Pacific Horticultural and Agricultural Market Access Program (PHAMA)

Technical Report 40: Capacity of the Scientific Research Organisation of Samoa to Undertake Food Safety and Quality Testing for Export Products (SAMOA19)

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Appendix A

Abbreviations

Abbreviation	Description
A$	Australian dollar
AOAC	Association of Analytical Communities
AOCS	American Oil Chemists' Society
APHA	American Public Health Association
ASAP	As soon as possible
EPC	Electric Power Corporation
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FDA	United States Food and Drug Administration
FTE	Full Time Equivalent (employee)
HACCP	Hazard Analysis and Critical Control Points, a systematic approach to food safety
HPLC	High Pressure Liquid Chromatography
IEC	International Electrotechnical Commission
ISO	International Organization for Standardization
ISO 17025	International standard for testing laboratories
LIMS	Laboratory Information Management System
MAF	Ministry of Agriculture and Fisheries
MAWG	Market Access Working Group
MCIL	Ministry for Trade, Commerce, Industry and Labour
NPK	Nitrogen, phosphorus, and potassium
NZ$	New Zealand dollar
PHAMA	Pacific Horticultural and Agricultural Market Access
SAT$	Samoan tala
SROS	Scientific Research Organisation of Samoa
SROS TS	Technical Services within SROS, performing analytical testing services
URS	URS Australia Pty Ltd
US$	United States of America dollar
WHO	World Health Organization
WIBDI	Women In Business Development Incorporation

Executive Summary

(i) The Scientific Research Organisation of Samoa (SROS) currently has the capacity and capability to perform a range of tests, some of which are accredited to ISO 17025, providing food safety and quality testing for export products. Accredited tests are Aerobic Plate Count, coliforms, E. coli, faecal coliforms, Listeria, Salmonella, ash, carbohydrates, fat / free fatty acids, sodium, potassium, calcium, moisture and protein. There are sufficient technically capable staff to perform these tests. A recent ISO 17025 audit (November 2012) did not raise any major non-conformances and ongoing accreditation was awarded – however, the lack of dedicated resources to maintain the Quality System and laboratory procedures is noticeable. It is recommended that the internal structure is changed to mimic that of a commercial contract laboratory. This will also create closer working relationships with industry, and provide knowledge of industry requirements.

(ii) Laboratory facilities, including instruments, are adequate, as are manuals with respect to ISO 17025 accreditation. For further development of the accreditation scope, there is a need for training in the areas of method development and validation, and calibration.

(iii) The two main sources of contract laboratory testing (export-related testing and food-related regulatory testing) are likely to grow in the medium term due to new government legislation and export growth. Local industry identified a range of tests to sustain and build their exports (e.g. testing of heavy metals, including mercury, histamine, Campylobacter and vibrio to species level) for which they seek testing; however, in most cases it was unclear what the volume of the required tests would be, nor was the timing known.

(iv) It would be advisable that the fee structure of SROS follows that of overseas laboratories, with a small premium to reflect local access and thus potentially faster turnaround times, as well as direct access to technical support. Setting fees based on cost recovery would mean that current prices for testing would increase fourfold to fivefold, which would not be acceptable for the local industry.

(v) SROS Technical Services (TS) will not be able to offer testing services to industry on a full cost recovery (sustainable) basis, as the testing volumes are too low. Only if testing volumes grow significantly (five times or more) will full cost recovery be possible. This could be the case, for example, should regular soil testing on a large scale be implemented, or if the new (to be developed) food hygiene standards require significant testing.

Taking into consideration points (i) to (v), the following recommendations are made:

(i) SROS should be restructured to ensure its Technical Services have dedicated resources to maintain and grow the ISO 17025 accredited testing services. This would allow improvement of the turnaround time of results, and allow expansion of accredited tests offered.

(ii) The restructure should include a mechanism that allows the laboratory to remain in close contact with all main stakeholders in industry and in government to maintain an up-to-date view on their customer needs. In particular, SROS should follow up on the likelihood and timing of the potential work in the soil testing area, as well as on the new Food Bill, as these two options could provide a significant and ongoing source of revenue.

