
Manus Cash Crop Feasibility Analysis

PART 1.



MARCH 2019

ALLIRA AGRI CONSULTING

Authored by: Hannah Wheaton

Table of Contents

Acronyms	3
Executive Summary	4
Introduction	5
Background.....	5
Methodology	6
Limitations.....	7
SECTION 1.....	8
Inventory of Cash Crops on Manus Island	8
Assessment of Crop Feasibility	13
SECTION 2.....	23
Assessment of Market Demand	23
SECTION 3.....	27
Analysis of Available Databases/Initiatives within PNG	27
Initiatives to be used as case studies	27
Initiatives available for active participation.....	33
SECTION 4.....	37
Potential Cash Crop Initiatives	37
SECTION 5.....	40
Constraints	40
Recommendations	41
Reference List	43
Interview List.....	48

Acronyms

Abbreviation	Description
ACIAR	Australian Centre for International Agricultural Research
CCI	PNG Cocoa Coconut Institute
CPB	Cocoa Pod Borer
DAL	Department of Agriculture and Livestock
DFAT	Department of Foreign Affairs and Trade
DME	Direct Micro Expelling
DPI	Department of Primary Industries
ENB	East New Britain
EU	European Union
FAO	Food and Agriculture Organisation
GESI	Gender Equity and Social Inclusion
HDL	High-density lipoprotein
HTFA	High Temperature Forced Air
HVCPs	High-value coconut products
Kgs	Kilograms
LDL	low-density lipoproteins
m	meters
MCT	Medium chain triglycerides
MDF	Market Development Fund
mm	millimeters
MORDI	Mainstreaming of Rural Development Innovation
MSD	Market Systems Development
mt	metric tonnes
NARI	National Agricultural Research Institute
NCD	National Capital District
NGO	Non Governmental Organisation
PGK	Papua New Guinean Kina
PHAMA	Pacific Horticultural and Agricultural Market Access
PICs	Pacific Island Countries
PNG	Papua New Guinea
PNGFA	Papua New Guinea Forest Authority
PPAP	PNG Productive Agriculture Partnerships
PWM	Partners with Melanesians
SGP	Small Grant Programme
SME	Small and Medium Enterprises
SROS	Scientific Research Organisation of Samoa
TADEP	Transformative Agriculture and Enterprise Development Program
TBC	To be confirmed

TCA	Tenkile Conservation Alliance
TKCP	Tree Kangaroo Conservation Program
U.S	United States
UNDP	United Nations Development Program
USD	United States Dollars
VCO	Virgin Coconut Oil
WCS	Wildlife Conservation Society
WST	Western Samoan Tala
WWF	World Wildlife Fund

Executive Summary

An inventory of existing cash crops on Manus Island indicated that there were eight cash crops present on the island and specifically, within the Great Central Forest. The cash crops identified for further research during the site visit were breadfruit, cocoa, coconuts, chili, galip nuts, ginger, eaglewood and vanilla. These eight crops were narrowed down to seven with the exclusion of eaglewood due to issues relating to its harvest and sale.

Production data varied across different sources and is yet to be verified. A series of interviews indicated that volumes of all commodities produced on Manus Island have declined to such an extent that most commodity traders on Manus island have ceased trading.

As in many cases, it is not the possibilities which define the path forward but the constraints. Transport availability and freight costs will be a deciding factor in the feasibility of domestic and export sale of all of the seven shortlisted cash crops and their value-added products. However, interested buyers for five of the seven crops have already been approached and they have expressed a willingness to work with the Manus growers despite the logistical challenges.

Even at this early stage it is apparent that new and innovative solutions will be required to work around the lack of economies of scale. Product differentiation either by quality or certification is going to be a key component to increase the value of products. In order to reduce overheads in the short term, it is recommended that the grower groups target a domestic market. Over time as the quality and volumes improve, an export marketing plan can be developed.

Luckily, there are many similar initiatives within PNG and in the Asia/Pacific region which can be used as case studies for the project design. There are also a number of programs which can actively assist the growers in developing their products, improving quality, obtaining certification and reaching their desired markets.

Introduction

Background

The Wildlife Conservation Society (WCS) is a global conservation organization working to save wildlife and wild places through science, conservation action, education, and inspiring people to value nature. WCS envision a world in which wildlife thrives in healthy lands and seas, valued by societies that embrace and benefit from the diversity and integrity of life on earth. WCS field programs in more than 60 countries in Asia, Africa, the Americas, and the Pacific build on more than 100 years of experience and scientific and technical expertise across the globe. In Papua New Guinea (PNG), WCS is committed to working with communities, government and other partners, to protect the country's biodiversity and natural resources through sound management practices. Since the 1970s, WCS has been supporting conservation research, community engagement and empowerment, and capacity building in PNG to strengthen management of species and places and promote resilience to future climate change. WCS's organizational capacity in PNG includes facilitating community-based conservation and adaptation, habitat and species monitoring, data management, education and outreach, and policy development. WCS PNG offices include headquarters in Goroka, a policy office in Port Moresby, and field offices in New Ireland and Manus provinces.

WCS has long-term presence in Manus Province to support community-based conservation and sustainable forest management, which has been developed over the past six years with support from the Australian Government Department of Foreign Affairs and Trade (DFAT). Like many lowland areas in Papua New Guinea there is pressure on communities in Manus Island to sell their forests to commercial logging companies for large scale clear-fell harvesting. While the Great Central Forest of Manus provides a myriad of livelihood benefits to communities and is recognised internationally as a hotspot for endemic biodiversity, the communities within it have few options outside of industrial logging to generate cash income.

In Manus, WCS aims to empower communities to protect the Great Central Forest, a Key Biodiversity Area under immediate threat from industrial resource extraction. In this region, WCS focuses on community-based conservation, improving food security and community livelihoods with communities that have signed conservation agreements. In November 2015, 64 clans from Pohowa, Tulu and Mondropolon tribal groups signed two-year conservation agreements to safeguard their forest. In November 2018, after 6 month of free and prior informed consent consultations, a total of 52 clans who own more than 40,000 hectares of the Great Central Forest decided to renew the conservation agreements until end of 2020. Under the conservation agreements, communities united in their pledge to withhold consent for industrial logging or large-scale commercial forest clearance for agricultural projects on their land, although subsistence use remained allowable. To incentivize longer term forest conservation, and reward landowners that pledge their land for conservation, the current project therefore aims to support conservation friendly cash crops as a way to sustainably increase cash incomes within these communities. Ideally, the long-term goal is to develop a

sustainable economic livelihood for forest communities while entrenching sustainable forest practices by way of a wildlife friendly certification scheme.

In other regions of PNG communities sell coffee, bulb onion, betel nut, peanut, galip nut, coconut and other crops (cash crops) for a relatively high prices in provincial, national and/or international markets. However, at present the communities of the Great Central Forest are not connected to any of these markets to sell crops.

The desired outcome of this report and subsequent site visit is to determine the feasibility of different alternatives for household production of conservation compatible agricultural products which can fetch comparatively high prices in provincial, national, or international markets.

Methodology

A systematic approach was taken to identify suitable reference material. As there are five distinct sections to this report, various approaches were taken to ensure sufficient coverage of the topics. Overall, 51 reports were read, 42 websites reviewed, and 29 interviews conducted.

To identify existing cash crops in Manus, literature searches were undertaken using the catalogue of resources at the Adelaide University, South Australian State Library, specific program websites, Google Scholar and the “Find It” online journal catalogue. All searches included the terms “Papua New Guinea + agriculture” and one or more of the terms “Manus” or “conservation” or “cash crops”.

Very little formalized literature in regard to quantifying the market demand for the crops outlined in section one, and the bulk of the information for this review was gleaned from interviews.

The analysis of available initiatives/databases in Papua New Guinea was firstly researched with a Google search for ‘livelihood project’ + ‘Papua New Guinea’. Over 16 million results were found and consequently, each interview asked interviewees what projects they were aware of in PNG (present and recently completed). These started to fall into two categories, those which could be used as case studies and those which could actively involve the growers in the Great Central Forest.

Lastly, other potential cash crops initiatives were found using web searches for the following terms; ‘conservation livelihood programs’, ‘rainforest alliance case studies’, ‘conservation areas + farming communities’, conservation areas + cash crops’. Further interviews also yielded projects/programs/initiatives in the same cash crops that have been suggested for the producers in the Great Central Forest.

Limitations

There was a general lack of published and peer reviewed data on the topics covered in this report. In some cases there was only one document available to verify information given verbally in interviews, but often this document was more than a decade old. This has meant that information has been difficult to triangulate and verify from a range of sources.

There is no centralized database for existing cash crop initiatives in PNG and in many cases, project/program/initiatives information on websites has not been updated. This has resulted on a heavy reliance on interviews as a source of information.

Lastly, commodity and cash crop markets are constantly changing, therefore prices and volumes stated are relevant for the time of the report writing only and are prone to rapid change depending on market conditions.

SECTION 1.

Commercial agricultural activity is relatively minor in Manus compared to other provinces of PNG. Production of copra was once an important commercial activity, but has now collapsed. Cocoa cultivation, to the extent it is occurring, is principally concentrated in neighboring Lou Island. Pak Island was said to be the centre of past commercial coconut plantations but this has also dwindled in the past decade. Some cocoa and rubber is commercially grown with marketing support from the Provincial Government but its value is minimal – in the order of PGK250,000 to PGK300,000 per year spread among some 300 growers (Edwards, M. 2014).

Inventory of Cash Crops on Manus Island

The *Agricultural Systems of Papua New Guinea Working Paper No. 18 (Manus Province: Text Summaries, Maps, Code Lists and Village Identification)* published in 2002 contains a comprehensive list of the vegetable, tree and cash crops grown all over Manus Island. In order to address the assignment brief, this list has been reduced to cover only those crops which are grown in the Great Central Forest, and those which can be scaled up and/or sold to a domestic or international market.

For this reason, whilst sweet potato (*Ipomoea batatas*), yam (*Dioscorea bulbifera*) and cassava (*Manihot esculenta*) are listed as a dominant staple crop in most areas in Manus, they have not been included in the following inventory. In addition to this, although a number of plants listed have scalable potential as cash crops, their presence within the Great Central Forest has not been verified by inhabitants on Manus Island or the Manus Department of Agriculture & Livestock. These are: cardamom (*Elettaria cardamomum*), both arabica (*Coffea arabica*) and robusta coffee (*Coffea canephora*) and peanuts (*Arachis hypogaea*). This will be further researched during the site visit to Manus in April 2019.

