

**SUB-REGIONAL OFFICE OF THE FOOD AND AGRICULTURE  
ORGANISATION OF THE UNITED NATIONS**



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**AGRO-BASED PROCESSING  
OPPORTUNITIES FOR TONGA**

**Apia, Samoa**

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**FAO Consultant**

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Richard Beyer

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## EXECUTIVE SUMMARY

For processing to be sustainable in the long term it must reach profitability. Three elements are necessary for profitability; a continuous and continuing supply of raw material of the correct quality, the technology to affect the changes necessary for market demands, and access to the market. Low levels of production are the constraining factor inhibiting a flourishing food processing sector in Tonga. The traumatic decline in fresh squash exports and the associated financial losses have created trepidation among farmers. Inadequate support infrastructure has compounded the disquiet. The resurrection of the High Temperature Forced Air (HTFA) treatment facility, the construction of new fumigators and the food processing facilities funded by the European Union under the 'Stabilization through Export,' programme (STABEX) are high-profile, progressive strategies from the Ministry. It is now vital that MAFFF (Ministry of Agriculture, Fisheries, Forests and Food) provide staff and budgets for preventative maintenance of these facilities to ensure the agricultural sector flourishes.

As the volumes of fresh crops increases to satisfy fresh crop markets, so the raw material base for processing will expand. Tonga has a significant comparative advantage with its moderate climate, relative freedom from pests and productive soils. In this environment, a number of highly acceptable crops are produced that outstrip those of competing Pacific Island Countries (PICs). Tomatoes, pumpkin, pineapples, eggplant, and high quality watermelon have become the mainstay of the fresh produce production. However, these items are highly seasonal which means that wastage level can be high at season glut. It is important for farmer motivation to maximise financial return for effort. Hence the recommended equipment for the STABEX-funded food processing facility lays emphasis on partial preservation at the height of the season for later on-processing during raw material scarcity.

Hence, the bulk of raw material for on-processing will be fresh produce that does not meet export or local quality standard and pre-frozen bulk fruits and vegetables. The technology chosen is consequently geared to producing familiar items that can be made from the favoured crops, but that can also accommodate novel and niche market products for which a maximum return is realized in the wealthy markets in Australasia.

The meat industry has further to travel but it is worth noting that the Tongan environment is particularly suitable for the Fiji Fantastic variety of sheep. The constraints are the cost of feed and land on which to graze. Large tracts of land that are currently idle could be used for grazing or feed grain production. It is recommended that an abattoir for production of high quality meat is considered. Both these issues merit further effort. Whole carcass slaughter will mean that the full range of meat will be produced increasing the availability of cuts with lower fat contents.

During discussions, the fishing industry has been steered towards a product development strategy that extends the valuable resource. Convenience products often include other cheap components (batter, breadcrumbs). It is recommended that the new STABEX-

funded fish processing facilities is designed to account for value added products rather than the current trend of exporting minimally processed loins, fillets and whole fish.

A function of MAFFF is to source trainers that can train key personnel to higher levels. This will be essential because much of the equipment is new to Tonga. Provision of training is an important role for MAFFF for the coming period for staff that will be involved with the processing facility. Training in food handling, food processing and product development will be offered in part two of this technical assistance programme. As processing activity increases and export markets are exploited attention must be paid to standards set by international regulators. Training in the roles, content and application of Codex is recommended.

Private sector operators are pivotal to economic progress through agriculture. The changes that are promised with the construction of the support infrastructure provide an excellent opportunity to forge synergistic links between the MAFFF, growers and processors through public-private partnerships. The STABEX-funded processing facilities may well house some regular production but they are more likely to provide the test-bed equipment for processes and industries that can be translocated to the private sector.

Concurrent with the anticipated rise in prepared foods must be a strengthening of the food control system. The spirit adopted in identifying the pillars required for a food control system is tailored to the Tongan environment in which there are limited resources. Hence for laboratory facilities, the hospital can be commissioned for microbiological assessments as required. Other analyses for nutrients (for nutrient labeling), toxicants, pesticides and herbicides do not require on-the-spot analyses and hence overseas laboratories can be used. In many instances analyses are cheaper because these laboratories enjoy enormous economies of scale when purchasing expensive analytical reagents. However there is reason to believe that processing activity will increase and the first steps in establishing a dedicated food microbiology laboratory are recommended.

The future of the food processing industry is bright but the engine of growth will be the private sector. Government through its instrument of the MAFFF must refresh its commitment to the provision of support services primarily to revitalize the fresh food industry, and through that - food processing. Legislation must be completed and all this activity must be broadcast to the end user. Improved communications through the promised regular dialogue between stakeholders will make a significant impact on the entire sector.

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## RECOMMENDATIONS

1. It is recommended that the Food Unit investigate the feasibility of producing a recipe book to encourage hotel and domestic chefs and cooks to make greater use of local raw materials.
2. It is recommended that alternative quarantine avenues are explored (dipping of tomatoes and water melon) to facilitate future export regimens.
3. Although export is favoured it is recommended that the product development programme also includes development of products for the domestic market with the proviso that they are perceived as cheaper alternatives to imported competitors.
4. It is recommended that product development activity emphasizes the advantages of flexible pouches over more conventional packaging such as cans, bottles and jars.
5. It is recommended that training scheduled for part two of this intervention includes food hygiene, food preservation and product development.
6. It is recommended that the two processing facilities (STABEX) are equipped with blast freezers and cold storage facilities so that excess crops can be frozen for later on-processing.
7. It is recommended that the two processing facilities are equipped with processing equipment that can be leased *in situ* to the entire spectrum of processors.
8. It is recommended that a feasibility study is conducted to establish the economic and technical viability of a general purpose abattoir in Tonga.
9. It is recommended that the MAFFF seeks funding from aid agencies for additional fencing to accommodate increasing sheep numbers.
10. It is recommended that the MAFFF initiate discussions with the Ministry of Labour, Commerce and Industry to organize a campaign to re-ignite confidence in Tongan-made products.
11. MAFFF are alerted to the fact that there will be a requirement for management and technical staff to maintain and operate the STABEX-funded food processing facilities and that funding must be identified for this purpose.
12. MAFFF are further alerted to the fact that the facilities will require constant repair and maintenance and that funding should be identified for this purpose.

- 13. It is recommended that a separate review is undertaken to ensure that all legislation including that covering biosecurity and quarantine are harmonious and comprehensive.**
- 14. It is recommended that the National Codex Committee is re-established to ensure that issues relating to Codex remain at the forefront for all stakeholders.**
- 15. It is recommended that a review of the inspection system is undertaken to ensure that there is no duplication or gaps and to identify training needs for inspectors that take the steps towards a risk-based inspection approach.**
- 16. It is recommended that stakeholders make use overseas laboratories for nutrient, pesticide and poison analyses and that the construction of new laboratories is deferred until momentum in the food processing sector increases.**
- 17. For tests that must be conducted within a short period (microbiological, water analyses) it is recommended that tests are conducted at the Hospital Microbiology Laboratory and the Tongan Water Board Laboratory. However it is recommended that the process of seeking funding for a microbiology laboratory is initiated by MAFFF.**
- 18. It is recommended that the laboratory attached to the STABEX-funded food processing facilities is equipped with these test kits for Ciguatera and histamine to support the fishing industry until such time that the fish processing unit is established.**
- 19. It is recommended that MAFFF begins the process of obtaining funding for a microbiology laboratory and make budgetary provisions for staff, consumables, repairs and maintenance.**
- 20. It is recommended that the Director of the Food Division identifies appropriate staff for training in food processing, food product development and food handling and hygiene.**
- 21. It is recommended that the Director of the Food Division identifies appropriate staff to assume the role of Codex correspondent and secretary to the NCC who can be supported by training in Codex.**

## AGRO-BASED PROCESSING OPPORTUNITES FOR TONGA

### 1 BACKGROUND

Of the 34,000 workforce in Tonga, 65% are engaged in agriculture. The sector contributes approximately 30 % to GDP but this is probably an underestimate in view of the high levels of informal and subsistence activity. Agriculture has a significant role to play in the welfare of the Tongan economy.

In 2004 a significant step was taken to stimulate the sector by way of a Cabinet Memorandum that recommended a model for an integrated National Food Control and Quality Assurance system for Tonga and the National Plan of Action for the steps to establish that system. This programme assumed a buoyant food industry but since its ratification implementation has been hampered by declining production levels. As with all Pacific Island Countries (PICs), production levels fall far short of potential. Large tracts of land in Tonga remain unproductive and important crops have been infected with disease. Suboptimal infrastructure has hampered further development.