(iii) The existing fee structure should be reviewed to better align with fee structures commonly used in contract laboratories. This would allow industry to compare SROS services with other providers, and for them to make an informed choice. The current fee for chemistry tests could be increased, while the fee for microbiological tests would need to be reduced.

It is strongly recommended that SROS implement recommendations (i)–(iii) before PHAMA commits to further support. This support could include the following, providing government support continues at current levels. Costs are detailed in Table 4-1 and Table 4-2.

(iv) A relatively easy suite of tests could be considered to be added to the range of tests currently offered by SROS. In the first instance, support to accredit the analyses for mercury, lead, cadmium, copper and zinc, and campylobacter and vibrio to species level is recommended to be funded. All of these tests underpin Samoa's exports.

(v) Additional training needs could also be considered in the areas of calibration, method development and validation, and business development, key account management and customer relations.

(vi) For mercury, ideally a new dedicated analyser would be required; however, accreditation can be achieved by using the existing equipment. Replacement of the mercury analyser would be warranted only once the testing volume increases.

(vii) Implementation of a LIMS (Laboratory Information Management System) – a software package that is specifically designed for managing the information flow in a laboratory – could also be considered. This includes, for example, the recording of sample details, customer details, test requirements, test results, test reports and invoicing. A LIMS contributes strongly to better systems and faster processing of samples and reporting, resulting in a faster turnaround time, with fewer errors during the process. Commercial packages are available for small to medium size laboratories. LIMS software packages applicable to small to medium laboratories retail at about A$25,000–50,000.

In summary, SROS is, with some changes in internal structure, capable of delivering and further developing services to test and certify against food and quality standards. It can only do this in a financially and operationally sustainable way due to the substantial funding being received from the Samoan Government.

1 Background

1.1 Food Export Industry in Samoa

Samoa has a range of value-added export industries that require diagnostic services to determine compliance with food quality and/or food safety standards. These requirements are currently being provided in an *ad hoc* manner by the Scientific Research Organisation of Samoa (SROS) and various international service providers. Access to an accredited local service provider able to undertake a wide range of specified tests for major export commodities (including fish, copra, kava, noni, and cocoa) has been identified by the Samoan Market Access Working Group (MAWG) as a high priority.

1.2 Government

The Samoan government has a strong focus on increasing export earnings, reducing the reliance on remittances from overseas in the medium to long term. It strongly supports SROS, which it regards as a necessary tool to support this growth of exports.

It is also working on improving on health-related regulations, for example development – in association with World Health Organization (WHO) and the Food and Agriculture Organization of the United Nations (FAO) – of the proposed Food Bill and its associated Food Standards, as well as other standards relating to bottled water and a standard related to the production and sale of eggs.

1.3 SROS and Technical Services

SROS was established in 2006 to provide scientific and technical research for the government and to develop new technologies to benefit Samoa's local industry and in turn the economy. SROS' mandate is to provide research in two main areas: adding value to existing commodities and developing renewable and sustainable biofuels.

The organisation consists of three research divisions (Industrial Research, Plant and Food Technology, and Environment and Renewable Energy), with a fourth function, the delivery of Technical Services (TS) (contract laboratory testing – SROS TS) shared between some of the staff of the three divisions.