Breadfruit (*Artocarpus altilis*)



Photo: <https://en.wikipedia.org/wiki/Breadfruit>

- Breadfruit is not as common in PNG as it is in other Pacific Island Countries (PIFON, 2016)
- Where grown, it is consumed solely for personal use
- Breadfruit has never been commercialized in PNG
- There is no data on the annual production of breadfruit
- There is no data on existing market size
- Site visit will explore the possibility to scale up
- Viable value-added products: breadfruit flour, breadfruit chips.

Cacao (*Theobroma cacao*)



Photo: <https://www.rainforest-alliance.org/species/cacao>

- The cacao tree is commonly called a cocoa tree in PNG
- Cocoa is commercialized in PNG and is one of the most important cash crops
- Manus' estimate production in the 1990's was approximately 100mt (DAL, 2019)
- PNG's production was 38,000mt in 2018 (PNG Cocoa Board, 2019)
- Access and price of domestic transport can hugely impact on farm gate prices to farmers
- Fluctuating price is a disincentive
- Viable value-added products: cocoa butter, cocoa powder, roasted cocoa nibs

Chili pepper (*Capsicum annuum*) 'Bird's Eye'



Photo: <https://www.herbies.com.au/spices/spices-papua-new-guinea/>

- Many varieties of chili are grown in PNG but there is commercial demand for 'birds eye' chilies (Makori, K. pers. comm.)
- Commonly grown for household use
- Fresh chilies are sold at the Lorengau market (DAL, 2019)
- There is no data on the annual production of bird's eye chilies for either PNG or Manus
- There is no data on existing market size although there is confirmed demand for dried chilies
- Site visit will explore the possibility to scale up
- Viable value-added products: dried chilies

Coconut (*Cocos nucifera*)



Photo: <https://florafaunaweb.nparks.gov.sg/special-pages/plant-detail.aspx?id=5618>

- Coconuts are an important crop in PNG, both for household consumption and export
- Copra is commercialized in PNG and is one of the most important cash crops
- There is no data on current copra or VCO production on Manus (DAL, 2019)
- PNG's copra production is approx. 20,700mt (PHAMA, 2017)
- VCO production is approx. 113mt (PHAMA, 2017)
- Access and price of domestic transport can hugely impact on farm gate prices to farmers
- Fluctuating price is a disincentive
- Viable value-added products: virgin coconut oil, biofuels, copra, copra oil and copra meal

Eaglewood (*Gyrinops ledermannii*)



Photo: <https://godasagardener.com/tag/eaglewood-tree/>

- Known to be present in the Great Central Forest (Noble, S. pers. comm)
- Not known if the resin has ever been harvested in Manus
- Commercialization is modest, the last recorded production volumes were 11.7mt in 2003 (Gunn, B. et al 2004)
- Site visit will explore the possibility to scale up
- Viable value-added products: resin for oil (Gunn, B. et al 2004)

Galip Nut (*Canarium Indicum*)



Photo: <https://www.arris.com.au/blog/galip-nuts-brand-packaging/>

- Wild trees present in the Great Central Forest Commonly harvested for household use (DAL, 2019)
- Occasionally sold at the local market in Lorengau
- Galip nuts have recently been commercialized in East New Britain
- No data on existing domestic or national production
- Market demand for fresh fruit 300mt+ per year (Galip Nut Company, 2019)
- Site visit will explore the possibility to scale up
- Viable value-added products: natural nuts (de-pulped), roasted nuts

Ginger (*Zingiber officinale*)



Photo: <https://azmartinique.com/en/all-to-know/fruit-vegetables/ginger-gingembre>

- Commonly grown for household use
- There is no data on the annual production of ginger for either PNG or Manus
- There is no data on existing market size although there is confirmed demand for dried ginger (Makori, K. pers. comm)
- Site visit will explore the possibility to scale up
- Viable value-added products: dried ginger

Vanilla (*Vanilla planifolia*)



Photo: <https://www.quora.com/What-is-the-difference-between-vanilla-and-Bourbon-vanilla-Is-Bourbon-vanilla-same-as-French-vanilla>

- *Vanilla Planifolia*, otherwise known as ‘bourbon’ vanilla flourished in PNG and was introduced to Manus in the 1990s (DAL, 2019)
- The vanilla industry operates in ebbs and flows with production usually scaling up frantically when the global price increases
- Estimated production on Manus is 1mt of cured beans per year (DAL, 2019)
- Domestic and export markets have shown that they can absorb all production
- It is a highlight technical crop which requires hand pollination and curing after harvest
- High prices are an incentive
- Viable value-added products: cured and dried beans

Assessment of Crop Feasibility

Breadfruit (fresh and frozen)

The export of fresh and frozen breadfruit in the Pacific has been limited to Polynesian countries. For more than a decade Fiji, Tonga and Samoa have been permitted to export fresh breadfruit to New Zealand, treated by the approved High Temperature Force Air (HTFA) quarantine treatment for fruit flies. The quantities exported have been small and well below market demand (Grandison, G. 2002). There are substantial and immediate market opportunities to expand fresh and frozen breadfruit export markets – however, significant marketing constraints remain not to mention difficulties in meeting biosecurity regulations (Goebel, R. 2005). For these reasons both fresh and frozen breadfruit are not viable cash crops options for Manus Island. There is however scope for two breadfruit value-added products; breadfruit flour and breadfruit chips.

Breadfruit flour

Breadfruit trees were listed as present in nearly every area of Manus in the 2002 *Agricultural Systems of Papua New Guinea Working Paper No. 18 (Manus Province: Text Summaries, Maps, Code Lists and Village Identification)* report.

It is very simple to make breadfruit flour, without the grating needed for similar products such as cassava flour. The breadfruit needs to be peeled, sliced into chips and then left on racks to dry. Once the breadfruit is sufficiently dry, it can be manually pounded to create a flour.

There is domestic demand for flour and growing domestic and international demand for gluten-free flour. The costs of breadfruit flour production on a small scale, using sun drying and manual pounding are relatively low (McGregor, A. 2018). Information provided by Kuinimeri Asora- Finau in her 2017 Breadfruit Summit presentation on the breadfruit flour processing feasibility conducted by Scientific Research Organisation of Samoa (SROS) said that the cost of producing breadfruit flour showed that without having to buy the breadfruit, and using an oven to dry the breadfruit chips, the cost was WST3.60/kilo which is equivalent to PGK4.50. On average, six breadfruit weighing on average 2kgs are needed to produce 1kg of breadfruit flour. This translates to a particularly high conversion ratio of 12 kgs of raw material to produce 1 kg of final product (McGregor, A. et al 2002).

Breadfruit chips

The domestic markets for chips and other such snack food is large – albeit much smaller than the flour market. Breadfruit chips can be made by peeling the fruit and cutting it into chips and sun drying. These can also be fried and salted for consumption. For the foreseeable future these products should be the main focus of small and micro enterprises wishing to process breadfruit.

Breadfruit - Health benefits

There is an increasing opportunity for breadfruit flour as a substitute for imported grains, particularly wheat flour. This domestic market is expected to be driven by non-communicable disease (NCD) health concerns, together with the increasing relative price of imported grains (McGregor, A. et al 2009). The Pacific islands have undergone a ‘nutrition’ transition from diets largely based on locally grown food to those primarily based on processed, imported, foods. Current diets are generally considered as nutritionally-inferior to traditional diets this has been a major contributor to NCDs which are now prevalent throughout the Pacific islands region. Diabetes is particularly relevant, with the region now ranking highest in the world in terms of the prevalence (McGregor, A. 2018).

Diets based on traditional Pacific food staples, including breadfruit, can mitigate the prevalence of type II diabetes. The three key positive nutritional features of breadfruit are that it is gluten free, has a moderate glycemic index and a high non digestible carbohydrate content.

Breadfruit – Notes

Climate change

The forecast situation for breadfruit in the face of climate change contrasts markedly to that for grain crops, where climate change is expected to have a significant negative impact. This has major negative economic implications for the Pacific Island Countries (PICs), where imported grains already represent more than half of their food imports and already exceed the value of their total exports. Thus, for a number of traditional staples, including breadfruit, climate change creates a major market opportunity with the real price of imported grains increasing. The challenge for Pacific island farmers, agribusiness and policy makers is to be able to take advantage of this opportunity (McGregor, A. 2018).

Food security benefits

Breadfruit has been identified as a key crop for food security in the Pacific islands, due to the crop’s:

- ability to secure food energy from the atmosphere, thanks to its large leaves and canopy and being relatively undemanding on the soil (Elevitch, C. 2011);
- high tolerance to climate change and climate extremes;
- compatibility to intercropping within agroforestry systems; and,
- ability to sequester carbon

Gender Equity and Social Inclusion (GESI)

The production of value-added products is often undertaken by women and thus a potential source of income. Since breadfruit trees already grow wildly and land would not need to be cleared to plant or harvest the, there is also opportunities for younger members of the community to harvest, dry and process the breadfruit as a means of securing income.

Cocoa (dry bean)

Cocoa was established on Manus in the 1970s and according to the local Department of Agriculture and Livestock (DAL) the farmers within the Great Central Forest have produced dried beans in the past for sale to local exporters. Cocoa was grown mainly in locations where there is volcanic soil, such as Lou, Baluan, Rambutchou and along river banks on the mainland of Manus.

In the 1990s, the Department of Primary Industry (now called the Department of Agriculture & Livestock), was able to facilitate cocoa cultivation, production and transport of cocoa from Manus to Lae with the assistance of Government funding. A centralized fermentary was located at the Department of Primary Industry (DPI) and local farmers sold wet bean to DPI who would then ferment and dry the beans before on-selling to Agmark in Lae.

DPI then changed the model so that farmers could ferment the beans themselves on their cocoa blocks and while fermentaries (which also had drying facilities) worked well for the initial two years of the project, supply soon dwindled when farmers had to pay for construction and maintenance of the fermentaries themselves.

In 2015 DAL secured a local market for dried cocoa with a business in Lorengau. At the time the price for wet beans was PGK3.80/kg but DAL was buying from local farmers at PGK5.00/kg in order to incentivise farmers. This distorted the market and the business in Lorengau was unable to continue buying cocoa.

Cocoa beans require careful post-harvest processing and storage in order to maintain the optimum quality of the beans. There has been a surge in funding to improve the cocoa industry since 2011 and there are no signs of this support abating (CABI, 2018). Premium quality cocoa is being sold domestically for PGK7400/mt, with premium export markets offering PGK11,023/mt. Thus if cocoa quality can be maintained, this is an economically viable cash crop for farmers.

Cocoa Butter

Cocoa butter, also called theobroma oil, is a pale-yellow, edible vegetable fat extracted from the cocoa bean. Cocoa butter can be manually pressed from dried cocoa beans using a press and it retains a cocoa flavor and aroma. This product can be used in beauty products to produce skin lotions, hair products etc. The process is very simple and does not need access to power or specialized equipment. The weight of cocoa butter is significantly less than that of beans, thus reducing freight costs.