Production figures for agricultural crops are not available but the Office of Statistics data would indicate that production is declining in Tonga with corresponding dependence on imported foods (see Tables 1 and 2). The sector has been hit by the near-collapse of the squash industry. At the same time Tonga has been the victim of rigorous competition from other nations. Many of the fresh crops that are suitable for overseas markets are hosts to pests that must be mitigated prior to importation into the major market countries – Australia and New Zealand. The lack of fumigation facilities and only intermittent use of the (HTFA) treatment plant have been serious impediments to income generation. These issues have been responsible for loss of income, decline in motivation and mistrust between the private sector and the MAFFF. Both these issues are near resolution through improved communication, equipment repairs and maintenance programmes, and comprehensive legislation that defines inspection.

**TABLE 1: FOOD EXPORTS**

	2008	2007	2006	2004
<b>Animal products</b>	\$5,497,274	\$5,606,936	\$7,697,985	\$6,686,445
<b>Vegetable products</b>	\$7,307,500	\$8,598,266	\$9,422,188	\$21,422,472 <sup>a</sup>
<b>Prepared food products</b>	\$160,178	\$224,096	\$712,611	\$448,539
<b>Total</b>	<b>\$12,964,952</b>	<b>\$14,429,258</b>	<b>\$17,832,784</b>	<b>\$28,557,456</b>

<sup>a</sup> Includes \$9.2 million value of squash to Japan



**TABLE 2 FOOD IMPORTS**

	2008	2007	2006	2004
<b>Animal products</b>	<b>\$34,723,769</b>	<b>\$30,142,257</b>	<b>\$26,731,310</b>	<b>\$23,006,765</b>
<b>Vegetable products</b>	<b>\$10,533,684</b>	<b>\$8,745,293</b>	<b>\$7,963,348</b>	<b>\$7,992,638</b>
<b>Prepared food products</b>	<b>\$46,653,141</b>	<b>\$43,191,653</b>	<b>\$33,919,985</b>	<b>\$29,227,319</b>
<b>Total</b>	<b>\$91,910,594</b>	<b>\$82,079,203</b>	<b>\$68,614,643</b>	<b>\$60,226,721</b>

Increased production is central to agricultural recovery. Farmers and land-owning families can be encouraged to increase production through tried and tested campaigns. School garden competitions, ‘Save your Seeds,’ and ‘Plant Five a Day,’ campaigns have had a quantifiable impact on school, domestic and tourism agricultural activity in other PICs. Increased production not only allows exporters to complete export orders but supplies that exceed export demand mean that culling can be more rigorous. Quality standards are less likely to be infringed and the reputation of Tonga as an international trader is enhanced. At the same time culled material becomes available for local consumers and for processing. It is laudable that this has been recognized by the Ministry which has successfully negotiated the STABEX-funded food processing facilities. Such facilities are very important to the sector because they will become showcases for products that can be manufactured by the private sector. The refurbishment of the HTFA, the completion of the fumigation facilities and these processing facilities should engender a much more collaborative environment.

A significant advantage for Tongan growers is their experience at producing high quality produce for export. The squash industry continues but other crops have emerged with potential to find lucrative markets – especially in the off-season of target markets. Tomatoes, water melons, eggplants, breadfruit and the range of root crops all have promise to increase foreign earnings.

High production levels combined with scrupulous adherence to quality standards supported by skilled post harvest handling engender excellent reputations in international trade.

Such guiding principles result in high levels of blemished and slightly inferior crops that can provide income if re-worked. Consumption of home-grown foods is encouraged in other PICs with the production of recipe books to increase the appeal of local crops for home consumption (Parkinson, 2001).

**It is recommended that the Food Unit investigate the feasibility of producing an equivalent recipe book to encourage hotel and domestic chefs and cooks to make greater use of local raw materials.**

Cocker Industries Ltd have taken the step to process items for the local market based on the 'Me Too,' principle of product development – using local resources to emulate imported items. Further opportunities for import substitution exist within Tonga

For would-be exporters, processing is attractive particularly at times when freight rates for fresh items are at the highest levels ever. Preservation through processing means that food items can be consolidated into shipping containers which are considerably more economical than using air-freight to ship small consignments of perishable items. Losses during seasonal gluts can be mitigated by partial processing. For instance, bulk frozen fruits (tomatoes and pineapples) can be on-processed during low seasons. Once foods are processed they are no longer hosts for pests and diseases. However they are required to conform to Codex Alimentarius standards. In addition they may have to meet regional standards such United States Food and Drug Administration (USFDA) and Food Standards Australia and New Zealand (FSANZ).

For food processing to be sustainable and therefore profitable three elements must be in place:

- Continuous and continuing supply of raw materials at the correct quality.
- The technology to affect changes required by the market.
- The Market.

### **1.1 Raw Materials**

Low volumes of raw material eliminate opportunities to trade in commodity items. Fortunately there is still a place for small island traders in consumer items especially in carefully identified niche markets. As value is added by increasing the features in a food item (convenience, acceptability) market volume decreases. This suits the small island agricultural environment. Hence the target market position should be based on small volume with maximum value addition because maximum return is realized from the small raw material base.

The raw material base for processing should be complementary to the fresh export industry. Misshapen and undersized squash and undersized *Sato imo* for instance, are ideal candidates in supply-driven product development. At the same time excess supply of fruits and vegetables such as tomatoes and pineapples can be reworked into a range of products for which there is demand both within Tonga and throughout the established international markets.

Despite these advantages for food processors, electricity in the PICs in general and Tonga in particular is expensive. It can be considered to be a raw material. Profit margins for the food processors based in the islands are very low and all steps must be taken to

reduce costs. It is imperative that throughput rates are as high as possible so that the fixed cost element per item produced is kept to a minimum. Reliance on one raw material is hazardous and processors are urged to develop product ranges that ensure continuous usage of equipment and facilities.

## **1.2 Technology**

It is regrettable that the technological base in Tonga is declining. Royal Tongan Breweries, the Feng Shun Noodle factory, the Mafi Pilot scale cannery, the milk processing factory are all recent casualties inflicted by the global downturn and the declining domestic market. These closures have been mitigated in part by the opening of Cocker Industries Ltd, Kingdom Fresh and Nishi Industries are extremely important operations commanding every possible support. They have the potential to lead Tonga into a resurgent food processing nation.

The opportunity for additional processors arises with the advent of the general purpose processing facilities currently under construction in Nuku'alofa and Vava'u. Through these facilities small scale processing can take place and a whole spectrum of medium scale entrepreneurs can graduate to commercial scale processing. The potential impact of this facility is revolutionary. The facilities will be the focal point for future development of food processing. They can be used to cement cooperation between the Government and the private sector and establish the platform for private-public partnerships.

## **1.3 Market**

The market for processed foods from PICs is stratified.

The local market is price-sensitive. During this period of world-wide international recession, remittances to Tonga have dropped by 40% (Rob Solomon, PMs Office). This represents a significant fall in the spending power of Tongans. Hence there is a shift in consumer spending away from luxury items towards utilitarian products. Simultaneously there has been a rise in domestic planting of root crops and vegetables.

The overarching policy of the Government favours development of foods for export. This supports the strategy of generation of foreign exchange. For fresh foods Tonga must conform to importing requirements (quarantine and biosecurity) protocols. The imminent completion of fumigation facilities and the resurrection of the HTFA using the value chain approach (Tiseli, FAO, 2009) are welcome. However there are precedents throughout Australia and New Zealand for other quarantine protocols such as dipping of tomatoes from Queensland. Such techniques are less expensive than fumigation and cause less physiological damage to living tissue.

**It is recommended that alternative quarantine avenues are explored (dipping of tomatoes and water melon) to facilitate future export regimens.**

Many other export industries have been successfully based on the preservation of traditional island (ready-to-eat) foods. 'Palusami,' vakalolo and other such products now enjoy a steady market in Australia and New Zealand and sales of canned vegetables in coconut milk increase annually from Fiji.

As processing activity matures then adding convenience to, and preserving, traditional dishes such as 'lu,' and 'faikakai,' can be considered. Once these have been standardized and stabilized they may be sufficiently consistent for export. These items may require some marketing support which can be expensive but careful positioning of these items in selected retail outlets in Sydney and Auckland can result in commercial success. There are precedents for a number of products from the PICs that are now regular exports into expatriate island communities in Auckland and Sydney. Assistance for product launch and placement is available through the Forum Secretariat Pacific Island Trade offices in Sydney, Auckland, Tokyo and Beijing ([www.forumsec.org.fj](http://www.forumsec.org.fj)). These offices are particularly useful in identifying contacts and importers for island products.

