428	296,958	347,674	278,857	361,450
Total world exports	**1,854,687**	**2,127,670**	**2,213,898**	**2,077,983**	**2,068,185**
PIC exports as % total	**4%**	**1.9%**	**1.1%**	**1.2%**	**1.4%**

Source: APCC 2015 Year Book and Oil World

Table 5: PIC and world copra exports: 2011–2015 (MT)

	2011	2012	2013	2014	2015
FIC exports					
FSM	146	540	540	76	-
Fiji	-	3	3	-	-
Kiribati	3,296	3,182	417	1,332	1,807
PNG	46,500	34,725	15,673	48,228	38,311
Samoa	-	-	-	-	1,968
Solomon Islands	37,287	28,582	9,200	15,856	17467
Tonga	-	-	-	-	-
Vanuatu	13596	16336	12508	25194	12584
Total PIC	**100,825**	**83,368**	**38,341**	**123,873**	**72,137**
Philippines	274	464	591	1954	480
Indonesia	34565	48305	29393	53802	48350
Malaysia	1141	1946	711	684	622
Rest of World	24799	33783	37758	39800	32541
Total world exports	**161,584**	**167,866**	**106,794**	**186,926**	**154,130**
PIC % of world exports	**53.6%**	**49.6%**	**36%**	**66%**	**46.8%**

Source: APCC Year Book and Oil World

World imports of copra oil are highly concentrated, with the EU accounting for about 50% – Germany the most important buyer (Table 6). USA accounts for about 25% of imports, coming almost entirely from the Philippines.

World copra imports are usually less than 20% of coconut oil imports and these are dominated by Europe and, in particular, Germany (Table 6). In 2006, Bangladesh emerged as an important market for Pacific Island copra, particularly for Vanuatu and Solomon Islands, only to withdraw from the market in 2014.

When it comes to the import of coconut oil and copra, India and China remain minor players. In 2015 China imported 95,500 tonnes of coconut oil, compared with total vegetable oil imports 8.5 million tonnes. For India coconut oil imports were 22,000 tonnes, compared with total vegetable oil imports of 15.1 million tonnes. India, however, is a major coconut oil producer – producing 1.1

million tonnes in 2015, that was sold almost entirely on the local market). Thus unless this pattern of consumption changes significantly, coconut oil and copra will not benefit directly from the demand growth of these giants. However, coconut oil market will benefit indirectly due to inter-relationship between all the oils that make up the "vegoil" complex.

Table 6: World coconut oil and copra imports: 2011–2015 (tonnes)

	2011	2012	2013	2014	2015
Coconut oil					
Europe	714,831	722,029	1,023,135	774,102	966,530
Germany	232,227	290,518	342,987	197,549	320,300
Netherlands	146,873	80,971	275,562	228,966	268,700
UK	49,793	42,380	42,772	62,436	32,800
Africa	26,978	31,555	30,589	24,166	26,700
Americas	470,762	621,791	636,812	370,412	521,870
USA	423,189	589,192	588,054	335,784	477,500
Asia	259,193	204,735	252,101	348,722	391,820
China	43,400	32,670	72,302	39,483	95,500
Japan	19,996	28,045	33,321	28,128	32,300
India	6,900	4,400	1,373	23,500	22,000
Korea Rep	49,130	45,466	39,084	40,718	43,500
Pacific	22,743	17,980	16,850	18,832	16,100
Australia	17,613	13,400	14,000	14,834	12,200
Total coconut oil imports	**1,494,507**	**1,598,090**	**1,959,487**	**1,536,234**	**1,923,020**
Copra					
Europe					
Germany	96	84	18	-	-
UK	26	50	-	44	48
France	285	147	1811	148	122
Belgium-Lux	-	-	-	-	1
Ireland	-	15	15	-	-
Spain	-	4	345	24	9
Others	34	95	60	210	1,431
Africa	17	1,790	50	73	1,979
Americas	-	157	108	-	6
USA	-	132	16	-	-
Trinidad & Tobago	-	21	49	-	-
Others	17	40	50	73	1979
Asia	169,024	143,297	76,604	38,290	121,159
Bangladesh	28,765	13,500	13500	-	-
India	1,00	1,000	1,600	480	1,500
China	4	52	-	-	40
Pacific	-	520	437	262	100
Australia	-	0	8	21	0
New Zealand	197	420	329	141	0
Total copra imports	**280,099**	**334,763**	**354,633**	**296,048**	**270,000**
Copra as % coconut oil imports	**18.7%**	**20.9%**	**18.1%**	**19.3%**	**14.0%**

Source: APCC 2015 Statistical Year Book

3.2.2
The traditional nature of the coconut oil and copra market

The market for crude coconut oil and copra is particularly narrow – traditionally characterised by little product differentiation. There was thus limited opportunity for niche market products from the small exporters in the PICs. Crude oil from crushed copra (CNO), the product produced by most PICs, is not an end product in most coconut value chains. For the most part, crude coconut oil is exported to a few large companies for manufacture into refined, bleached and deodorised (RBD) oil for consumption in the importing countries or for re-export. These companies are mainly located in Europe (particularly Germany and the Netherlands) and Asia (particularly the Philippines). Copra is also exported directly for processing into crude coconut oil and then for further processing into RBD oil. All copra and copra oil, regardless of where it is milled, receives the Federation of Oils, Seeds and Fats Association (FOSFA) price, with quality discounts applying.

More recently, opportunities for niche market oil opportunities have emerged with the rapid development of markets for virgin coconut oil (VCO). VCO is produced directly from fresh mature coconut kernel and thus by-passes the stage of first making copra. Unlike crude or RBD coconut oil, relatively small quantities of VCO can be differentiated in the market in terms of its quality and certification, based on such things as origin, organic production and fair trade. Such niche market products will be the focus of Section 4 of this overview market report.

3.2.3
Time series analysis of coconut product prices and their trends

Commodity prices tend to be unstable, with vegetable oils particularly so. Copra and coconut oil are ranked as the must unstable of all agricultural commodities – something PIC copra farmers and millers are readily aware of. Crude coconut prices for the last two decades for crude coconut oil and copra are plotted in Figure 4 and Figure 5. The first decade was a period of unstable prices with a marked overall downward trend. This was followed by decade of even more unstable prices but with prices trending significantly upwards. Prices reached record levels exceeding USD 2,000/tonne in 2011 and now stand at around USD 1,600/tonne.

Unstable coconut oil prices and the significant upward price trend over the last decade can be explained by a combination of factors:

- the expansion of world trade in vegetable oils with the closure of the Uruguay Round in 1996;
- the high income elasticity for edible oils and income growth in the major growth markets of China and India;
- the replacement of the negative health image of tropical oils for food use in North American and EU markets with a positive health image, and the increasing awareness of the health problems associated with trans fatty acids (TFA) with some other vegetable oils;
- the diversion of edible oils supplies (particularly palm oil and soya bean oil) for use as bio-fuel, which increased the demand for coconut oil. More recently the demand for biofuel has declined with the falling of petroleum prices and growing international concern over the environmental impact of deforestation for oil palm planting and soybean production. This has had a price depressing effect on vegetable oils, including coconut oil;
- continuing contraction in global coconut supply that has been exacerbated by major cyclonic events such as in the Philippines which is the dominant world coconut producer. The production decline has been even greater in PICs than the Philippines– but this represents only a small proportion of global supply.

Figure 4: Coconut oil prices: 1996–2016

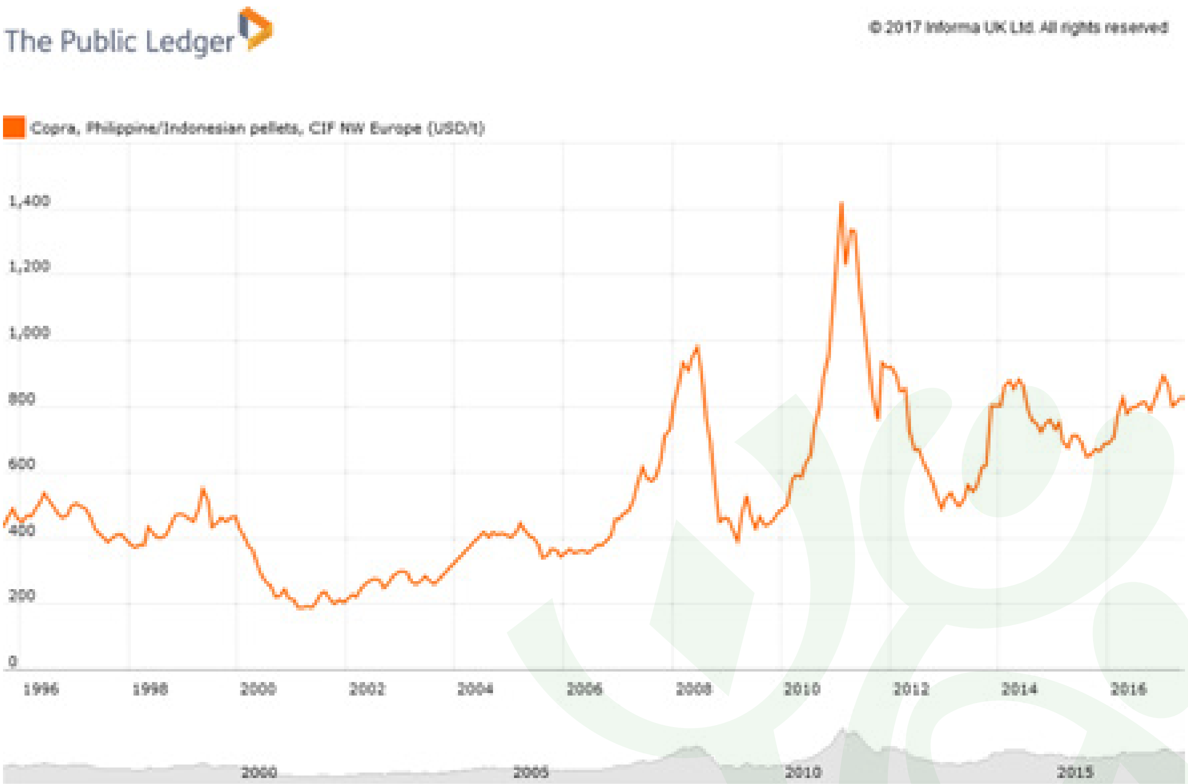


Figure 5: Copra prices: 1996–2016

3.2.4
Comparative performance of coconut oil with other vegetable oils

The Asian Pacific Coconut Community (APCC) has ranked the production/export performance of the 13 major vegetable oils over four decades (Table 7). Over this period, coconut oil has slipped from number 5 in production to number 7. In terms of exports, coconut oil's ranking has fallen from 4 to 5.