Cocoa Powder

Powder is a by-product of butter pressing, however a lumpier and less refined powder can be produced from pounding the beans without completing the butter extraction. When sugar is added to cocoa powder this makes a hot chocolate drink, the shelf life of the cocoa powder without the cocoa butter is longer as the moisture content is lower.

Cocoa nibs

Cocoa nibs can be produced either by maximizing the waste products from winnowed or screened cocoa, or they can be derived from whole, export grade beans. Nibs can be raw or roasted, however roasted nibs have a longer shelf life. Nibs are lighter than the whole bean and easier to package, store and transport. They can be sold as a snack food by themselves or can be used in cooking.

Cocoa – Notes

Health Benefits

Cocoa is a rich substance with high minerals and nutrients providing innumerable health benefits. Increased consumption of PNG's own cocoa products domestically has the potential to improve nutrition. Specifically, cocoa is one of the richest sources of polyphenols, it is especially abundant in flavanols, which have potent antioxidant and anti-inflammatory effects. Cocoa, both in its powdered form and in the form of dark chocolate, may be able to help lower blood pressure. Flavanol-rich cocoa improves the level of nitric oxide in your blood, which relaxes and dilates your arteries and blood vessels and improves blood flow. What's more, cocoa has been found to reduce "bad" LDL cholesterol, have a blood thinning effect similar to aspirin, improve blood sugars and reduce inflammation. These properties have been linked to a lower risk of heart attack, heart failure and stroke (Mandl, E. 2018).

Gender Equity and Social Inclusion (GESI)

Small scale value adding often supports women and youth employment given that the production of value-added products is often undertaken by women. The set-up cost to press cocoa butter and powder is low and can present an entrepreneurial opportunity to younger members of the community who may not have access to land to farm themselves.

Chili (Fresh)

Fresh chili is often sold at the local market however there is a stable and sizeable domestic market for birds eyes chilies. These are purchased fresh at PGK8.50/kilo and then turned into various chili products (Makori, K. pers. comm). The bird's eye chili plant is a perennial and therefore there would be no need for annual replanting programs for the bushes. These are hardy plants and resistant to changes in the weather. They take from 90-120 days to grow and start bearing fruit and they produce fruit year-round (Elevitch, C. 2015).

Chili – Dried

Value added products from chilis are easy to make, such as chili infused oil and dried chilis. The process to dry chilies is very easy and does not require any equipment or access to power. The chilies have to be washed, then put on racks to dry. The chilies can also be threaded on to string and left to hang in a well-ventilated place. It can take between 2-3 weeks for the chilies to properly dry and these can be crushed into powder or used for cooking in their dried form. Drying the chilies reduces the possibility of spoilage during storage, it also decreases the freight costs for the crop.

Coconuts

The three main economic products are derived from the nut of the coconut palm in PNG are: copra, copra oil and copra meal. Although coconut will regenerate naturally from seed in coastal locations, almost all coconut palms in PNG have been planted by people. In PNG, coconut is grown in environments where mean annual rainfall ranges from 1000mm to 6500mm. It is cultivated from sea level to 1000m altitude; however, the commercial cultivation of coconut is mostly restricted to coastal locations. Coconut normally bears all year round, but production falls significantly during droughts (PHAMA, 2017).

Copra

Copra is an important source of village income. In the early to mid 1990s, an estimated 527 000 people (17% of the rural population) lived in households where cash was earned from selling copra. From 2004 to 2006 copra and copra oil generated average annual export earnings of PGK93 million; this was only 6% of the total value of agricultural exports in this period. Most of this amount (85%) was earned from copra oil exports (PHAMA, 2017).

Copra production was also adversely affected by significant declines in export prices in 2000 and 2001. In 2002, copra production fell to its lowest level since 1947 and in 2003 copra production reached a historical low of less than 9000 metric tonnes (mt). Deteriorating infrastructure and increasing transport costs, fewer purchasing depots, and a switch from exporting copra to processing it into oil within PNG have contributed to this decline (PHAMA, 2017).

Average smallholder yields are typically in the range 400–700 kg of copra/ha, with an average of about 500 kg/ha. Like other export tree crops, plantation copra yields are higher than those for smallholders, with a range of 700–1000 kg/ha in nationwide surveys and an overall average of about 900 kg/ha (PHAMA, 2017).

Copra is pressed for oil, and the residual product is copra meal which is often sold as stock feed. Copra oil production fell in 2001, but recovered in 2003. In 2006, the value of copra oil exports (PGK60 million) was more than seven times that of copra exports (PGK8 million). Copra meal exports averaged 14 000 mt/year during the 1990s, with an average value of PGK1.6 million/year (PHAMA, 2017).

The dramatic price fluctuation of copra acts as a disincentive to farmers to produce this labour intensive crop. The bulky nature of the copra also results in high freight prices and in many cases, farmers fail to break even when copra prices are low. Given the lack of copra buyers on Manus, and the volatile nature of the commodity, it is not recommended that copra be considered as a cash crop to the WCS communities in the Great Central Forest.

Virgin Coconut Oil (VCO)

Currently, virgin coconut oil is being produced on Manus and sold at the local market for both cooking and cosmetic use (DAL, 2019). The production of VCO and related products (such as soap, body oils, desiccated coconut, stock feed, bio fuel etc.) has emerged as a viable alternative to copra production in some areas. The

first known producer of VCO began producing for the local market in East New Britain (ENB) province in the early 1990s. To date there are 14 small to medium size enterprises (SMEs) producing VCO and related products in Port Moresby, Central Province, East Sepik, Madang, New Ireland, East New Britain and Bougainville Province

VCO production has more than doubled since 2011 from about 56 tonnes to 113 tonnes in 2015. The same trend can be observed for other related coconut oil products. There are currently three medium size producers (processing more than 1 000 coconuts a day) and the biggest of the three has been exporting VCO products since 2008 (PHAMA, 2017). In PNG and internationally, there is a growing demand for high-value coconut products (HVCPs) such as white copra & its derivatives – body oils, lotions & creams, coconut soap, virgin coconut oil, coconut cooking oil, coconut water (processed & green tender nut), and coconut fibre products. In Europe, U.S., Japan and Australasia, growth in demand for VCO has been driven by its health and cosmetic properties. However, current exports by PNG companies of HVCPs are very limited.

Although the method of oil production for the makers of VCO on Manus is yet to be confirmed, the Direct Micro Expelling(DME®) system was developed in the Solomon Islands for remote communities and is now successfully being used all around the Pacific. The device does not need access to power in order to function (although it is recommended for faster processing time) and has the potential to produce a very high quality oil.

Direct Micro Expelling (DME®) uses a totally different approach to coconut compared to that of the copra industry. With DME®s extract the oil from fresh coconuts on-site, rather than taking the nuts (in debased form) to a large-scale processing plant located in another country as is often the case in many island communities (Kokonut Pasifik 2019).

VCO can be produced in a number of ways but given the logistical challenges of the growers in the Great Central Forest, consolidation may be required to ensure the economies of scales needed to make the product economically viable. Establishment costs can be prohibitively expensive if there isn't donor funding support, or if the farmer group is not already involved in business practices.

The production of VCO requires more information from the site visit in order to determine its feasibility.

Coconuts – Notes

Health Benefits

Coconut oil is one of the few foods that can be classified as a "superfood." Its unique combination of fatty acids can have positive effects on health, including fat loss, better brain function and various other impressive benefits. Coconut oil is high in healthy saturated fats that have different effects than most other fats in standard diets. These fats can boost fat burning and provide the body and brain with quick energy. They also raise the good HDL cholesterol in blood, which is linked to reduced heart disease risk. Most fats in the diet are called long-chain triglycerides, but the fats in coconut oil are known as medium chain triglycerides (MCTs). What this means is that the fatty acids are shorter than most other fats (1). When these types of fats are consumed, they go straight to the liver, where they are used as a quick source of energy or turned into ketones. Ketones can have

powerful benefits for the brain, and are being studied as treatment for epilepsy, Alzheimer's and other conditions (Gunnars, K. 2018).

Gender Equity and Social Inclusion (GESI)

The production of VCO does require a significant input of manual labour, although if labour saving methods are used it can be much less strenuous than other crops. VCO production would be suitable for women and young people in the community and the range of products available (such as beauty products) may appeal to women and younger generations more.

Eaglewood

Eaglewood (also called agarwood, gaharu or aloeswood) is known around the world for its highly valuable perfume and incense, and PNG is one of the last remaining frontiers for natural areas of these trees. The trade in eaglewood first commenced in PNG in the late 1990s. Prior to the demand for export of eaglewood, the tree species had not been regarded as having any cultural or commercial importance. To date, only one species of eaglewood, *Gyrinops ledermannii*, is known to occur in Papua New Guinea. The value of the tree is in the resin found in a small percentage of tree.

Increasing demand for the tree's oil has led to local landowners overharvesting its timber, hence reducing the chances of natural regeneration and causing commercial extinction in some areas. Villagers are then paid only a fraction of the real value of the wood. The lack of information and awareness of eaglewood is creating major problems exacerbated by the remoteness of producers and landowners who harvest the resin wood (Sunari, L. 2015).

Eaglewood resin/oil

There is very limited information on the harvesting of gaharu and there are no regulations governing the exploitation of the resource. Trade figures on exports are kept by the PNG Forest Authority (PNGFA), but it is well known that there is a substantial unrecorded trade making it difficult to obtain reliable figures on gaharu production and sale. At the same time villagers are frequently unaware of the value of the wood and are at the mercy of the buyers until they become better informed about the true worth of gaharu (Chatterton, P. 2004)..

Official records show two main buyer/ exporting companies. The exporters collectively engage about 24 agents who trade with several hundred households which are harvesting gaharu. Companies wishing to trade in gaharu are required to obtain a license issued by the government. The annual license fee is PGK1000. In addition to the annual license, PNG registered companies are required to pay a registration fee of PGK10 000 while foreign companies pay PGK50 000. There is also a 10% export levy on the value of the shipment. The legal buyers and traders often fly into collection sites in order to buy gaharu directly from local collectors. The gaharu is exported primarily to Singapore with smaller shipments to Malaysia and Indonesia via Vanimo and Port Moresby or through West Papua. Official trade statistics indicate that 1011, 2670, 10508, 9479 and 11708 kg of gaharu were exported in the last five years from 1999 to September 2003. Illegal trade in gaharu is estimated to be much larger than the legal trade (Chatterton, P. 2004).