In the context of the welfare of the nation however, it is important to consider import substitution as an additional strategy to alleviate the deficit in the balance of trade. To launch new foods onto the local market they either have to be familiar to local consumers. Novel foods should not be eliminated but they require advertising and consumer-education support.

**Although export is favoured it is recommended that the product development programme also includes development of products for the domestic market with the proviso that they are perceived as cheaper alternatives to imported competitors.**

However locally produced copies ('Me Too,' product development) with which the Tongan community is familiar will be successful only if they can be produced locally at lower prices, given that Tongan products are not valued as highly by the consuming public (see Section 2.2.8 Page 19). Full cost analysis is essential prior to embarking on production of items seeking this market (see Section 2.3.2, Page 22).

If the final retail price is not below the imported competitor the local product will fail. Hence decisions on product range must be based on sound objective data relating to volumes imported and the value chain supporting the supply of raw materials and the costs of production in Tonga.

The private sector must be aware of market dynamics and the shift in Tonga towards importation of basic, inexpensive foods. Large but unknown numbers of packs of two minute noodles enter the country with at least six brands on the market. Such a dynamic is not altogether without opportunity. Supplementary packs containing dried or frozen vegetables and spices designed to improve the acceptability and (equally importantly) the nutritional value could be produced in Tonga. With appropriate marketing, noodles can be transformed from barely adequate snacks into well-balanced meals. Sauces and spice mixes can add interest to bland island starchy staples encouraging greater consumption. They can also be a vector to increase the availability of vital nutrition supplements (eg vitamin A).

## **1.4 Packaging**

The cost of importing packaging material is often prohibitive for processors in the islands. Cans and glass jars are heavy and cannot be manufactured in Tonga. Flexible pouches are now familiar to most consumers and appear widely in Tongan supermarkets. Furthermore small consignments can be imported which eases cash-flow.

**It is recommended that product development activity emphasizes the advantages of flexible pouches over more conventional packaging such as cans, bottles and jars.**

There are precedents for packing a wide range of products in flexible pouches (eg papaya spears in juice - Cook Islands) and freight costs are lower.

Recycling causes less pollution and glass jars can be re-used provided that new lids are used at each product cycle. Processors' cooperatives provide lobbying power for approaches to Government for duty concessions and also increase buying power for imported items and should be considered as the industry matures.

## **2 APPROACH**

This study was approached within the framework of the Terms of Reference attached in annex 1.

### **Terms of Reference**

#### **2.1 Review all available evidence and information on the status of the food industry in Tonga.**

The data shown in Tables 1 and 2 were sourced from the Annual Foreign Trade report which is compiled by the Statistics Office. There are no internal pre-recession statistics available - the latest, broad-based data being 2008. The approach adopted therefore, was to visit all identifiable processors. At the same time the Tonga Grower's Federation was contacted to identify those growers and exporters that have the desire to begin value adding. Livestock farmers and the Fishing Industry Association of Tonga (FIAT) were consulted.

Those contacted are shown in Annex 1. Activity in the sector is currently confined to these few medium scale processors (including fisheries) with a number of cottage-scale entrepreneurs with the ambition to expand.

The food industry is dynamic and has suffered a number of setbacks in recent years. Products produced in semi-domestic facilities are present in the market but they are produced by groups who are difficult to identify. Many of the products are produced in un-controlled conditions and in some cases spoil at the point of sale. Further training in food preservation will be available during a second technical mission under this programme planned for June and this should be broadcast to this group.

A half day workshop was held as an introduction to existing and would be processors entitle 'An Introduction to Food Product Development.' This was designed to assist MAFFF in broadcasting the imminent opening of the food processing facilities and also to stimulate interest in product development as a means of increasing the income from locally grown crops. However this should be preceded by training in food handling and hygiene and the fundamental principles of food preservation.

**It is recommended that training scheduled for part two of this intervention that will include food hygiene, food preservation and product development is broadcast throughout sector.**

Training resources will be sent to Tonga prior to the visit to aid in attracting as many practitioners as possible.

Cocker Industries Ltd

This organization is led by an established entrepreneur who has based the product range that substitute imported foods wherever possible using local raw materials. Pineapple jam is made from excess pineapples at the height of the season and throughout the year using frozen pineapples. Other items include fried chips manufactured from the range of starchy staples, bottled water, nonu (*Morinda citrifolia*) oil and soap.

Kingdom Exports Ltd

This company has established extensive processing facilities for freezing root crops for export. There is enormous scope (and intent from the owner) to broaden the product range.

'ENE'IO Enterprises Co Ltd

This organization is a village based cottage industry producing chutneys, sauces, nonu and taro chips. They have been supplied with additional formulations. Vava'u has a significant soursop resource and a range of products that might ensue have been discussed. This organization represents an important nucleus for processing in Vava'u

Karalus Enterprises

This organization is in limbo pending the settlement of the tender process for the equipment. The tissue culture laboratory and the coffee processing equipment are essentially complete and can be resurrected as a new enterprise. This company has the potential to return to full prosperity.

## Organics Ltd

Organic produce herbs and vegetables and have a continuous and continuing established local market. This would be an ideal platform for small scale spice and herb added value products such as pastes and condiments in novel packaging.

## Rob Buster

Rob Buster owns a mixed crop farm. Chutney and jams are made from farm raw materials but are the main vanilla producers in Tonga. They have extended their range to vanilla tinctures and extracts. Rob Buster intends to extend his operation and options for new crops were discussed with him.

## Fishing Industry Association of Tonga (FIAT)

The fishing industry is characterized by having made little investment in product development. The industry however is based on a dwindling resource. Catches maximized during 2002 at approximately when the export value was in excess of \$15 million but in recent years changes to the migratory patterns of the pelagic fish. Boats have to travel further for catches. This is manifest in a decline in profitability (see Table 1).

There is a proposal for a fish processing facility to be funded by STABEX. This will provide a massive impetus for value adding in the fishing industry. The industry is conservative in its approach to product development with the STABEX plant design centering on the production of fillets and loins. However, it is important to recognize that fish is a dwindling resource and that trading in commodity items such as whole fish, loins and sides does not ensure the best possible return. Product development could ensure greater profitability especially if fish is 'extended,' by blending with other components (eg breaded and battered, fish pate etc).

FIAT has been informed about value adding and processing training planned for later in part two of this programme.

## Livestock

Chickens: There are six major egg farms with approximately 1,000 birds each. The meat processing industry is hampered without processing facilities. A previous report (Beyer, 2002: Ecoconsult Pacific) has concluded that the cost of feed and the demands on the water resource were prohibitive. At that time a small chicken freezing factory was in operation (300 birds per week), but this has since been closed. No further attempts have been made to restart the chicken processing industry. Chickens that are not back-yard killed are imported and are sold frozen through retail outlets.

Bovine animals: It has been recognized that there are opportunities for rearing Kobi beef for the Japanese market. Lia Hone College has a herd of 400 animals and is using AI

programme to improve the stock. Tupou College has 613 animals. There are no abattoir facilities so these animals are killed informally.

Dairy: Tonga operated a fully equipped dairy processing unit but it was not profitable therefore not sustainable. The current average yield of milk per animal is approximately 2 Litres per day which is not competitive. There are three dairy farms that sell milk to consumers in the locale. They are not registered and they do not process the milk. A dairy industry is not likely to succeed on this basis.

Sheep: Tonga was the recipient of 100 'Fiji Fantastic,' sheep provided through the FAO Regional Programme for Food Security. These are flourishing at the MAFFF farm but are now constrained by lack of grazing land. The farm must increase its grazing area by increased fencing. The animals will begin to suffer as nutrition is compromised. At the current time the policy is that MAFFF give the one ram and three ewes to farmers that can demonstrate that they are equipped with land, fencing, and generally good farming practices) to maintain a herd. MAFFF retains ownership of the females to be used for further propagation but the male offspring are retained by the farmer for ultimate breeding or slaughter. The success of this policy is that there is now a sizeable flock throughout Tonga (Tupo College now owns 103 sheep). This is an extremely promising project and in regard to production of sheep meat is highly successful. The constraint now emerges that the flock at Vaini is seriously undernourished since the grazing area is inadequate. The colleges face the same difficulty.

At the same time there are large areas of unused land that is ideally suited to sheep production. Most is privately owned.

Pigs: There are four major pig farms. It is difficult to define the exact number of piggeries in Tonga since there are a number of households that keep pigs but only trade occasionally. There are two butcheries that cure hams and bacons but the trade is informal. It is estimated (S.Sevelli; I-Butchery) that over 90% of pork is consumed unprocessed. To recommend that pigs are farmed formally so that disease and nutrition can be controlled would challenge Tongan culture. However the genetic improvement programme funded by Chinese aid may foreshadow more wide-spread processing at a later date.

