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Feasibility Study for the Establishment of a HTFA (Heat Treatment) Facility in the Central Division of Fiji

Technical Report #105

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Client: Department of Foreign Affairs and Trade

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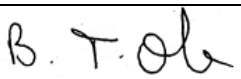
	30-Nov-2016	Editing and formatting	Trevor Ole / Project Director	
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Acronyms

Abbreviation	Description
ACIAR	Australian Centre for International Agricultural Research
AMA	Agricultural Marketing Authority
BAF	Biosecurity Authority of Fiji
BCR	Benefit/Cost Ratio
BQA	Bilateral Quarantine Agreement (New Zealand – Fiji)
CAAF	Civil Aviation Authority of Fiji
EBITDA	Earnings Before Interest, Tax, Depreciation and Amortisation
EU	European Union
FJD	Fiji Dollar
FSC	Fiji Sugar Corporation
GDP	Gross Domestic Product
HACCP	Hazard Analysis Critical Control Point
HTFA	High Temperature Forced Air
IHRDP	Integrated Human Resource Development Project
IRR	Internal Rate of Return
MAWG	Market Access Working Group
MOA	Ministry of Agriculture
MOF	Ministry of Finance
NES	National Export Strategy
NWC	Nature's Way Cooperative
NZD	New Zealand Dollar
NZMPI	New Zealand Ministry of Primary Industry
PHAMA	Pacific Horticultural and Agricultural Market Access Program
PICs	Pacific Island Countries
QTI	Quarantine Technologies International
SPC	Secretariat of the Pacific Community
SPS	Sanitary and Phytosanitary
TLTB	iTaukei Land Trust Board
USAID	United States Agency for International Development
USD	United States Dollar

EXCHANGE RATES
(May 2016)
Fiji Dollar (FJD) 1.00 = Australian Dollar (AUD) 0.65
AUD 1.00 = FJD 1.54

Executive Summary

Background

The Pacific Horticultural and Agricultural Market Access Program (PHAMA) was requested to undertake a feasibility study for the establishment of a new high temperature forced air (HTFA[1]) facility in the Central Division of Fiji to process fruit for export. The existing HTFA facility operated by Nature's Way Cooperative (NWC) has been operating for over 20 years treating products grown in the Western parts of Viti Levu. Exporters in the Central and Eastern Divisions do not have access to an HTFA facility and deal exclusively in non-HTFA products, mainly root crops.

Fiji has a vibrant fresh produce marketing sector supplying both domestic and export markets. It is well ahead of the other Pacific Island Countries in export marketing of fresh produce and is home to around 20 experienced and capable exporting businesses which have well-established linkages with overseas customers. Non-sugar agricultural exports vary between about 12,000 tonnes and 18,000 tonnes of which about 75% consists of root crops, mainly dalo (taro) and cassava. HTFA commodities (papaya, eggplant, breadfruit and mangoes) make up only 6% of the export volume, and about the same percentage of the value.

The volume of HTFA commodities exported varied from just over 400 tonnes in 2009 to almost 1,600 tonnes in 2011. This range is mainly due to variations in the volume of papaya exports. On average around 50% of HTFA exports are papaya, 44% are eggplant and 6% are mangoes (breadfruit exports are not reported separately), although the proportions vary markedly between and within years. In value terms HTFA exports vary between about FJD 1.5 million and FJD 4.8 million per annum.

Project Justification

A number of market studies and consultations suggest that there are un-realised opportunities for export of HTFA products produced in the Central Division. Consequently there is strong support from farmers and exporters for the establishment of a second HTFA facility. Government supports the concept of a second facility and is prepared to finance some or all of the investment provided a feasibility study demonstrates that it could be operated on a full cost recovery basis.

Fresh produce exporters in the Central and Eastern Divisions are keen to diversify their product range to help mitigate the risks of periodic supply shortages, and reliance on a small product range. Growers have indicated their interest in producing for export provided there is a reliable market, appropriate infrastructure, and prices are reasonable. There is good year-round production potential in the Central Division for papaya and eggplant without the need for irrigation. Some of the Western Division exporters may also be interested in sourcing HTFA commodities in the Central Division in order to diversify their sources of supply.

However, there is no justification for a second HTFA facility if it merely provides a competitor for NWC. Diverting supplies to a new facility would damage NWC's capacity to upgrade its services and contain costs. A key pillar of the justification is that a second facility would provide an incentive for farmers and exporters who are currently outside the catchment area of NWC, to diversify from root crops into HTFA products. In this way the new facility would complement the services provided by NWC but would not become a direct competitor.

All HTFA produce is currently exported by air from Nadi. The runway and cargo handling facilities at Nausori Airport do not allow for its use by wide bodied aircraft and there are few international flights using this airport. Wide bodied aircraft are essential for HTFA commodities which must be transported in sealed air freight containers due to risk of fruit fly re-infestation. Moreover wide-bodied aircraft have much greater cargo capacity ranging from 14 to 20 tonnes. The proposal to extend the runway and upgrade passenger and freight handling facilities at Nausori creates the potential for export of HTFA commodities. There is also potential to use refrigerated sea freight for exports out of Suva.

The fact that NWC has struggled financially over many years suggests that a different operating model is needed for a new facility. NWC demonstrates that it is very difficult to operate an HTFA facility as a

[1] HTFA is a heat treatment process used to prepare fresh produce that is susceptible to fruit fly infestation for export to countries that are either fruit fly free or have restrictions on the importation of fruit fly susceptible fresh produce.

stand-alone business due to the large fluctuations in throughput levels. The new facility therefore needs to be part of a larger and more diversified agro-processing business in which technical and managerial staff can be assigned to other duties during the inevitable supply downturns. The scale of the facility also needs to be tailored to the likely level of throughput, and be able to process small consignments efficiently. The multi-purpose Agricultural Marketing Authority (AMA) agro-processing facility in Nausori is considered appropriate to host the new facility.

Feasibility

The objective of a new HTFA facility is to facilitate diversification of fresh produce exports from the Central and Eastern Divisions by enabling treatment and export of produce, which cannot currently be handled by NWC due to the logistics of harvesting and transporting perishable produce via Nadi. A new facility should incorporate the following design and operational features:

- Operation as part of a multi-purpose agro-processing plant which will incur minimal overhead costs and allow for shut-down during periods of low or zero supply.
- A small-scale modular design capable of being up-scaled in line with the availability of HTFA commodities for export.
- A split chamber HTFA unit with three tonnes per batch capacity and able to process small batches by using one side of the chamber only.
- Operation on a full cost recovery basis, and also to provide for asset maintenance, upgrading as required to maintain its accreditation and eventual replacement.
- The facility should provide HTFA services only and should not finance research and extension activities which are the responsibility of MOA and the exporters.

The facility would be operated by AMA in Nausori. The catchment area would be the Eastern half of Viti Levu in an arc reaching from Navua in the South to Rakiraki in the North, and possibly from Islands in the Eastern Division. Produce could also be sourced from the Sigatoka valley during periods when NWC is operating at full capacity.

The facility would require an investment of around FJD 664,000 and would be able to operate profitably after throughput reaches around 100 tonnes per quarter. This is substantially less than the break-even throughput level of NWC due to the smaller and more flexible operating model. Based on throughput of 150 tonnes per quarter from year 5 onwards, the facility would generate a financial benefit/cost ratio of around 1.2 (with a 7% discount rate) and a financial internal rate of return of 17%.

With throughput levels above around 100 tonnes per quarter, the facility would be able to reduce its charges below the FJD 0.72/kg level (currently charged by NWC). In a best-possible situation with throughput of 200 tonnes per quarter, the facility would be able to break even at around FJD 0.40/kg, but the most likely range would be FJD 0.50-0.60/kg at throughputs in the range of 100-150 tonnes per quarter. The fee structure should also include a levy for asset maintenance, upgrading and replacement. The aim would be to accumulate the levy in a sinking fund to reach around FJD 700,000 by year 10. This would require a levy of around FJD 0.16-0.18/kg.

Risks

There are a number of other risks inherent in the operation of an HTFA facility in the Pacific, which have been amply demonstrated by the experiences of NWC and its equivalent in Tonga. By far the greatest risk is the low and erratic supply of fresh produce. This is influenced mainly by seasonal conditions, particularly natural disasters which disrupt supplies. The feasibility of the project is also linked to the Nausori airport upgrade. This risk can be avoided by deferring establishment of the facility until the airport upgrade is well underway and there are clear indications that the airlines will initiate regular wide bodied services.

The successful operation of a new facility also depends on complementary investments to develop the upstream parts of the export marketing value chain in the catchment area, in particular the registration and training of growers according to the biosecurity protocols. Loss of accreditation by one or more importing countries due to a pest interception or protocol failure is a material risk. It must also be recognised that agro-marketing parastatals like AMA have a poor record of sustainability in the Pacific

Islands. Whilst AMA is currently well supported by Government there is a risk that once this is phased out, it will experience financial difficulties which may affect its capacity to sustain HTFA services.

Conclusions and Recommendations

At first sight, the concept of establishing a new HTFA facility in a situation where the existing NWC facility is struggling to operate sustainably appears to have little merit. Dissatisfaction with NWC is not a valid reason to establish a new facility, and it makes no sense if the new facility does nothing more than provide a competitor for NWC. However, the investment would be justified if the following conditions prevail:

1. The availability of a new facility generates a sustainable increase in production of HTFA commodities suitable for export in the Eastern half of Viti Levu.
2. MOA is able to provide the services needed to train and supervise a new group of Bilateral Quarantine Agreement (BQA)-registered growers to supply fresh produce to exporters and users of the facility.
3. The existing Central Division fresh produce exporters diversify their businesses to incorporate HTFA exports, or some of the Western Division HTFA exporters expand their operations into the Central Division.
4. The Nausori airport upgrade is completed and airlines respond by establishing at least 2-3 wide bodied aircraft services per week to Auckland and/or Eastern Australia.
5. AMA (or a suitably qualified alternative) agrees to build and operate the new HTFA unit on a full cost recovery basis, including imposition of a levy to provide for asset maintenance.
6. The facility is adequately capitalised: the Government (possibly with donor support) must be able to fund the investments, amounting to around FJD 700,000 which includes civil works, equipment and underwriting of operating losses during the first 2-3 years.
7. The operator (AMA) agrees to make HTFA services available to all registered growers and exporters and will not compete with these by engaging in exporting on its own account.

Recommendation 1: Lessons learned over the last 20 plus years indicate that a new approach to the provision of HTFA services is required to avoid the ongoing sustainability issues encountered by NWC and other HTFA facilities in the Pacific Islands. This points to a smaller, leaner and more flexible operating model working as part of a diversified agribusiness enterprise such as AMA, rather than as a stand-alone service business.

Recommendation 2: The large number of conditions required for successful establishment and operation of the proposed facility, and the commercial risks involved, make it unlikely that private enterprise would see this as an attractive investment option. It should therefore be seen as a public good investment financed by Government but operated on a full cost recovery/user-pays basis.

Recommendation 3: A decision on whether to proceed with the establishment of a second HTFA facility should be deferred until the exact timing and extent of the Nausori airport upgrade is known and the intentions of the airlines with regard to aircraft type and freight services are clear.

1.0 Introduction

1.1 Background

The Pacific Horticultural and Agricultural Market Access Program (PHAMA) in Fiji has a mandate to support new and improved market access for commodities and marketing pathways identified and prioritised by the Fiji Market Access Working Group (MAWG). During the course of 2015-16 the first specific issue raised with the MAWG, through the Ministries of Finance and Agriculture was to conduct a feasibility study for a possible second High Temperature Forced Air (HTFA) facility to process fruit fly host commodities for export. HTFA is a heat treatment processed used to prepare fresh produce that is susceptible to fruit fly infestation for export to countries that are either fruit fly free or have restrictions on the importation of fruit fly susceptible fresh produce.

The existing HTFA facility operated by Nature's Way Cooperative (NWC) has been operating at Nadi airport for over 20 years treating products (mainly papaya and eggplant) grown in the Western parts of Viti Levu (Sigatoka Valley, Nadi and Lautoka regions). Exporters based in the Central and Eastern Divisions of Fiji do not have ready access to an HTFA facility and deal exclusively in non-HTFA products, mainly root crops.