PNGFA guidelines on the minimum prices paid to resource owners for gaharu wood are as follows:

Super A grade: USD560/kg

A grade: USD420/kg

B grade: USD280/kg

C grade: PGK140/kg

D grade (very wet): PGK14/kg

(Chatterton, P. 2004)

The concept of Eaglewood resin is theoretically possible and certainly high value, however the harvesting of the resin is fraught with problems. Given that the Great Central Forest is a conservation area it is not recommended at this stage that the Wildlife Conservation Society promote the harvesting of resin/oil without significant further research.

Galip Nut

Galip nuts have recently been commercialized in PNG through 'The Galip Nut Project'. The Galip nut project is a joint development between National Agricultural Research Institute (NARI), the University of the Sunshine Coast, the University of Adelaide and The Australian Centre for International Agricultural Research (ACIAR) funded by DFAT. These organisations pooled together research and expertise to create 'The Galip Nut Company' which is the commercial entity now selling galip nuts overseas and throughout PNG.

The Galip Nut Company buys ripe fruit for PGK 1-1.50 per fruit. De-pulping was initially done manually but the project has now invested in a commercial de-pulping machine. The nuts in shell are then dried to 4.5% moisture levels and either cracked by hand or by an automated cracking machine. The galip nuts are then either sold as natural (in the skin), peeled or roasted.

The company is operating in Kerevat but cannot meet market demand. Their figures show that each family has access to roughly 10 galip trees, which produce 100-150kgs of ripe fruit per year. This can yield a family PGK1,000 per year, and they aren't required to de-pulp, dry and crack the nuts which can be very time consuming.

From 1mt of wet nut, the Galip Nut Project yields approx. 40kgs natural galip nuts. The Galip Nut project is currently selling their products for PGK150-185/kg.

Galip (de-pulped)

The process of extracting the galip nut from the fruit is laborious but does not require any specialized equipment or access to a power source. The team at the Galip Nut Company have expressed an initial interest in sourcing supply from anywhere in PNG, as they cannot currently meet demand. Therefore at this stage, it is deemed feasible to harvest galip nuts for commercial use. Freight would be too costly to send whole galip fruit, but it would be feasible to send de-pulped galip fruit to Kokopo where it can be further processed.

Galip (roasted)

If the community wanted to roast their own galip nuts for sale they would be able to do so, and this product would be worth more at the local market place than fresh galip nuts and have a longer shelf life. Initial discussions suggest that the Galip Nut Company would wish to roast nuts themselves in their East New Britain processing facility to ensure consistency and quality. Roasted galip nuts are still feasible, but the market is less defined.

Ginger (fresh)

Fresh ginger is currently sold at the local market however there is a substantial domestic market for spices in PNG. Current prices for ginger are PGK6/kilo. Ginger grows all year around but usually takes 8-10 months to reach maturity. This means that with staggered plantings there could be year-round harvest and sales of ginger.

Ginger (dried)

Due to the moisture content in fresh ginger, it cannot be stored for any length of time. To ensure the quality of the root is maintained ginger can also be dried to later be turned into powder. The process of drying is very simple, the root is washed, the skin peeled off, it is then sliced thinly and left on racks outside to dry which should take between 3-7 days.

Vanilla

The global vanilla market is largely dependent on the state of production in Madagascar which produces 80% of the global vanilla crop (Burton, J. 2018). Prices are volatile and reflect changes of production in Madagascar, for example in 2003 the price of vanilla reach USD500 per kilogram but had dropped to less than USD25 per kilogram by 2010 (Heneghan, C. 2016). In 2016 there was a supply shortage which led prices doubling from the previous year. Prices peaked again in 2017 due to great damage to crops in Madagascar caused by cyclone Enawo (Gale, J. 2018). The price of vanilla remained high in 2018 due to bad weather conditions in Madagascar and their consequent inability to meet crop goals. In August 2018 prices for cured vanilla beans were USD450 to USD500 per kilogram (Schmidt, J. 2018).

Some estimate that at least 30% of the global demand for vanilla bean has been lost in the last two years due to high prices. There is strong competition from synthetic vanilla which is now being used in the majority of vanilla products on the market today (Aust & Hachman 2018).

In an effort to stabilise the vanilla market, the industry has started prioritising sustainability within their business and supply chains (Miltner, O. 2017). The Sustainable Vanilla Initiative (whose members represent 70% of the worldwide vanilla bean market) aims to secure vanilla bean farmers' livelihoods and long-term stability of high-

quality vanilla bean supply by investing in crop diversification at the farm level, better agricultural practices and sector professionalization (Miltner, O. 2017).

Vanilla was introduced to Manus Island in the 1990s and during this time DPI Manus purchased *planifolia* vanilla cuttings from the National Agriculture & Research Institute (DAL, 2019). Vanilla prices dropped in 2002 and production declined in response to this. Currently vanilla prices are high, but the supply in Manus is low.

When crops are abandoned due to low prices, farmers are unable to pick up where they left off when prices suddenly increase again. The cultivation of vanilla is extremely labor-intensive. The plants themselves don't even start producing vanilla beans until after three years. When they finally do bloom, the flowers only stay open for one day and have to be carefully pollinated within 12 hours of blooming. The beans can be harvested after developing on the vine for four months and the curing process can take between 1-2 months. Grading the vanilla is also important and will affect the marketability and price. Quality is demonstrated by the vanillin content (minimum 2%) and moisture content (between 20% to 30%).

Despite the many difficulties of vanilla production, when done well, the returns are high. Consequently, vanilla is recommended as one of the cash crops for the farmers in the Great Central Forest.

SECTION 2.

Assessment of Market Demand

From the above analysis, the following cash crops and associated products have been deemed suitable for the farmers within the Great Central Forest: breadfruit flour, breadfruit chips, cocoa, cocoa butter, cocoa powder, cocoa nibs, dried chillies, virgin coconut oil, dried ginger, fresh galip nuts and vanilla.

Due to the remote nature of Manus Island, direct export would be a challenge for farming communities. There is a higher chance of success if cash crops with robust domestic market are selected for targeted production.

It should be noted that commodity markets by their very nature are dynamic and the data available today may not be relevant in 6 months' time. The prices reflected in this report are relevant for March 2019.

Breadfruit Flour

Establishments costs	Nil if drying racks already available
Cost of Production (excluding in-kind labour)	PGK4.50
Market Price (Lorengau)	Undetermined
Freight	To be confirmed during site visit
Possible Buyers	Manus inhabitants

Breadfruit chips

Establishments costs	Nil if drying racks/space already available
Cost of Production (excluding in-kind labour)	PGK2.50
Market Price (Lorengau)	Undetermined
Freight	To be confirmed during site visit
Possible Buyers	Manus inhabitants

Cacao

Establishment costs	Between PGK5,000 – PGK13,190 ¹
Cost of Production (excluding in-kind labour)	PGK6/63.5kg bag dried cocoa
Market Price – Domestic (delivered Lorengau)	PGK7,400/mt ² – (sales per kg available)
Market Price – Export (delivered Lorengau)	PGK11,023/mt ³ (sales per kg available)
Freight Costs	To be confirmed during site visit
Possible Buyers – Domestic	Outspan Agmark Elliven Cocoa Exports Queen Emma Chocolates
Possible Buyers – Export	Atypic Chocolates Ratio Cocoa Roasters Jasper and Myrtle Wellington Chocolate Factory OCHO

Cocoa Butter

Establishment Costs	PGK350
Cost of Production	Cost of packaging
Market Price (Lorengau)	Undetermined
Freight	To be confirmed during site visit
Possible Buyers	Manus inhabitants

Cocoa Powder

Establishment Costs	By-product of cocoa butter
Cost of Production	Cost of packaging
Market Price (Lorengau)	Undetermined
Freight	To be confirmed during site visit
Possible Buyers	Manus inhabitants

Chili (fresh)

¹ Based on landed costs of clear plastic for cocoa solar driers and solar bubble driers. It is assumed timber is available free of charge to construct fermenting boxes

² Price based on farm gate prices offered in Madang and Lae, averaged across 3 major exporters for the month of March 2019.

³ Price based on average price of existing premium contracts taken between Jan-March 2019

Cost of Production	Nil
Market Price Domestic (delivered Lorengau pre freight)	PGK8.50/kilo
Freight	To be confirmed during site visit
Possible Buyers	Paradise Foods Papindo

Virgin Coconut Oil (VCO)

Establishment Cost	PGK20,000 ⁴ - PGK80,000 ⁵
Cost of Production	Dependent on which production model used
Market Price Domestic (delivered Lorengau pre freight)	PGK8.20/100ml (PHAMA 2017).
Freight	To be confirmed during site visit
Possible Buyers	Manus inhabitants

Galip (de-pulped)

Cost of Production	Nil
Market Price Domestic (delivered Lorengau pre freight)	PGK1 = PGK1.50 per de-pulped nut
Freight	To be confirmed during site visit
Possible Buyers	The Galip Nut Company

Ginger (fresh)

Cost of Production	Washing (presumed nil)
Market Price Domestic (delivered Lorengau pre freight)	PGK6/kilo
Freight	To be confirmed during site visit
Possible Buyers	Paradise Foods Papindo

⁴ Based on cost for DME pressing device only

⁵ Based on coating as per Kokonut Pasifik website for all items including a generator

Vanilla

Cost of Production	Nil if drying rack/hanging space already available
Market Price Domestic (delivered Lorengau pre freight)	A grade: PGK500/kilo B grade: PGK300-400/kilo C grade: PGK200/kilo
Freight	To be confirmed during site visit
Possible Buyers	Paradise Foods (Port Moresby/ Lae) Papindo (Lorengau) Intec Vanilla (Lae) Elliven Vanilla Exporters (Madang)

SECTION 3.

Analysis of Available Databases/Initiatives within PNG

An initial internet search of 'livelihood project' + 'Papua New Guinea' yields over 16 million results. Although the number varies throughout reports, many articles written in the past decade cite that over 700 aid/donor funded/NGO/not for profit/religious/Corporate Social Responsibility projects and programs are working in Papua New Guinea at any one time (Anderson, T. 2012). The Australian Government alone has committed AUD572 million to Papua New Guinea in 2018/2019.

The most valuable information about livelihood initiatives came from a series of interviews. At the time of writing this report, there was no centralized source which summarized or listed all of the agricultural and/or livelihood initiatives programs currently active in PNG. The below listing is designed to provide an overview, however ongoing interviews and meetings will further refine the listing.

Initiatives to be used as case studies

Amruqa

They are a small family business based on Vunakanau Estate, in Rabaul, East New Britain Province. Their name 'AMRUQA' comes from a local Qaqet language, and is the name for the Rosewood Tree meaning: regrowth - regeneration.