## **ToR 2.2 Key Issues and needs for the Tongan Processing Industry**

### **2.2.1 Seasonality**

The successful processors are those processors that have based their processing on a regular raw material supply. Tinoapai Farms Ltd, Kingdom Fresh Ltd and Karalus have based their processing on raw materials for which there is a continuous year-round supply.

Fresh fruits and vegetables are valuable raw materials for processing. However, wastage levels of fresh fruits such as tomatoes, pineapples and watermelon are high at the height of the season and this is a disincentive for farmers. Every effort should be made to



prevent wastage. Freezing in bulk is technique that is used universally to preserve large volumes of crops at season glut.

**It is recommended that the two processing facilities (STABEX) are equipped with blast freezers and cold storage facilities so that these items can be frozen for later on-processing.**

Freezing at the height of the season incurs extra handling costs and power costs as products are frozen and then held in cold storage. These costs must be added to the raw material costs and adjusted for the length of time in the cold storage and fluctuations in the power costs as they occur. Costs are discussed in greater detail in Section 2.3.2 (Page 22).

### **2.2.2 Technology**

The technology base in Tonga is sparse. Karalus Industries has a world class tissue culture laboratory and a highly sophisticated coffee processing operation. Kingdom Fresh is equipped with good freezing and packing equipment but other operations are small scale - relying on little more than kitchen/restaurant scale equipment.

Small scale processors do not have the cash-flows to purchase appropriate equipment. Seed funding and venture capital are difficult to secure in Tonga. The STABEX-funded processing facility has the potential to incubate processing activity by providing access to equipment – a low cost entry into the industry.

**It is recommended that the two processing facilities are equipped with processing equipment that can be leased *in situ* to the entire spectrum of processors.**

For established processors with known markets the facilities located at Vava'u and Nuku'alofa will be used for product range expansion to increase market depth and width.

For newcomers to the industry, close assistance will be required in establishing the value chain, processing costs and the market. STABEX has a representative in Tonga and will source technical and marketing assistance where necessary. The day to day running of the facility will be transferred to MAFFF as STABEX support is withdrawn. It is however suggested that a board of control is established along the lines of that now recently installed to manage the day-to-day running of the HTFA facility in Tonga and recommended by the FAO/Tiseli report. This is discussed further in Section 2.3.3 (Page 23).

The equipment range is designed to process items such as jams, chutneys, chips, juices and frozen vegetables. These are items that have been identified by processors as having sufficient raw material for profitability. However this choice does not preclude the development of novel foods for export to high-value niche markets.

Emphasis has been placed on extensive freezer capacity (Recommendation Number 6) that can be leased by small scale processors for incremental withdrawal of bulk-frozen

raw material to support year-round processing. The additional costs incurred by partial processing are discussed in Section 2.3.2 (page 22).

There are no formal abattoir facilities in Tonga and this means that meat is not inspected, pH values are not achieved and the meat can put public health at risk. A general purpose abattoir capable of modification for sheep, pigs and beef will reduce the risk and produce meat of higher eating quality. Slaughter of whole animals will increase the availability of primal cuts maybe leading to reduced consumption of high fat cuts such as flaps.

**It is therefore recommended that a feasibility study is conducted to establish the economic and technical viability of a general purpose abattoir in Tonga.**

### **2.2.3 Marketing**

Government policy is predisposed towards exports of foods. The advantage of such policy is that new funds are imported into the country. Many crops are exported fresh and this is predicted to increase as the HTFA and fumigators are commissioned (Tiseli, FAO 2009).

However export of fresh crops cannot be considered in isolation. Fresh crops are must meet overseas market expectations. Therefore it is inevitable that wholesome crops with minor blemishes and defects which still have high value become available. For the farmers every effort should be made to create outlet for these items. This maximizes the financial return for the farmers removing the temptation to include substandard items in overseas consignments – suppliers' reputations are built on consistent high quality but easily tarnished by quality disappointments.

At the present time there is no guidance on the possibilities that can ensue from a supply-driven product development programme. Idea generation is a fundamental part of product development training and it should not be restricted to 'Me Too,' product development. Niche export markets can be highly lucrative and costs of manufacture easier to recover.

### **2.2.4 Land**

There are very large tracts of land currently lying idle. Much of the land would support the burgeoning sheep industry. Other land would be particularly suitable for growing cereal crops (especially millet) which is an excellent base for animal feed. Fishmeal is a by-product of in-depth processing of fish and may add to the viability of an animal feed industry eventually.

Fencing is the critical issue for sheep production. Unused land can be used for low maintenance livestock such as sheep.

**It is recommended that the MAFFF seeks funding from aid agencies for additional fencing to accommodate increasing sheep numbers.**

### **2.2.5 Packaging**

Packaging for products manufactured in the PICs is always expensive in comparison with those in overseas competing companies. Product development programmes in other nations have overcome this by using flexible pouches which are much less expensive to transport to the islands and which can be obtained in small consignments. Many nations now have processor cooperatives that collaborate to buy packaging components in bulk. Poly ethylene terephthalate (PET) bottle blowing equipment is now relatively inexpensive. The Cooler Pure Water company has a PET moulding machine – it is possible that bottles can be manufactured under a leasing arrangement.

Webs, films and laminates can be imported in bulk and fabricated to processors' specifications in Tonga.

### **2.2.6 Funding**

Expansion of promising food companies is hampered by inaccessibility of funding. Other interventions have highlighted the problem of financing. It is suggested that private investors are contacted as an alternative to the commercial banks whose current policies are more punitive than in other PICs. Again a processors' cooperative may have some influence with aid agencies and the banks to ease the funding situation.

### **2.2.7 Industry Perception of the Ministry of Agriculture Fisheries and Forests**

Growers, industry practitioners and other private sector stakeholders have been somewhat suspicious of Government but attitudes are improving as a result of more regular dialogue and consultation. Government resources are scarce and so must be directed to facilitate greater activity within the sector. Research and extension services should not be conducted in isolation – programmes must respond to needs of the stakeholders. Regular meetings between the stakeholders including legislators, private sector and the Ministry staff would provide a forum for grievances and policy advice.

A 'Help Desk,' with a dedicated phone line has been used in other PICs to facilitate dialogue between stakeholders and Government. However the desk must be supported with an awareness campaign and the necessary staff to follow up topical items.

It is encouraging that the new CEO for Growers Federation has supported the proposal for more dialogue and plans to continue dialogue between the stakeholders on a regular basis.

### **2.2.8 Consumer Perception that Tonga-made is Inferior**

There is a perception among the retail and consuming public that items produced in Tonga are inferior to those produced overseas. This may have grown out of the neglect for consistency and perceived value for money. Campaigns to promote the consumption

of local crops have helped other developing nations. The Tupu I Tonga campaign of 2004 was designed to raise awareness of Tongan produced items. The launch was accompanied by an exhibition of the enormous range of local foods and handicrafts.

**It is recommended that the MAFFF initiate discussions with the Ministry of Labour, Commerce and Industry to organize a campaign re-ignite confidence in Tongan-made products.**

**2.3 Carry out a SWOT (strength, weakness, opportunities, threat) analysis for the sector and its stakeholders; to identify products with the best potentials for development including appropriate technologies.**

The issues annotated here are discussed throughout the body of this report.

**Strengths:**

- Highly literate but relatively inexpensive workforce.
- Hard-won reputation for producing selected highly acceptable crops (tomatoes, water melon, chilies squash.
- Isolated from many pests and diseases.
- Excellent communications.
- Some infrastructure that provides access to farming areas.
- The political intent to increase the well-being of the Tongan people.
- Membership of WTO.
- Infrastructure in place for the implementation of Codex.
- Commitment to food processing through the food processing facilities (STABEX).
- Technological support for export of fresh produce (HTFA, Fumigator) and the expertise to run them.
- Crop seasonality provides windows of opportunity for export to New Zealand and Australia.
- Experience in trading with overseas nations.

**Weaknesses**

- High dependency on imported foods.
- Poor stakeholder communications.
- Inadequate infrastructure in some areas.
- Lack of venture capital resulting from lack of investor confidence.
- Slow Ministry response to private sector needs (HTFA, fumigators, alternative treatments for quarantine).
- Inadequate farmer understanding of the commercial aspects of farming.
- Inadequate farmer understanding of obligations in fiscal and production contractual agreements.
- Paucity of technology.

- Only isolated understanding of market requirements.
- Crops seasonality.