Consultations with fresh produce exporters during 2015 as part of the exporters symposium raised the question of establishing a second treatment facility in the Central Division to cater for growers and exports based on the Eastern side of Viti Levu, particularly in the provinces of Tailevu, Naitasiri and Rewa and the possibility of sourcing supplies from other islands serviced regularly by ferries. Initial discussions with the Ministry of Finance (MOF), the Ministry of Agriculture (MOA), and the Agricultural Marketing Authority (AMA) indicated support for this strategic development in order to diversify fresh produce exports. The Fiji MAWG subsequently proposed that a feasibility study be undertaken for a second HTFA facility and emphasised that all stakeholders need to be included in the consultations in order to benefit from the lessons learned in operating the NWC facility at Nadi. PHAMA agreed to fund the feasibility study but made no commitment to contribute to development of an additional facility, even if the outcome of the analysis was positive.

1.2 Scope of Work

The scope of work involves a feasibility and benefit-cost analysis for the construction and operation of a second HTFA facility that can provide heat treatment of fresh fruits and vegetables that are fruit fly hosts, and cannot be exported to Australia or New Zealand without such treatment. The analysis considers issues including intended purpose(s) of the proposed facility; general design requirements to meet these purposes, current and potential customers and supply base, target export markets, current and forecast demand and associated logistics (e.g. access to air and sea freight), basis of ownership, organisation setup, governance and management (for its ownership and operation). It also considers possible locations and associated pros/cons, legislative and other regulatory requirements, relevant technical issues for the operations (e.g. heat treatment itself, receival, processing and storage of produce), risk, and financial analysis.

The analysis of supply issues and producer/exporter benefits includes consideration of the throughput volumes needed for viability, current production of suitable crops (including post-cyclone Winston), logistic and estimated cost of domestic movement of produce from farm to the facility then export, estimated future production, farm gate and exporter prices and likely lead time for farmers and other stakeholders to become export ready.

The financial analysis is based on assumptions on throughput volumes and fees/charges that take into consideration the current and expected volumes of relevant crops being produced in Fiji that could feasibly be treated at the facility, range, volume and consistency of produce being treated at the existing heat treatment facility, capacity, fees/charges and financial status of the existing heat treatment facility. It also includes cost estimates for investments, start-up expenses, design, construction and commissioning, operating expenses, and considers requirements for up-front and future financing for capital, infrastructure and operations.

1.3 Methodology

The study was undertaken by the following team:

David Young	Economist/Market Analyst and Team Leader
Pita Wise	National Consultant, Policy and Institutions
Pauliasi Tuilau	National Consultant, MOA, Agricultural Marketing

Logistical support and guidance was provided to the team by Losalini Leweniqila (PHAMA National Coordinator, Fiji). The first stage of the work was undertaken in Fiji and involved consultations with a range of stakeholders including NWC management, several leading fresh produce exporters, growers in both the Western and Central Divisions, MOF, MOA and the AMA. This was followed by analysis of the strategic, policy and regulatory framework under which the HTFA facility would operate. Further factfinding was then undertaken to develop the technical specifications for the HTFA facility, prepare investment and operating cost estimates and finalise the benefit-cost analysis.

2.0 Agricultural Production and Marketing Context

2.1 Agricultural Sector Overview

Fiji's agricultural sector is generally considered in three parts: sugar, non-sugar commercial and subsistence. The sugar sub-sector has struggled in recent years due to loss of preferential access to the EU market, the expiry of many of the long term leases for sugar lands, and the financial difficulties of the Fiji Sugar Corporation (FSC). The non-sugar commercial sub-sector is where horticultural export crops are mainly grown, and has shown improvement in performance over the last decade with the development of export market outlets, mainly to New Zealand as well as the growth of the domestic market, supplemented by tourism. The subsistence sub-sector is the basis of livelihood for a third of the population and mainly focuses on traditional fruits, vegetables and root crops with some produce entering domestic market channels, but very little being exported.

Fiji's population is approximately 850,000 of whom 58% reside in rural areas. They very much depend on agriculture as a source of income and employment. The majority of farmers in rural areas are either semi-commercial or subsistence farmers with average farm size of 5 to 10 ha. Although the contribution of the agriculture sector to GDP continues to decline, it remains an important sector of the economy in terms of income generation and food security, and to support diversification due to the decline in the sugar Industry, and to provide foreign exchange earnings.

Over the last two decades the contribution of the agriculture sector to GDP declined from 15.6 per cent in 1995 to 8.6 per cent in 2015. As shown in Table 1, since 2011 the sector has stabilised at around 8-9% of GDP.

Table 1: Contribution of Agricultural sector to GDP (FJD million)

	2011	2012	2013	2014	2015	2016(f)
Total GDP	5,739	6,010	6,440	7,130	7,521	8,018
Agriculture Sector						
Subsistence Agriculture	153	156	158	164	167	173
Informal Agriculture	38	39	39	41	41	43
General Government	8.2	8.4	9.2	11.0	11.5	11.9
Formal Agriculture	274	325	408	415	429	472
Total Agriculture	473	528	615	631	649	700
% Contribution of Agriculture	**8.2**	**8.8**	**9.6**	**8.9**	**8.6**	**8.7**

The sugar industry contributes to around 7% of GDP, generates on average 30% of total domestic exports and provides direct and indirect employment to over 50,000 people, consisting of approximately 18,000 growers, 3,000 FSC employees and 17,000 cutters and drivers. In total over 250,000 people are directly or indirectly involved in the sugar industry. However, FSC is currently dependent on continuing Government financial assistance. The current restructuring program with an injection of FJD 120 million is to revitalise the sugar industry to be more efficient and be able to compete in the international market. The major challenge for the industry is the expiry in 2017 of preferential access to the EU market which has been in place since 1975.

The non-sugar component contributes around 6% of GDP and accounts to 14% of agricultural exports. It constitutes traditional food crops (dalo, cassava, yams, kumala and yaqona), tropical fruits (pineapple, papaya and mango), vegetables, pulses, eggplant, ginger, tobacco, rice, spices, cocoa, coconut produce, beef, dairy, pork, poultry meat, eggs, sheep, goat and bee products. The major export commodities are root crops (dalo, cassava and yams), fruits (papaya, pineapple and mango) and vegetables.

2.2 Institutional Framework

Fiji has four key institutions which are essential for the development and maintenance of the horticultural export sector. These include:

- The **Ministry of Agriculture** (MOA) which provides the necessary research and extension support for horticultural production and marketing, and plays a key role in supporting farmers to respond to new export marketing opportunities, such as the establishment of a second HTFA facility.
- The **Biosecurity Authority of Fiji** (BAF) was created in 2011 and has a key role in administering the Fiji-New Zealand Bilateral Quarantine Agreement (BQA) which has underpinned the establishment of a vibrant fresh produce export trade with New Zealand. BAF is also responsible for maintaining a high level of quarantine protection for Fiji – which is itself important in accessing export markets. The BQA defines protocols for production, harvesting, storage, packing and exporting a number of fresh produce commodities. BAF provides inspection and certification services to verify BQA protocols are being implemented along the marketing pathway from farm through to point of export. Similar (or stricter) protocols and certification arrangements are required for the development of new export pathways to Australian markets.
- **Nature's Way Cooperative** (NWC) operates the HTFA facility at Nadi international airport, which is an essential component of maintaining export market access for fruit fly host species. The operations of NWC are supervised and certified by BAF.
- The **Agricultural Marketing Authority** (AMA) is an autonomous parastatal company with a mandate to facilitate marketing of agricultural and commodities for farmers and fishers in remote rural areas and to develop domestic and export marketing pathways. AMA operates an integrated agro-industrial and marketing facility at Nausori.

2.3 Policy Framework

Despite stagnation and challenges, successive Governments in Fiji have been committed to the revitalisation of the agricultural sector. A sugar industry re-structuring master plan is currently in place outlining the way forward for the sugar industry. The current Government is also committed to the revitalisation of the non-sugar sub-sector due to the decline in the contribution of sugar production to GDP and also to improve exports and encourage food security. The policy goal is "to establish a diversified, economically and environmentally sustainable agriculture sector". To achieve this goal four key outcomes have been identified:

- To build a modern agriculture sector in Fiji as an organised system of producing, processing and marketing crops, livestock and agriculture products.
- To develop an integrated production, processing, energy and transport infrastructure support system to improve delivery of agricultural services.
- To enhance capabilities to generate and secure foreign investment and public-private partnerships and other innovative business arrangements.
- To improve project implementation and policy formulation capabilities within MOA and its partner institutions.

The major emphasis is on strengthening linkages along agricultural value-chains from production, distribution, storage, marketing and value addition to improve efficiency for the sector to be a driver of economic growth. This will help alleviate poverty, build food security and self-sufficiency and raise the level of exports. Programs and projects are being developed to support mechanisation, value addition, organic farming and build capacity within the sector. This includes support to commodities such as taro, ginger, cassava, poultry meat and eggs, copra and coconut product and BQA products identified as potential growth commodities.

Commodity and industry plans are being developed to map out clear strategies on key commodities identified. Collaboration and co-ordination with bodies such as the Fiji Crops and Livestock Council

and other industry players are being nurtured to drive efficiency, quality and the establishment of standards. Effective support to farmers through extension services will be strengthened to facilitate the transfer of appropriate information including farming practices and market information. One aspect of the strategies is to graduate small farmers to semi-commercial to fully commercial farmers. This will be undertaken through selective identification of potential commercial farmers, and young farmers are to be encouraged to take up farming to be professional and be provided with all the necessary tools and support.

2.4 National Export Strategy

The National Export Strategy (NES) was developed in 2006 by the Ministry of Industry, Trade and Tourism to achieve sustainable economic growth through encouraging competitiveness, value addition and export diversification in areas of competitive advantages. Six major sectors are prioritised to improve export performance, address the challenges of reversing the widening trade deficit, and the need to stabilise the country's foreign reserve position. These sectors are agro-business, forestry, marine products, mineral water, information and communication technology (ICT) and audio-visual.

Implementation of the NES commenced in 2007. Annual budget allocations have been used to assist 29 companies to a value of FJD 5.1 million through export infrastructure development. Yearly implementation shows indications that the NES fund has the potential to achieve its objectives and could be utilised to effectively support government targets under the Roadmap for Democracy and Sustainable Socioeconomic Development. Some of the assistance to the private sector has included a collection and processing facility for taro and other export commodities in Taveuni; the NWC HFTA facility in Nadi; aquaculture development in Vanua Levu; and upgrading standards of fishing vessels to meet requirements for fish exports to EU.

2.5 Fresh Produce Marketing

Fiji has a vibrant fresh produce marketing sector supplying both domestic and export markets. It is well ahead of the other Pacific Island Countries in export marketing of fresh produce and is home to around 20 experienced and capable fresh produce exporting businesses which have well-established linkages with customers in New Zealand, Australia, North America and Asia.

Appenidx B shows the volume and value of non-sugar agricultural exports from Fiji between 2009 and 2014 (2015 data are not yet available). Figure 1 below shows that total exports vary between about 12,000 tonnes and 18,000 tonnes of which about 75% consists of root crops, mainly dalo (taro) and cassava. HTFA commodities (papaya, eggplant and mangoes[2]) make up only 6% of the export volume on average. Figure 2 shows that the value of non-sugar exports ranges between FJD 40 and 50 million of which about FJD 2.6 million or 6% are HTFA commodities.

Figure 3 shows that the volume of HTFA commodities exported varied from just over 400 tonnes in 2009 to almost 1,600 tonnes in 2011. This range is mainly due to variations in the volume of papaya exports which varied from 177 tonnes in 2009 to 1,071 tonnes in 2011. On average around 50% of HTFA exports are papaya, 44% are eggplant and 6% are mangoes, although the proportions vary markedly between and within years. Figure 4 shows that in value terms HTFA exports vary between about FJD 1.5 million and FJD 4.8 million per annum.

[2] Breadfruit exports are not reported separately.