All of their products are grown traditionally the natural way and their stainless steel distillation and coconut oil processing lines ensure that the high quality of their products is maintained consistently to international standards. Amruqa sells to both domestic and export markets and is a great case study of product development for a community project.

Email: amruqa@gmail.com

Website: <http://www.amruqa.com/>

Australian Government Funded Programs

(includes ACIAR)

Market Development Facility

At MDF, teams work with businesses, associations and governments in Asia Pacific to help farmers and workers thrive. They use a market systems (MSD) approach to achieve long-term, lasting growth and create sustainable jobs for poor women and men. Whilst this approach is more suited to larger businesses, the market systems development approach should be considered for establishing the project in Manus.

Contact: Shariful Islam

Email: Shariful.Islam-mdf@thepalladiumgroup.com

Website: <http://marketdevelopmentfacility.org/content/partnerships/papua-new-guinea/>

Australian Centre for International Agricultural Research (ACIAR)

ACIAR has many projects in Papua New Guinea, including five which are managing under the Transformative Agriculture and Enterprise Development Program (TADEP). Two of these have developed frameworks which are relevant to the WCS communities on Manus:

Family Farms Team

This project aims to enhance the economic development of PNG women smallholders and their families. Most women farmers hope to improve their family livelihoods, but very few have the necessary agricultural and business acumen. Women smallholder farmers in Papua New Guinea grow essential subsistence crops while caring for their families. They are key to agricultural livelihoods, but face significant constraints.

PNG Cocoa

This project aims to make smallholder cocoa enterprises in Papua New Guinea's East Sepik, Madang, New Ireland and Chimbu Provinces more productive and profitable. Cocoa is a profitable smallholder crop and export trade commodity in Papua New Guinea and drives rural development. 150,000 smallholder farming families grow cocoa, which accounts for 18% of agricultural exports. Old cocoa plantings have become overgrown, resulting in low yields, under-harvesting and heavy losses to pests and diseases, especially Phytophthora Pod Rot (Black Pod). The Cocoa Pod Borer (CPB) nearly destroyed cocoa production in Papua New Guinea, always low due to poor management. Only the Papua New Guinea Cocoa Coconut Institute's (CCI) new varieties and methods, which can increase yields to high levels, could revive the industry. This project will help the smallholder farmers who make up more than 90% of production widely apply these new varieties and straightforward methods.

Contact: Elizabeth Brennan

Email: eab@agcorp.com.au

Website: <https://tadep-png.com/project/family-farm-teams/>

CARE (Coffee and Cocoa Programs)

CARE has trained thousands of coffee farmers on farm management and family business management. The training helps the farmers understand how important it is to give women an equal share in making decisions, household work and income. Men's attitudes and behaviours towards women are already changing for the better, and farming practices are improving because of this training. They have also set up a Coffee Industry Graduate Program to encourage more PNG women to become professionals that can help farmers with agricultural knowledge. Since the project started, the number of women participating in farming and business management training has also grown rapidly.

Contact: Christopher Hershey

Email: Christopher.hershey@careint.org

Website: <https://www.care.org.au/country/papua-new-guinea/>

Food and Agriculture Organisation of the United Nations

FAO's presence in Papua New Guinea goes back 40+ years when the country became a member of the United Nations with the signing of the UN Convention in 1975. The long partnership between FAO and PNG was strengthened with the recent opening of a country office in 2013. FAO assistance has aimed at achieving food security through environmentally sustainable local food production. Recent interventions have focused on strengthening policy and planning, including the development of a National Agriculture Development Plan.

Technical support to the Department of Agriculture and Livestock (DAL) for the preparation of Policy Partnership on Food Security (PPFS) Action Plans (ended Dec 2018)

In partnership with the Department of Agriculture and Livestock and other relevant government agencies, FAO has undertaken activities to review and renew Papua New Guinea's National Food Security Policy for the next ten years. The process involved facilitating multi-stakeholder consultations to formulate the new policy and ensure that relevant government agencies provided inputs for its formulation. Activities also included the strengthening of coordination and linkages with other relevant policy processes being undertaken in Papua New Guinea. As a result of this process, a new 10-year National Food Security Policy Framework and a National Level Action Plan were developed. The Policy has also been rolled out to three pilot provinces, and provincial level food security plans have been drafted for these pilot provinces. A submission of the policy is being prepared for the National Executive Council's (Government Cabinet) formal endorsement.

Technical support to the Papua New Guinea Forest Authority to implement a multi-purpose National Forest Inventory (Finishes Mar 2019)

FAO has also been supporting the National Forestry Authority in conducting the country's first Multi-purpose National Forest Inventory to estimate greenhouse gas emissions in Land Use and Land Use Change and Forestry. Methodologies for the Inventory were developed, tested and documented. Numerous technical trainings in various fields including botany, zoology, soil survey, data management and analysis were conducted. Field assessments have already been carried out in selected provinces, and the initial findings from the Inventory were presented at a Research Conference.

Support to Formulation of EU funded program on Rural Entrepreneurship, Investment and Trade in PNG (i.e. Agri Value Chain Development Program for the Sepik region) – finished Dec 2018

This is a EU (pipeline) programme on value chain development of three agricultural commodities - cocoa, vanilla and fisheries - in selected communities of East Sepik and parts of Sandaun provinces. The programme aims at improving sustainable and inclusive economic development and job creation with a specific focus on women, youth and climate change. The project will be built around four mutually reinforcing pillars: i) business enabling environment; ii) support services, key for the development of value chains; iii) physical infrastructure (including transport and energy) and iv) community engagement, in particular of women and youth. FAO is expected to play a coordinating role in the rolling out of the project over the next four to five years. Under this TCP, FAO's current efforts are in project formulation in consultation with possible stakeholders of different aspects of the value chain development process.

Contact: Helmtrude Sikas-lha

Email: Helmtrude.Sikaslha@fao.org <Helmtrude.Sikaslha@fao.org>

Website: <http://www.fao.org/papua-new-guinea/fao-in-papua-new-guinea/en/>

Live and Learn Environmental Education

Managing Fire to Conserve Biodiversity and Reduce Climate Vulnerability

This project is in the Gimalapira Conservation and Sustainable Resource Management area in central West New Britain, Papua New Guinea. The project balances the protection of important ecosystems through the establishment of a community-managed conservation area, with enhancing income earning opportunities through sustainable development initiatives, potentially including improved agricultural production, eco-tourism and payments for ecological services. These income earning opportunities reduce the pressure on landowners to engage in environmentally degrading activities such as commercial logging and destructive wildfires. The project will work to reduce the vulnerability of the biodiversity conservation area, the villages, and the agricultural and forest resources to a future major fire event through the development and implementation of a fire management plan. It is funded by USAID, and works in partnership with Live & Learn and the Nakau Programme.

Contact: Christian Nielsen

Phone: +61 3 9650 1291

Website: <https://livelearn.org/projects>

Oxfam

Oxfam in PNG's livelihoods project is helping farming families boost the quality and quantity of the crops and assisting them to sell these for a decent price at lucrative markets. Making a decent income from crops means that farmers can send their children to school, access decent healthcare and reliably put nutritious food on the table.

Partners with Melanesians

Partners with Melanesians Inc. (PWM) is a national not-for profit Non-Government Organisation working on Conservation and Community Development in rural areas of Papua New Guinea. It was established in 1985 as a literacy project by academics and students from the University Papua New Guinea to support education initiatives in the Managalas Plateau of Oro Province. Partners with Melanesians has been working alongside community based organisations in Managalas by providing technical support and advise to the local community members. This has helped people embark on sustainable eco-enterprises like coffee production, Okari nut projects, large scale production and sales of agricultural produce and women's sewing projects among others. All these projects are aimed at improving the local population's livelihoods through capacity building and community empowerment. Seeing such benefits in their lives, it is hoped to encourage people to claim ownership of the bigger Managalas Conservartion Area Project.

Contact: Kenn Mondiai

Email: kmondiai@pwmpng.org.pg

Website: <http://www.pwmpng.org.pg/>

The World Bank

PNG Productive Partnerships in Agriculture (PPAP)

The development objective of the Productive Partnerships in Agriculture Project for Papua New Guinea is to improve the livelihoods of smallholder cocoa and coffee producers through the improvement of the performance and the sustainability of value chains in cocoa-and coffee-producing areas. There are three components to the project. The first component of the project is institutional strengthening and industry coordination. The objective of this component will be to improve the performance of sector institutions and to enhance industry coordination in the coffee and cocoa sectors. Existing stakeholder platforms for industry coordination will be consolidated to address short- and long-term issues such as sector governance, skills development in the industry, improvement in extension services, industry strategy on threats to quality and quality promotion, information within the industry, market development and crop diversification. The second component of the project is productive partnerships. The objective of this component will be to increase the integration of smallholder producers in performing and remunerative value chains, by developing and implementing productive alliances between smallholders and the private sector aiming at improving market linkages in the project areas. The third component of the project is market access infrastructure. The objective of this component will be to improve market access for smallholder cocoa and coffee growers in the areas targeted under the project

Contact: Martin Powell

Email: c2c@ppap.cocoaboard.org.pg

Website: <https://www.worldbank.org/en/country/png>

Tree Kangaroo Conservation Program

The Tree Kangaroo Conservation Program (TKCP) began in 1996 as a conservation research study to determine the status of the endangered Matschie's tree kangaroo. TKCP's community-based strategy helps provide benefits and improve the standard of living for the more than 12,000 people in 50 villages throughout YUS. Indigenous landowners and community members participate in TKCP's work, including scientific research, land mapping, education, health, sustainable livelihoods, and conservation outreach activities. Under PNG's unique land tenure system, more than 90% of all land in the country is held and controlled by customary landowners. As such, the sustainability of the YUS CA depends upon the commitment of the local landowners. TKCP is truly about empowering the local stewards of the environment.

Contact: Niels Hove

Email: niels.hove@treekangaroo.org

Website: <https://www.zoo.org/tkcp>

United States Agency for International Development's Lowering Emissions in Asia's Forests (ended Dec 2016)

Together with USAID's Lowering Emissions in Asia's Forests project and The Nature Conservancy, these communities encompassing 18,000 hectares (44,500 acres) have implemented participatory land use planning. All villagers take part in zoning their community land for specific uses: agriculture, conservation, forest use, gardening, hunting and village development. There have also been benefits to the agricultural practices of the Urumarave people, who grow nearly everything they consume, and trade or sell excess produce. Through technical assistance and training, villagers have set aside plots of land specifically for gardening on land less susceptible to erosion and landslides. They practice "intercropping," or growing two or more crops in proximity, to increase food production while using less land and water.