## **Opportunities**

- Off-season production of high value fresh crops
- Fresh crops exports can resume with the completion of the fumigators and the refurbishment of the HTFA facilities as laid out in the value chain approach recommended in the FAO Report (Tiseli,2009).
- The availability of fertile flat well drained land for further cultivation
- Year-round processing is possible with appropriate handling of crops at the height of the season.
- Vava'u can become a significant source of products with the establishment of the fumigator and food processing facilities.
- Countries in the free trade areas are potential markets.

## **Threats**

- The lack of outlets for farmers for produce as a disincentive for further production.
- High standards imposed by market countries (FSANZ, USDA).
- Competition from other PICs.
- Rising costs and reliability of distribution networks
- Declining remittances reducing spending power of local consumers.

### **2.3.1 Products with the Best Potential for Processing**

#### Seasonal Crops

The philosophy behind the identification of products with the best potential for processing is that based on those that support the fresh crop exports. Hence the raw material for processing are blemished fruits and vegetables not reaching export standards, or those which exceed export requirements. In some cases excess fresh products will be frozen at the height of the season. Hence they will be supply-driven products.

#### Fruits

##### *Pineapples:*

Sweet and sour sauce

Jam

Ice-cream topping and ripple

Pineapple juice

*Tomatoes:*

Tomato sauce and chutney

Chili tomato sauce

Tomato juice

*Water Melon:*

Water melon juice

Jellies

Mineral waters

*Soursop*

Juice

Ice cream ripple

Jam

*Root crops*

Root crops are available year-round and form the base for a frozen root crop industry. There is scope for the export of free-flow frozen breadfruit in addition to the normal range of taro, cassava and kumara (sweet potato). Additional to this can be added frozen *Sato imo* and breadfruit.

Squash can be processed into soup base, free-flow frozen convenience vegetables and baby food base.

Root crops can be further processed into frozen French fries, and chips.

### **2.3.2 Economic Viability**

Sustainability equates to profitability and it is crucial that economic feasibility is established before any financial commitment is made for equipment, raw materials, packaging and processing facilities by private sector manufacturers. As the formulation reaches finality, the features required for sale are established and then it becomes possible to define production costs. Estimated production costs are derived from the elements shown in Table 3.

On completion of the final product formulations there must be a full analysis of costs involved at each stage of the manufacturing chain. Products based on seasonal crops will incur additional costs over competitors because of blast freezing and storage of raw materials.

Blast freezing costs have been solicited from three Fiji-based processors whose costs for freezing and storage are remarkably similar. They report that for the first month (including blast freezing) the costs are \$FJD 6c per Kg for the first month and \$FJD 4c per Kg for every month while in cold storage. This is based on power charge of \$FJD

48c per KWh. Corrected for currency differentials and the cost of power in Tonga of \$TOP 96c per KWh these equate to \$TOP 12.5c per Kg for the first month including blast freezing and \$TOP 8c per Kg per month for cold storage. These freezing costs must be added to the raw material costs and they will depend on the time spent in the frozen storage and fluctuations in power costs as they occur.

The processing facilities will be the vehicle by which most new entrants to the food industry can define these costs. Once these elements have been defined, the product must cost less than its competitor in a price-sensitive environment such as the domestic Tongan market.

**TABLE 3: PROCESSING VALUE CHAIN**

Value Chain	Costs
Farm gate	Raw Material
Transport to processing facility	Fuel Human resource
Storage	Human resource Power for blast freezing Power for frozen storage
Processing	Human resource Additional raw materials Equipment lease or purchase Power Water Waste disposal Packaging Repairs and maintenance Fixed costs: rates, debt servicing, phone rentals, depreciation Research and Development
Final product storage	Fixed costs Power
Marketing	Promotional visits (fuel) Human resource (sales) Advertising and promotional items
Distribution	Fuel Human resource

It is impossible to define the costs without the formulation, the equipment and the raw material costs but a commonly used formula is to triple the costs of the raw material and

add a further 10%. Final costs rarely exceed this figure and it can be used as a working model for estimating success. Three options are available for those products that fail to undercut the price of the competition:

1. The product must be reformulated to reduce costs or add further value.
2. A market that is prepared to meet the higher price must be found and targeted.
3. The product must be abandoned.

### **2.3.3 Processing Facility Management**

The completed processing facilities will be handed to the MAFFF for ongoing management. This is scheduled to be completed before December 2010. To stimulate food processing in Tonga these facilities have to be the instrument for development and processing for use by the private sector. To ensure sustainability, the facilities must be maintained and equipment and buildings repaired as necessary. It must have management aided by technical staff to prevent abuse and to ensure that the service can be maintained. Hence a budget for ongoing repairs and maintenance including salaries and wages must be identified. However a user-pays charge must be met by private sector participants. Charges can be recouped in a number of ways either on a cost plus basis or by charging royalties on successful products.

It is suggested that the management board comprises representatives from all stakeholder groups including MAFFF, the private sector processors, farmers groups and successful entrepreneurs.

**MAFFF are alerted to the fact that there will be a requirement for management and technical staff to maintain and operate the STABEX-funded food processing facilities and that funding must be identified for this purpose.**

**MAFFF are further alerted to the fact that the facilities will require constant repair and maintenance and that funding should be identified for this purpose.**

### **2.3.4 Technological Requirements**

Food processing is fragmented into a series of steps known as unit operations. It is anticipated that the products identified here (that are not already in production) by the private sector can be developed in the STABEX-funded processing facilities. The following processes have been identified. The equipment to affect those unit operations are given in Annex 3.



### Jams Jellies Sauces (Juices)

- |                              |                                      |
|------------------------------|--------------------------------------|
| 1. Size reduction/separation | 10 Litre Homogeniser/blender         |
| 2. Heat exchange/mixing      | Steam jacketed pan                   |
| 3. Conveying                 | Pump                                 |
| 3A. Separation (juices)      | Filter press                         |
| 4. Filling                   | Header Tank (semi automatic filling) |
| 5. Sealing                   | Vertical rotary sealer               |

### Chips

- |                              |                        |
|------------------------------|------------------------|
| 1. Size reduction/separation | Abrasion peeler        |
| 2. Washing                   | Steep tanks            |
| 3. Size reduction            | Slicer                 |
| 4. Separation                | Sieves                 |
| 5. Heat exchange             | Deep fryers            |
| 6. Separation                | Draining               |
| 7. Packaging                 | Hand packaging         |
| 8. Sealing                   | Vertical rotary sealer |

### Frozen Root Crops (French Fries)

- |   |                    |
|---|--------------------|
| 1. Size reduction/separation              | Abrasion peeler    |
| 2. Size reduction                         | Hand or chipper    |
| 3. Size reduction (French Fries)          | Mechanical chipper |
| 4. Heat Exchange Blanching (French Fries) | Deep Fryer         |
| 5. Heat exchange Cooling (French Fries)   | Cooling trays      |
| 6. Heat exchange                          | Blast freezing     |

### **ToR 2.4 Recommend a national strategy to accelerate development of the Food Industry addressing all aspects of Food Safety and Control.**

In many member countries of the World Trade Organisation (WTO), food control systems have been based on the FAO/WHO guidelines and Codex standards. Effective food control systems are essential to protect the health and safety of consumers and critical in enabling countries to assure the safety and quality of their foods entering the international trade and to ensure that imported foods conform to national requirements. Immediate strategies centre on the food that is available for sale, barter or exchange but the wider implications encompass biosecurity including border protection and the safe use of agrochemicals. Five building blocks have been identified as the means to achieving the stated aims

#### **2.4.1 Food Law and Regulations**

Food legislation is the unambiguous, objective and unbiased document that dictates the necessary actions that ensure safe wholesome foods. Tonga has enacted the Public Health Act 2008 which is currently undergoing some amendments to define the

Competent Authority and the responsibilities of each Ministry. The Act was promulgated by the Ministry of Health as the Public Health Act 2008. The Food Bill which is awaiting endorsement by Cabinet requires some modification to eliminate duplication and identify executive roles with more definition. Nevertheless food legislation is at an advanced stage and has been facilitated by the Technical Assistance in Support of Strengthening the Food Safety and Food Quality Control System in the Kingdom of Tonga (Nyampong, FAO, 2006).

In the event that the merging of two articles cannot be resolved without legal advice, **it is recommended that a separate review is undertaken to ensure that all legislation including that covering biosecurity and quarantine are harmonious and comprehensive.**

Internationally recognized food standards however are enshrined in Codex Alimentarius and the Ministry has been empowered to communicate using computer and office equipment provided by FAO. Tonga is the current regional coordinator for the FAO/WHO Coordinating Committee for North America and the South West Pacific. In order to provide comprehensive, coordinated food quality and safety matters across the sectors, an active Codex committee can be very useful.