Figure 1: Total Non-Sugar Agricultural Exports (tonnes)

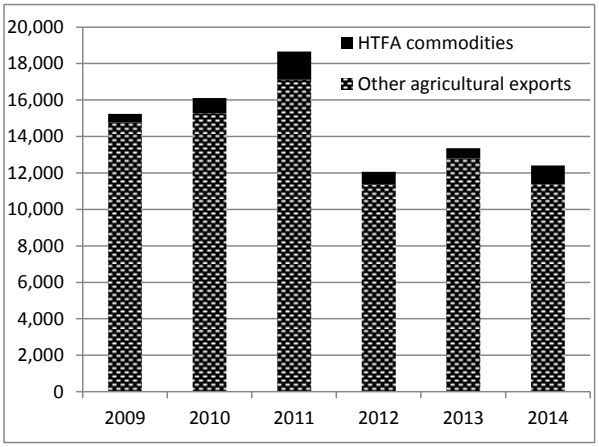


Figure 2: Total Non-Sugar Agricultural Exports (FJD'000)

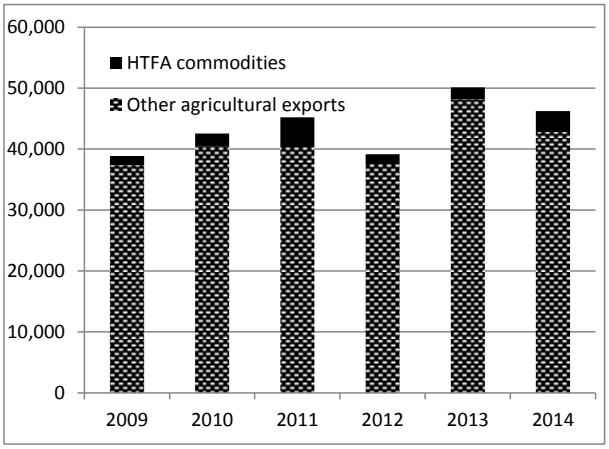


Figure 3: **Exports of HTFA commodities (tonnes)**

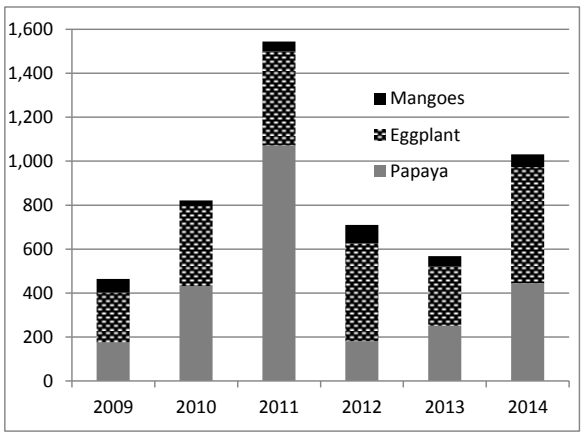
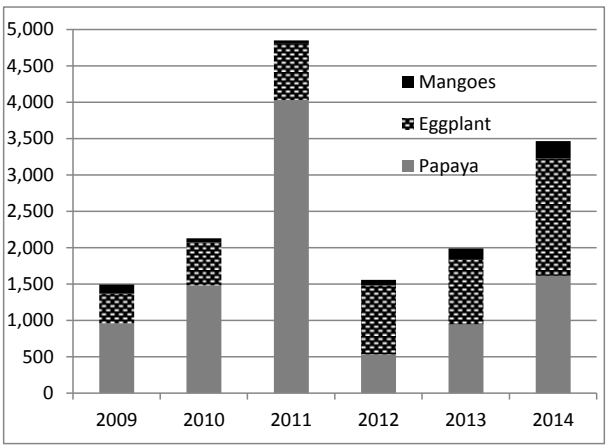


Figure 4: **Exports of HTFA Commodities (FJD'000)**



Existing HTFA Facilities

There are currently three HTFA facilities in Fiji. One small unit is located in the island of Rotuma which was built in 2013 to treat fruit and vegetables exported to Pacific Island countries particularly for Tuvalu and Kiribati. It is currently of limited use due to the lack of supply and irregular shipping services to other Pacific Islands through Rotuma. The second facility is located in Koronivia (Central Division) Agricultural Research Station. This small unit (250 kg capacity) is intended for use for research and training, but it is understood to be idle. NWC is the only commercial scale HTFA unit in Fiji and by far the largest in the Pacific Islands.

2.6 Nature's Way Cooperative

NWC was established in 1995 to own and operate the HTFA treatment facilities on behalf of Fiji's fruit growers and exporters[3]. Its core business is the heat treatment of fruit fly host products to enable them to be exported. The equipment and technology used is subject to a licencing agreement for use of a patented technology held by a New Zealand-based company, Quarantine Technologies International (QTI).

[3] Nature's Way Cooperative (Fiji) Ltd Inclusive Strategic Business Plan for period 2014-2017

NWC is a service cooperative that treats and packs fruits for its members on a fee-for-service basis. It is not directly involved in exporting which is handled by individual exporters. However the exporters must be NWC members to utilise the facility and they should purchase their produce for treatment from BQA-registered farmers who are members of the cooperative. NWC has more than 150 shareholding members, most of whom are smallholder farmers located in the Sigatoka Valley, Lautoka, Nadi and Ba and surrounding areas.

NWC provides treatment, packaging, marketing and technical services to both the exporters and growers. The exporters pay NWC a treatment fee computed on a per kilogram basis immediately after the service is completed. Initially a small enterprise handling just 30 tonnes of papaya each year, NWC now has four HTFA treatment chambers with a total capacity of 12 tonnes per shift or about 3,000 tonnes per annum.

NWC experiences large within and between year fluctuations in throughput which are mainly weather related (droughts, floods and cyclones) and provide a major challenge to management of the business, as well as the exporters who use its services. Since treatment fees are NWC's sole source of revenue, annual throughput has a major bearing on financial viability.

Throughput depends mainly on the availability of produce for export. Exporters maintain that supply rather than demand constrains their export volumes. The low and variable level of capacity utilisation means that overhead costs are a heavy burden, leading to relatively high service charges, currently set at FJD 0.72 per kg. NWC is attempting to address issues affecting the supply of fruit for export through its own extension program and those of other institutions supportive of the export industry. Likewise, NWC also aims to increase awareness of the international markets on the quality of Fiji fruits and vegetables through marketing development strategies.

As part of its efforts to stimulate production of export crops NWC is engaged in a number of research and extension activities including ACIAR-funded papaya and breadfruit research and a New Zealand funded Research and Extension Partnership[4]. The New Zealand Partnership runs from July 2015 to July 2018, is valued at NZD 0.64 million and has six components:

1. Developing a website to enhance online presence of fresh fruit and vegetable exports.
2. Developing an industry wide "Fiji Red" papaya brand.
3. Reducing treatment costs through improved market access with New Zealand.
4. Sea freight and hot water treatment incentive scheme.
5. Research and development activities for product improvement and new product development.
6. Reviewing and updating the BQA related to fruit fly host commodities.

New Zealand also financed an extension program between June 2013 and June 2016 costing NZD 0.53 million. This included: purchase and operation of a vehicle, expanding production of HTFA crops outside the Sigatoka valley, value chain training, a certified seed scheme, support for establishment of breadfruit orchards, organic papaya production, post-harvest hot water treatment, and advisory services for NWC members.

Appendix C presents a summary of NWC's latest (2014-15) financial statements, a year in which it processed around 900 tonnes of product. With charges of FJD 0.72/kg and cost of sales of only FJD 0.09/kg this generated a robust gross margin of FJD 0.63/kg or FJD 566,008 in total. However, overhead costs amounted to FJD 619,734 leading to an overall loss of FJD 47,197. Clearly the high level of overhead costs presents a challenge. **Table 2** below demonstrates the sensitivity to the throughput level showing that throughput needs to be 1,000 tonnes or more for NWC to break even based on the current service charge of FJD 0.72/kg. However over the last five years throughput has only exceeded 1,000 tonnes on one occasion.

Table 2 also demonstrates that beyond 1,000 tonnes the service charge required to break even could be substantially reduced. Given the usual weather-related supply disruptions about the most that could be expected would be around 2,000 tonnes (or two-thirds of full capacity), which could be processed for around FJD 0.40/kg. This would be most welcome among the exporters. However it would be

[4] Natures' Way Cooperative (Fiji) Ltd. (March 2016) AGM 2014-15, CEO's Report

prudent to charge more than the break-even processing fee in order to accumulate cash reserves as a contingency measure to deal with the inevitable supply disruptions, and to provide for the maintenance and eventual replacement of the equipment.

Table 2: NWC Sensitivity Analysis, Tonnes Processed and Profitability (FJD'000)

Tonnes processed	500	750	1,000	1,250	1,500	1,750	2,000	2,250	2,500	2,750	3,000
Shifts worked a/	42	63	83	104	125	146	167	188	208	229	250
% of capacity b/	17	26	35	43	52	61	69	78	87	95	104
Gross Income c/	368	548	728	908	1,088	1,268	1,448	1,628	1,808	1,988	2,168
Cost of Sales	47	70	94	117	140	164	187	210	234	257	281
Overheads	620	620	620	620	620	620	620	620	620	620	620
Profit/Loss	-299	-142	15	171	328	485	641	798	954	1,111	1,268
Total cost/tonne	1,333	920	713	589	507	448	403	369	341	319	300
FJD/kg break even	1.32	0.91	0.71	0.58	0.50	0.44	0.40	0.37	0.33	0.32	0.28

a/ 12 tonnes/day b/ Full capacity = 50 weeks x 5 shifts less 10 days holiday = 240 shifts/year
c/ At FJD 0.72/kg

NWC has been in operation for over 20 years and a number of valuable lessons have been learnt since its establishment. It has experienced difficulty in raising capital from is shareholders (members) or in accessing finance through the commercial banking system. Consequently it has relied heavily on donor and Government funding. NWC was established through support from USAID which provided the original treatment chamber and ancillary equipment at a cost of FJD 249,000. It also met the cost of the Manager for one year and technical assistance to establish the facility. The land was provided by the Civil Aviation Authority of Fiji (CAAF) whilst MOA provided FJD 250,000 for the construction of the building.

The capacity of the facility has expanded since it was established and now includes four chambers, each able to process around three tonnes of produce per shift. If it operates all four chambers for 250 shifts it could process 3,000 tonnes per annum, more with multiple shifts and weekend work. However the erratic supply of produce for export means that it has never processed more than about 1,600 tonnes a year, and in recent years the throughput has mostly been between 500 and 1,000 tonnes. This low and variable level of capacity utilisation has major implications for NWC's cost structures and financial viability and generates important lessons for the design of the proposed new facility.

Although maintenance has been regularly carried out, some of the equipment is 15-20 years old and will require major overhaul or replacement at some point. However NWC's balance sheet indicates that it does not have the financial resources to finance a major refurbishment program without donor support or a new injection of capital. This demonstrates the importance of setting charges at a level which does not just cover recurrent costs, but enables reserves to be accumulated to update/maintain and eventually replace the equipment.

Despite many challenges, NWC has been able to survive for over 20 years as an independent cooperative with continuity of management and governance arrangements. Whilst it receives support from Government and donors, there is no interference by these agencies, or by shareholders (members) in the business operations. However there is considerable dissatisfaction amongst the membership about the cost and quality of services provided. In addition, NWC's accreditation as a treatment facility under the BQA was recently suspended due to a breach of BQA procedures. Dissatisfaction with NWC has created tensions between the growers/exporters and management and led to the formation of a new industry group known as the Fiji Fresh Produce Exporters Association. This is a regrettable situation as a united front is a pre-condition for a successful cooperative organisation.

2.7 Agricultural Marketing Authority

AMA is a Government commercial company which was established under an act of Parliament[5] in 2004. Its principal role is facilitating the purchase, sale and export of agricultural and marine products in local and international markets. Its mandate is to serve the inaccessible areas of the country which

[5] The Agricultural Marketing Authority Act No.2 of 2004

are not well serviced by private sector traders. The company head office and operations are based in the former Rewa Rice Mill building complex in Nausori town, with an extensive network of suppliers throughout the country. It is managed by an independent board of directors which guides the management team. The board is appointed by the Minister of Agriculture. There are four operating divisions: Procurement; Sales and Marketing; Technical Support; and Accounts and Finance. The objectives of AMA are:

- To assist producers and those without access to markets in facilitating the marketing of their produce and at the same time improve their livelihood.
- To expand the range of produce traded and allow for a wider representation and presence in other parts of Fiji.
- To purchase, sell and export agricultural and aqua-produce.
- To identify markets for Fiji produce and to facilitate and develop the marketing of the brand "Fiji Fresh" for all produce exported.
- To import agro and aqua inputs.
- To support agricultural activities undertaken by people in rural areas and in utilising their land, earning for their livelihood and addressing issues of unemployment and poverty.
- In conjunction with BAF and MOA to facilitate proper grading standards and adherence to quality control requirements for all export produce.
- To eventually operate as a Government Commercial Company.
- To contract agro and aqua producers.