USAID, using the global dataset from the University of Maryland, has found that community conservation agreements based on participatory land use plans reduce forest clearance by up to 50 percent compared to communities that do not have a land use plan. USAID is also working with communities across the Adelbert Range to better understand the drivers of deforestation and degradation.

World Vision

World Vision first began implementing the PPAP in 2014. Funded by the Government of PNG and the PNG Cocoa Board, with support from the World Bank, the project gives farmers the knowledge and materials they need to grow better cocoa in Bougainville, as well as in East Sepik and Madang. As part of this World Vision have implemented a sustainable crop upgrading process for farmers – giving them access to new, more productive

and resilient strains of cocoa, carried in our sustainable nurseries. At the same time, they also help farmers to rehabilitate their existing crops, ensuring an ongoing source of income as they transition to the newer crop. They are also learning to recognise and prevent the spread of disease in their plantation, which is particularly important with the risks that the cocoa pod borer poses to the industry. The project also provides farmers with farming tools, which enable them to look after their crops more effectively. Many locals have also received bud grafting lessons. They teach locals the skills to clone the most resilient and highest-yielding crops. Seedlings can then be sold to other members of the community – offering a sustainable income for the future.

Contact: Heather MacLeod

Email: Heather_MacLeod@wvi.org

Website: <https://www.wvi.org/papua-new-guinea>

Initiatives available for active participation

Australian Government Funded Programs

(includes ACIAR)

PHAMA Plus

The Pacific Horticultural and Agricultural Market Access Program (PHAMA) provides practical and targeted assistance to help Pacific island countries manage regulatory aspects associated with exporting primary and value-added products. This encompasses gaining access for products into new markets and helping to manage issues associated with maintaining and improving existing trade. The scope of the newly extended program includes accessing domestic markets and will focus on the coffee, cocoa and handicraft industries.

Contact: Sidney Suma

Email: s.suma@phamaplus.com.au

Website: <http://phama.com.au/>

Australian Centre for International Agricultural Research (ACIAR)

ACIAR has many projects in Papua New Guinea, including five which are managing under the Transformative Agriculture and Enterprise Development Program (TADEP). One of these is relevant to the WCS communities on Manus:

Galip Nut (Canarium)

This project seeks to expand markets and processing of canarium nuts in East New Britain, Papua New Guinea, by strengthening private sector capacity and engagement using nuts from existing trees. *Canarium indicum* is an agroforestry tree in Eastern Indonesia and the Pacific that produces edible nuts. Donor agencies have tried

to commercialise the industry in Papua New Guinea and the Pacific. Nuts could improve the livelihood of the rural poor in developing countries and meet the Millennium Development Goal of eradicating poverty and hunger. Nuts are highly nutritious, can be stored for long periods, and can be sold for cash, processed and exported to distant markets. Women in Papua New Guinea grow and trade canarium nuts; they cultivate, harvest, process and sell them.

The project will take a whole of value-chain approach. It will research markets, provide technical advice, build capacity, mentor businesses, and give private and public sector stakeholders access to infrastructure. It will target the private sector at three different scales: smallholder and small scale entrepreneurs, small and medium-sized enterprises, and large scale processors.

Contact: Elizabeth Brennan

Email: eab@agcorp.com.au

Website: <https://tadep-png.com/project/family-farm-teams/>

Fairtrade

Producer Support Programs

Fairtrade Producer Networks offer direct support to farmers and workers through a network of field staff who are specialists in the Fairtrade Standards, certification processes and requirements. They provide advisory services to farmers and workers, as well as training and information to help them comply with the Fairtrade Standards, strengthen their business capacities, and deepen Fairtrade impact. Enabling farmers and workers to become better organized is the basis for all producer support services. Additional programmes of support in thematic areas, such as climate change, gender and workers' rights enable producers to strengthen their organizations and meet the specific needs of their members. Other programmes help producers to tackle human rights issues in their communities, such as child labour or to improve their financial and HR management. We aim to deepen these programmes further going forward.

Contact: Gabriel Iso

Email: lopng@fairtrade.org.nz

Website: <https://www.fairtrade.net/producers/>

Kokoda Track Foundation Ltd

Light Up PNG

Our Light Up PNG project supports women to establish small businesses from which they can earn a regular income. Business skills training combined with literacy skills and training in the provision of solar-related services are provided to women's groups across remote and rural parts of PNG.

Contact: TBC

Email: admin@kokodatrackfoundation.org

Website: <https://www.ktf.ngo/livelihoods>

Rainforest Alliance

Thriving farmers and healthy forests go hand-in-hand. Subsistence farming and commercial farming combined are responsible for more than 80 percent of tropical deforestation. As the world's population increases, so does the demand for food—and with it, the pressure to raze forests for more farmland. Making current cropland more productive is one of the most direct ways to improve farmer livelihoods and halt deforestation. Rainforest Alliance aims to support farming communities whilst preserving the environment around them.

Contact: Putri Mayasari

Email: pmayasari.nepcon.org

Website: <https://www.rainforest-alliance.org/issues/food>

Tenkile Conservation Alliance

Alternative livelihood Projects - Protein Farming

A major component of TCA's work is to establish a sustainable source of protein in each village. In order to reduce the amount of overhunting in the area, people need to actively manage their own sources of protein in the villages. People have a limited supply of village protein and have few resources to develop in this area without external assistance. Since 2004, TCA has established alternative sources of protein for village communities with varying degrees of success. Alternatives such as rabbits, chickens and fish are all kept in farmed conditions with appropriate materials, training and livestock being distributed throughout the project area. TCA currently focuses its efforts on providing fish fingerlings to villages when requested.

Food security and small income generating activities

Activities include the delivery of rice milling machines, rice farming training and management training, investigation into vanilla farming practices and develop ways to improve success.

Contact: Jim Thomas

Email: tenkileconservationalliance@yahoo.com.au

Website: <https://www.tenkile.com/>

The Kinaka Project

As a pilot sustainable livelihood project, the Kinaka Project in Bougainville established a small community owned vanilla farm to develop strategies for business development and improving value chains that will lead to opportunities for research and development and open up international market access. Currently they have approximately 500 individual vanilla plants on the farm. The plants started fruiting in late 2017. The Kinaka Project also conducts training programs targeting different aspects of vanilla farming, pollination, harvesting and post harvest processing, storage and other important training needs. They already have a market target in

Melbourne through the social entrepreneur Mekai Vanilla (<http://www.mekai.net/>) who imports and distributes coffee and vanilla from Bougainville throughout Australia.

Contact: Stanley Lothe

Email: info@kainakeproject.org

Website: <https://www.kainakeproject.org/livelihood-projects>

United Nations Development Programme (UNDP)

Development challenges in Papua New Guinea are as diverse and complex as the country itself. To respond to these challenges, UNDP in PNG concentrates its efforts on building the country's capacity to promote inclusive, pro-poor growth, effective governance, and sustainable and resilient development.

Small Grant Programme

The Global Environment Facility Small Grants Programme embodies the very essence of sustainable development by "thinking globally acting locally". By providing financial and technical support to projects that conserve and restore the environment while enhancing people's well-being and livelihoods, SGP demonstrates that community action can maintain the fine balance between human needs and environmental imperatives. In PNG, SGP continues to support vulnerable and isolated communities across PNG in their efforts to protect and manage their natural resource while building their resilience against climate change. SGP only awards grants to not for profit organizations.

Contact: TBC

Email: registry.pg@undp.org

Website: www.pg.undp.org

World Wildlife Fund

WWF has been working on conservation issues in Papua New Guinea (PNG) and the Solomon Islands for many years. In 2008 WWF's Pacific Office based in Fiji was divided in order to provide more effective coverage in this vast yet biologically important region. The newly formed "Western Melanesia Programme Office" based in Papua New Guinea also encompasses the Solomon Islands.

WWF is collaborating with local authorities and other non-government organizations (NGOs) to provide education and training to local communities about the importance of eaglewood as a resource, and encouraging sustainable management of the industry. These training workshops come under a project funded by the United Nations Food and Agriculture Organization. As part of a pilot project, eaglewood management teams have been set up in selected locations around PNG to work directly with rural eaglewood farmers in practicing and promoting sustainable harvest and trade of eaglewood industry.

Phone: +675 325 1179

Website: http://www.panda.org/wwf_offices/papua_new_guinea/

SECTION 4.

Potential Cash Crop Initiatives

Equator Initiative

Five continents, 500+ communities and thousands of ideas. Explore our Solutions Database to learn how outstanding local communities and indigenous peoples around the world are making possible the achievement of the UN Sustainable Development Goals through nature-based actions.

Website: <https://www.equatorinitiative.org/knowledge-center/nature-based-solutions-database/>

Kokonut Pasifik (Virgin Coconut Oil)

Their mission is to provide empowerment to remote rural villages on tropical coasts of developing countries. KPSI believes people have the power to create their own solutions and livelihoods if given appropriate opportunities and our mission is to assist in facilitating these opportunities. They believe in: equity in wealth distribution, opportunity for all who are prepared to work, partnerships that support and encourage but do not control, the power of business to help people help themselves through trade not aid and sustainable agricultural practices

Contact: Bob Pollard

Email: kpsibob@gmail.com

Website: <https://www.kokonutpacific.com.au/business/dme-equipment-costs>

Live and Learn Environmental Education

Alternative Forest Livelihoods

Nakau applies the principles of fair trade where the majority of project benefits are delivered directly to indigenous landowners. Businesses and individuals partner with Nakau to create life-changing impacts for local landowners and the rainforests under their stewardship. Funding from sales of conservation credits

allows indigenous landowners to switch from activities that degrade or clear forest, to a new conservation economy that protects forests and provides capital for new and sustainable development pathways. Landowners in project sites in Fiji, Vanuatu and Solomon Islands have given up rights to logging timber in exchange for the opportunity to sell rainforest carbon offsets as a way of generating revenue for local economic development, such as producing and selling rainforest honey, agroforestry products such as nuts, and learning centres and visitor accommodation. The sites across Fiji, Solomon Islands and Vanuatu produce 62,222 carbon credits annually, which have been purchased by companies such as at Optus Australia.

Sustainable Livelihoods through community empowerment in Cambodia

The project aims to contribute to reducing poverty and increasing incomes and environmentally sustainable livelihoods in disadvantaged communities in Cambodia. This is achieved by strengthening Self-help Groups in ten villages and supports two Self-help Group Federations in Trapeang Rung commune (Kaoh Kong province) and Phat Sanday commune (Kampong Thom province), Cambodia. The project is implemented in partnership with Assis Aid. The Sustainable Livelihoods project provides technical skills training and has allowed women in rural Cambodia to up skill in on-farm and off-farm activities based on their needs. It has allowed diversification in their economic activities, increased household income and opened up new opportunities (for example - chicken-raising and bookkeeping) in agriculture. Women have also been encouraged to take on leadership roles within established community-based organisations and savings groups.