**It is recommended that the National Codex Committee is re-established to ensure that issues relating to food standards generally and Codex in particular remain at the forefront for all stakeholders.**

#### **2.4.2 Food Control Management**

Food control management is the system that ensures that legislation is in place for the protection of consumers, that an inspection service is available to verify safety and honesty that the system can be verified by objective laboratory analyses and that there is adequate feedback to ensure that trauma is contained effectively and that the same incident is not repeated. Tonga awaits the completion of legislation which will determine unequivocally the 'Competent Authority,' the body that is empowered to enforce food related action.

#### **2.4.3 Inspection Services**

Incoming items of food are inspected by the Quarantine Department for pests and diseases, by the Ministry Labour, Commerce and Industry (MLCI) for fiscal purposes and occasionally by the MAFFF Food Division when available. In-country food inspections are undertaken by the Ministry of Health, the Ministry of Labour and the MAFFF Food Unit and the Quarantine Department and the Ministry of Commerce Industry and Labour (occasionally by the Ministry of Finance). Inspections are conducted on an *ad hoc* basis. Given limited resources, risk-based approach should be considered. Any new approach should empower inspectors to assess Good Hygienic Practices and Good Manufacturing Practices. Hazard Analysis and Critical Control Points Currently, there are no inspectors in the Food Unit and there is little communication between agencies about the programmes and the outcomes of inspections.

Hence there are occasions when foods are not subject to inspection and there are instances when incoming food is subject to inspection by four agencies. In spite of this, there are many items on sale that do not conform to Codex standards. More coordination in the inspection service will assist in avoiding duplication - at the same time ensuring that there is a reduced risk of substandard food reaching consumers.

**It is recommended that a review of the inspection system is undertaken to ensure that there is no duplication or gaps and to identify training needs for inspectors that take the steps towards a risk-based inspection approach.**

The defined output should be a co-ordinated, risk-based inspection service in which scarce resources are not duplicated while ensuring that full protection through rigorous inspection is provided.

#### **2.4.4 Laboratory Services: Food Monitoring and Epidemiological Data**

In order to meet the requirements of Codex it is necessary that there is access to laboratory services. Unfortunately the costs of such services are prohibitive for most analyses. The cost of equipping a laboratory to undertake analyses such as basic nutrient analyses (protein fat, saturated fat, trans fatty acids, fibre, energy and even some vitamins) is estimated to exceed \$TOP 2.5 million (Architects Pacific; J S Hill and Associates). This does not include the cost of fittings such as a clean room, fume hoods and other essential items. The frequency with which these analyses will be required is so low that the cost of consumables for each assay would be very high indeed.

For new products requiring nutritional labelling then the products can be sent to AGAL (Sydney) or the Institute of Applied Sciences Laboratory at USP in Suva.

Some items require analyses to be conducted within four hours. Water characteristics such Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD) soluble solids and suspended solids are regularly undertaken at the Tongan Water Board Laboratory.

Microbiological assessments must also be conducted within four hours of collection. Once again the cost of equipping a fully compliant laboratory for food is prohibitive. It is therefore more practical to use the Hospital Microbiology Laboratory on a contractual basis whenever necessary.

The STABEX-funded food processing facility has space set aside for laboratory services however after discussions with the Director of Agriculture and the STABEX representative it has been concluded that laboratory should be used for quality control of products developed. As such only limited equipment is required. These are given at Appendix 4.

**It is recommended that overseas laboratories are used for nutrient, pesticide, contaminants and poisons analyses and that the construction of new laboratories is deferred until momentum in the food processing sector increases.**

**For tests that must be conducted within a short period (microbiological, water analyses) it is recommended that tests are conducted at the Hospital Microbiology Laboratory and the Tongan Water Board Laboratory.**

At the same time, fish processing companies have requirements for histamine and Ciguatera toxin analyses. These analyses can be conducted using kits (that can be used on boats). **It is recommended that the laboratory attached to the food processing facility should be equipped with these test kits to support the fishing industry until such time that the STABEX-funded fish processing unit is established.** Assessment of histamine and ciguatera toxin analyses are most valuable if conducted just prior to export to account for build-up during capture, landing, processing and other handling events.

#### **2.4.5 Information, Education, Communication and Training**

An increasingly important role for food control systems is the delivery of information, education and advice to stakeholders throughout the farm-to-table continuum. These activities include the provision of balanced factual information to consumers; the provision of information packages and educational programmes for key officials and workers in the food industry; development of train-the-trainer programmes; and provision of reference literature to extension workers in the agriculture and health sectors.

Simultaneously food control agencies should address the specific training needs of their food inspectors and laboratory analysts as a high priority. These activities provide an important means of building food control expertise and skills among all stakeholders, and thereby serve an essential preventive function. Consumer health is protected by the Ministry of Health. Consumer welfare is protected by the MLCI and biosecurity by the MAFFF

These five pillars should form the basis of future installation of a national food control system. The recommendations made here have been formulated on the basis that resources are limited. However more efficient inspection services can result in more comprehensive coverage with less duplication. In most instances, laboratory services can be sourced either in existing laboratories or within laboratories throughout the region.

**ToR 2.5 Assess existing analytical capacity (infrastructure, human capacity) and determine analytical needs based on identified opportunities and sustainability criteria. Identify capacity building needs and laboratory equipment requirements to match projected needs.**

The analytical capacity has been discussed in some detail in ToR 3. However, it is necessary to assess the hazards since this will form the basis for future laboratory design.

In turn this will support the risk-based approach recommended for the inspection services for the coming period.

The hazards that can affect food are broadly classified into:

- Chemical
- Biological and
- Physical

*Chemical hazards* are the agro-chemicals such as pesticides, herbicides and plant hormones, heavy metals and the full range of toxicants that can occur as a result of sabotage. Organic agrochemicals are detected using either high pressure liquid chromatography (HPLC) or gas chromatography (GC). These are expensive items and only run economically if the number of samples is large. Metals are detected using either atomic absorption or ion capture spectrophotometry. Laboratories in Australia and New Zealand undertake many of these analyses and this is the cheapest option since the cost of this equipment is high and the consumables used in their operation expensive. Laboratories analyzing a large number of samples therefore are less expensive than those that enjoy economies of scale. Furthermore there is no requirement for capital outlay for sophisticated equipment.

*Biological hazards* are microbiological or invasive insects or other infesting species. Microbiological assessment must be initiated within four hours of collecting samples. At the moment this can be achieved at the hospital where most food poisoning organisms can be assessed. Insects and other invasive pests can be identified and remedial action can already be taken by the Quarantine Department. As food processing activity gains momentum the requirement for microbiological assessment will increase. Microbiology laboratories are not compatible with chemical laboratories so it is not feasible to include microbiological assessments at the food processing facility.

**It is recommended that MAFFF begins the process of obtaining funding for a microbiology laboratory and make budgetary provisions for staff, consumables, repairs and maintenance.** It will be necessary to recruit a fully qualified microbiologist/food scientist responsible to the Competent Authority. The microbiologist will require technical assistance. Since the laboratory will be used by several agencies (Ministry of Health, MAFFF and MLCI), it is suggested that it falls within the responsibility of the Competent Authority. It may be possible to recoup some running costs through a user-pays system.

The microbiology laboratory should be equipped with:

- Three incubators
- Fume hood
- Autoclave
- Plating bench
- Anaerobic jar

- Domestic chest freezers (- 20°C)
- Refrigerator (4-7°C)
- Stomacher
- Sufficient glassware for dilution (dilution bottles, disposable Petri-dishes, pipettes, test tubes, durum tubes)
- Microscope (binocular, 10x, 400x, 1,000x)
- Consumables (media, reagents, gloves)
- Water still
- pH meters
- Top loading balance 0-2,000g +/- 0.1g

*Physical hazards* are usually inadvertent access of tobacco, wood, textiles, soil, sand and soil. These can be assessed using a microscope and where contamination is small - a filth test. The Vaini laboratory is well equipped to detect insects and small items of physical contamination. Filth tests are very rare and can be conducted at the AGAL laboratory or the Institute of Applied Sciences, USP Suva.

Hence the overall conclusion is that the STABEX-funded food processing facilities should be equipped with basic quality control equipment to support the anticipated product range. The soluble solids and the pH of these products are fundamental to keeping quality and safety. Below pH values of 4.2 most food poisoning organisms are inhibited. There are very few pathogenic species among the yeasts and moulds that grow in these high acid environments. Their presence is easily detected so that they rarely cause pathological disease. In addition this range of microorganisms is easily destroyed by heating. During development of the product range safety margins will be in-built to ensure that no bacteria survive and so there is no practical risk to consumers.