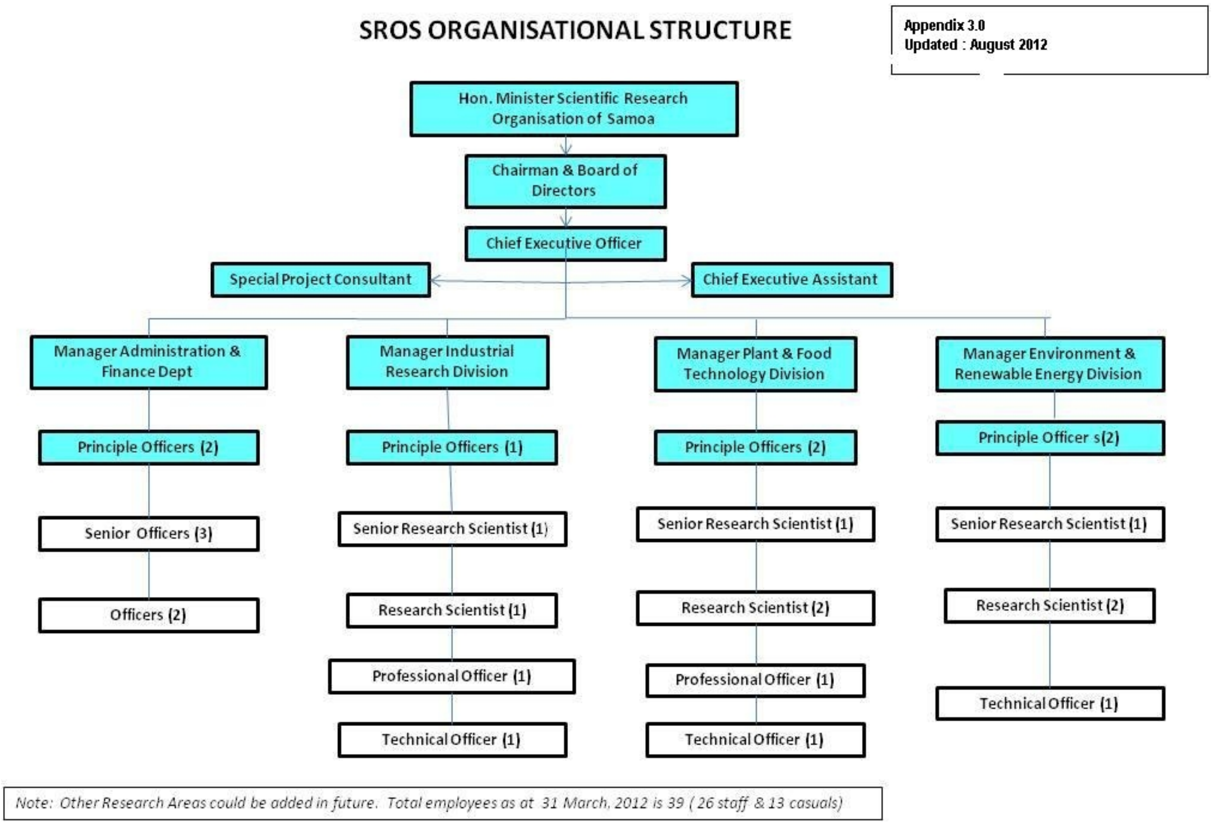
SROS TS is **not** a division on its own, but relies on availability of staff from the three divisions.

In addition, there is a support Administration and Finance Division.

SROS receives funding from the government (SAT$2.2 million in 2010, SAT$3.01 million in 2011).

Currently active projects are:

- Research into the commercial development of biodiesel. A pilot plant is operating, with two vehicles using biodiesel, and work is done on using biodiesel for EPC's new power station at Fiaga;
- Assessing bioethanol technologies resulting in an industrial process suitable for feedstock available in Samoa. A bioethanol fermenter has been purchased and installed;
- Establishing a commercial avocado oil processing operation. This is in its final stages and SROS is looking for a commercial partner;
- Developing new product prototypes utilising local produce (e.g. breadfruit flour, margarine from avocado oil). Some prototype products from breadfruit and cassava have been launched; and
- Providing Technical Services (laboratory testing) to the food export businesses in Samoa.



1.4 Required Investigation/Terms of Reference

This study is divided into two stages. Stage 2 is dependent on the outcomes from Stage 1 and endorsement by the Samoan MAWG.

The overall objectives of this activity are to:

1. Determine what additional technology and equipment is required to provide the desired services.
2. Establish an improved base of appropriately skilled personnel who can act as certified diagnostic service providers.
3. Strengthen the systems used to manage and verify food safety and food quality inspection programs for value-added export products.
4. Establish a sustainable structure for delivery of testing services to support export industry needs.

The specific Terms of Reference for Stage 1 are:

1. Identify/confirm the current and potential medium-term market access-related quality and food safety testing requirements for fish, food and agricultural semi-processed and processed food products being produced in Samoa for export.
2. Assess the current capacity of SROS in terms of equipment, staff competencies, quality management systems and methodologies to meet importing countries' testing requirements, and identify gaps or areas for improvement.
3. Assess laboratory facilities, quality manuals and training competencies with respect to ISO/IEC 17025 accreditation, identify any gaps and identify necessary actions to attain accreditation.