Contact: Christian Nielsen

Phone: +61 3 9650 1291

Website: <https://livelearn.org/projects>

Livelihoods Fund– Vanilla Project (Madagascar)

For the past fifty years, agriculture has relied on the monoculture of selected plant varieties and the large-scale use of fertilizers and pesticides to increase yields. The side effects of intensive agriculture are now plain to see: soil degradation, water pollution, diminishing biodiversity, farmers made vulnerable to climate change, and increasingly dependent on suppliers of agricultural technology. The Livelihoods funds promote farming practices that can increase food production while preserving our natural resources.

Phone: +33 (0) 1 44 35 33 66

Website: <http://www.livelihoods.eu>

Mainstreaming of Rural Development Innovation (MORDI) Tonga Trust

Sustainable Lives Through Community Development

MORDI works towards aiding the rural isolated communities of Tonga fight poverty. Many of these communities have been shown how to live sustainable lives through MORDI community development projects and skill development trainings.

It works to empower the communities to realize their full potentials and take ownership by involving them with the community activities as opposed to isolating them. The women and the youth which have been identified as more vulnerable, are given the opportunity to participate in community development activities.

Email: admin@morditonga.to

Website: <https://www.morditonga.to/>

Pacific Island Farmers Organisation Network

Their mission is to make Pacific Islands Farmer Organisations more vibrant, viable and sustainable organisations. Essential for effective engagement with farmers, Farmer Organisations are critical in empowering livelihoods for rural households across the Pacific Islands region. They have members in Fiji, Tonga, Samoa, Vanuatu, Solomon Islands, Papua New Guinea and Timor-Leste.

Email: info@pacificfarmers.com

Website: <https://pacificfarmers.com/>

Trees That Feed Foundation

The Trees That Feed Foundation plants fruit trees in Haiti, Jamaica, Antigua, The Bahamas, Barbados, Costa Rica, Puerto Rico, St. Vincent, Suriname, Ghana, Kenya, Liberia, Uganda, Pakistan, and soon Dominica, U.S. Virgin Islands and Tanzania. Breadfruit trees, mango trees, many others. Their vision is seeing self-sustaining communities and entrepreneurs, based on agroforestry.

Email: info@treesthatfeed.org

Website: <https://www.treesthatfeed.org/>

Women in Business Development Inc. (Samoa)

Women in Business Development has extensive experience in small scale value-adding and getting products to market. Women in Business Development is dedicated to strengthening village economies in Samoa in ways that honor indigenous tradition, use traditional and modern technology, and promote fair trade. Since 1991, they have been committed to empower and equip rural families to cultivate sustainable businesses that maximize farm-based resources.

Email: data@womeninbusiness.ws

Website: https://www.womeninbusiness.ws/women_in_business.html

SECTION 5.

Constraints

Capacity

The success of any venture is reliant on the motivation and capacity of those undertaking the work. The small volumes of the cash crops identified in this report mean that in order to make their cultivation economically feasible, the products will need to be differentiated by quality or certification. This requires skill in post-harvest practices and extensive record keeping. To access the best prices the farmer groups will need to be proactive in continually seeking out new markets. They will need to understand what motivates their buyers and tweak their marketing pitch accordingly. This requires literacy skills, people skills and use of technology including phone apps and social media.

Access to basic tools

Whilst the most low-tech options have been suggested throughout the course of this report, access to specialized tools and equipment will definitely make the work easier and increase crop yields. Manus lacks the access to basic tools for production, let alone access to items such as solar bubble driers, grafting knives, clear plastic for drying, small cocoa presses etc. Even if these items can be purchased for the projects, a plan needs to be put in place for their maintenance and replacement if necessary.

Connectivity

The quickest and easiest way to reach buyers, both domestic and international, is through email. Social media and websites are also powerful tools through which to advertise commodities and value-added products to potential buyers. Connectivity in the Great Central Forest does not allow for this level of communication.

Freight

Freight issues dominate the discussion for cash crops and this has a ripple effect in regards to other problems. If freight cannot be arranged in a timely manner, this means goods spend longer in storage and may decline in quality.

Cocoa and copra are transported in jute bags which can weigh up to 70kgs, these are unwieldy and expensive to transport. For their products to reach Lorengau from the Great Central Forest, farmers often hire a banana

boat at the cost of PGK300 + fuel. If their product is lightweight and they can carry it easily into town, a boat fare for an individual still represents PGK100 return trip.

Freight costs then need to be considered from Manus to their end destination. Buyers have been identified in East New Britain, Lae and Port Moresby and given the initial volumes of the cash crops, break bulk shipping or air freight may be the only options available. This is likely to be expensive and whilst the cost may be shared between the buyer and the producer, it will undoubtedly be worked into the farm gate price that growers receive.

Fluctuating prices

Cash crops are often abandoned when prices drop and both vanilla and cocoa are susceptible to dramatic changes in price. To ensure stability, trading to premium markets is preferred over bulk markets. This however is only possible if the products have a differentiating factor from all of the other cocoa/vanilla on the market.

Both cocoa and vanilla farmers are well known in PNG to abandon their crops when the price drops. The problem that this causes is that when prices increase again, the farmers are not in a position to harvest immediately or to their full potential.

Recommendations

Manus is rich in agricultural diversity however it does not appear to grow any one commodity or cash crop on a significant scale. Based on initial assessment of the cash crops available on Manus Island, seven have been pre-selected for further analysis, these are breadfruit, chili, cocoa, coconut, ginger, galip nuts and vanilla.

There are four simple ways in which to increase the economic value for stakeholders; higher prices for their existing product, increasing supply of their existing product, differentiated supply and/or market segmentation and maximizing the waste products/value adding. The following approach is recommended to maximise economic returns:

1. Accurately quantify the production of existing commodities and seek alternate buyers. Initial focus to be on cocoa, vanilla and galip nut (pending site visit verification) as these crops are already established.
2. Cluster growers in geographic groups to reduce freight and increase leverage in sales negotiations
3. Differentiate the product. The cheapest way to do this is to ensure that the product is of the highest quality which in the case of cocoa and vanilla is reliant on post-harvest practices. Certification tends to be costly and time consuming and, in some cases, does not return the same premiums as top-quality products. Certification it is an excellent way to differentiate a mediocre product.
4. Maximise waste products. High quality products result in rejection of substandard beans/pods/nuts through careful quality control. For example, screened cocoa beans can be turned into nibs/butter or powder, reject vanilla pods can be turned into vanilla paste or vanilla essence.
5. Increase supply. Once farmers have a high-quality product with established markets, they can steadily increase production.

-
6. Business diversification. The more different products that a group can work with, the more they protect themselves against crop failure, price fluctuation etc. At this stage the farmers can start to sell their chili and ginger to spice buyers.
 7. Increase food security and decrease reliance on store bought products by teaching value-added products from breadfruit and cocoa. Any products surplus to requirements can be sold in the local market.

The benefit of this approach is that by working with known products, in their existing form, producers can hopefully see results sooner than if they had been required to make changes to infrastructure and current farming practices. The focus in the short term should be domestic markets due to high freight costs and lack of connectivity. Should the communities wish to develop their own brand, they can do this while they continue to increase production, improve quality and refine any value-added products. The political situation on Manus is a constraint but can also be a distinct marketing advantage as consumers in the Asia/Pacific region are sympathetic to their situation.

There are a plethora of cash crop/livelihood initiatives being implemented in PNG and in the Pacific region. Similar conservation programs should be consulted in the design of the program for growers in the Great Central Forest, namely the TKCP, TCA and PWM for their work in coordinating farmers into cluster groups to easier consolidate and market cash crops. ACIAR's Family Farms project has developed an approach which is now used widely through PNG to engage women and entire families in the decision-making process around agriculture. The Equator Initiative is a valuable resource for innovative thinking in community livelihood programs all around the world.

Live and Learn Environmental Education has extensive experience in looking at community driven, holistic approaches to livelihoods. Moreover they make their training and learning material available to the public which could save time on 'reinventing the wheel' later on in the project. Kokonut Pasifik Solomon Islands is also a very valuable resource for investigating the possibility of the Great Central Forest growers producing VCO.

Both the PHAMA Plus Program and Fairtrade are able to provide practical assistance in linking producer groups to established markets (domestic and export). The Kinaka Project, Amruqa and Women in Business (Samoa) should be consulted to provide practical information of product development for small scale community projects.

This document is continuing to develop but will serve to inform the scope of the site visit to be conducted from 18th April – 11th May 2019.

Reference List

1. Alcorn, J. (1993) *Papua New Guinea conservation needs assessment: volume 1*. Papua New Guinea Department of Environment and Conservation, Boroko.
2. Anderson, T. (2012). *Land and livelihood economics in Papua New Guinea – shifting the paradigm*. 10.13140/2.1.4049.6644.
3. Aust & Hachman (2018) *Vanilla Market Update*, <http://www.austhachcanada.com/november-2018-english/> (Accessed 10 March 2019)
4. Beehler, B. (1993) *Papua New Guinea conservation needs analysis volume 2*. Papua New Guinea Department of Environment and Conservation, Boroko.
5. Bitto, B. & Petit, N. (2016) *Towards sustainable agricultural commodities in Papua New Guinea – the case of palm oil, coffee & cocoa*. FCPF/UNDP
6. Brooksbank, L., Towles, S. Lynch, P. (2017) *Sustainable Energy for Manus Province*, PNG Impact Conference: 12/13 Dec 2017 – UPNG, https://researchonline.jcu.edu.au/53140/1/Sustainable_energy_for_Manus_Province.pdf, (accessed 21st March 2019)
7. Burgering, C. (2018) *Agri Commodities Insights – Cocoa*. <https://insights.abnamro.nl/en/2018/12/price-of-coffee-follows-brazilian-real/> (Accessed 15 March 2019)
8. Burton, J. (2018) *The Leading Countries in Vanilla Production In The World*. *World Atlas*. <https://www.worldatlas.com/articles/the-leading-countries-in-vanilla-production-in-the-world.html> (Accessed 30 March 2019)
9. B. Gunn, P. Stevens, M. Singadan, L. Sunari and P. Chatterton Year of Publication: (2004) *Eaglewood in Papua New Guinea Series: Resource Management in Asia-Pacific Working Paper No. 51* Publisher: Resource Management in Asia-Pacific Program Research School of Pacific and Asian Studies The Australian National University Place of Publication: Canberra ISSN – 1444-187X
10. Byrna, S. (2018) *Papua New Guinea’s vanilla sector success relies on education and regulation*, Business Advantage PNG, <https://www.businessadvantagepng.com/papua-new-guineas-vanilla-sector-success-relies-on-education-and-regulation/> (accessed 12th March 2019)