**TABLE 4: SUMMARY OF LABORATORY ACCESS**

	<b>HAZARDS</b>	<b>In-country laboratory</b>
<b>FOOD SAFETY</b>	Chemical Biological Physical	No Yes No
<b>FOOD BORNE DISEASE TRACEABILITY</b>	Chemical Biological	No Yes
<b>WATER</b>	Biological Chemical	Yes Yes
<b>NUTRITIONAL LABELLING</b>	Chemical	No

The equipment required initial stages of processing are pH meters and refractometers to determine soluble solids content of jams, juices and sauces. Accurate temperature control is required and a vacuum oven will be used for moisture content determinations. As discussed a microbiology laboratory is recommended as the processing industry matures.

A dedicated structure is required for this and so the food processing facility is unsuitable to house such a laboratory

**ToR 6 Provide appropriate recommendations to MAFFF on best possible approaches/option to accelerate the development of the agro-processing industry.**

MAFFF has the responsibility to facilitate activity within the agriculture sector and undertake the roles that are beyond the resources of the private sector. As the executor of legislation it has the responsibility to ensure that the nation is protected at its borders from invasive species and to ensure that the public health is maintained through safe and effective use of agro-chemicals and that opportunities for malpractice are minimised. The MAFFF is the agency to monitor overseas research activities and adapt them to Tongan conditions. Trainers can be sourced within the Ministry or assistance can be requested from outside agencies.

There are two constraining factors in the development of a full-capacity food processing industry are low production volumes and shifting market dynamics.

### **6.1 Low production volumes**

A number of factors have resulted in the steady decline in plantings of crops but the most important is the continuing decline in financial returns from farming. These are caused by:

- The high cost of agro-inputs such as fertilizer, pesticides, fencing and appliances.
- Diseases.
- Delayed advice about developments in farming practices.
- Dwindling trends in market volumes caused by failure to meet quarantine requirements of the importing country.
- Low prices for fruits and vegetables sold on the local market.
- High wastage caused by seasonal overabundance.
- Decline in the number of farmers.

It is suggested that the food processors consider forming an association. It will be possible to cooperate over purchasing especially from overseas suppliers that might offer price reductions for larger orders – this is particularly relevant for packaging materials. In addition, associations have more lobbying power with Governments and may be able to influence such issues as duty on imported items destined for manufacturing (see Section 6.2) and the apparent anomaly that allows finished consumable products to be imported duty-free while manufacturing components attract duty.

### **6.2 Shifting market dynamics**

National and international markets are dynamic and are influenced by such factors as price, availability, convenience, quality, consumer perception and competing products.

For local markets, buying consortia (Chinese) have cooperated to import products at very low prices and convenience stores are able to set low retail prices. Because the buying range is very high they are able to offer a wide range of products year-round. Statistics indicate that imported items are mostly processed, convenient products (of which two minute noodles are the most popular).

In some instance processed foods found in supermarkets are extremely cheap (450g coconut milk available at \$TOP 1.79). It is impossible to compete with this price without some fiscal protection. There is no relief on duty and consumption tax (value-added tax) for raw materials including packaging destined for the manufacturing industries in Tonga. At the same time some complete items (bottled water) enjoy concessions. It is very difficult for local processors to compete under these circumstances.

Locally grown root crops are less convenient, packaged in ways that suit the producer not the consumer (10 – 15Kg baskets of cassava and yam). Such tradition would indicate that these starchy staples are price-sensitive. However these volumes may not suit all consumers. The market for alternative-sized packages should be tested.

For international markets, the continuing strategy of competing nations is to increase market share. This is achieved through continuous programmes of product development and the most successful agricultural and food trading nations invest high proportions of GDP in research and development. They are able to lead market trends and enjoy the price advantages that reward the first on the market. Hence it is important that timely market information is made available to stake-holders. Insufficient use is currently made of the Pacific Island Forum Secretariat Trade offices in Sydney, Auckland Tokyo and Los Angeles.

It is important however that the private sector retains its own marketing role. The roles of Government should not go beyond the provision of market information of national importance, negotiation of trade access treaties bilateral quarantine agreements and to act as the medium to broadcast changing market requirements (EU, FSANZ and USFDA).

Although the Codex Contact point remains with the Director of Agriculture, the roles and responsibilities of that post are such that relief should be provided as far as possible. The Food Division has an obvious role to play not only in assuming day to day management and monitoring of Codex issues but as a high profile focal point within Tonga for broadcast and maintaining food standards – an obligation required by membership of the World Trade Organisation (WTO).

### **6.3 The Food Division**

Currently the food division operates a small development kitchen which used to prepare semi-processed foods such as jams and chutneys. This is an excellent base on which to build intellectual capacity in food processing, food product development, food hygiene



and handling. This will be invaluable for food processors that plan to use the food processing facilities and there is synergy to be enjoyed by uniting the current development kitchen with the processing facilities. This programme of training will be provided in part 2 of this technical assistance mission.

To increase the profile of the Food Division both domestically and internationally, it is suggested day-to-day issues relating to Codex may become an additional role. This can be achieved by selecting the Director or her staff as a Codex correspondent supplying the Codex contact point with important information and providing secretarial services for the National Codex Committee (NCC). This function must be supported with appropriate training in Codex.

**It is recommended that the Director of the Food Division identifies appropriate staff for training in food processing, food product development and food handling and hygiene.**

It is envisioned that these staff will play an important role in the day to day functioning of the food processing facilities.

**It is recommended that the Director of the Food Division identifies appropriate staff to assume the role of Codex correspondent and secretary to the NCC who can supported by training in Codex.**

#### **6.4 The Way Forward**

1. As Tonga struggles to recover from its economic nadir it is suggested that the Ministry and the Growers Federation combine in a submission to the Ministry of Finance to seek short-term fiscal relief for imported agro-inputs including fertilizer, fencing material, pesticides, biocides and components for animal feed. This can be reviewed once the food processing sector gains momentum.
2. A similar exercise to assist the nascent food processing industry is recommended to assist with items such as selected food additives (processing aids), small scale equipment and packaging.
3. The Research Division is very clear on its roles of monitoring overseas research results and adapting this to Tonga's special conditions. The practice of using farmers in assisting with field trials is both foresighted and relevant. Information exchange can be improved with regular field days and training. The Department should include in its monitoring programme the availability of relevant experts and the funding mechanisms that might be used for in-country training.
4. Facilities that support fresh exports (HTFA, Fumigator) must not be allowed to fall into disrepair and the Department of Quarantine must prepare a formal maintenance schedule to avoid breakdowns. Wherever possible smaller-scale

- backup facilities should be purchase to cover all eventualities (Refer to Clyde Engineering: [www.clyde.com.fj](http://www.clyde.com.fj)).
5. The Food Division of the MAFFF should assume the role of secretariat to the NCC and should be the National Correspondent for Codex communications.
  6. It is suggested that an additional training in Codex is arranged for the Director and selected staff of the Food Unit.
  7. The Food Division operates a development kitchen for the training of women's groups food product development. It is recommended that the trainers of this group receive training in food handling, the principles of food processing and food product development so that they are prepared to undertake development work at the STABEX-funded food processing facilities.
  8. The high wastage at season glut results from inadequate coordination among farmers. During the recent round table discussion (Beyer, MAFFF and the private sector) the CEO of Growers Federation has indicated that dialogue between the stakeholders will take place on a regular basis.
  9. It is important that planting schedules are reviewed to ease the difficulties farmers face when the same crops flood the market.
  10. It is suggested that the Growers Federation and the MAFFF investigates the use of cellphones for dissemination of extension and market information at least once a week.
  11. The Ministry must be aware that the excess crops produced at the height of the season will be the raw material base for processing. Product development programmes at the food processing facilities should reflect this.
  12. The perception that Tongan-made items are inferior is considered to have arisen out of lack of reliability. A high profile NCC which includes retailers, consumer groups and the inspections services can assist in the establishment of a coordinated more rigorous inspection service. In other PICs the NCC has secured funding for a review of the inspectorate.
  13. It is recommended that consideration is given to the revival of Tupu I tonga campaign which sought to re-instill confidence in Tongan-made items (Recommendation 10).