The functions of AMA are to assist producers of agro-processors in marketing of their products; to identify markets for and to facilitate and develop marketing of agro-produce; and to purchase, sell and export and import agro-produce or import agro-inputs. The act also enables AMA to do any other thing necessary to properly carry out its functions. It empowers AMA to:

- Acquire, hold or dispose of property, enter into contracts, mortgage, pledge, sell or otherwise encumber or dispose of its property.
- Invest, lend money or raise loans.
- Export agro-produce, import agro-input and in special circumstances and with the approval of the Minister, import agro-produce.
- Do any other thing that a legal person can do in connection with its functions.

Funding Arrangements

AMA is considered by the Government as a major element of its effort to revitalise the agricultural sector and has provided the necessary resources to support its activities. This is directed at improving employment and income opportunities in the rural sector, diversification away from sugar, to raise the level of exports and improve food security. Table 3 below details the resources provided by the Government to support AMA.

Table 3: Government Budget Contribution to AMA (FJD'000)

Year	Capital Grant	Operation Grant	Total
2012	2,164	500	2,664
2013	1,302	500	1,802
2014	3,314	500	3,814
2015	1,500	400	1,900
2016	5,600	1,329	6,929
Total	13,880	3,229	17,109

Table 3 shows that in 2016 there has been a substantial increase in both the Capital Grant and Operating Grant. The increase in the Capital Grant is to support AMA to further improve its facilities which have been transferred from the defunct Rewa Rice Company to AMA. In recognition of the improvement in coverage of services and profitability of AMA, its operating grants have continued to increase. Government will continue to support AMA up to the 2018 budget when the next general election will be held.

After consultation with the Executive Chairman and staff of AMA and stakeholders, and an inspection of its facilities, it was found that AMA has the capacity to accommodate a new HTFA facility. AMA is considered a suitable home for the proposed facility because of the lack of a potential private sector proponent or partner and because:

- It is strategically located near Nausori international airport, the Suva port and farmers in the Eastern half of Viti Levu, in an arc reaching from Navua in the South to Rakiraki in the North.
- Parts of the existing facility have been upgraded to HACCP standard for processing fish and virgin coconut oil, and it has the capacity to easily accommodate a new HTFA unit. Capital and operating cost are expected to be contained, since the structure and management systems are in place.
- AMA is already exporting fresh and frozen commodities to Australia and New Zealand. This will minimise both capital and operating costs in setting up an HTFA unit. There is a strong relationship with farmers in the Central Division and also the maritime zone and Vanua Levu.
- Fresh produce collection centres have been established in a number of selected locations.
- The risk of depending entirely on HTFA commodities is minimised through AMA's diversified operations with non-HTFA commodities for local and overseas markets.
- AMA has well-organised logistic arrangements for transportation of commodities from farms to the processing centre in Nausori.

3.0 Project Rationale

3.1 Challenges

The challenge of expanding fresh produce exports needs to be considered in light of the challenges faced by Fiji's agricultural sector as well as those faced by small island developing countries generally. The small domestic market, geographic isolation, high transport costs, lack of economies of scale, and weak bargaining power in international markets, all create significant challenges for fresh produce growers and exporters. These are exacerbated by a number of other constraints including:

- Poor management, low productivity and inconsistent production.
- Restricted market arrangements based on biosecurity and other considerations.
- The high cost of delivering produce to markets.
- Frequent natural disasters.
- Traditional attitudes of subsistence farmers and lack of awareness of modern agricultural techniques including post-harvest handling and marketing.
- Lack of awareness about farming as a business.
- Inadequate infrastructure including roads, port facilities and shipping services in the more remote areas.
- Lack of access to finance by both farmers and exporters – commercial banks see agriculture and agribusiness as a high risk venture.
- The land tenure system which makes access to productive land a challenge.

Appendix A shows the number and costs of natural disaster to the agricultural sector in the last eight years. The effect of these disasters is quite difficult to manage (see Box 1 below) and is being exacerbated by climate change. Mitigation and adaptation strategies need to be developed and implemented as part of measures to increase and stabilise fresh produce exports.

Box 1: Disaster Risk Profile of Fiji

Fiji is located in the tropical cyclone belt and experiences frequent tropical cyclones characterised by damaging winds, rain, and storm surge. The country experiences, on average, one cyclone per year. Fiji is within a relatively quiet seismic area, but is surrounded by the Pacific Ring of Fire, which aligns with the boundaries of the tectonic plates and is associated with extreme seismic activity, volcanic activity, large earthquakes, and tsunamis. In addition, the country suffers from extreme events associated with climate variability, including sea-level and temperature extremes and droughts.

In the past decades, Fiji has been affected by multiple devastating cyclones. In 2012 alone Fiji experienced two major flooding events and one tropical cyclone (Evan). The effects of natural disasters in Fiji are far reaching, negatively impacting on (among other sectors) agriculture, housing, transport infrastructure, tourism and primary industries. Since 1980, disaster events in Fiji have resulted in average annual economic damages of around FJD$35 million and impacted around 40,000 people each year. In the same period, at least 186 people have been killed by flooding and storm events alone.

Fiji is expected to incur, on average, FJD$158 million (USD$85 million) per year in losses due to earthquakes and tropical cyclones. In the next 50 years, Fiji has a 50 percent chance of

experiencing a loss exceeding FJD$1.5 billion (USD$806 million), and a 10 percent chance of experiencing a loss exceeding FJD$3 billion (USD$1.6 billion.)[6], however these figures may be worse once the impacts of climate change are taken into consideration.

Source: Government of Fiji (May 2016) Draft Post-Disaster Needs Assessment Tropical Cyclone Winston, February 20 2016

3.2 Opportunities

Despite these challenges there are opportunities to be considered. Fiji's comparative advantage is in high value niche market export and in traditional food production. The domestic market, particularly the tourism Industry offers the biggest opportunity for expansion of the sector particularly non-sugar agriculture. Creating better linkages and synergies between the agricultural sector and the tourism Industry will create demand in the domestic market. However, modern commercial agro-food logistics and marketing increasingly demands that farmers be part of a reliable supply chain with built-in food quality and safety. Reliable food supply chains will help retailers reduce losses, integrate packaging and handling and better meet consumer demands.

The need to diversify away from reliance on the sugar sector will encourage the production of other commodities for export and for food security. "Clustering" small farms will improve production efficiency through introducing modern technologies, technology transfer, knowledge, and expertise. The opportunities to further increase production particularly in horticulture are quite encouraging to meet the local demand and for export.

3.3 Horticultural Export Potential

A strategic analysis of Fiji's fresh produce export potential undertaken by PHAMA in 2012[7] made the following observations about Fiji's horticultural export potential:

- Horticultural exports have performed relatively well during a period when the traditional commodity sectors, particularly sugar and copra, have struggled.
- The horticultural export sector is based on small farmers and includes ginger, tropical fruits, root crops and vegetables, and is now, after years of disappointment, the fastest growing part of the agricultural sector.
- Fresh produce exports would have been significantly greater if the Australian market had been more accessible.
- The continued growth in niche horticultural exports has confirmed the competitive advantage of this area of Fiji's agriculture, although this has not been sufficient to offset the decline of the sugar industry.
- 150,000 Indo-Fijians have migrated to Australia, New Zealand and Canada. These people maintain a strong demand for products from Fiji. The large and increasing Asian and Pacific Island population also offers a significant market for many of these products.
- The horticultural export industry has been built around air freight capacity, which is linked to the number of people visiting Fiji. The limitation on the volume and weight of air cargo and the cost of air freight has undermined the competitiveness of some products in some markets.
- Sea transit times to New Zealand are 3–6 days and to Australia 10–16 days, making sea freight export feasible for some fresh produce.

[6] These figures are based on modelling from Pacific Catastrophe Risk Assessment and Financing Initiative (2015).

[7] PHAMA (2012) Technical Report 22: Feasibility Study on Selected Horticultural Exports from Fiji to Australia

- The establishment of the HTFA facility by NWC enabled Fiji to continue exporting fruit fly host species after ethylene dibromide treatment was banned. The existing HTFA facility has the capacity to handle a substantial increase in throughput.
- New Zealand has adopted a simple protocol for import of non-fruit fly host species which has allowed for substantial trade in items such as chilli and okra. Other items such as eggplant and papaya are exported, the latter also to Australia, after HTFA treatment.
- The best strategy for penetrating the Australian market is to target the July to September winter window with superior quality produce. Fortunately, this is Fiji's peak supply period for many items.

The strategic analysis also included an assessment of the capacity of the horticultural export sector to take advantage of identified market opportunities. Key capacity issues include:

- Farmers and production systems: the ability of many farmers to grow export crops according to the exacting quality and biosecurity standards is recognised as a constraint. Farmer training and extension need to include marketing and entrepreneurship as well as the traditional technical support.
- Traders and middlemen: the success of horticultural exports can be largely attributed to the skill and resilience of the exporters. It would be unwise to intervene in commercial marketing arrangements as long as these remain competitive. However, there are measures that could be taken to encourage the system to deliver better quality produce for export markets, including incentives for adoption of plastic field boxes and training programs in fresh produce quality and handling.
- Physical infrastructure such as roads, wharves, airports, telecommunications, electricity and water supply is essential for efficient movement of produce from farmers to the consumer. Public investment in such infrastructure can lead to a major produce marketing response.
- Air freight capacity and cost: the only way to export significant volumes of produce at reasonable cost is by sea. Fiji has international standard ports at Suva and Lautoka, but most ships sail to Australian ports via Auckland, which increases the transit time. In addition, there are no international ports on Vanua Levu.
- Quarantine barriers: export protocol development based on risk assessment procedures needs to be strengthened and accelerated (a key objective of PHAMA). This calls for a program of professional upgrading in order to establish a technically competent quarantine service (now actioned through creation of BAF).
- Research support is required to enhance product quality, reduce marketing costs and improve market access.
- Accelerating export protocol development: it was recommended that a steering committee be established for the specific purpose of export protocol development – the Fiji MAWG has subsequently adopted this role.

3.4 Project Justification

Fiji's policy framework incorporates a commitment to diversification of the economy in general, and the agricultural sector in particular, as part of the Government's agenda to stimulate export-led growth and at the same time ensure food security. In this context, a number of market studies and consultations with key stakeholders suggest that there are un-realised opportunities for export of HTFA products to be produced in the Central Division. Consequently there is strong support from farmers and exporters for the establishment of a second HTFA facility. However, this comes with the expectation that it will be financed by the Government, probably with support from donors.

The rationale of the proposal is to complement the NWC facility which mostly services the Western part of Viti Levu (Sigatoka, Nadi, Lautoka, Ba and surrounding areas). Government supports the concept of a second HTFA facility to service parts of the country not currently serviced by NWC and has indicated that it is prepared to finance some or all of the investment provided a feasibility study and benefit-cost analysis demonstrates that it could be operated on a full cost recovery basis.

There are currently 8-10 fresh produce exporters based in the Central and Eastern Divisions who are almost exclusively engaged in taro and cassava exports, in fresh/chilled as well as frozen forms. These exporters are keen to diversify their businesses to help mitigate the risks of periodic supply shortages, largely weather related, and reliance on a small product range. Some of the existing Western Division exporters may also be interested in sourcing HTFA commodities in the Central Division in order to diversify their sources of supply as insurance against climatic extremes such as droughts and cyclones.

There are a number of reasons why growers in the Central and Eastern Divisions do not currently produce HTFA commodities for export. Being close to Suva, they tend to focus on the domestic market for fresh fruit and vegetables, and root crops which can be sold locally and are also in strong demand from exporters. Transporting perishable commodities such as papaya and eggplant to Nadi for HTFA treatment prior to export is technically possible but has never been done because of the expense and the logistic and compliance issues in getting produce to Nadi in good condition. These problems are well understood by growers and exporters in the Sigatoka Valley which is much closer to Nadi. There is also the need to comply with the BQA protocols which requires close supervision by both MOA and BAF, both of which are available in the Western but not in the Central and Eastern Divisions. The establishment of a second HTFA facility would address these constraints provided there are complementary measures taken by the exporters and MOA/BAF to ensure that all elements of the marketing/quarantine pathway are in place.

However, the rationale for a second HTFA facility makes no sense if it merely provides a competitor for NWC. Although there is some dissatisfaction among farmers and exporters with the services provided by NWC, and the costs incurred, diverting supplies to a new facility would further damage NWC's capacity to upgrade its services and contain costs. A key pillar of the justification is that a second facility located in the Central Division would provide an incentive for farmers and exporters who are currently outside the catchment area of NWC, to diversify from root crops into HTFA products, and that the volume of production and exports would eventually be sufficient for viable operation of a new facility. In this way the new facility would complement the services provided by NWC but would not become a direct competitor.