4. Assess industry demand for testing and the potential revenue base, and examine the operational costs and fee structure required to provide and maintain adequate testing capacity locally by SROS in Samoa.
5. Develop a costed model for improved diagnostic services to meet industry requirements (user pays system). This model will include comment on facilities, equipment, procurement options, staffing levels, skills training (operational and management), and verification and accreditation requirements.

2 Approach

2.1 Meetings with Industry

A range of meetings was held with industry representatives (Table 2-1). The main purpose of these meetings was to understand existing and future requirements of industry for laboratory testing services through SROS. An additional area of interest was to assess the value to industry of having access to these services within Samoa – instead of having to access these overseas.

Table 2-1 List of export businesses that have provided input

Organisation	Contact	Business type
Apia Export Fish Packers	John Luff	Fish export
Pure Pacifika Samoa	Masuisui Junior Pereira	Food export, contract manufacturer
Women In Business Development Incorporation (WIBDI)	Adi Tafuna'i, Stephen Hazelman	Coconut oil, other foods exports
Wilex	Eddie L. Wilson	Taro, bread fruit, and kava export
Soil Health Pacific Ltd	Edwin Tamasese	Sustainable food and fertilisers
Ah Liki Wholesale	Lomia Tuala	Import and export, food processing

2.2 Meetings with Government Agencies

In order to gain insight into the Government's perspective on SROS, and the export industry in general, meetings were held with Ministry of Agriculture and Fisheries (MAF)-Quarantine, MAF-Codex and MAF-Crop Research.

Table 2-2 List of government bodies that have provided input

Department	Contact	Role
Quarantine Services	Mr Pelenato Fonoti, Assistant Chief Executive Officer	Quarantine regulatory body; also Chairman of Samoan MAWG
	Ms Olive Jay To	Pesticide Registrar
Codex at Ministry for Trade, Commerce, Industry and Labour (MCIL)	Unasa Iulia (Assistant Chief Executive Officer Fair Trading, Legal Metrology, Competition Law, Policy & Codex Division) Margaret Fruean (Assistant Chief Executive Officer Registry of Companies & Intellectual Properties Division)	Food Standards setting department
MAF-Crops	Emele Ainuu (Principal Advisory Officer and Acting Assistant Chief Executive Officer – Crops) Seuseu Dr. Joseph Tauati (Consultant) Toilolo Pueata Tanielu (Senior Research Officer) Levaopolo Ricky (Senior Crop Development Officer) Mulitalo Iuma (Research Officer) Fata Alo (Crop Development Officer)	Government research – livestock and agricultural

2.3 Assessment of Existing Capabilities of SROS TS

Through meetings and discussion with SROS staff, as well as observing existing laboratory practises, an assessment of the existing capabilities within SROS was made, with an emphasis on those staff working in the Technical Services Area.

A mini-audit was performed, in order to understand the workflow within the ISO-accredited Technical Services area.

All chemistry Key Technical Personnel (signatories) were interviewed:

- Mr Samani Tupafia – Chemistry Signatory
- Dr Pousui Fiami Leo – Chemistry Signatory
- Ms Sekotilani Aloi – High Pressure Liquid Chromatography (HPLC) technician
- Mr Notise Faumuina – Chemistry Signatory.

In addition, meetings were held with:

- Mr Tilafono Leatiogie David J. Hunter – Chief Executive Officer of SROS
- Ms Kuinimeri Asora Finau – Manager Plant & Food Technology Division/Quality Manager
- Mr Kenneth Wong – Volunteer Services Abroad volunteer at SROS.

In the microbiology area, a meeting was held with a number of staff, including Ms Kuini Finau and Ms Seeseei Molimau.

3 Findings

3.1 Food Export Industry in Samoa

Meetings were had with a range of food exporting companies.

None of the organisations met were using testing laboratory services at a significant level, nationally or overseas. Most of the testing they were doing was performed by SROS. Appendix A lists the tests performed by SROS TS in the period April–October 2012. This is summarised in Table 3-1 – using the expenditure by customer.