Table 7: Changing production and export rankings of vegetable oil

Vegetable oil	1960s	1970s	1980s	1990s
Soybean	1/1*	1/2	1/2	1/2
Palm oil	8/2	5/1	2/1	2/1
Rapeseed	7/11	6/6	4/5	3/4
Sunflower	3/3	2/4	3/3	4/3
Groundnut	2/5	3/5	6/8	5/9
Cotton	4/7	4/7	5/9	6/10
Coconut	5/4	7/3	7/4	7/5
Clove	6/8	8/8	8/7	8/8
Palm kernel	12/10	12/12	10/6	9/6
Corn	11/12	10/11	9/10	10/7
Linseed	9/6	9/9	11/11	12/12
Sesame	10/13	11/13	12/11	11/13
Castor	13/9	13/10	13/12	13/11

Note: The first number is the production ranking and the second number is the export ranking
Source: Boceta 2000

The overall decline in coconut oil exports is reflected in APCC data for the last seven years for major exporting countries (Table 8).

Table 8: CNO exports 2010–2016

Country	2010	2011	2012	2013	2014	2015	2016
Philippines	1,746	1,137	1,353	1,511	1,137	1,124	895
Indonesia	857	840	830	868	911	917	843
India	413	407	401	376	395	371	363
Malaysia	45	51	44	53	50	52	42
Vietnam	33	34	34	34	34	34	33
Papua New Guinea	52	55	55	36	22	16	18
Mexico	132	130	131	129	127	127	127
Other Countries	310	311	311	322	311	311	333
Total	**3,616**	**2,991**	**3,288**	**3,358**	**3,015**	**2,980**	**2,980**

Source: APCC 2017

The decline in prominence of coconut oil can be attributed to a combination of three main factors:

- coconut trees are significantly less efficient producers of oil than their nearest competitor – oil palms;
- aging coconut palms are not being replaced; and
- major losses due to severe cyclonic events.

These factors are discussed briefly below.

Copra yields, when compared with oil palm yields, are low

A well-managed copra plantation can produce the equivalent of 1.7 tonnes oil/ha/year, even if higher yielding hybrids are planted. For old coconut plantations (trees > 50 years old), which are the vast majority of coconut plantings in the Pacific Islands, the achievable yields are significantly lower. In comparison, better oil palm plantations in Malaysia and Indonesia produce 7.5 tonnes oil/ha/year, together with 1.5 tonnes of kernels, which produce an almost perfect substitute for coconut oil (Corely 2003: 5). Relative to the output achieved, the labour requirements for producing copra are higher than those for palm oil. Throughout the Pacific Islands, labour has become increasing scarce in the coconut growing area in the face of rapid rates of urbanisation.

Increasing senility of coconut trees that have not been replanted

The APCC attributes the declining prominence of coconut oil to a stagnant area under coconuts, the senility of existing coconut stands (Table 9) and the absence of appreciable replanting programmes (Boceta: 7), factors that are only too common for PIC coconut producers. The situation has deteriorated significantly over the last few decades and the area under coconuts and the number of productive trees has continued to decline. The fundamental reason for this decline is that the expected future financial returns from replanting have not been sufficient to justify the effort involved. There is an urgent need to develop less arduous processing techniques for copra. In addition, the issue of creating a reasonable economic value for senile palms needs to be developed, thereby providing an incentive for farmers to clear and replant. Coconut timber has for several decades been seen as the product most likely to provide this opportunity. However, the overall uptake has been disappointing. It is only recently that there has been technological development that allows for viable large-scale use of coconut timber in flooring and veneer products.

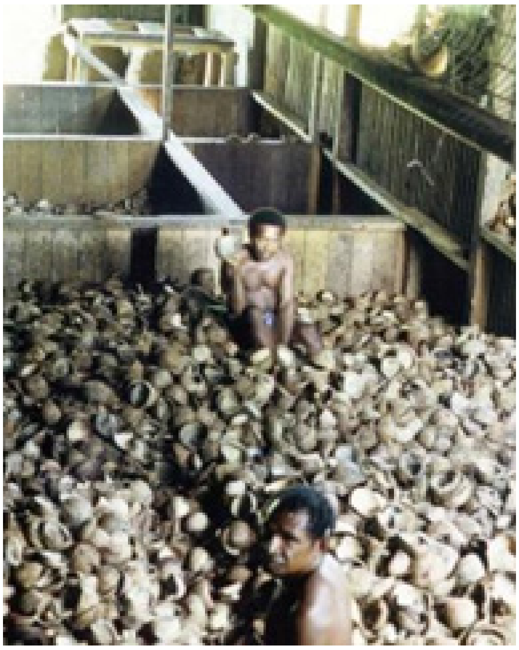
Table 9: The status of existing APCC coconut planting

Country	Coconut Area (Hectares)	Productivity (Nuts/Ha)	Estimated number of trees	Estimated senile palms (50%)
Fed. States of Micronesia	18,000	2,197	2,160,000	1,080,000
Fiji	62,000	2,387	7,440,000	3,720,000
India	2,141,000	10,119	256,920,000	128,460,000
Indonesia	3,610,000	4,530	433,200,000	216,600,000
Marshall Islands	20,000	2,730	2,400,000	1,200,000
Malaysia	88,000	7,464	10,560,000	5,280,000
Marshall Islands	8,000	4,375	960,000	480,000
Papua New Guinea	221,000	6,710	26,520,000	13,260,000
Philippines	3,502,000	4,196	420,240,000	210,120,000
Samoa	99,000	2,697	11,880,000	5,940,000
Solomon Islands	38,000	2,631	4,560,000	2,280,000
Sri Lanka	440,000	6,623	52,800,000	26,400,000
Thailand	206,000	4,859	24,720,000	12,360,000

Country	Coconut Area (Hectares)	Productivity (Nuts/Ha)	Estimated number of trees	Estimated senile palms (50%)
Tonga	31,000	2,423	3,720,000	1,860,000
Vanuatu	92,000	4,512	11,040,000	5,520,000
Vietnam	159,000	7,834	19,080,000	9,540,000
Jamaica	16,000	6,156	1,920,000	960,000
Kenya	177,000	1,462	21,240,000	10,620,000
	10,928,000	**APCC av. 4,661**	**1,311,360,000**	**655,680,000**

Source: APCC 2017

A typical low productivity copra plantation on Espirito Santo, Vanuatu



Men working in a copra dryer, East New Britain, Papua New Guinea. (Source: Mike Bourke)

Major losses due to extreme cyclonic events

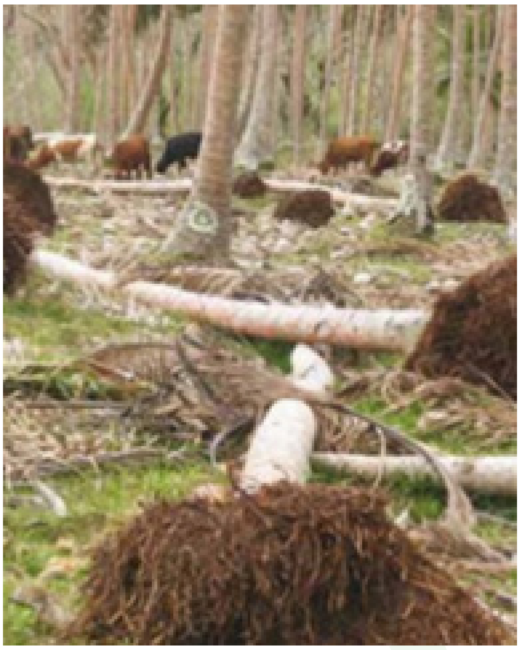
The coconut palms in PICs have proven to be relatively tolerant to cyclones since they evolved in a cyclone-prone environment. As noted in the recently published SPC book, ***Vulnerability of Pacific Island agriculture and forestry to climate change***:

> *South Pacific tall coconut varieties evolved in cyclone-prone environments and therefore have adapted to survive in the strongest of winds. The most violent winds can uproot or break mature palms, but only young and senile palms are really vulnerable. A major problem facing Pacific Island coconut industries is the ever-increasing percentage of senile palms. The main cyclone damage to coconut palms comes from the stripping of fronds which causes premature nut fall and damage to young inflorescences, delaying (although not stopping) future nut production (Taylor et al. 2016: 249).*

Recent years, however, have seen some severe cyclones (category 4 and above – Cyclones Pam in Vanuatu and Winston in Fiji) destroy significant numbers of economically mature coconut trees (between five and 50 years old), not just young and senile trees.

A number of aid-funded projects in the 1980s endeavoured to introduce hybrid coconut varieties. The results were disappointing. The shorter and less elastic palms were found to be to be far less cyclone tolerant than the local tall varieties. Labouisse et al. (2007) found considerable variation in resistance to wind across three groups (dwarf, tall and dwarf x tall) studied in the collection in Espiritu Santo, Vanuatu – with the local tall variety proving to be far more tolerant (Taylor et al. 2016: 249).

The consequences for global coconut oil supply have been most significant in Philippines, the world's dominant coconut producer. Super Typhon Haiyan that struck in November 2013 is reported to have destroyed 15 million coconut trees – or 4% of the total number of the trees in the Philippines (The Wall Street Journal Nov. 21, 2013). Over the same period, PIC coconut industries suffered similar severe cyclone losses. In Fiji, Samoa and Vanuatu, several severe cyclones associated with the El Niño Southern Oscillation (ENSO) cycles, and probably climate change, caused considerable damage to the coconut palm stock. The damage caused has been significantly accentuated by the increasing percentage of senile trees (many over 100 years old). Category 5 Cyclone Pam struck Vanuatu in March 2015 – fortunately on this occasion the cyclone missed the main coconut growing island of Santo. However, Fiji was not so fortunate with Cyclone Winston, which directly hit the main coconut growing areas of Vanua Levu, southern Taveuni and Lau. Some 15% of the mature commercial coconut palms on Wainiyaku Estate in southern Taveuni were destroyed (Personal Communication, Gary Tarte). Wainiyaku Estate is Fiji's largest processor and exporter of VCO and this development represents a major setback.



20 year coconut plantation on Efate, Vanuatu – one week after Cyclone Pam.