Commercial fruit and vegetable growers in the Rewa delta area and other parts of the Central Division have indicated their interest in producing for export provided there is a reliable market, appropriate infrastructure is in place, and prices are reasonable. There is good year-round production potential in the Central Division for papaya and eggplant without the need for irrigation, as is the case with the Sigatoka Valley and other parts of the West and North.

The request for a new HTFA facility came from growers and fresh produce exporters based in the Central and Eastern Divisions of Fiji. Very few of these produce or export fruit fly host commodities and focus mainly on root crops such as dalo and cassava even though agro-ecological conditions are favourable for papaya, eggplant and breadfruit production (but not for mangoes due the lack of a distinct dry season during the flowering period). Production of these commodities is currently concentrated in areas with ready access to Nadi airport and the NWC HTFA facility. However, many growers and exporters are unhappy with the cost of NWC treatment services, currently fixed at FJD 0.72/kg for all commodities.

The runway and cargo handling facilities at Nausori Airport do not currently allow for its use by wide bodied aircraft and there are few direct flights between Nausori and Australia or New Zealand. Current flights include:

Route	Airline	Aircraft	Frequency	Time	Cargo a/
Nausori-Auckland	Fiji Airways	B737	Mon/Wed/Fri	11.05-14.10	2.2-3.6 tonnes
Nausori-Sydney	Fiji Airways	B737	Sun	07.15-10.20	

a/ In addition to passenger baggage

Wide bodied aircraft are essential for HTFA commodities which must be transported in sealed air freight containers and cannot be stowed loose in the cargo hold as is the case with B737s, due to risk of fruit fly re-infestation. Moreover wide-bodied aircraft (e.g. B767, B 777, A330 etc.) have much greater cargo carrying capacity ranging from 14 to 20 tonnes per flight.

The proposal to extend the runway and upgrade passenger and freight handling facilities at Nausori creates the potential for operating wide-bodied services. Gaining access to land for the runway extension has delayed the upgrade for some years. However MOF has informed that consent has now been given by the iTaukei Land Trust Board (TLTB) to the Ministry of Lands to conclude a leasing arrangement between the customary landowners and the Civil Aviation Authority. The cost of the upgrading is expected to be around FJD 25 million of which more than half is for strengthening and widening the runway. Since the arrangements for leasing the land have been finalised, it is most likely that the work will commence in 2017. However it is un-certain how the airlines will respond to this opportunity. Nausori is always likely to remain a secondary airport compared to Nadi which services most of the tourist traffic.

There is also potential to use refrigerated sea freight for exports out of Suva for some HTFA commodities from where the shipping time to Auckland is several days shorter than from Lautoka. Sea freight has been trialled successfully for papaya exports to New Zealand, and the New Zealand market is also supplied with papaya from as far away as the Philippines.

The fact that NWC has struggled financially over many years (see Section 2.6), with continuing reliance on Government and donor support, suggests that a different operating model is needed for the proposed Nausori facility. In particular the NWC experience demonstrates that it is very difficult to operate an HTFA facility as a stand-alone business due to the large amount of variation in throughput levels. The Tonga HTFA facility has experienced similar difficulties for much the same reasons. This means that there are long periods when the facility operates well below its capacity, and after major climatic events such as Cyclone Winston in 2016 there is no throughput at all.

The direct costs of HTFA treatment are quite modest and gross margins are high at the current service charge of FJD 0.72/kg. However, the need to maintain technical and managerial staff and other fixed costs regardless of throughput means that overheads are very high. The new facility therefore needs to be part of a larger and more diversified agro-processing business in which technical and managerial staff can be assigned to other duties when the HTFA unit is idle during the inevitable supply downturns. The scale of the facility also needs to be tailored to the likely level of throughput, and to include the capacity to process small consignments efficiently. NWC has only operated at full capacity for short periods and does not have a small chamber or dual/split chamber unit designed to process small consignments. NWC is attempting to address the problem of low and variable throughput by engaging in research and extension activities on HTFA commodities, but these have tended to increase overhead costs without yet achieving the desired increase in throughput. Moreover, research and extension including grower registration and supervision under the BQA are the responsibility of MOA and should not have to be undertaken by NWC.

3.5 Options

It is clear from the NWC experience that operation of an HTFA service facility as a stand-alone business enterprise presents formidable challenges. The fresh produce exporters are well aware of this and have not therefore expressed interest in investing in such a facility. Although there are a number fresh produce exporters in the Central Division, they show no interest in providing such service because of the high capital cost and small size of the operation. Moreover their current operations are limited to the export of fresh and frozen commodities which do not require HTFA treatment. However, they support the concept of having a facility in the Central Division and indicate that they would be interested in exporting HTFA commodities, if a treatment facility is available, farmers are able to supply the produce, and the Nausori Airport upgrade is completed.

Against this background it seems that Government intervention and/or donor assistance will be necessary for the establishment and operation of a new facility. Whilst there is a support from Government in terms of its policy agenda, there are two main options that need to be considered: (i) build an independent HTFA facility with its own management and operational structure; or (ii) establish the facility as a separate division or cost centre of an existing agribusiness enterprise. The NWC experience demonstrates that the first of these options is likely to struggle. The only existing agribusiness considered appropriate to host the new facility is the AMA agro-processing facility in Nausori.

4.0 Feasibility of New HTFA Facility

4.1 Overview

The objective of establishing a new HTFA facility in the Central Division is to facilitate diversification of fresh produce exports from the Central and Eastern Divisions by enabling treatment and export of fruit fly host produce, which cannot currently be handled by NWC due to the logistics of harvesting and transporting perishable produce to Nadi for treatment and shipment. More than 20 years of experience with HTFA in Fiji and other parts of the Pacific indicates that a new facility should incorporate the following design and operational features in order to be financially viable.

- Operation of the facility as part of a multi-purpose agro-processing plant which will incur minimal overhead costs and allow for shut-down during periods of low or zero supply.
- A small-scale modular design capable of being up-scaled in line with the availability of HTFA commodities for export.
- A single split chamber HTFA unit with three tonnes per batch capacity but able to process smaller batches efficiently by using one side of the chamber only.
- Operation on a full cost recovery basis sufficient to cover recurrent costs, and also to provide for asset maintenance, upgrading as required to maintain its accreditation under the BQA, and eventual replacement after 10-15 years.
- The facility should provide HTFA services only and should not finance research and extension activities which are the responsibility of MOA and the exporters.

Initial technical specifications for the proposed single-split chamber unit including buildings, HTFA equipment and other equipment are provided in Appendix D.

4.2 Ownership and Management

The facility would be operated by AMA and located in its agro-industrial centre in Nausori, a short trip from both Nausori Airport and the port of Suva. The catchment area for the facility would be the Eastern half of Viti Levu in an arc reaching from Navua in the South to Rakiraki in the North, and possibly from Islands in the Eastern Division. Produce could also be sourced from the Sigatoka valley during periods when NWC is operating at full capacity.

The need to operate the facility as part of a diversified agro-industrial business, rather than as a single-purpose, stand-alone unit limits the ownership and operating options. The fresh produce exporters have expressed interest in having access to a second HTFA facility located in the Central Division but do not have the resources to undertake the required level of investment, or to operate such a facility. AMA is the only feasible option for ownership and operation. Its existing multi-purpose processing/packing facility located in the old Rewa Rice mill at Nausori has abundant space available, and AMA has the management structure and operational skills needed for successful management of an HTFA facility as part of its diversified business. Government has demonstrated its confidence in AMA's capacity through substantial funding allocations for upgrading the Nausori facility and extending its reach into areas poorly serviced by private sector agro-traders. Operation of an HTFA unit is entirely consistent with AMA's mandate to improve market access for Fiji's farmers. AMA has demonstrated that it is capable of obtaining HACCP certification for its fish and virgin coconut oil processing units.

The HTFA would therefore operate as a profit centre/division of AMA. It would have just three staff members: an HTFA division manager, an HTFA technician and an Accounts Clerk. The management team could be re-deployed within other divisions of AMA during periods when there is minimal or low levels of throughput. All operating labour and service/maintenance staff would be drawn from AMA's existing staff resources as required according to the level of throughput and paid at standard hourly rates. This approach would enable costs to be pared back to a minimum during low throughput periods or to shut down the operation completely when there is nothing to process, such as periods after a cyclone or other natural disaster. The flexibility of the operating model would also be enhanced by

having a split chamber HTFA unit able to efficiently process batches of between 1.0 and 3.0 tonnes, as well as use of the small HTFA chamber currently at Koronivia Research Station which can be used for batches of up to 0.25 tonnes.

4.3 Financial Analysis

Appendix E presents a financial analysis for the HTFA unit to assess its overall financial viability based on the operating model described above. The key assumptions underlying the analysis are as follows:

- Construction of a 450 m^2 enclosure including an insect-free packing area within the existing AMA factory shell.
- Purchase, installation and commissioning of a new split chamber HTFA unit together with all ancillary equipment, software and operating licenses.
- Operations to commence in the final quarter of Year 1 with a volume of 50 tonnes per quarter, increasing to 150 tonnes per quarter over the first four years.
- A service charge of FJD 0.72 per kg treated – the same as the current NWC charges.

Details of the design specifications are given in Appendix D and cost and revenue estimates are detailed in Appendix E. Based on these assumptions the facility would require an investment of FJD 664,000 and would be able to operate profitably after about two and a half years when throughput reaches around 100 tonnes per quarter. This is substantially less than the break-even throughput level of NWC due to the smaller and more flexible operating model. Based on throughput of 150 tonnes per quarter from year 5 onwards the facility would generate a financial benefit/cost ratio of around 1.2 (with a 7% discount rate) and a financial internal rate of return of 17%.

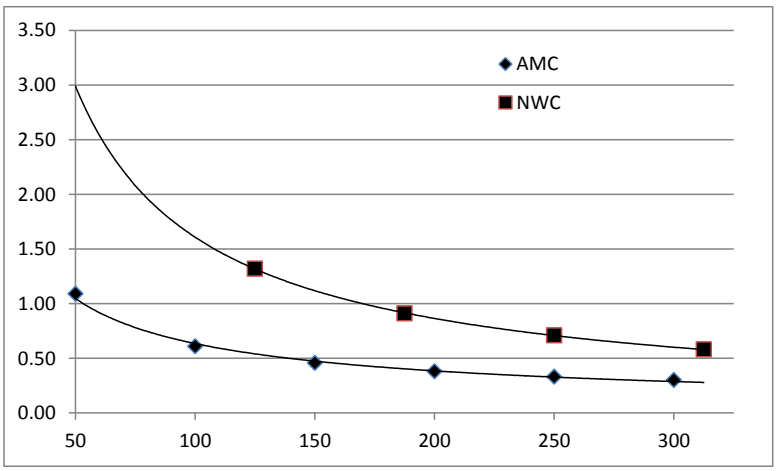
Table 4: Summary of Financial Projections (FJD'000) with Throughput of 150 Tonnes per Quarter

	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Total
Investment Costs	659	1	1	1	0	664
Gross Income	35	194	280	366	420	1,295
Cost of Sales	7	38	55	72	82	254
Gross Profit	**28**	**156**	**225**	**294**	**338**	**1,041**
Overhead Costs	85	149	147	147	147	676
Net Cash Flow	**-715**	**5**	**76**	**145**	**190**	**-299**
EBITDA a/	**-56**	**6**	**78**	**147**	**190**	**365**
Depreciation	27	61	55	50	45	236
Profit/loss	**-83**	**-54**	**23**	**97**	**145**	**128**
Benefit/Cost Ratio	1.24			Internal Rate of Return		17%

a/ Earnings before interest, tax, depreciation and amortisation

Figure 5 demonstrates that with throughput levels above around 100 tonnes per quarter the AMA facility would be able to reduce its charges below the FJD 0.72/kg level due to its smaller scale, greater flexibility and lower overhead cost structures. In a best-possible situation with throughput of 200 tonnes per quarter the facility would be able to break even at around FJD 0.40/kg, but the most likely range would be FJD 0.50-0.60/kg at throughputs in the range of 100-150 tonnes per quarter. By contrast NWC is much more expensive to operate at low/variable throughput levels and could not begin to reduce charges until throughput exceeds about 250 tonnes per quarter.

Figure 5: Break-Even Processing Fee (FJD/kg) at Different Throughput Levels (t/quarter)



An alternative pricing regime could also be considered based on a flat rate per batch, rather than per kg – which is the approach used in Tonga. This is intended to improve efficiency by encouraging exporters to aggregate consignments into larger batches and avoid the high costs of processing small consignments.