-
11. CABI, 2018. Improved management strategies for cocoa in Papua New Guinea. [online pdf] Available at: <file:///Users/user/Desktop/project.pdf> [Accessed 28 November 2018].
 12. Chatterton, P. (2004) *Eaglewood in Papua New Guinea*.
<https://www.researchgate.net/publication/277157133> (accessed 20th March 2019)
 13. Edwards, M. (2014) *The Manus Economy*. Adam Smith International
 14. Elevitch, C. (2011) *Specialty Crops for Pacific Islands*. Permanent Agricultural Resources, Honolulu, Hawaii
 15. Elevitch, C.R. (2014). *Traditional Trees of Pacific Islands: Their culture, environment, and use*. Permanent Agriculture Resources (PAR), Hōlualoa, Hawai'i. <http://www.traditionaltree.org>
 16. End, M.J. and Dand, R. (2015) *Cocoa Beans: Chocolate and Cocoa Industry Quality Requirements*. CAOBISCO/ECA/FCC
 17. Folger, J. (2018) Commodities: Cocoa. Investopedia.
<https://www.investopedia.com/university/commodities/commodities1.asp> (Accessed 20 March 2019)
 18. Future Market Insights (2017) *Cocoa Powder Market: Global Industry Analysis 2012 – 2016 and Opportunity Assessment; 2017 – 2027*. <https://www.futuremarketinsights.com/reports/cocoa-powder-market> [Accessed 11 March 2019]
 19. Gale, J. (2018) *Vanilla volatility very vexing for buyers*. In: *IEG Vu Agribusiness Intelligence*. Global Outlook, https://iegvu.agribusinessintelligence.informa.com/-/media/agri/iegvu/fn-market-reviews-pdfs/food-news-market-review-supplements/iegvu_global_outlook_2018_online_v2.pdf (Accessed 12 December 2019)
 20. Geoff Lipsett-Moore, Edward Game, Nate Peterson, Earl Saxon, Stuart Sheppard, Allen Allison, John Michael, Rose Singadan, James Sabi, Gaikovina Kula and Roselyn Gwaibo (2010) *Interim National Terrestrial Conservation Assessment for Papua New Guinea: Protecting Biodiversity in a changing Climate*; Pacific Island Countries Report No. 1/2010. 92 pp.
 21. Gercama, I. & Bertrams, N. (2018) *Vanilla fever: Fear sours the sweet scent of Madagascar's success*. <https://mg.co.za/article/2018-03-16-00-vanilla-fever-fear-sours-the-sweet-scent-of-madagascars-success> (Accessed 17 March 2019)
 22. Goebel, R. (2005). *Breadfruit – The Australian Scene' –*, *Tropical Fruit Expert, Innisfail, North Queensland*. Presented to the 1st International Breadfruit Symposium, 2005, Nadi, Fiji Islands.
 23. Grandison, G. (2002). *Report on Fresh Breadfruit Exports to New Zealand*. South Pacific Trade Commission, New Zealand.

-
24. Gunnars, K. (2018) *Top 10 Evidence-Based Health Benefits of Coconut Oil*, Healthline, <https://www.healthline.com/nutrition/top-10-evidence-based-health-benefits-of-coconut-oil#section1>, (accessed 13th March 2019)
 25. Heneghan, C. (2016) *Why the vanilla industry is rallying behind a global sustainability initiative*. <https://www.fooddive.com/news/why-the-vanilla-industry-is-rallying-behind-a-global-sustainability-initiat/432327/> (Accessed 13 March 2019)
 26. Hide, R., Allen, B., Bourke, R., Fritsch, D., Grau, R., Helepet, J., Hobsbawn, P., Lyon, S., Poienou, M., Pondrilei, S., Pours, K., Sem, G. and Tewi, B. (2002) *Manus Province: Text Summaries, Maps, Code Lists and Village Identification. Agricultural Systems of Papua New Guinea Working Paper No. 18*. Land Management Group, Department of Human Geography, Research School of Pacific and Asian Studies, The Australian National University, Canberra.
 27. The International Cocoa Organization (2018) *The Chocolate Industry*. ICCO, <https://www.icco.org/about-us/icco-news/20-last-quarterly-bulletin-of-cocoa-statistics.html> (Accessed 3 March 2019)
 28. Intercontinental Exchange (2019) *Agriculture*. [online] <https://www.theice.com/agriculture> (Accessed 26 March 2019)
 29. Kokonut Pasifik (2019) *DME checklist for small business*, Kokonut Pasifik, <https://www.kokonutpacific.com.au/business/checklist-small-business> (accessed 14th March 2019)
 30. Lee, W. (2014). *Manus Province poverty and social assessment report*. WCS PNG Technical Report No. 3. Wildlife Conservation Society, Goroka, Papua New Guinea. 131pp.
 31. M'Buke Island People's Association Inc. (2019), *Disaster of May 2018*, M'Buke Island People's Association Inc., <http://www.mbukeisland.org/disaster-of-may-2018/> (accessed March 18th 2019)
 32. Mandl, E. (2018) *11 Health and Nutrition Benefits of Cocoa Powder*, Healthline, <https://www.healthline.com/nutrition/cocoa-powder-nutrition-benefits> (accessed 13th March 2019)
 33. Manus Provincial Government (2018) *Manus Integrated Development Plan 2018 -2022 II*. Manus Provincial Government
 34. Mashetty, B. (2018) *Why cocoa has a future in PNG*. Interviewed by Lavari, L. [online newspaper] The National, <https://www.thenational.com.pg/cocoa-future-png> (Accessed 28 March 2019)
 35. McGregor, A. M (2002). *Growing and Marketing of Breadfruit as a Commercial Crop*. UNDP Fruit Tree Development Project. Samoan Min of Agriculture Forests and Metrology
 36. McGregor, A. & Stice, K. (2018) *Pacific Island Breadfruit Market and Marketing Study with a focus on FIJI and SAMOA*. ACIAR, Australia.

-
37. McGregor, A., Bourke, M., Manley, M., Tubuna, S., and Deo, R. (2009). *Pacific island food security: situation, challenges and opportunities*. Pacific Economic Bulletin, Volume 24 Number 2.
 38. Miltner, O. (2017) *Does Madagascar's vanilla industry have a sweet future?* <https://www.ozy.com/fast-forward/does-madagascars-vanilla-industry-have-a-sweet-future/82005> (Accessed 6 March 2019)
 39. Our Pacific Ways (2012) *Manus project fills farming extension service gap*, Our Pacific Ways, <https://ourpacificways.wordpress.com/tag/coconut-oil/>, (accessed 28th March 2019)
 40. Pacific Island Farmers Organisation Network (2016) *Pacific Island Breadfruit Roundtable Conference Summary Document*. SPC. Fiji
 41. PHAMA (2017) *Coconut markets for PNG*, PHAMA Program, <http://phama.com.au/wp-content/uploads/2018/02/TR113-Coconut-markets-for-PNG.pdf>, (accessed 17th March 2019)
 42. Pilling, D. (2018) *The real price of Madagascar's vanilla boom*, Financial Times, <https://www.ft.com/content/02042190-65bc-11e8-90c2-9563a0613e56> (Accessed 4 March 2019)
 43. PNG AgriNews (2019) *Video: Climate change adaptation through agriculture interventions in Manus Province*, PNG AgriNews, <https://pngagrinews.wordpress.com/2019/01/11/video-climate-change-adaptation-through-agriculture-interventions-in-manu-province/>, (accessed 26th March 2019)
 44. Ragone, D. (2006), *Species Profiles for Pacific Agroforestry*. PAR, www.traditionaltree.org (accessed 12 March 2019)
 45. Rain, P. (2018) *Will the 2018 crop bring lower vanilla prices?* <https://vanillaqueen.com/will-2016-vanilla-crop-see-easing-prices/> (Accessed 14 March 2019)
 46. Schmidt, J. (2018) *Cook's Vanilla Market Report August 2018: Vanilla Price Prediction*. <https://www.cooksvanilla.com/cooks-vanilla-market-report-august-2018-vanilla-price-prediction/> (accessed 12 March 2019)
 47. Sethi, S. (2017) *The Bittersweet Story of Vanilla*. <https://www.smithsonianmag.com/science-nature/bittersweet-story-vanilla-180962757/> (accessed 5th March 2019)
 48. Shimizu, K. (2019) *Support to Rural Entrepreneurship, Investment and Trade in Papua New Guinea (STREIT PNG)* Powerpoint Presentation. FAO.
 49. Stuckings, N., Hide, R., Bourke, R., Allen, B., Hobsbawn P. and Conway, J. (1997) *Papua New Guinea Agriculture Literature Database*.

-
50. Sunari, L. (2015) *Eaglewood management in Papua New Guinea*, World Wildlife Fund, <http://wwf.panda.org/?19230/B-Project-Profile-BBREaglewood-management-in-Papua-New-Guinea>, (accessed on 28th March 2019)
51. Tree Kangaroo Conservation Program. (2018) *Tree Kangaroo Conservation Program 2017 Annual Report*. Seattle, Washington, USA.

Interview List

Name	Organisation
Andrew McGregor	PARDI
Barbara Masike	The Nature Conservancy PNG
Basavraj Mashetty	Olam
Benjamin Sipa	Live and Learn Environmental Education
Craig Johns	The Galip Nut Company
Daniel Okena	Tree Kangaroo Conservation Society
Dave Wissink	Morobe Mining Joint Venture
Dhawal Patel	Ela Enterprises
Elizabeth Brennan	Transformative Agriculture and Enterprise Development Program
Gabriel Iso	Fairtrade
Geraldine Paul	World Vision PNG
Jane Ravusiro	PHAMA Plus
Jeremy Grennell	Pacific Trade Invest
Jim Thomas	Tenkile Conservation Alliance
Karina Makori	Paradise Foods
Ken Mondiai	Partners with Melanesians
Martin Powell	PNG Productive Agriculture Partnerships
Mirjam Nuessle	Tsang Supermarkets
Mona Mato	Pacific Trade Invest
Nathiel Wartovo	Cocoa Board
Oma Wamu	Ministry of Agriculture - Manus
Putri Mayasari	RFA
Rick Passaro	Tree Kangaroo Conservation Society
Ron Neville	Elliven Cocoa Exports
Sarah Letts	CARE
Scott Jenkinson	NKW Group
Sylvia Noble	Wildlife Conservation Society
Taro Taylor	Tropicana Supermarkets
Theo Simos	The Galip Nut Company