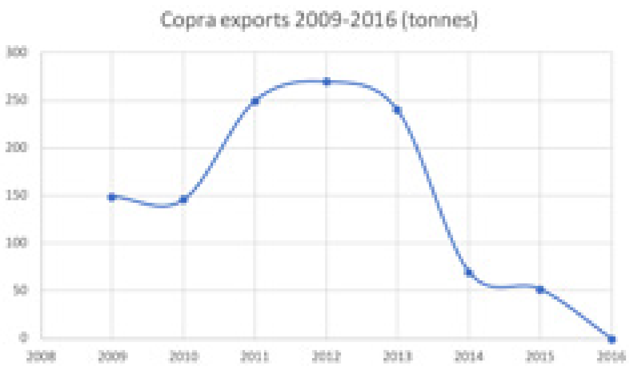
A well-managed 25 year coconut plantation in Wainuyaku, southern Taveuni, 18 months after cyclone Winston.

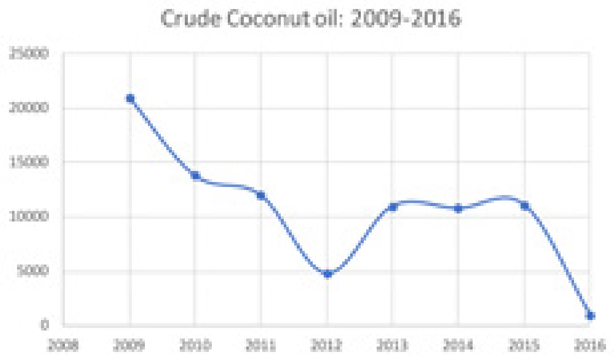
The decline in PIC coconut and copra production and exports

All three of the factors discussed above, together with the increasing impact of coconut rhinoceros beetles (CRB)[7], have had a substantial effect on PIC coconut production and coconut oil and copra exports, all of which have been in significant decline, as illustrated by the graphs in Figure 6 derived from the Central Bank statistics of Fiji, Papua New Guinea, Samoa, Solomon Islands and Vanuatu.

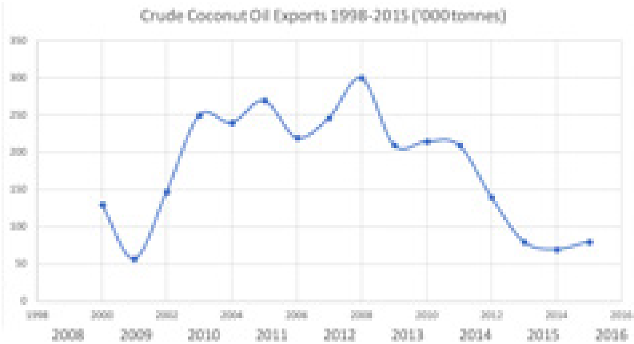
7 See **https://lrd.spc.int/information-and-networks/pest-list-database/the-pacific-communitys-biosecurity-team-conducts-pest-information-system-training-for-cook-islands**

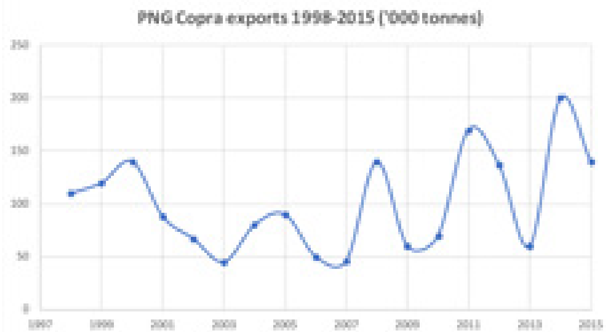
Fiji



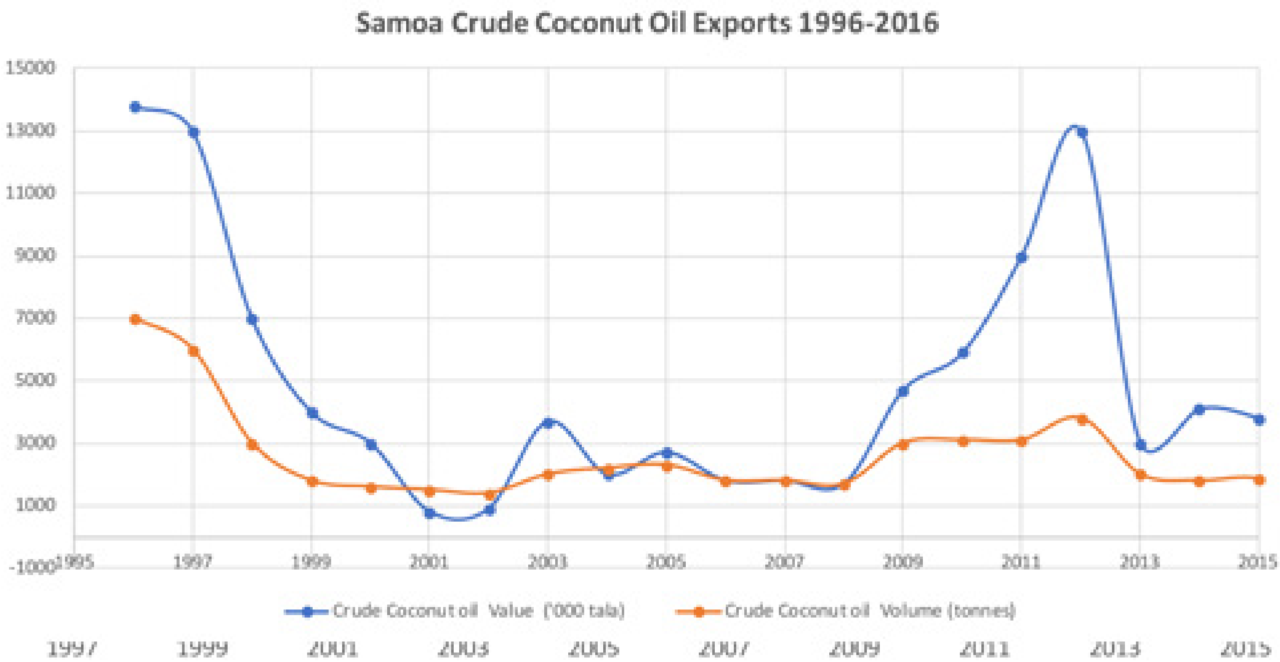


Papua New Guinea

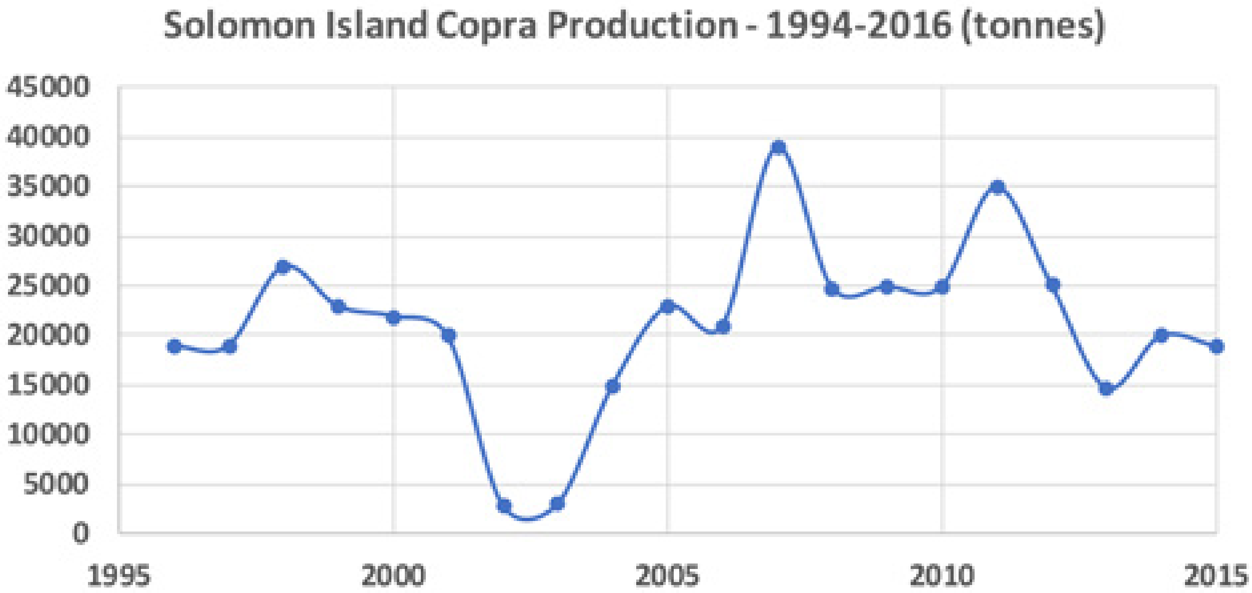




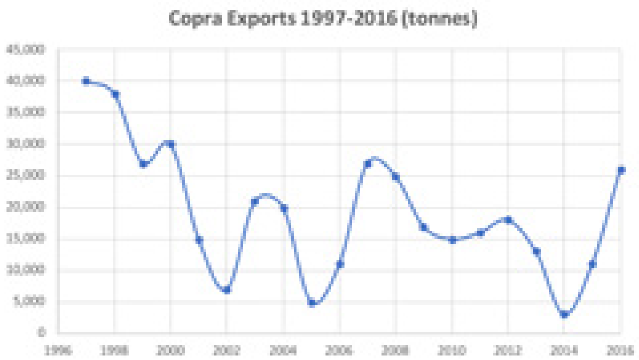
Samoa

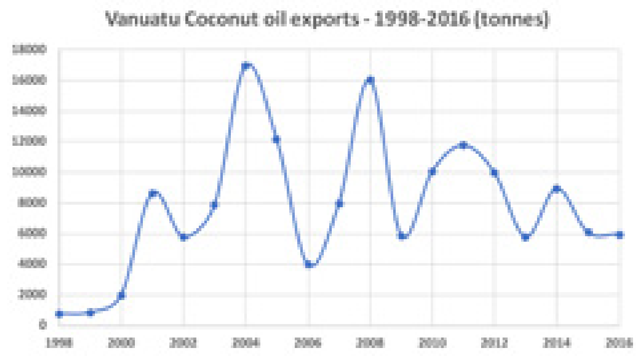


Solomon Islands



Vanuatu





Source: Central Bank statistics of Fiji, Papua New Guinea, Samoa, Solomon Islands and Vanuatu

Figure 6: Coconut production and coconut oil and copra exports in five Pacific Island countries

4 Non-traditional markets for Pacific Island coconut products

As discussed and analysed above, recent years have seen a more favourable market situation for the traditional PIC coconut export products of copra and coconut oil, with prices reaching record levels. Historically, these products were shipped to large-scale processors in Europe. These processors remain the dominant buyers but it has become increasingly difficult for Pacific Island exporters to take advantage of an improved market for crude coconut oil (CNO) and copra. The main reason for this is that shipping directly to European buyers has become largely uneconomical due to decreasing volumes available to ship and the reduction in the availability of Europe-bound shipping. CNO and copra are now largely shipped to Asian markets such as Singapore, Malaysia and the Philippines. This is reflected in the example of Vanuatu in Table 10. The nearby markets of Australia and New Zealand have ample shipping available but the copra oil markets are relatively small and are mainly for refined bleached and deodorised (RBD) oil. However, the additional price received for value-added RBD does not justify the investment required for the scale of PIC milling operations. It is highly unlikely that the situation will change in the foreseeable future with coconut production in the PICs continuing to decline.