In addition to cost recovery, the fee structure should also include a levy for asset maintenance, upgrading and eventual replacement after 15-20 years, or earlier if regulatory changes demand. The aim would be to accumulate the levy in a sinking fund to reach around FJD 700,000 by year 10 and to maintain it at this level until needed. Based on quarterly throughput of 100-150 tonnes from year 5 onwards, this would require a levy of around FJD 0.16-0.18/kg. It should be noted that NWC does not currently collect such a levy and does not therefore have the financial capacity to sustain its operations in the long run without external support. Failure to collect this levy would subject the new HTFA facility to a similar outcome.

4.4 Risks

NWC's 20 plus years of experience shows that by far the greatest risk is the low and erratic supply of fresh produce for processing. This is influenced mainly by seasonal conditions, particularly natural disasters which disrupt supplies of the two main HTFA commodities, papaya and eggplant. All parts of Fiji are vulnerable to natural disasters and there are indications that weather-related disasters (cyclones, droughts and floods) may be on the increase.

In the case of papaya a major cyclone or flood can halt production for almost a year while new plantings come into production. After similar events, eggplant production can recover more quickly. In cases where an important production area such as the Sigatoka Valley is subject to major event, supply of both commodities is curtailed, as has been experienced during the first half of 2016 following cyclone Winston. Whilst a new HTFA facility would not be spared from this risk, the small scale/low cost and flexible operating model would minimise its impact.

In contrast market-related risks are fairly minimal. All fresh produce exporters in Fiji maintain that they are constrained by supplies of exportable material rather than the size of the market or the prices on offer. During good seasons when supplies are relatively abundant they experience few difficulties in expanding shipments. Most fresh produce importers in New Zealand, but to a lesser extent in Australia, are also constantly on the lookout for additional supplies of HTFA commodities, and express frustration about the continuity of supply from Fiji and other Pacific Island Countries. They would welcome the establishment of new supply pathway via the Nausori facility.

The proposal to establish a second HTFA facility is largely dependent on completion of the Nausori Airport upgrade and the Airlines' response in scheduling regular wide bodied aircraft services such as A330s, B767s and B777s with freight capacities of at least 10 tonnes. Whilst it would be possible to use sea freight out of Suva for items such as papaya, or to fly produce out of Nadi, the feasibility of the project is closely linked to the airport upgrade. This risk can be avoided by deferring establishment of

the Nausori facility until the airport upgrade is well underway and there are clear indications that the airlines will initiate regular wide bodied services.

The successful establishment and operation of a new HTFA facility also depends on complementary investments to develop the upstream parts of the export marketing value chain in the catchment area of the facility, in particular the registration and training of growers according to the BQA protocols. This has been done over a number of years in the Sigatoka Valley and other parts of Western and Northern Viti Levu. However growers in the proposed catchment area are mainly accustomed to supplying the domestic market for fruit and vegetables or non-HTFA exports such as taro and cassava. Hence if there is to be an adequate supply of BQA-compliant material to be processed, MOA will be required to establish a grower registration and certification system similar to that operating in the Sigatoka Valley, although at a smaller scale. The capacity of MOA to facilitate this within a 2-3 year time frame presents a material risk.

There are a number of other risks inherent in the operation of an HTFA facility in the Pacific, which have been amply demonstrated by the experiences of NWC in Fiji and its equivalent in Tonga. A new facility would not be immune from these risks, the most important of which is loss of accreditation by one or more importing countries due to a pest interception or procedural failure. It must also be recognised that agro-marketing parastatals like AMA have a poor record of sustainability in the Pacific Islands. Whilst AMA is currently well supported by Government there is a risk that once this support is phased out that the organisation will experience financial difficulties which may affect its capacity to sustain HTFA services.

5.0 Conclusions and Recommendations

5.1 Conclusions

Performance of Fiji's fresh produce export sector over the last decade has been one of the few bright spots in an otherwise stagnant agricultural sector, but has not been sufficient to offset the decline of the sugar industry. The HTFA sub-sector has had a chequered history with occasional spikes but long periods of under-performance, mainly related to low and erratic supplies of fresh produce for export.

At first sight, the concept of establishing a new HTFA facility in a situation where the existing NWC facility is struggling to operate sustainability appears to have little merit. Dissatisfaction with NWC is not a valid reason to establish a new facility, and it makes no sense if the new facility does nothing more than provide a competitor for NWC.

However, there are circumstances in which the creation of a second HTFA facility would be justified as a public investment under Fiji's national strategies for promotion of exports and diversification and revitalisation of the agricultural sector. The investment would be justified if the following conditions prevail:

1. The availability of a new HTFA facility generates a sustainable increase in production of HTFA commodities suitable for export in the Eastern half of Viti Levu.
2. MOA is able to provide the services needed to train and supervise a new group of BQA-registered growers in the Central Division to supply fresh produce to exporters and users of the facility.
3. The existing Central Division fresh produce exporters diversify their businesses to incorporate HTFA exports, or some of the Western Division HTFA exporters expand their operations into the Central Division.
4. The Nausori airport upgrade is completed and airlines respond by establishing at least 2-3 wide bodied aircraft services per week to Auckland and/or Eastern Australia.
5. AMA (or a suitably qualified alternative) agrees to build and operate the new HTFA unit on a full cost recovery basis, including imposition of a levy to provide for asset maintenance, upgrading and eventual replacement.
6. The facility is adequately capitalised: the Government (possibly with donor support) must be able to fund the investments, amounting to around FJD 700,000 which includes civil works, equipment and underwriting of operating losses during the first 2-3 years.
7. The operator (AMA) agrees to make HTFA services available to all registered growers and exporters and will not compete with these by engaging on exporting on its own account.

Establishment of a new HTFA facility and addressing the problems of NWC are not mutually exclusive options. Regardless of whether the seven conditions are satisfied, there will still be a need to address the problems experienced by NWC and the HTFA exporters related to the low and irregular supply of raw material. This calls for an intensified research and extension effort to boost yields and quality, increase the number of BQA-registered growers, and diversify production areas and the product mix in order to improve the regularity of supply. These actions fall within the mandate of MOA. At the same time NWC needs to develop a more flexible operating model which reduces its overhead costs.

5.2 Recommendations

Recommendation 1: Lessons learned over the last 20 plus years indicate that a new approach to provision of HTFA services is required to avoid the ongoing sustainability issues encountered by NWC and other HTFA facilities in the Pacific Islands. This points to a smaller, leaner and more flexible operating model working as part of a diversified agribusiness enterprise such as AMA, rather than as a stand-alone service business.

Recommendation 2: The large number of conditions required for successful establishment and operation of the proposed facility, and the commercial risks involved, make it unlikely that private enterprise would see this as an attractive investment option. It should therefore be seen as a public good investment financed by Government but operated on a full cost recovery/user-pays basis.

Recommendation 3: A decision on whether to proceed with the establishment of a second HTFA facility should be deferred until the exact timing and extent of Nausori airport upgrade is known and the intentions of the airlines with regard to aircraft type and freight services are clear.

6.0 Standard Limitation

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Appendix A

Recent History of Natural Disasters in Fiji

Appendix A Recent History of Natural Disasters in Fiji

Event	Date	Cost	Remarks
TC Mick	14 Dec 2009	FJD$ 15 million	Damage to Fiji's agriculture sector caused by TC Mick not only affected farmer's livelihoods but the economy as a whole.
TC Thomas	16 Mar 2010	FJD$ 50 million	Damage to crops and the natural vegetation were extensive. Apart from the devastating strong wind velocity, which twisted and uprooted crops, further damages were done through salt spray to crops and vegetation along the coastlines.
Flash flooding	28 Mar 2012	FJD$ 17 million	A total of 12,799 crop and livestock farmers on the flats were directly affected. Crops affected were mostly root crops, vegetables and fruits, that were planted on the flats and rolling slopes.
TC Evan	16 Dec 2012	FJD$ 44 million	The total damage and loss for the three sub-sectors consisted of 67 per cent attributable to crop, 19 per cent to livestock and 14 per cent for forestry.
Flash flooding	14 Mar 2014	FJD$ 172,000	The Tailevu Province recorded the highest at FJD$74,614, followed by Naitasiri Province at FJD$54,614, Serua Namosi at FJD$39,569 and Rewa Province at FJD$12,196.
El Nino drought	2014-15	FJD$1.5m	River water levels dramatically reduced in Sigatoka and Ba while small creeks and tributaries ran dry including residential boreholes in rural areas of the West. The quality and quantity of fruits and vegetables dramatically dropped. This pushed prices up in the municipal markets. On the other hand, exporters worked tirelessly to maintain quotas for their market outlets especially for eggplants, okra and chillies.
TC Winston	20 Feb 2016	FJD$ 231 million	TC Winston, an extremely destructive Category 5 cyclone struck Fiji directly. It was the most intense tropical cyclone on record to affect the country. Fiji's Eastern Division was the first to be struck, with Koro, Ovalau, and Taveuni islands sustaining severe damage. The cyclone swept across Fiji's islands, reaching its peak strength shortly before making landfall on Viti Levu,
TC Zena-Flood	6 April 2016	FJD$ 1.6 million	The Sigatoka Valley, Fiji's Salad Bowl was severely affected. Flood waters, sand, mud, debris and gravel covered most of the prime flat land (bila lands) - especially the Nabitu and Lokia flats.

Appendix B

Agricultural Export Statistics

Appendix B Agricultural Export Statistics

	Tonnes Exported						Average
Commodity	2009	2010	2011	2012	2013	2014	2009-14
Dalo	9,482	10,513	12,449	6,083	8,796	7,649	9,162
Cassava	2,522	2,258	2,382	1,996	1,313	1,842	2,052
Ginger	1,025	992	860	1,978	1,655	1,090	1,267
Papaya	177	432	1,071	182	252	445	427
Rice	782	789	486	237	94	151	423
Eggplant	225	365	428	444	268	529	376
Yaqona	220	277	315	291	155	219	246
Other Vegetables	219	136	290	529	161	138	245
Other root crops	167	147	149	86	469	25	174
Dairy products	234	64	61	105	47	20	89
Poultry	98	15	61	24	88	105	65
Mangoes	63	25	45	83	48	58	54
Pigs	10	37	30	7	6	30	20
Sheep	7	20	4	2	3	60	16
Beef	3	46	17	3	1	9	13
Yams				10	8	36	9
Pineapple	17		5	8	6	13	8
Kumala	0		5	2	1	0	1
Honey		0			0	0	0

	Value (FJD'000)						Average
Commodity	2009	2010	2011	2012	2013	2014	FJD'000
Dalo	20,089	10,513	22,269	15,241	23,979	21,757	18,975
Ginger	6,351	992	5,641	11,114	10,683	8,025	7,134
Cassava	2,934	2,258	2,878	2,765	2,498	2,792	2,687
Yaqona	4,050	277	4,454	315	5,941	291	2,555
Papaya	958	432	1,481	1,071	4,031	182	1,359
Rice	1,323	789	1,321	486	1,053	237	868
Eggplant	411	365	591	428	771	444	502
Other Vegetables	653	136	455	290	482	529	424
Other root crops	416	147	348	149	880	86	338
Dairy products	916	64	425	61	399	105	328
Poultry	540	15	71	61	390	24	184
Pigs	28	37	85	30	290	7	80
Mangoes	124	25	57	45	48	83	64
Beef	34	46	46	17	87	3	39
Sheep	29	20	117	4	56	2	38
Pineapple	28			5	3	8	7
Yams						10	2
Kumala	0			5	2	2	1
Honey		0	1				0
Total	38,882	16,117	40,241	32,088	51,595	34,588	35,585

Appendix C

Nature's Way Cooperative Financial Analysis

Appendix C Nature's Way Cooperative Financial Analysis

Table 1: NWC Proft and Loss Account, 2014-15

Tonnes processed	901	
	FJD	FJD/t
Fruit treatment income	648,895	720
Entrance/subscription fees	1,421	2
	650,316	722
Cost of sales	84,308	94
Gross Margin	566,008	628
Other income	6,539	7
Total Income	572,547	635
Expenses(Overheads)	619,734	688
Profit/Loss	-47,187	-52

Table 2: Sensitivity Analysis Tonnes Processed and Profitability (FJD'000)