Table 3-1 Revenue of SROS TS by customer for the period April–October 2012

Customer	SAT$
Ministry of Health	10000
SROS Internal Research projects	9020
Ah Liki	1900
Pure Pacifica Samoa	995
Vailima Breweries	235
Apia Fish Exports	595
Fonoti Perelini	600
Neila's fish market	600
Patrick	500
WIBDI	260
Wilex	280
Total	**24985**

SROS TS performed a relatively wide range of tests in this period, in many cases only on a few samples (Table 3-2).

Table 3-2 Tests performed by SROS TS in the period April–October 2012

Tests April - October 2012	Number	cost SAT$
APC-MF *	22	100
APC Petrifilm *	10	100
Alcohol	7	30
Ash *	10	30
BOD	3	75
Brix	2	30
Carbohydrates *	9	30
Chlorine	2	20
Coliform counts MF *	40	100
Coliform count petrifilm *	6	100
Coliform Detect Colitag *	28	100
Conductivity	6	20
E.Coli count MF *	27	100
E.Coli count petrifilm *	8	100
E.Coli detect Colitag *	29	100
E.Coli detect MF *	3	100
Energy	8	75
Enterobacteriaceae	2	100
Faecal Califorms MF *	34	100
Fat / FFA *	9	50
Histamine	1	75
Listeria *	1	200
Loss on Drying	7	20
Minerals Na, K, Ca *	6	60
Moisture *	4	80
pH	11	20
Protein *	6	75
Salinity	4	10
Salmonella *	16	200
Total dissolved solids	9	20
Specific gravity	2	20
Staph count by petrifilm	2	100
Turbidity	2	10
Vibrio parahaemolyticus detected/not detected	17	200
Water activity	5	100
Yeast and moulds	10	100

* indicates an ISO 17025 accredited test.

While most businesses are using, or have used, SROS for export purposes, they expressed that they would prefer SROS to offer a wider range of tests accredited to ISO 17025. This international standard is accepted worldwide as a guarantee for reliable results, and as such products with a certificate of analysis from an ISO 17025 accredited laboratory will be easier to export.

In Table 3-3, expected future testing requirements are summarised – tests that export businesses would prefer to have accredited to ISO 17025.

Table 3-3 Interviewed food producing / exporting businesses

Organisation	Business type	Size (relative)	Testing requirements	Volume	Probability	Time line
Apia Export Fish Packers	Fish export, mainly tuna (frozen albacore)	Large	Nutritional Panel, Hg, Cd, Pb, Histamine	Medium	Good	In 2–3 years
Pure Pacifika Samoa	Contract food manufacturing, noni fruit, coconut oil	Medium	General export requirements (coconut oil, noni in capsules)	?	?	–
WIBDI	Food manufacturing, coconut oil export (Bodyshop New Zealand), Cassava	Medium	Microbiological testing of coconut oil, soil nutrient	Low	Good	ASAP
Wilex	Food export manufacturing, packaging, soap, cocoa processing, frozen taro and breadfruit to United States of America	Medium/ large	Nutritional Panel, kavalactones, flavokavin B	Medium to high	Good	ASAP
Ah Liki Wholesale	Food export manufacturing, packaging, New Zealand beef processing, ham, sausages, bacon, snacks, coconut cream, tissues	Large/very large	Microbiological food safety testing, other export related testing	Medium	Good	ASAP
Soil Health Pacific Ltd	Fertilisers, agricultural / soil fertility consultants	Small/ medium	Soil nutrient testing	High to very high	Low to medium	ASAP–3 years
			Pathogens on fertiliser, NPK fertiliser testing	Very low	Good	ASAP

Very low = less than 1 sample per month

Low = around 1–3 samples per month

Medium = 1 sample per week

High = 2–3 samples per week

Very high = > 5 samples per week

Apia Export Fish Packers – have a good export market (Japan) without the need for much testing. Histamine levels in fish are controlled through a comprehensive Hazard Analysis and Critical Control Points (HACCP) plan, which, according to Phil Luff from Apia Export Fish Packers, removes the need for testing. There is a small risk that the customer / overseas market regulator may find high levels, and the company accepts that; in that case, the shipment will need to be dumped. This hasn't happened yet. Currently, some of their product is processed in Indonesia for export to the United States of America. There are plans to bring this fish processing to Samoa (new facility). When this happens, more testing will be required, mainly histamine and label claim verification.