Table 10: The direction of trade of Vanuatu's CNO and copra exports: 2000–2016

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Copra																	
Europe markets																	
Belgium	-	-	-	2,503	3,053	4,319	3,761	-	-	-	-	-	-	-	-	-	-
Germany	-	-	-	-	5,862	-	1,396	-	-	-	-	-	-	-	-	-	-
UK	2,356	1,000	1,508	222	-	-	-	-	-	-	-	-	-	-	-	-	-
Sub-total	2,256	1,000	1,508	2,725	8,915	4,319	5,156	-	-	-	-	-	-	-	-	-	-
Other markets																	
Philippines	-	-	-	-	-	-	3,211	19,573	18,175	10,087	12,043	13,336	6,906	5,570	19,474	11,062	21,600
Bangladesh	12,194	6,322	3,771	3,298	-	-	38	3,758	-	-	-	-	-	-	-	-	-
Australia	1	-	-	1,318	-	-	-	-	-	-	-	-	4,220	-	1,689	-	3,491
Hong Kong	-	-	-	-	-	-	-	-	-	-	-	-	2,049	4,311	3,793	-	-
Malaysia	-	-	-	-	-	-	-	1,553	3,205	1,667	-	-	-	-	-	-	1,300
Singapore	-	-	-	-	1,250	-	1,696	-	-	270	-	-	214	-	-	1,522	1,506
Japan	2,923	2,902	2,063	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Other	2,256	1,000	1,504	222	3,004	-	2,761	0	0	528	90	260	58	160	238	-	35
Total	17,374	10,224	7,338	7,341	13,169	4,319	12,862	24,884	21,380	12,553	12,133	13,596	13,447	10,041	25,194	12,584	27,932
Europe markets as a % of total	**13%**	**10%**	**20%**	**37%**	**68%**	**100%**	**40%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**
CNO																	
Europe markets																	
Belgium	-	-	1,843	4,201	5,281	2,703	2,196	1,593	-	-	-	-	-	-	-	-	-
Germany	-	-	-	-	2,434	6,745	-	1,877	1,741	-	-	-	-	-	-	-	105
Netherlands	839	-	-	-	749	892	-	1,587	7,868	-	11	11	-	-	-	-	-
France	-	-	1,045	3,283	1,627	0	2	890	866	2,246	12	8	-	-	-	-	0
Sub-total	839	-	2,889	7,484	10,090	10,340	2,198	5,948	10,475	2,246	23	18	-	-	-	-	105
UK	-	-	-	**0**	**3,326**	**1,255**	**918**	**0**	-	-	-	-	-	-	-	-	-
Australia	688	8,729	6,957	1	-	1	780	13	-	-	2,173	2,327	2,365	3,975	7,974	6,295	4,533
Malaysia	-	-	-	-	-	-	-	-	-	-	-	8,411	3,712	-	800	-	1,218
New Zealand	-	-	-	-	-	-	0	2,152	5,755	442	1,117	1,258	146	47	4	20	130
Other	34	4	12	4	5,546	8,389	0	1,986	1,742	218	4,464	7	715	2	60	4	157
Total	1,561	8,733	9,858	7,489	16,529	13,239	3,896	8,222	16,231	2,906	7,777	12,021	6,938	4,023	8,838	6,319	6,037
Europe markets as a % of total	**54%**	**0%**	**29%**	**100%**	**61%**	**78%**	**56%**	**72%**	**65%**	**77%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**2%**

Source: Vanuatu Department of Statistics

Thus attention has now turned to niche coconut products for both export and domestic markets. Much smaller volumes are differentiated in the market, which enables the receipt of significantly higher prices that can allow for commercial viability. The differentiation has been in terms of specific quality attributes, origin (country or specific in-country location), and certification (organic or fair trade) or various combinations of these. The focus for PIC producers has been on virgin coconut oil (VCO). Globally, however, there has been a very large increase in the demand for a wide range of products – in particular coconut water and coconut milk/cream.

The markets for VCO, coconut water, and coconut milk and cream products are discussed below with a focus on the ability of PIC producers' ability to supply to these markets.

4.1 Virgin Coconut Oil (VCO)

VCO marketed Nature Pacific (Aust.) Ltd the largest importer from Fiji.

VCO being produced by Copra Millers of Fiji Ltd in Savusavu.

VCO is produced directly from fresh, mature coconut kernel and thus by-passes the first stage of making copra. VCO is officially defined by the Philippines National Standard as:

an oil obtained from the fresh, mature kernel of the coconut by mechanical or natural means, with or without the use of heat, without undergoing chemical refining, bleaching or deodorizing, and which does not lead to the alteration of the nature of the oil (Balwalan 2011: 12).

VCO as an oil is suitable for consumption without the need for further processing. There are two broad types of VCO processing technologies:

- fresh-dry VCO processing (which involves either fresh dry; low pressure oil extraction or high pressure oil extraction or centrifuge oil extraction); and
- fresh-wet VCO processing (which involves either: the fresh wet: the modified kitchen method or the modified natural fermentation or centrifugal extraction).

'VCO is the purest form of coconut oil. It is clear/ colourless, contains natural Vitamin E and has not undergone atmospheric and hydrolytic oxidation as attested by its low peroxide value and low free fatty acid content. It has a mild to intense fresh coconut aroma. The intensity of the scent depends on the process used in its production' (Balwalan: 13). A common misconception is that oil must be 'cold pressed' to be classified as VCO and this term is often used in the marketing of the product.

RBD and VCO coconut oil have the same physical and chemical characteristics but have different sensory attributes. VCO, according to Balwalan (2011), is considered unique in that it is the only oil that is multi-functional. It has more uses than RBD coconut oil and can be utilised in all applications where crude and RBD coconut oil are traditionally used. It is seen as a much better alternative than RBD or palm kernel oil if it is available in reasonably large quantities at an affordable price. The major uses for VCO are as a:

- hair and skin conditioner;
- oil base for various cosmetic and skin care products;
- carrier oil for aromatherapy and massage oils; and
- nutraceutical and functional food.

The Philippines were the first to enter the VCO market in the mid-1990s on a very small scale. ITC (2016), reports that VCO exports from Asian Pacific countries in 2001 amounted to only two tonnes but reached 7,300 tonnes in 2012 – with prices up to five times that of crude coconut oil on global markets (ITC 2016: 11). When the first VCO exporter from the Philippines entered the USA market in 2001, it received USD 11,000 per tonne, falling back to just over USD 3,000 per tonne by the end of decade (Bawalan 2011: 9). The average export price received for Philippines VCO sold in the USA over this period was nearly five times higher than that of RBD coconut oil (CNO) (Bawalan 2011: 9)

Since 2000, the growth of VCO exports has been exponential, as reflected in Philippines' VCO exports shown in Figure 7. By 2015, the Philippines were exporting over 35,000 tonnes of VCO. Philippines VCO is now sold to 42 countries – USA (60%), Netherlands (10%), Canada (8.5%) and the balance to Europe, China, Japan, Singapore, Australia and SE Asia (APCC 2017). Price, fob Manilla, currently ranges from USD 4,000–6,000/tonne (APPC 2017). Gatz International noted: 'Growth could have been even stronger if sufficient production capacity would have been available, as producers struggle to expand their production capacity at the same pace as demand. With more desiccated coconut factories converting part of their capacity into VCO production, this will have an increasing impact on desiccated coconut output' (Public Ledger Jan 8 2015).

Source: APCC 2017

Figure 7: Philippines VCO exports: 2001–2015 (tonnes)

There has also been rapid growth in VCO exports from Sri Lanka, with 16,000 tonnes exported in 2016 (Public Ledger Sept 2016). This compares with only 5,233 tonnes in 2013 (Table 11). Australia has been a major market for Sri Lankan VCO, which competes directly with VCO from the Pacific Islands. In recent years there have been major quality issues with Siri Lankan VCO (Public Ledger, various issues). It is notable that the fob price received for Sri Lankan VCO has not been significantly higher than that received for Sri Lankan RBD oil (Table 11).

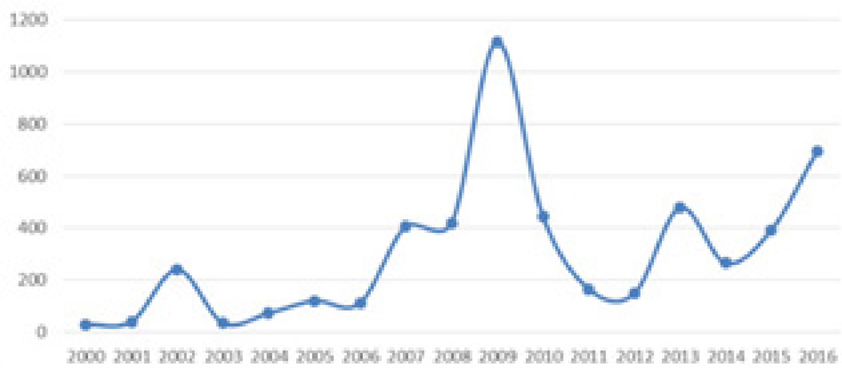
Table 11: Sri Lankan VCO exports: 2013–2015

	2013	2014	2015
VCO			
Quantity (Tonnes)			
Europe	24	68	3,588
Asia	40	253	1,734
US	1,146	3,183	5,444
Australia	150	1,295	1,750
New Zealand	27	95	125
Other	714	2,384	712
Total	**2,101**	**7,278**	**13,353**
Value ('000 USD fob)	10,973	39,783	74,374
USD/tonne fob	5,223	5,466	5,570
RBD			
Quantity (Tonnes)	3,821	11,254	8,679
Value ('000 USD fob)	17,154	58,438	46,338
	4,489	**5,193**	**5,339**

**Source: APCC Statistical Year Book 2015*

Among PICs, Fiji, Samoa and Solomon Islands were early entrants into VCO export markets (Figure 8 and Figure 9). Samoa's Women in Business and Fiji's Wainiyaku Estate on Taveuni were amongst the first to secure organic certification, which was to provide them with a major advantage in terms of obtaining recognition in the market. In Solomon Islands, Kokonut Pacific (Solomon Islands) Ltd (KPS) sourced its VCO supplies through its network of small, village-based direct VCO micro expellers. In subsequent years, more Pacific Island entrants ventured into VCO production – including Marshall Islands, Papua New Guinea and Vanuatu. These have largely been small-scale village-based operations and actual production and export figures are not available.