Tonnes processed	500	750	1,000	1,250	1,500	1,750	2,000	2,250	2,500	2,750	3,000
Fruit treatment income a/	360	540	720	900	1,080	1,260	1,440	1,620	1,800	1,980	2,160
Entrance/subscription fees	1	1	1	1	1	1	1	1	1	1	1
	361	541	721	901	1,081	1,261	1,441	1,621	1,801	1,981	2,161
Cost of sales	47	70	94	117	140	164	187	210	234	257	281
Gross Margin	315	471	628	784	941	1,098	1,254	1,411	1,568	1,724	1,881
Other income	7	7	7	7	7	7	7	7	7	7	7
Total Income	321	478	634	791	948	1,104	1,261	1,417	1,574	1,731	1,887
Expenses(Overheads)	620	620	620	620	620	620	620	620	620	620	620
Profit/Loss	-299	-142	15	171	328	485	641	798	954	1,111	1,268
Break even fee/kg	1.32	0.91	0.71	0.58	0.50	0.44	0.40	0.37	0.33	0.32	0.28

a/ At FJD 0.72/kg

Appendix D

Specifications for Proposed HTFA Facility

Appendix D Specifications for Proposed HTFA Facility

Building

Construct new enclosure inside the existing AMA building complex at Nausori including the following:

- Fruit receival area for unloading and packing into treatment baskets (lugs): 150m^2
- Insect-free packing area: 300m^2
- Outloading area for sea freight containers
- Store-room for cartons etc.
- Airlock for loading sealed air freight containers for transport to airport
- Computer room/office for HTFA technician
- Polypropylene door strip curtains between sections
- Connection of electricity and water supply

Total cost estimate: **FJD 90,000**

HTFA Equipment

- Comex HTFA chamber, 250 kg capacity transferred from Koronivia. To be used for trials and small commercial consignments. **No cost**
- Split wide body HTFA chamber supplied by QTI New Zealand. This allows for redundancy of treatment capacity to ensure that exporters do not lose perishable product batches due to any technical breakdowns. It also allows for efficient processing of smaller consignments. Capacity 144 lugs/1.8 tonnes per load on right side and 96 lugs/1.2 tonnes per load on left side. Both sub chambers would have independent instrumentation complete with controllers, fans, pumps and computers. The only common elements would be the boiler which could serve both units and the backup generator which will be capable of running both sub-chambers at the same time. Cost estimate: NZD 215,000 = **FJD 310,000**
- The advantages of a dual-chamber system are:
  - While one side is running the other side can be outloaded
  - Ability to use the side which is most efficient for the fruit load
  - If there is a technical problem with one side the other side is still independent and operational
  - Smaller loads can be processed at lower cost
  - The two sub-chambers can share the same boiler and standby generator
- On the other hand the cost of a dual-chamber HTFA unit is about 30% more than a single chamber.
- Shipping of equipment from Auckland to Suva (one 40 foot container). **FJD 8,500**
- Technical assistance/consultancy for ten days of testing and thermal mapping for certification to NZMPI standards and full training of staff. **FJD 25,000**
- All QTI costs are turnkey and involve testing at the point of construction prior to shipping, installation and commissioning. The intellectual property in the HTFA facility would remain with QTI and AMA would be issued with a licence to use the system.

Other Equipment

- Supply of 40 litre lugs: One container load of 700 lugs ex Taiwan, including shipping. **FJD 25,000**

- Hot water bath (gas fired) for fruit dipping. **FJD 9,500**
- Stainless steel packing tables. **FJD 8,000**
- 30 m^3 cold storage unit in insect-free area. **FJD 18,000**
- Platform scale. **FJD 3,000**
- Pallet jack. **FJD 3,500**
- Walk-behind forklift. **FJD 23,000**
- Boiler, 300 litre capacity. **FJD 11,000**
- Standby generator. **FJD 15,000**
- Workshop, tools and miscellaneous equipment. **FJD 7,500**

Appendix E

Financial Analysis for Proposed HTFA Facility

Appendix E Financial Analysis for Proposed HTFA Facility

Table 1: Investment Costs for HTFA Unit (FJD'000)

	Unit	Unit Cost FJD'000	No	Cost FJD'000	Comments
Building		90.0	1	**90.0**	Construct new 450 m2 building with insect-free area inside existing AMA shed
HTFA Equipment					
Comex HTFA chamber	chamber			0.0	Transfer from Koronivea Research Station - no cost
QTI dual chamber unit	chamber	310.0	1	310.0	Supplied and installed on turnkey basis
Shipping for equipment	contaner	8.5	1	8.5	One 40 foot contaner from Auckland to Suva and trasport to Nausori
Consultancy	days	2.5	10	25.0	For testing, temperature mappign and NZMPI certification
			Subtotal	**343.5**	
Other Equipment					
4WD pickup	vehicle	40.0	1	40.0	Second hand
Supply of lugs	load	25.0	1	25.0	One container load of 700 lugs ex Taiwan, including shipping
Walk-behind forklift	unit	23.0	1	23.0	
Coldstore	unit	18.0	1	18.0	30 m^3 cold storage unit in insect-free area
standby generator	unit	15.0	1	15.0	
Boiler	unit	11.0	1	11.0	300 litre capacity
Hot water bath	unit	9.5	1	9.5	Hot water bath (gas fired) for fruit dipping
Stainless steel tables	table	4.0	2	8.0	For packing fruit into cartons
Pallet jack	unit	3.5	1	3.5	
Platform scale	unit	3.0	1	3.0	
Other items	set	7.5	1	7.5	Workshop, tools and miscellaneous equipment
			Subtotal	**163.5**	
Contingencies (10%)				**59.7**	
			Total	**656.7**	

Table 2: Gross Margins for Operation of HTFA Unit

Unit: One tonne of fruit processed and packed for export

Gross Income	Unit	FJD per Unit	No	FJD	Comments
Processing fee	kg	0.70	1,000	700.00	Fee charged to exporter to treat and pack in cartons
		Total Gross Income		**700.00**	
Cost of Sales					
Fruit treatment	kg	0.02710	1,000	27.10	Based on NWC costs for 2014-15
Electricity and water	kg	0.03727	1,000	37.27	Based on NWC costs for 2014-15
Labour	hours	5.00	12	60.00	Based on NWC labour use, 4.5 workers/chamber and 3t/chamber/shift
Gas and supplies	kg	0.01304	1,000	13.04	Based on NWC costs for 2014-15
		Total Cost of Sales		**137.41**	
	Gross Margin per Tonne			**562.59**	

Table 3: Summary of Quarterly Financial Projections (FJD'000)

	Year 1				Year 2				Year 3				Year 4				Year 5				Total
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	
Investment Costs																					
Building		45	45																		90
HTFA equipment			172	172																	344
Other equipment			82	82																	164
Contingencies			30	30																	60
Working capital a/	0	0	0	2	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	9
Total Investment Costs	**0**	**45**	**328**	**286**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**0**	**0**	**0**	**0**	**666**
Tonnes Processed	0	0	0	50	63	75	88	100	113	125	138	150	163	175	188	200	200	200	200	200	2,425
Gross Income																					
Processing fees 0.70 FJD/kg	0	0	0	35	44	53	61	70	79	88	96	105	114	123	131	140	140	140	140	140	1,698
Total Gross Income	**0**	**0**	**0**	**35**	**44**	**53**	**61**	**70**	**79**	**88**	**96**	**105**	**114**	**123**	**131**	**140**	**140**	**140**	**140**	**140**	**1,698**
Cost of Sales																					
Fruit treatment 27.10 FJD/t	0	0	0	1	2	2	2	3	3	3	4	4	4	5	5	5	5	5	5	5	66
Electricity and water 37.27 FJD/t	0	0	0	2	2	3	3	4	4	5	5	6	6	7	7	7	7	7	7	7	
Labour 60.00 FJD/t	0	0	0	3	4	5	5	6	7	8	8	9	10	11	11	12	12	12	12	12	
Gas and supplies 13.04 FJD/t	0	0	0	1	1	1	1	1	1	2	2	2	2	2	2	3	3	3	3	3	32
Total Cost of Sales	**0**	**0**	**0**	**7**	**9**	**10**	**12**	**14**	**15**	**17**	**19**	**21**	**22**	**24**	**26**	**27**	**27**	**27**	**27**	**27**	**333**
Gross Profit	**0**	**0**	**0**	**28**	**35**	**42**	**49**	**56**	**63**	**70**	**77**	**84**	**91**	**98**	**105**	**113**	**113**	**113**	**113**	**113**	**1,364**
Overhead Costs																					
HTFA section manager	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	180
HTFA technician			5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	90
Accounts clerk			3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	63
Repairs and maintenace b/					7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	7.6	122
Accountancy and audit					1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	24
Vehicle operation		1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	23
Insurance		1.0	2.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	54
Staff training			5.0	5.0	3.0	3.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	44
Office consumables		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	19
Communications (phone/internet)		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	19
Miscellaneous overhead costs		2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	38
Total Overhead Costs	**9**	**15**	**30**	**31**	**38**	**38**	**37**	**37**	**37**	**37**	**37**	**37**	**37**	**37**	**37**	**37**	**37**	**37**	**37**	**37**	**676**
Net Cash Flow	**-9**	**-60**	**-358**	**-288**	**-3**	**4**	**12**	**19**	**26**	**33**	**40**	**47**	**54**	**61**	**68**	**75**	**76**	**76**	**76**	**76**	**22**
Cumulative Net Cash Flow	**-9**	**-69**	**-427**	**-715**	**-719**	**-715**	**-703**	**-684**	**-658**	**-626**	**-586**	**-539**	**-485**	**-424**	**-356**	**-280**	**-205**	**-129**	**-53**	**22**	
EBITDA	**-9**	**-15**	**-30**	**-3**	**-3**	**4**	**12**	**19**	**26**	**33**	**41**	**48**	**55**	**62**	**69**	**76**	**76**	**76**	**76**	**76**	**688**
Depreciation	0	1	9	16	16	15	15	15	14	14	14	13	13	13	12	12	12	11	11	11	236
Profit/loss	**-9**	**-16**	**-39**	**-19**	**-18**	**-11**	**-3**	**5**	**12**	**20**	**27**	**34**	**42**	**49**	**56**	**64**	**64**	**64**	**65**	**65**	**452**
Depreciation of equipment																					
Opening Value	0	0	44	363	630	614	599	584	569	555	541	528	515	502	489	477	465	453	442	431	
Investments	0	45	328	283	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	657
Depreciation 10 %	0	1	9	16	16	15	15	15	14	14	14	13	13	13	12	12	12	11	11	11	
Closing Value	0	44	363	630	614	599	584	569	555	541	528	515	502	489	477	465	453	442	431	420	

a/ One month of cost of sales b/ 2.5% of cost of buildings, 5% of cost of all other items

Table 4: Benefit-Cost Analysis (FJD'000)

	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Yr 9	Yr 10	Yr 11	Yr 12	Yr 13	Yr 14	Yr 15
Investment Costs	659	1	1	1											
Costs of Sales	7	38	55	72	82	82	82	82	82	82	82	82	82	82	82
Overhead Costs	85	149	147	147	147	147	147	147	147	147	147	147	147	147	147
Total Costs	750	189	204	221	230	230	230	230	230	230	230	230	230	230	230
Revenues	35	194	280	366	420	420	420	420	420	420	420	420	420	420	420
Net Cash Flow	-715	5	76	145	190	190	190	190	190	190	190	190	190	190	190
Discount Rate	7%	NPV Benefts	3,113	NPV Costs	2,516			BCR	1.24		IRR	17%			
NPV = Net Present Value BCR = Beneft/Cost Ratio IRR = Internal Rate of Return															

Table 5: Sensitivity Analysis

	Tonnes Processed at Full Development						
Per quarter	75	100	125	150	175	200	225
Per annum	300	400	500	600	700	800	900
Profit/Loss (FJD'000) a/	-23	33	89	145	202	258	314
BCR	0.75	0.92	1.09	1.24	1.38	1.51	1.63
IRR (%)	-11	3	11	17	23	27	32

a/ From year 5 onwards

Appendix F

Design and Cost of Developing and Implementing an HTFA Facility in Suva

Appendix F Design and Cost of Developing and Implementing an HTFA Facility in Suva

The following note was requested from Plant & Food Research Limited (Auckland New Zealand) to provide a full costing of a HTFA facility to supplement this Technical Report #105.