## ANNEX 1: TERMS OF REFERENCE

### TECHNICAL ASSISTANCE ON AGRO-PROCESSING IN TONGA

#### Part 1: CONSULTANCY TO IDENTIFY AGRO-BASED PROCESSING OPPORTUNITIES FOR TONGA

##### 1 Background

Under the Government's Strategic Plan 8 (SDP8), agriculture and fisheries including food, livestock and forestry are highlighted as the key economic sectors that can make major contributions to achieving two of the SDPS's goals namely:

Goal 3 - Promoting sustained private sector-led growth; and  
Goal 4 - Ensure equitable distribution of the benefits of growth

The agricultural sector has maintained a significant role in contributing to the growth of the Tongan economy in the following forms:

- Major food source for majority of the Tongan people
- Accounts for 28% of GDP
- Accounts for 70% of average total exports over the past 10 years and
- Provides 40% of total employment'

Bring the major source of livelihood for majority of the Tongan people, Agriculture offers the best potentials for the development and growth of the Tongan economy particularly in the area of root crops, forestry including fruit trees development, livestock development, agro-processing and agriculture development. Under the Ministry of Agriculture and Food, Forests and Fisheries Corporate Plan and in alignment with the Government's SDP8 agro-processing utilizing root crops and fruit tree crops is being recognized as having good potentials for development to facilitate import substitution and for exports, and will also support food security. Tonga's agro-processing industry is very much under-developed due to a number of reasons including:

- Lack of drive/commitment to seriously promote and explore the potentials/opportunities for development of agro-food processing/value-adding products utilizing local produce/products
- Lack of technical and marketing expertise on agro-processing/value added Production
- Lack of awareness by the communities of the Agro-products and appropriate technologies which offer the best potentials for development.
- Lack of incentives including training on agro-processing and agri-business

As a first step, the Food Unit of MAFFF has conducted in 2008 a Baseline Survey on existing private sectors and household entrepreneurs operating in the industry. This survey focuses on "who is doing what", the rate and level of development food safety practices (sight observation at time of visit), needs and concern of the Food Processors.

The Ministry is currently without a Food Technologist or qualified personnel to assess the national situation with the view to promoting improvements and development of the

food industry in Tonga especially agro-processing. MAFFF therefore seeks the assistance of a technical expert to assist Tonga in identifying and recommending the best ways and means and the opportunities that exist to accelerate the development of Tonga's food processing in Industry.

## **2 Description of position (supervision and duties)**

Under the general supervision of the FAO Representative and the technical guidance of the FAO SAP Food and Nutrition Officer, the consultant will work in close collaboration with the Ministry of Agriculture, Forestry and Foods and private sector representatives in Tonga, to undertake the following duties:

- 1 Review all available evidence and information on the status of the food industry in Tonga.
- 2 Carry out consultations with stakeholders to determine concerns key issues and needs of the domestic food processing industry.
- 3 Carry out a SWOT (strength, weakness, opportunities, threat) analysis for the sector and its stakeholders; to identify products with the best potentials for development including appropriate technologies.
- 4 Recommend a national strategy to accelerate development of the Food Industry addressing all aspects of Food Safety and Control.
- 5 Assess existing analytical capacity (infrastructure, human capacity) and determine analytical needs based on identified opportunities and sustainability criteria. Identify capacity building needs and laboratory equipment requirements to match projected needs.
- 6 Provide appropriate recommendations to MAFFF on best possible approaches/option so accelerating the development of the agro-processing industry.

## **3 Outputs**

The consultancy will produce a comprehensive report addressing the above areas, and a concise end of consultancy report summarizing findings, conclusions and recommendations with a draft report to be discussed with stakeholders at the end of field visit. The output is to be submitted to FAO-SAP in electronic form (MS Word) for review and clearance.

## **4 Qualifications**

- Advanced university degree in food science, food processing/agro-business or related relevant subject;
- At least 10 years practical experience in food processing/value adding/agro business;
- Experienced and knowledge of Tonga and/or the Pacific region and Asian region;
- Working knowledge of English.

Envisaged starting date: August 2009  
Duty Station: Nuku'alofa, Tonga with in-country travel  
Language: English  
Duration:

## ANNEX 2: CONTACTS

		PHONE (++676)	EMAIL	FOOD PRODUCTS
Cocker Enterprises Ltd	Edgar Cocker	7775001	<a href="mailto:edgarc047@yahoo.com">edgarc047@yahoo.com</a>	Jam, juices chips vanilla. Coconut oil.
Kingdom Fresh	David Edwards	7718002	<a href="mailto:david@exportculture.com">david@exportculture.com</a>	Frozen root crops
'ENE'IO Enterprises Co Ltd	Judy and Haniteli Fa'anunu	7715350/7756169	<a href="mailto:eneiobg@hotmail.com">eneiobg@hotmail.com</a>	Chutney fried chips, nonu
Tinopai Farms	Pousima Afeaki	8783729	<a href="mailto:tinopai@kalianet.to">tinopai@kalianet.to</a>	Coconut, coconut oil, fresh vegetables
Paul Karalus	Paul Karalus	8781657	<a href="mailto:paulkaralus@gmail.com">paulkaralus@gmail.com</a>	Tissue culture, frozen vegetables, coffee
	Lee Miller	8775205	<a href="mailto:leeintonga@gmail.com">leeintonga@gmail.com</a>	Organic vegetables, chutneys
Pacific International (Tonga) Ltd	Kantaro Oishi	27119	<a href="mailto:pitonga@kalianet.to">pitonga@kalianet.to</a>	Noni
Nishi Trading Co Ltd	Minoru Nishi Jenny Nishi	63028 43091	<a href="mailto:nishi@kalianet.to">nishi@kalianet.to</a> <a href="mailto:nishijm@kalianet.to">nishijm@kalianet.to</a>	Fresh root crops
I-Butchery	Steve Seveli	873150	<a href="mailto:stssweb@gmail.com">stssweb@gmail.com</a>	Meat
Pangia Motel	Earl Emberson	8815762	<a href="mailto:pangiamotel@kalianet.to">pangiamotel@kalianet.to</a>	Tourism
Alatini Fisheries Co Ltd	Tricia Emberson	8816759	<a href="mailto:tricia@alatini.to">tricia@alatini.to</a>	Fish processing
Tima Tupou	FIAT	783117	<a href="mailto:Fishexport.tonga@gmail.com">Fishexport.tonga@gmail.com</a>	Fishing Industry

### ANNEX 3 A: PROCESSING UNIT EQUIPMENT REQUIREMENTS

Quantity	DESCRIPTION
2	Free standing electrically powered steam-jacketed tip-pan 100 to 200 Litre. 220-240 Volt single phase power. Tipping fitted with stirrer 7 revs per minute. Operating at 100degC to 130degC Operating pressure 0.09MPa
2	10 Litre blender/homogenizer. 220 240 Volts single phase.
2	Header tank 200 Litre with fitted with semi-automatic filling drain
2	Vacuum sealer capable of sealing 6 x 1Kg packs per cycle. Inert gas bleed not necessary. 220-240 Volts single phase
6	Stainless steel inspection tables 2.4 metres x 1.2 metres standard working height
6	40 Litre portable plastic waste bins
4	200 Litre plastic soak tanks
2	Pumps capable for transfer of pulps and jams
2	Twin basket deep fryers gas fueled 10 Litre capacity
2	20 Litre abrasion peelers
2	Heavy duty French fries cutter 5 Kg per minute
2	Balance 0 – 20 Kg tare 0.5 Kg +/- 1g
2	Filter press for clarifying juices
2	Vertical rotary sealer for stand-up pouches
16	20 Litre storage bins with lids
2	Blast freezers (inbuilt)
2	Storage freezers (inbuilt)

### ANNEX 3 B: FOOD PROCESSING LABORATORY EQUIPMENT

Quantity	DESCRIPTION
2	pH metres 240 volts single phase
2	Hand held refractometers reading soluble solids 28 - 62 %
2	Hand held refractometers reading soluble solids 58 - 90%
2	Stainless steel probe thermometers – 20°C to 150°C
1	Vacuum oven
2	Top loading balance 0-2000g tare 100g +/-0.1g



## **ANNEX 4**

### **REFERENCES AND ADDITIONAL MATERIAL**

**Beyer, R.**, Feasibility Study on the Establishment of Medium Scale Chicken Processing in Tonga; Ecoconsult Pacific Ltd, 2002

**McGregor, AM.**, Pacific Economic Bulletin Volume 22 Number 3; Asia Pacific Press, 2007

**Nyampong, YOM.**, Strengthening the Food Safety and Food Quality Control System in the Kingdom of Tonga; FAO, Rome 2006

**Parkinson, SJ.**, A Taste of the Pacific. USP Press 2001

**Tiseli, VT.**, Utilisation of the HTFA Facility to Expand the Export of Fresh Fruits and Vegetables from Tonga to New Zealand: A Value Chain Approach; FAO, 2009