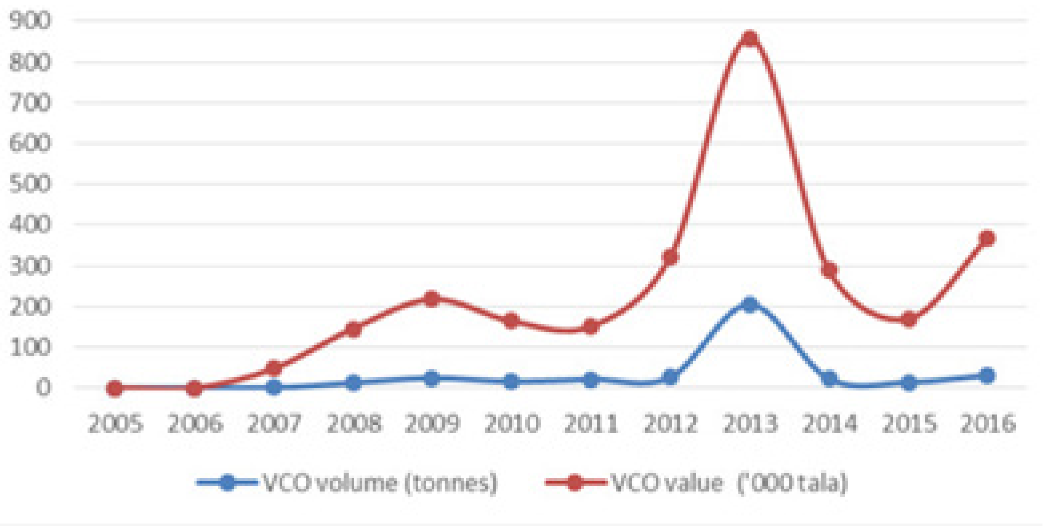
The scale of investment required for VCO is considerably smaller than that for RBD – classified as either medium, small or even micro-village scale. This, coupled with the significantly higher price that has been received for VCO, has made VCO production feasible for PIC producers, despite the substantially greater labour input requirements. The high prices on offer encouraged governments, NGOs and donors to promote village-based VCO enterprises with the expectation that markets would be readily available. There was a misconception that VCO could be readily 'pushed' through the value chain, rather than being 'pulled' through it by larger processing exporting companies, such as Wainiyaku Estate on Taveuni, which was connected to the market. A major challenge for micro, or village scale, producers has been to achieve consistently high quality oil that meets international standards. In the case of Fiji, it is reported that a particular challenge for micro village-based VCO producers has been the consistent achievement of a final moisture content of 0.1% that is necessary to prolong shelf-life.[8] Even if quality standards are meet, small producers have faced additional challenges relating to their throughput being insufficient to provide an adequate return for the work input required and to create sustainable marketing and market linkages. As a consequence. many of these small village-based VCO enterprises have fallen by the wayside and it is expected to become increasingly more difficult for them to remain viable in the current, less favourable price environment.



Source: EP&S MoA Fiji Bureau of Statistics

Figure 8: Fiji exports of VCO: 2000–2016

8 Based on discussions with Copra Millers Fiji Ltd (Ashok Kumar), Fiji AgroMarketing (Mere Salusalu), Nature Pacific Pty Ltd (Stacey King) and Brother Sepo (Tutu Rural Training Centre, who was involved with village-based VCO production on Rotuma)



Source: Central Bank of Samoa

Figure 9: Samoa exports of VCO: 2005–2016

Thus, over the last decade, VCO has transformed itself from a niche product, which readily commanded prices up to five times that of crude coconut oil on global markets, to a commodity that secured a reasonable price premium, provided that quality standards are met. Pacific Island VCO producers are now having to adjust to this market reality. Nature Pacific Ltd., the largest Australian-based importer of Fiji VCO, notes that there are still unrealistic price expectations amongst many Pacific Island VCO producers and promoters. Previous fob prices, such as AUD 12/litre, are no longer feasible if markets are to be maintained, let alone expanded. The company believes that current realistic prices for good quality VCO to allow market expansion are:

- non – organic: AUD 3.50/litre
- organically certified: AUD 4.00–AUD 4.50/litre.

At these prices, around 60,000 litres (three container loads) a month of PIC VCO could readily be sold in Australia. Organic certification is now generally regarded as a necessary condition for the successful marketing of VCO – which imposes a significant cost burden for VCO producers, who rely on high cost external third party certification (Bawalan 2011: 49).

To remain competitive in export markets, Pacific Island VCO producers need to produce a premium quality product that can be differentiated in the market by organic and other certification such as 'origin' or fair trade. They are also finding it necessary to produce other bi-products that spread overheads and the cost of buying the coconuts from farmers. The Fiji experience, at least, has shown that this is more likely to be achieved by larger, more centralised processing entities that are connected to the market and 'pull' the product through the VCO value chain.

4.1.1
A need for greater focus of domestic markets

There also needs to be more emphasis on domestic markets than on the increasingly commoditised export market for VCO. Lessons can be learnt from the experience of the Philippines in this respect, where VCO is now common as a functional food that can be readily purchased from supermarket and drug stores, packaged in 250 and 500 ml bottles (Balwalan 2011: 9).

VCO retailing in Manila (Source: APCC 2017)

In the Pacific Islands, VCO tends to be mainly available in speciality stores targeting tourists. In supermarkets and in stores catering for local consumers, the vegetable oil shelves are dominated by soya bean oil, canola oil, etc. Suva's upmarket supermarkets offer small quantities of high priced VCO, including products imported from Sri Lanka.

Small offerings of VCO and other coconut oil in a major Suva supermarket, with shelves dominated by soya bean and canola oil

Sri Lankan VCO shares the shelves with locally produced VCO in Suva supermarket

The low level of domestic VCO in PICs can be explained by a combination of factors: price, coconut oil's reputation as an inferior product, and the unfavourable labelling requirements for competing oils. The retail price of VCO is significantly higher than the price of soya bean and canola oil.[9] In the Pacific Islands, coconut oil generally has a reputation as poor man's inferior product, compared with the other imported cooking oils. In Fiji, in the 1990s, Wainiyaku Estate on Taveuni pioneered the development of high quality coconut oil – first producing premium cold press copra oil, which was then then followed by the manufacture of VCO. Organic certification was obtained for the export of their oil to the US market. A concerted effort was also made to sell Wainiyaku coconut oil on the local market, utilising established distributors. However, local market sales proved not to be viable, due to food safety certification and labelling requirements for their product – despite the fact that the product was approved for importation into the USA

9 The following retail prices were in place for vegetable oil products in major Suva supermarket at the beginning of July 2017:
- locally produced VCO – 500 ml plastic bottle FJD 14.95
- imported Sri Lankan VCO – 500 ml glass jar FJD 16.30
- locally produced crude coconut oil – 750 ml plastic bottle FJD 3.95
- canola oil - 750 ml plastic bottle FJD 2.80
- soya bean oil – 750 ml plastic bottles FJD 2.80
- mustard oil - 750 ml plastic bottle 4.95

as a food product. In addition, the major imported oils (soya and canola) are subject to price control regulations and incurred zero tariff. They are also not subject to 'trans fat' labelling regulations, as is now the case in a number of major markets.

Fiji currently imports around 17,000 tonnes of vegetable oil with a landed value of some FJD 20 million (Fiji Bureau of Statistics). If Fiji VCO consumption reached 5% of total vegetable oil imports, this would represent a market of nearly 1,000 tonnes, which is more than the total coconut oil exported in 2016. To achieve anywhere near this level of domestic sales, a combination of measures needs to be taken.

- The price at which VCO is made available to the local market needs to be significantly reduced. There are substantial savings available to pass on to local consumers from not having to incur transport and other exporting costs.
- In Fiji, price relativities are currently distorted with canola and soya bean oil being subject to Commerce Commission price controls and not subject to import duty. A major review of these regulatory arrangements is necessary.
- A substantial consumer education campaign expounding the health benefits of consuming VCO and food grade copra oil needs to be mounted. There needs to be an attitudinal change locally to coconut oil, such as has occurred internationally. To be successful, such a campaign would require the support of the major vegetable oil importing and distributing companies.

Investigating PIC domestic VCO value chains is recommended as a priority for the CIDP.

4.1.2
A need to re-look at small-scale high quality copra production

Approximately half the VCO produced globally is used in the nutraceutical and functional food uses – with the balance used in a range of natural oleo chemical products, such as hair and skin care products and aromatherapy and massage oils. For most non-food uses, high quality copra oil is a suitable substitute for VCO (per. com. Stacey King, Managing Director, Nature Pacific). Small-scale copra mills have been utilised in Fiji, Solomon Islands and Vanuatu to produce high quality copra oil (well dried and stored copra without smoke contamination). The Solomon Island Small Holder Agriculture Study Vol 3 (2016: 13) notes that:

A worthwhile innovation in the PIC coconut industries has been the introduction of Indian Tinytech cold press mills. If good-quality copra is used, then the oil quality is equivalent to that achieved with a DME. Tropical Products operates this system at Ranadi, buying in copra. Smaller units are operated at Choiseul Bay and at Taalu on Malaita. The Malaita operation supplies Tropical Products with oil.