PFR SPTS No. 13860

Design and cost of developing and implementing a high-temperature forced-air treatment facility located in Suva, Fiji for the export of fresh fruit and vegetables

Fullerton R
Plant & Food Research Auckland

September 2016

1 BACKGROUND

The DFAT project Pacific Horticultural and Agricultural Market Access (PHAMA) programme approached Plant & Food Research Limited (PFR) to provide a cost estimate for the construction and implementation of a high-temperature forced-air (HTFA) treatment facility in Suva, Fiji. It is intended that the estimated cost provided here will be incorporated into a larger cost-benefit analysis exercise which will determine the feasibility of establishing a second HTFA facility in Fiji (additional to the current facility located at Nadi). The aim was to identify and cost the key components needed in a functional facility, namely, the treatment unit and computer control system. It was also requested that the ancillary facilities and equipment needed to ensure compliance with regulatory standards would be identified though the estimation of costs was not part of the assignment.

2 PROJECT OBJECTIVES

1. Prepare an estimated costing for the construction, testing, installation and certification of a HTFA treatment unit and computer control system.
2. Identify key technical elements in the biosecurity system required for sustained export operations.
3. Prepare a brief report to assist in the overall cost-benefit analysis being collated by PHAMA.

3 METHOD

The project team comprised Barry Stevenson (consultant design engineer), Mark Roche (Technolutions, software engineer, control systems specialist), Barbara Waddell (PFR, disinfestation specialist, experience in installation and certification of HTFA unit in Cook Islands), Dr Bob Fullerton (experience in design and installation of HTFA facilities in Cook Is and Tonga, and concept design and indicative cost of a HTFA facility for Samoa).

Mark Roche visited Tonga in November 2014 where he was able to examine and gain first-hand knowledge of the unit installed there which was designed by Dr Mike Williamson. In particular Mark was able to observe the control systems used on the unit.

That was followed by a series of meetings between Stevenson, Roche, Waddell and Fullerton to discuss the design and functioning of the Williamson machines with particular attention to its limitations under conditions of variable volumes of produce of different types.

Stevenson and Roche then worked together to consider alternative options to the Williamson design that would allow greater versatility for commodity type and daily volume.

4 CONSIDERATION FOR UNIT DESIGN AND CONTROL SYSTEMS

Key considerations and criteria for developing a design

The options considered for a new treatment unit in Suva were:

1. Duplicate the Nadi facility with the installation of a unit of the Williamson design in Suva
2. Consider a different design that would potentially be better suited to smaller volumes of produce and smaller units of produce

Key conclusions from the discussions were:

1. The Williamson machine was designed primarily for treatment of pawpaw, a large, dense commodity, and is not easily adaptable to small volumes of small fruit such as chilli or some varieties of eggplant.
2. The Williamson unit was initially based on the dimensions of a 20 foot shipping container split down the middle to provide two independently operated chambers. Each chamber was designed to accommodate four bins custom-sized to the machine, each containing approximately 400kg of pawpaw. For durability in an island environment, the units delivered to the Pacific Islands were normally constructed of stainless steel. Over time there have been a number of variations designed by Williamson including 'single chamber' four-bin units of the type installed at Nadi, to a wide-bodied single chamber shipping container unit installed in New Caledonia. In addition there have been a number of 'experimental' single bin units designed, for example the unit at Atele in Samoa. The units are normally able to accommodate similarly custom-sized pallets stacked with crates of the commodity.
3. The heating phase of the Williamson unit is relatively slow and there is no provision for cooling to avoid temperature over-run (from the fan motor heat) during the final 20 minute treatment period. This period starts only when the monitor fruit at the top of the stack reaches treatment temperature. This results in the bottom fruit of the stack being exposed to temperatures that damage the fruit during the over-run time.
4. The control systems of the Williamson machines are antiquated and continue to be based on outdated hardware and software.
5. The software is protected by Williamson and only he is able to make changes. This 'captive client' approach has resulted in exorbitant costs being charged to have existing units in Rarotonga, Tonga and Fiji repaired or reprogrammed over the years.
6. The performance of the Williamson unit in terms of meeting biosecurity standards has been well verified and tested over the past 20 years and there are normally no obstacles to certification.
7. The Williamson design was patent protected in the past. At present it appears that the patents have lapsed but it is considered prudent not to attempt to design a unit based on a similar principle.
8. Should PHAMA opt for the Williamson design then the most expedient solution would be to simply order one from him and have him install and programme it.
9. Given the limitations of the Williamson unit in terms of flexibility of produce type, produce load and temperature management, consideration was given to an alternative design using

a modular concept that would be adaptable to local requirements for volume and type of produce to be treated. It would have a better matched, faster and more efficient heating system and incorporate positive cooling to avoid temperature over-run. It would use modern, state-of-the-art control systems that would allow multiple units to run concurrently from the same control unit and use open code software that would permit any authorised operator to make changes. It can also be monitored remotely.

10. The control systems and software can be retrofitted to existing HTFA units in the region to upgrade and simplify repairs and operations.

5 DELIVERABLES

The quotation for design, commissioning and on-site costs is attached (Appendix A). The concept diagram of the new design is attached (Appendix B).

In brief, it is a modular unit capable of taking two standard-sized bins or pallets of crates providing the flexibility needed for treating smaller lots of produce. The produce can be loaded into bins or crates fitted into a cradle on rollers allowing for easy loading and unloading without a forklift. The unit is fitted with two centrifugal fans that will provide much greater air flow and hence faster and more even heating than the Williamson machine.

Being of modular design there is flexibility to match the number of modules to the anticipated production. For small but regular quantities of produce, a single two-chamber unit may be adequate. For larger volumes, or in the case of sustained higher production, more modules can be added.

The control system has the capability of controlling multiple modules simultaneously. This offers added flexibility and advantage in that one chamber can be filled and be undergoing the treatment cycle while the next unit is being filled. This will significantly increase the daily throughput compared with the Williamson design in which the whole chamber has to be loaded before a single run can commence.

The control system will also allow different modules to operate to different parameters so that different types of produce could be treated to different specifications simultaneously.

6 ANCILLARY EQUIPMENT

Key elements of a commercial treatment facility will include

- Building with separate areas able to separate untreated and treated fruit
- Access between areas to allow movement of forklift but be fly proof
- Produce handling equipment – benches, roller beds, flotation tanks, fruit sizer etc. as appropriate
- Coolstore facilities for storing treated produce
- Standby generator in case of power failure during treatment run
- Platform scales with electronic data capture for receiving produce
- Electronic balance for establishing 'largest fruit' as monitor fruit for control of the process.

For certification and subsequent routine accuracy checks of probes and probe calibration

- Water bath for calibration of probes
- Reference thermometers

Overall the cost to design, build and commission a two-bin or 24-crate chamber is estimated as NZ$181,424. Further detail is provided below.

[3] THE NEW ZEALAND INSTITUTE FOR PLANT & FOOD RESEARCH LIMITED (2016)

APPENDIX A

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Phone –64 9 2364050, Email mark@technolutions.co.nz

3rd July 2016

Estimate brought together by Barry Stevenson and Mark Roche for PFR.

This estimate for the cost to design, build and implement a HTFA treatment chamber must be considered within the overarching design of the whole facility. This includes the building, facilities and services to ensure the chamber will work to the approval of MPI New Zealand and other regulatory authorities.

The cost to develop this new model and deliver it to compliance is broken into 4 separate costs so it is possible to understand each component. The cost per unit is for a 2 bin or 24 crate chamber. This makes the whole project scalable in 2 bin sizes. The crate concept is to allow manual loading and unloading especially with smaller fruit for example chillies.

Note: This is based on construction in NZ then shipping to Fiji and installation/commissioning involving appropriate expertise from NZ.

One off design costs					
Mechanical Design	180	$	85	$	15,300
Control Design and Software	240	$	85	$	20,400
		Total		**$**	**35,700**

Per Unit cost (2 Bins)		
Mechanical		
Materials	$	28,400
Labour	$	26,000
Manage build /order materials	$	9,000
Control		
Materials	$	20,166
Labour	$	9,750
Total Unit Cost	**$**	**93,316**

Commissioning and MPI Cert					
Labour in NZ	120	$	85	$	10,200
MPI Cost (estimate only)	16	$	200	$	3,200
Fruit Cost for Commissioning loads	2	$	1,000	$	2,000
Thermal Mapping Logger	1	$	6,000	$	6,000
Thermal Mapping Logger Software	52	$	85	$	4,420
		Total		**$**	**25,820**

Site costs					
Crates	76	$	100	$	7,600
Bins	4	$	500	$	2,000
Calibration Thermometer(ECE)	1	$	800	$	800
Installation labour	120	$	85	$	10,200
Flights, 2 return trips	4	$	400	$	1,600
Accommodation	16	$	118	$	1,888
Shipping, 2 units 1 20' container	1	$	2,500	$	2,500
		Total		**$**	**26,588**

Unknown costs
Water supply
Electricity supply and possible backup generator
Cooling tower
Water heater, Gas, diesel, electric, heat pump for chamber heating

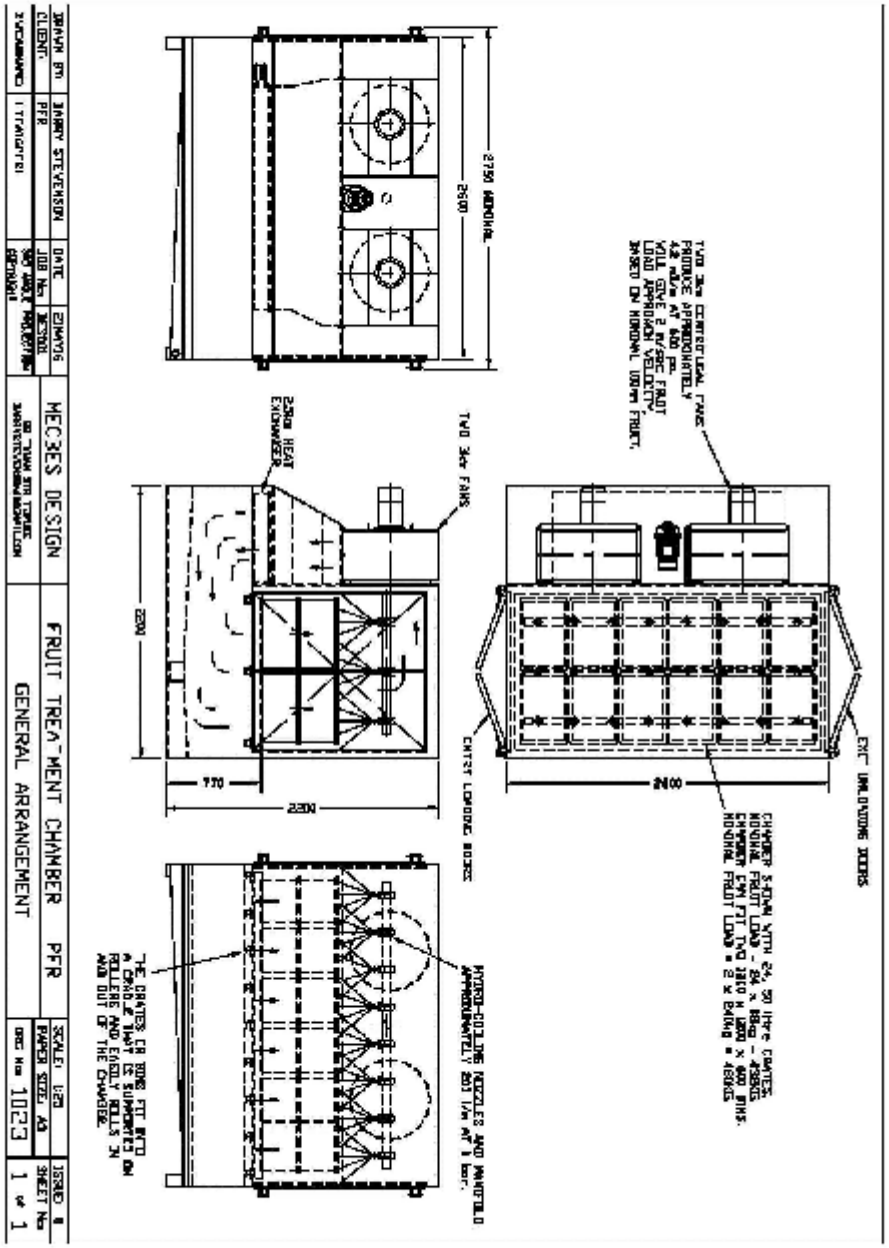
The machine will be able to be monitored and software updated remotely reducing the number of trips to Fiji. If the operator had user changes they would like which do not compromise the MPI certification then these could be done remotely. For a small added cost all pumps could have feedback added for fault logging.

If you have any questions then please ask.

Thanks,

Barry and Mark

APPENDIX B



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