The capital cost of Tinytech cold press mills is low. The mills are capable of handling around 600 kg of copra in a day. The oil extraction rate is lower than that of a conventional CNO copra mill (around 52% oil). If high-quality copra is used with appropriate driers, the quality of the oil produced is equivalent to that derived from a VCO DME[10] process in many of its uses. This copra oil could be used as a high quality cooking oil for domestic markets, but awareness campaigns and regulatory changes are required to significantly develop this market. Significantly, Tinytech mills use far less labour than DMEs (three people are required to produce around 300 litres of oil compared with six people to produce 45 litres from a DME). Thus the returns to effort can be higher, particularly in a lower price environment for VCO. Provided high quality copra is utilised, meeting oil quality standards is far less difficult than with a VCO DME mill. As with VCO DMEs,

10 The fresh-dry direct micro expeller (DME) is the most common technology used in VCO processing in the Pacific Islands. It is highly labour-intensive operation involving:
- pre-selection of mature nuts;
- husking the nuts;
- splitting the husked nuts in half;
- grating the fresh kernel into fine particles using a motorised DME grater;
- drying of the freshly grated kernel on a flat bed drier to 10–11% moisture in batches of 3 to 3.5 kgs utilising two people;
- loading the dried grated kernel into a DME cylinder press to extract the oil; and
- settling the oil to remove the fine particles of dried kernel (Balwalan 2011:20-22).

The precessing capacity is about 300 nuts in an eighthour day, involving around 4-people.

financial viability depends on achieving a reasonably high throughput. However, these mini copra mills can remain profitable at a significantly lower product price. A number of these mills were set up in Fiji as part of bio-fuel projects but are currently not being utilised.

Investigating small-scale, high quality copra value chains is recommended as a priority for the CIDP.

4.2 Coconut water

Using young coconuts for their water is a major traditional use for coconuts in all PICs. Selling young coconuts to urban markets and tourists has developed into an important micro enterprise industry in some countries, such as Samoa. Tonga, Samoa and to a lesser extent Fiji have developed worthwhile exports of green drinking coconuts to New Zealand and Australia (Table 12). For Tonga, this represents by far the country's largest coconut product export.

Table 12: Tongan and Samoan fresh coconut exports (2011–2016)

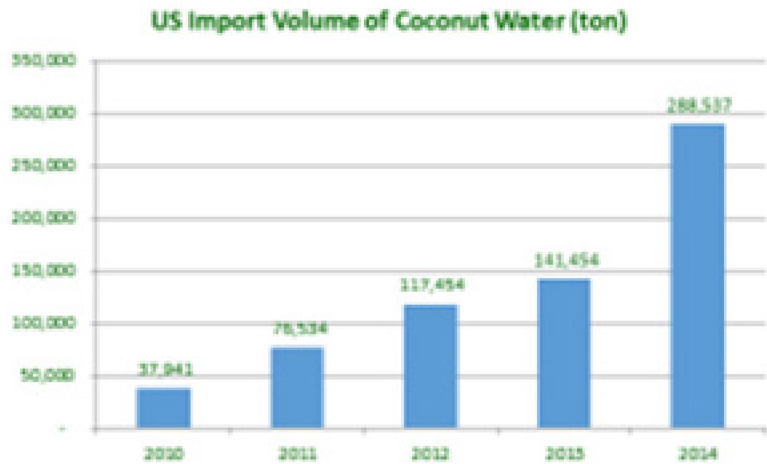
	2011	2012	2013	2014	2015	2016
Tonga*						
Quantity ('000 pieces)	1,158	1,041	1,598	1,502	1,431	
Samoa**						
Quantity ('000 pieces)	864	728	173	840	645	927
Value ('000 tala)	583	453	118	567	408	685
***QQM, MAFF**						
****Samoa Central Bank**						

According to Australian grocery sales data, 9.3 million litres of coconut water was sold in 2015 for a retail value of AUD 47.4 million (supplied by Pacific Trade and Invest Sydney). This coconut water was UHT packaged and was entirely imported – mainly from the Philippines and Thailand, with none coming from the Pacific Islands. Fresh whole coconuts from PICs now have to compete with these packaged products.

In recent years, coconut water (UHT treated) has emerged as the fastest growing coconut product market globally. Coconut water has become a major part of what is known as the 'sport-drink' value chain (ICT 2016: 11). In 2014, the global coconut water market was estimated at USD 1.36 billion and is projected to increase to USD 4 billion in 2019 (Technavio 2015). The rapid growth is driven by the marketing strategies of the leading global soft drink firms (brands): Coca-Cola (Zico), Pepsi (O.N.E.) and Vita Coco (Technavio, 2015). The USA is the largest market for coconut water, with Brazil and Thailand being the main suppliers (Table 13).

A selection from the wide range of coconut water available on the market (Source: APCC 2017)

Table 13: Tongan and Samoan fresh coconut exports (2011–2016)



Country of Origin	%
BRAZIL	38
THAILAND	32
PHILIPPINES	8
SINGAPORE	6
SOUTH AFRICA	5
MALAYSIA	3
SRI LANKA	3
OTHERS	5

Source: APCC 2017

The coconut water exports from the Philippines increased from 16.7 million litres (fob value USD 15.1 million) in 2011 to 65.8 million litres (fob value USD 81.1) in 2015 (Table 14). It is notable that Australia is now the third biggest market for Philippines' coconut water after Europe, while New Zealand is the 6th biggest after China.

Table 14: Philippines coconut water exports: 2011–2015

	2011	2012	2013	2014	2015
Quantity ('000 Ltrs)					
US	13,622	13,857	4,574	18,417	33,872
Europe	481	769	1,056	5,904	22,260
Australia	528	655	1,286	2,024	1,245
Japan	261	14	32	677	1,098
China	229	346	629	2,688	670
New Zealand	42	250	298	332	187
Other	1,522	2,045	2,532	5,806	6,492
Total	**16,685**	**17,936**	**10,407**	**35,848**	**65,824**
Value USD '000 fob	**15,113**	**18,543**	**10,163**	**41,034**	**81,153**

Source: Philippines Coconut Authority (APCC Statistical Year Book 2015)

4.2.1
PICs have not been part of the coconut water boom

Given the huge growth in consumption of coconut water internationally, there would seem, on the face of it, to be a major market opportunity for PIC coconut producers. However, apart from fresh whole nuts, PICs have not been participants in this boom and are unlikely to be so for the foreseeable future. This even applies to the nearby Australian and New Zealand markets. The absence of PIC involvement can be explained by a combination of three main factors:

- perishability of coconut water once it is removed from the coconut;
- the capital investment required to preserve the water in a way that maintains its flavour and nutritional value; and
- the throughput requirements to make the large investment required viable.

These are discussed briefly below.
Coconut water rapidly ferments and spoils after exposure to air. Thus it has not been globally traded, except in very small volumes of whole coconuts. However, in the early 2000s, processing

and packaging technology was applied to coconut water that extended its shelf-life for over nine months (ITC 2016: 12). These commercial technologies are: thermal treatment, micro- and ultra-filtration, and pasteurised packaging (commonly in Tetra Pak packages) (Prades et al. 2012). In 2012, Tetra Pak opened a knowledge centre in Singapore to provide innovative technologies to firms in the global coconut water markets (Technavio 2015). Setting up coconut processing plants equipped with the modern technologies requires large-scale investment and substantial throughput of coconuts to be viable (ITC 216; Beyer 2017). Coconut water is low in acid, so it will support the rapid growth of a wide range of bacteria unless quickly sterilised through the UHT production line. Fiji Dairy is probably the only enterprise in PICs with the facilities to do this, but it would need a throughput of at least 6,000 litres per run to make this viable (per. com. Beyer 2017). Getting a sufficient supply of coconuts to achieve this is not seen as realistic. A new coconut water facility in a coconut-producing location, such as Savusavu in Fiji or Espirito Santo in Vanuatu, may be considered. However, it is unlikely that these plants would to be viable, considering the capital cost required and the quantity of coconuts that are available. Table 15 presents indicative estimates of the throughput requirements for a viable UHT treatment and packaging facility for coconut water. The regular access of at least 50,000 suitable fresh green coconuts per day would present a major challenge, particularly if they are to be harvested from the tree, as is the case in the Philippines and in other major coconut water producing countries. In the Pacific, the vast majority of coconut palms are old tall varieties – thus for good reason the traditional practice is to wait until the coconuts have fallen to the ground before they are harvested. An appropriate tree-climbing technology would need to be adopted in PICs.

Table 15: Indicative estimates of minimum throughput requirements of a UHT treatment and packaging facility for coconut water

Carton size	Capacity carton/hr	Lts required/ 16 hr day	No. of coconuts required/16 hr
1L	2,000	32,000	80,000
500ml	2,000	16,000	40,000
250ml	4,000	16,600	40,000
200ml	6,000	19,200	48,000

Tetra Pak Carton Filler – est. min cost for minimum size USD 100,000

Source: Personal communication, Dr Richard Beyer, July 2017

4.3
Coconut milk and cream products

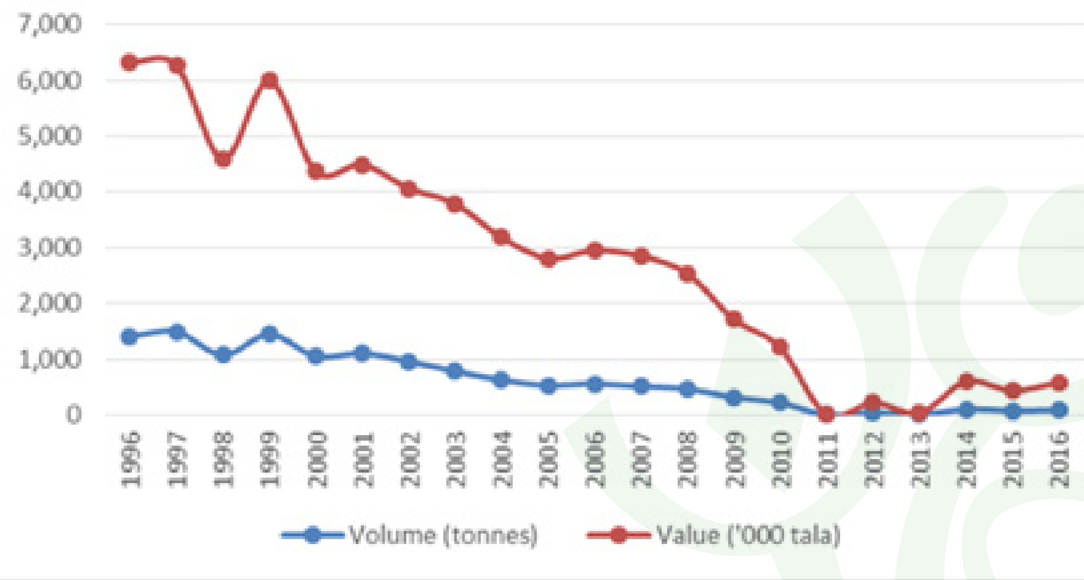
Coconut milk and cream are products that have also recently experienced rapidly growing demand (ITC 2016: 11). This has been driven by rising consumer appreciation of the health benefits of these products and the need for new alternative dairy food and beverage products to cater for the increasing awareness of lactose intolerance. In 2014, the retail value of coconut-based alternative dairy food and beverage products in the USA was estimated at USD 193 million, dominated by coconut milk at USD 104 million (Frost and Sullivan 2015). The market for dairy alternatives, predominately derived from almond, soy beans and coconut, has been projected to grow 18% per year during 2014–2021, reaching USD 6.27 billion in 2021 (Frost and Sullivan 2015).

Samoa was an early pioneer in processing and exporting coconut cream. In 1997, Samoa exported 1,490 tonnes of coconut cream for a fob value of 4.9 million tala (Figure 10). Since that time, coconut cream exports have steadily fallen, with only 86 tonnes exported (fob value 497,000 tala) in 2016. While the Samoan coconut cream was considered to be of superior quality, Samoa found it difficult to compete in US, Australian and New Zealand markets with coconut milk and cream from the Philippines. In 2015 the Philippines exported 3,468 tonnes of coconut milk/ cream for a fob value of USD 6.8 million.

Coconut and coconut cream products, with lesser scale constraints, are seen to probably offer the best niche market opportunity for PIC coconut products. As noted by the ITC 2016 Value Chain Report for the Caribbean, if proper investment is made in quality standards and workforce skills to control the risk of contamination, the processing technology for grated coconut and milk and cream products is competitive on a small and medium scale – as it simply involves extraction using expellers and filtration processes (ITC 2016; PHA 2014).

The necessary conditions for Samoa and other PICs to recapture a market share for coconut cream and milk products are seen to be:

- organic and origin certification; and
- the reform of labelling regulations in target markets that enable the superior quality to be indentified by consumers.



Source: Central Bank of Samoa

Figure 10: Samoa's coconut cream exports: 1996–2016

A number of potential coconut milk/cream products have been identified by Dr Richard Beyer where PIC processors could be competitive. These are:

- coconut cream freeze
- coconut yogurt

The Australian made COYO Organic Yogurt provides an excellent example of such products. The ingredients for this product are 97% coconut milk, together with organic tapioca starch and vegan cultures; and all the ingredients are imported. Dr Beyer is of the view that breadfruit starch would be superior to cassava starch and this would provide an additional opportunity for Fiji and other PICs. At the Pacific Coconut Sector Value Chain Workshop Nadi, Fiji. July 2017, he expressed his willingness and keenness to collaborate with Pacific Island suppliers (Gosling 2017). Those coconut producing countries with substantial and growing tourism industries (Fiji, Vanuatu and Samoa) were seen to offer particularly good opportunities for these products.

The basic processing equipment required for coconut cream/milk products is:

- a bowl chopper, which can be sourced from New Zealand and landed in Fiji for around USD 18,000;
- a high efficiency pasteuriser with a capacity to process 60/litres/hr, which can be sourced in the USA and landed in Fiji for around USD 20,000; and
- a batch freezer with a capacity to freeze 40 to 60 litres/hour (not for the coconut yogurt), which can be sourced in the USA and landed in Fiji for around USD 18,000.

Investigating the coconut cream freeze and coconut yogurt value chains is recommended as a priority for the CIDP.

4.4 Coconut timber

This overview market study has identified major growth in market opportunities for coconut products over the last decade, particularly over the last few years. This has come at a time when there has been a continuing world-wide decline in coconut production and nowhere more so than in the Pacific region. For the Pacific, this accelerating downward production trend is the consequence of the ever-increasing percentage of senile coconut palms. In the case of Fiji, senile palms now account for more than 60% of all planted coconuts (Table 16). The trend of ever-increasing senility needs to be urgently reversed, if PICs are to realise significant sustainable benefits from the more favourable market environment that now prevails.

Table 16: Senility of PIC coconut palms

	Fiji	PNG	Samoa	Solomon Islands	Vanuatu
Est. area under coconuts (ha)	62,000	221,000	1,584,000	59,000	92,000
Est. no of palms	6,200,000	22,100,000	9,902,500	5,900,000	9,200,000
Est. no of senile palms	3,720,000	11,050,000	1,584,400	1,180,000	4,600,000
% of senile palms	**60%**	**50%**	**16%**	**20%**	**50%**

Source: Bulai 2017

It has long been recognised that a necessary condition for replanting is that farmers obtain an immediate worthwhile return from removing their old palms. Coconut timber is seen as the main product to provide this return. From a timber quality perspective, the older the coconut palm the better. Senile palms have a higher percentage of dense heartwood, and thus are more valuable. Two decades ago an FAO Pacific Forestry Sector Study describes some of the uses to which coconut timber can be put.

High density coconut wood could be used as posts, power and telecommunication poles, trusses, floor tiles (parquet), girts, floor joists, purlins, balustrades and railings and other load bearing structures. When coconut logs are to be used in ground contact under exposed conditions (e.g. as posts or as poles for electrical wires) they must be properly treated. Medium density boards can be effectively used for walling, horizontal studs, ceiling joists and door/window frames. As a rule, coconut wood with density below 400 kg/m3 should not be used as structural framing materials. However, they can be used in the internal parts of a building such as ceiling and wall lining in the form of boards and shingles. A problem related to structural application of coconut wood is the difficulty of nailing and subsequently splitting of high density wood finishes (Arancon 1997: 8).

At the turn of the century, the expectation was that the demand for coconut timber would soon provide the necessary reward to farmers to remove their senile palms, and this would at least then give them the option of replanting. A particularly encouraging development was the establishment of a factory by Pacific Green (PG) near Sigatoka, Fiji in the early 1990s to manufacture premium quality coconut furniture (www.pacificgreenfiji.com). Pacific Green soon became a well-known international brand. However, at the end of the company's ten-year tax free status in Fiji, it shifted its main furniture making operation to China to reduce costs and to be closer to the market.

Pacific Green still maintains a small processing facility near Sigatoka, with coconut logs shipped from Vanua Levu. However, the high transport cost and the low farm gate price on offer provide little incentive for farmers to remove their senile palms. Yet even a full-scale luxury coconut furniture factory located in the Pacific Islands could make only a small dent in the region's over 20 million senile coconut palms.

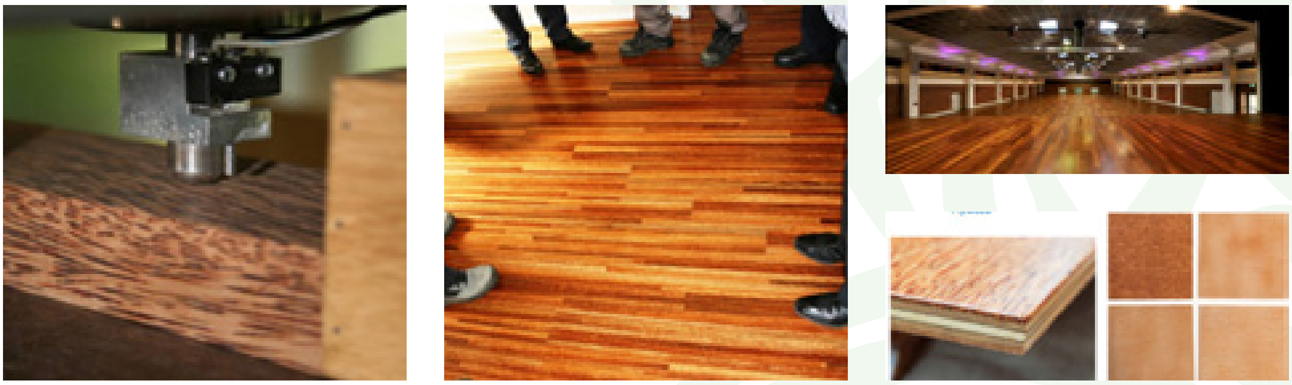
Commercial bulk product uses for coconut timber, such as flooring and veneer, have to be in place if a major overall impact is to occur. Sairusi Bulai, in his presentation to the CIDP Regional Value Chain Workshop, identified the major constraints to developing a significant veneer market for coconut timber (Bulai 2017). These are:

- low volume recovery, particularly from log periphery;
- variable board sizes; and
- variable board quality.

The Australian Centre for International Agriculture Research (ACIAR), in collaboration with the University of Tasmania and the Pacific Community (SPC) has addressed these challenges in an applied research project.[11] This work involved a staged approach from laboratory to semi-industrial to industrial scale which has addressed the challenges of:

- recovery from log per periphery:
- accommodating varying density across the log; and
- slicing the hard-vascular bundles without damaging the surrounding soft matrix.

The result of this applied research is encouraging, providing appropriate technology for the commercial uptake of a number of significant scale plywood and veneer products, some of which are shown below.



'Converting Logs from Senile Coconut Palms into High Quality Veneer' presentation to the CIDP Regional Value Chain Workshop, Nadi Fiji July 11–13, 2017 (Source: Sairusi Bulai, 2017)

11 ACIAR FST/2009/062: Development of advanced veneer and other products from coconut wood to enhance livelihoods in South Pacific communities

Preliminary market research conducted as part of the ACIAR/SPC Coco Veneer Project generated encouraging results (Blackburn and Nolan 2016). Coconut plywood veneer samples were distributed to Australian veneer-based product companies for evaluation and comment. The darker coloured coconut veneer received a particularly favourable response, with the suggestion that different colour groups could be combined to provide a distinctive and appealing end product.

ACIAR/University of Tasmania/SPC Report notes:

> *Most responses were very favourable, with one premium veneer supplier being especially attracted to the* ***darker coloured, higher density veneer.*** *Most companies were understandably reluctant to comment on price, though Mr Soren Holm, the Director of Global Ventures/ Eco-Core®, a plywood board producer specialising in multiply high pressure laminates for appearance products, thought a combination of light and dark coconut veneers arranged in the same board would produce an attractive product. He also commented that he would expect a value of at least $8.00 AUD per m2 sheet to be realised for dried good quality, dark veneer with a consistent appearance. EcoCore has subsequently requested the supply of coconut veneer for in-house product development and evaluation (p, 6). The $8.00 AUD per m2 sheet price cited equals a value of approximately $2,640 per m3. It is possible the coconut veneer could command a higher price for certain grades, given that* ***the veneer has a very even appearance with potentially three distinct colour grades*** *that can be combined to produce a range of attractive plywood or multi-laminar appearance products (page 6).*

Preliminary financial modelling in the ACIAR/UT/SPC Report bodes well for the establishment of a significant coconut veneer industry, where even the less attractive options readily permit downstream participants to add value along a future chain, allowing them to grow with an increasing product demand from the consumers (Blackburn and Nolan2016: 16). Following on from this applied research project, a Fijian company, based in Labasa, Vanua Levu, has commenced commercial trials of such products (per. com Sairusi Bulai, July 2017). Similar interest is being shown by companies in Solomon Islands and Samoa.

The ACIAR/UT/SPC CocoVeneer Report concluded that a detailed value-chain analysis, examining the full range of chain activities, is essential. This is first needed so that potential participants can better understand the opportunities and focus on production, chain logistics, distribution and marketing to meet consumers' needs.

A detailed value chains analysis for coconut timber in the manufacturing of veneer products is recommended as a priority for the CIDP.

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Annex 1: The Broad Input Output Structure of Coconut Product Value Chains

Primary on-farm products	Primary processed products	Advanced processed products	Manufactured products
1. Mature coconuts	**A. Copra** (dried kernel) – undertaken on farm	**a. Crude coconut oil** – undertaken in larger PIC coconut countries and some importing countries in small to medium sized factories	**Refined coconut oil** - refined bleached and de-odourised (RBD oil) – undertaken in consuming countries involving large facilities
Final markets • Farm household for direct consumption • Domestic markets (urban population) for direct consumption • Export markets (Aust, New Zealand, US) for direct consumption	**Final markets** Export (Bangladesh, Philippines, and other PICs)	**Final markets** • Export markets (Europe and Asia) for refining and manufacturing into oleochemical and food products • Domestic markets for direct food consumption • Domestic markets for biofuel.	**Final markets** • Household food products – baking, alternative dairying, confectionary • Oleochemical products - cosmetics, soaps, personal care, pharmaceutical, detergents
	B. Fresh coconut kernel	**a. Virgin Coconut Oil (VCO)** **Final markets** **Domestic** • household food products – baking, cooking, alternative dairy, health products) • Cosmetics and body care products (local population and tourists) **Export** • household food products – baking, cooking, alternative dairy, health products) • Cosmetics and body care products • Niche certified (organic, fairtrade origin etc.)	
		b. Desiccated coconut **Final markets** **Domestic** • household food products – baking, cooking) **Export** • household food products – baking, cooking)	
		c. Coconut milk and cream **Domestic markets** • household food products – particularly for Pac. Is cooking) • coconut ice cream and yogurt (particularly for tourists) **Export markets** • household food products – particularly for Asian and Pac. island cooking) • coconut ice cream and yogurt	

Primary on-farm products	Primary processed products	Advanced processed products	Manufactured products
	C. By - products a) Coconut husk **Final markets** • Domestic horticulture and floriculture • On-farm power generation	**a) Coir** Final markets **Domestic and export markets** - natural fibre composites and geotextile products	
	b) Coconut shell **Final markets** • Local handicrafts	**b) charcoal / activated carbon** **Final markets** Domestic and export markets - Fuel, air and water filtration	
2. Green coconuts (immature nuts)	a. Bottled/tetra Pac coconut water – limited in PICs because of capital investment and scale constraints	b. Processed and packaged coconut water (higher level of processing) not done in PICs because of capital investment and scale	
Final markets • Farm household for direct consumption • Domestic markets (urban population and tourists for direct consumption • Export markets (Aust, New Zealand, US) for direct consumption	**Final markets** Packaged Fresh coconut water/health and sport drinks	**Final markets** Health and sports drinks largely not processed in the Pacific islands	
3. Coconut Palms	**A. Sawn logs** **Final market** Limited farm household use	**a) Coconut timber** **Final market** Local market building material **b) Handicrafts** Final market Local – particularly tourist market **c) Basic furniture** Final market Local market	**a) Coconut furniture** **Final market** High end furniture market – particularly international markets b) High quality veneer and flooring **Final market** Local and export markets

Annex 2: Processes for producing VCO[12]

Type of Process	Quality of Oil and Recovery	Advantages and Limitations
	Fresh Dry Process	
High Pressure Expeller Method Wet Milling Route MC of dried kernel for extraction should be at 3-4%	FFA – 0.05-0.08% MC – 0.07-0.1% Color – water-clear Oil Recovery – 60kg per 100kg of dried mill kernel; 31kg per 100kg of fresh milled Coconut Kernel with testa (based on 50% initial MC of Fresh Kernel) Highest extraction efficiency	Produces full protein medium-fat Coconut flakes with testa as a co-product which can be further processed into coconut flower or sold as an aflatoxin-free animal feed ingredient Long shelf life of oil – 1 year and above. Uses mechanical type of equipment to produce the oil Applicable in a village-scale plant operation (5000 + nuts per day)
High Pressure Expeller Method Desiccated Coconut Route MC of dried kernel for extraction should be at 3-4%	FFA – 0.05-0.08% MC – 0.0-0.1% Color – water-clear Oil Recovery – 58kg per 100kg of desiccated coconut; 30kg per 100kg of fresh pared ground kernel (based on 50% initial MC of Fresh Kernel) Highest extraction efficiency	Produces full protein medium-fat Coconut flakes without testa as a co-product Long shelf life of oil – 1 year and above. Uses mechanical type of equipment to produce the oil More appropriate to be used in tandem with existing DCN processing plant
High Pressure Expeller Method Grated Nut route MC of dried kernel for extraction should be at 3-4%	FFA – 0.05-0.08% MC – 0.07-0.1% Color – water-white Oil Recovery – 30kg per 100kg of fresh grated kernel (based on 50% initial MC of Fresh Kernel)	Produces full protein medium-fat Coconut flakes without testa as a co-product Long shelf life of oil – 1 year and above. Uses mechanical type of equipment to produce the oil Applicable in a village-scale plant operation (5000 + nuts per day)
Low Pressure Extraction Method MC of dried kernel for extraction should be within the range of 10-12%	FFA – 0.1-0.2% MC – 0.17% and below Color – water-clear Oil Recovery – 25kg per 100kg of fresh grated coconut kernel; (based on 50% initial MC of Fresh Kernel) Highest extraction efficiency	Uses manually operated equipment to produce the oil. Produces a semi dry coconut residue that has to be dried or processed to have market value. Shelf life of oil can be very short if milled or grated coconut kernel is not properly prepared prior to oil extraction. Oil drying is recommended to ensure long shelf life.

12 Taken from Bawalan (2011) p, 39

Type of Process	Quality of Oil and Recovery	Advantages and Limitations
Fresh Dry Process		
Fresh Wet Centrifuge Method (2 phase centrifuge)	FFA – 0.04-0.08% MC – 0.1% and below Color – water-clear Oil Recovery- about 28 litres of oil per 100 liters of coconut milk (about 17kg of oil per 100kg fresh grated kernel) (based on 50% initial MC of kernel) Reported oil recovery rate was computed from the information provided by a VCO produce using a 2-phase centrifuge. Oil recovery rate using a 3-phase centrifuge may be different	Produces the best quality coconut oil with the best sensory attributes if done in a two-stage centrifuge process. Can only be applied in a medium scale operation as investment cost is very high. Optimization of the process is still required to improve oil recovery rate. Current oil recovery rates are much lower than the modified fermentation process. Lowest extraction efficiency. Further processing of the coconut skim milk into health beverage and the sepal generated into coconut can improve profitability.
Bawalan-Masa process (VCO from Coconut milk Residue)	FFA – 0.05-0.08% MC – 0.07-0.12% Color – water-clear Oil Recovery – 17kg per 100kg of wet residue) Coconut flour – 26.3kg per 100kg of wet residue	Further recovery of high-value oil from residue makes coconut milk/VCO processing more profitable. Long shelf-life of oil – 1 year and above. Produces low-fat high-fiber coconut flour as a by-product. Requires mechanical type of equipment to produce the oil. Production process has to attached or integrated to an existing coconut milk processing plant or high-capacity VCO plant. Maximizes the income from coconut kernel when used in tandem with coconut milk processing or the fresh-wet centrifuge process of VCO production

Annex 3: The longer term comparative advantage of coconut oil: the impact of climate change

It is not expected that climate change, through until at least 2050, will have a significant effect on coconut production (Taylor et al. 2016). The main impact will be from the expected increased intensity of cyclones, coupled with the growing percentage of senile coconut palms with little or no replanting.

The major direct competition for coconut products from the Pacific Islands comes from the Philippines. It can be expected that the Philippines will be similarly affected by climate change, with the possible exception of cyclone frequency in the Philippines. Some studies depart from the view that across the globe cyclones will increase in intensity but decrease in frequency, and suggest that tropical cyclones are likely to become stronger and more frequent in the coming years, with a potentially significant increase in storm frequency and intensity in the Northwest Pacific Ocean Basin (Emanuel 2013). Typhoon Haiyan (November 2013) could be indicative of future cyclones for the Philippines. Should typhoons of similar intensity to Haiyan become a more regular occurrence in the Philippines, the Pacific coconut industry could benefit. However, pests and diseases could also influence the impact of climate change between the two regions (e.g. Bogia coconut syndrome in the Pacific) where current lack of information prevents any projection of impact from climate change. Knowledge gaps concerning key pests and diseases must be addressed so that opportunities, if available, can be utilised by Pacific coconut growers.

In the production of oil and meal, coconuts have numerous close substitutes that will be variously affected by climate change. The price of oils reflects their demand and supply and competitive position amongst other oils and fats. As a result of this inter-relationship, the prices of vegetable oils tend to move together. As discussed above, the lauric oils (palm kernel oil and coconut oil) are almost perfect substitutes. On balance, oil palm is probably better placed to cope with climate change than coconuts, which would further enhance palm oil's competitive position (Taylor et.al 2016 p, Chpt 5). In particular, palm oil production, compared with coconut oil production, is minimally affected by cyclones due to the major oil palm production areas being located in equatorial locations outside the cyclone climatic zone. However, as discussed above, overall both oil palm and coconuts are expected to be less affected by climate change than grain crops, such as soya bean and rape seed, the main source of vegetable oil.

A further consideration is the cost of fossil fuel. Despite the current fall in fuel prices, as global oil consumption continues to rise, the cost of fossil fuel derived inputs required to maintain production will increase. Soya bean and rapeseed require and draw large quantities of nitrogen from the soil. Zimmer (2010) estimates that rapeseed requires 100 kg of nitrogen per tonne of oil produced, compared with the estimated 25 kg of nitrogen used per tonne of palm oil produced. Copra production uses virtually no fossil fuel, with fertiliser rarely, if ever, applied. Thus, with the important exception of increasing transportation costs, copra industries will not be affected by rising energy costs.