Pure Pacifica – mainly a contract manufacturing operation. Identified a number of opportunities (noni fruit (dry and put in capsules), cocoa, coconut oil, organic certification of produce). Very supportive of SROS.

WIBDI – focus on organic growing of produce (cassava/breadfruit). They provide soil testing and advice. Export coconut oil to the Body Shop in New Zealand. They have a number of new product ideas (have just built a new warehouse to manage their raw material availability) and need testing services, including shelf-life / best-before testing (WIBDI indicated that New Zealand and Australia are too far away).

Wilex – have a strong focus on export, including packaging, coconut oil based soap, cocoa and (at a later stage) kava. They export value-added cocoa-based products to Australia, frozen taro and breadfruit to the United States of America (just established WilexUSA to facilitate this). Very supportive of SROS.

Ah Liki Wholesale – main activities are around processing imported raw material (beef, vegetables) and packaging and exporting the value-added products (chips, sausages, coconut cream, paper tissues), most of this to New Zealand. They have also just finished building a new brewery, which will require process water testing as well as some product testing (and wastewater compliance monitoring?). They are working on implementing a comprehensive HACCP system, which will require regular testing.

Soil Health Pacific – are working with small farmers (around 450 at this stage) to reduce the cost of fertiliser by more targeted application, which requires soil testing on a regular basis. This will be ongoing, regular (twice a year?) testing. They estimate the total number of farms they will work with to be around 1700. They also provide nutrient solutions, requiring microbiological testing. They think SROS is good to have, but it is too slow, and does not deliver the service they require.

Overall, the general outlook of the export industry is positive. Most of the companies are planning to expand facilities (some already have started) and invest in new pathways to overseas markets. The main export markets are New Zealand, Asia (China) and the United States of America. Unfortunately, none of the organisations spoken to was able to commit to a certain level of testing.

The mainly small-to-medium size of typical food export focussed companies mean the actual volume of testing required is not very large (refer to Table 3-2 and Table 3-3). This is verified by the numbers of tests performed by SROS in the last year (Table 3-2). Based on information gathered, a steady growth is to be expected. A couple of larger opportunities (e.g. soil nutrient testing, MAF Crops / Soil Health Pacific / WIBDI), should they eventuate, would increase the testing volume considerably.

As is not unusual in the contract laboratory industry market, customers look for a diverse range of tests, fast, and at minimal cost.

In Samoa, testing requirements are often infrequent, sometimes one-offs – for example, when testing is related to new product development. Where the testing is related to overseas market access requirements, the testing will be recurring – however, the size and frequency of export shipments is relatively low.

Industry feedback is that the costs of testing are too high. Compared to overseas laboratories, the prices for the microbiological tests are very high, and would have to be halved to come close to the overseas laboratories. In contrast, the prices for the chemistry tests are lower than overseas.

3.2 Government

There is little regulatory testing required in Samoa at the moment. Most food safety testing is performed for export-related purposes stipulated by importing countries. Some *ad hoc* testing for residues on imported foods and fertiliser is performed by a laboratory in Australia. These tests, to declare products 'residue free', are very expensive to run, and only through large volumes of testing can a laboratory provide this service sustainably.

The Samoan MCIL is aware of this gap in food safety testing, and has the development and enforcement of legislation on food standards as a short-term high priority action for the next few years (*MCIL Sector Plan for Trade, Commerce and Manufacturing (2012–2016)*, vol 2, p. 24–25). New legislation is expected for local bottled water, and more importantly, for Food Hygiene monitoring in general – an opportunity for SROS to increase its volume of samples and thereby revenue.

Table 3-4 Government testing requirements

Organisation	Testing requirements	Volume	Probability	Timeline
Quarantine Services	Residues	Very low	Good	Immediate
MAF-Crops	Soil testing, nutritional analyses (carotene, vitamins etc.)	Low to medium	Medium	Immediate
Codex at MCIL	Fat (imported meat), bottled water, eggs, Food Hygiene related testing	Medium to high	Good	1–3 years

The Samoan Government is looking for SROS to grow its accreditation scope (add more tests to the ISO 17025 scope), while increasing the revenue generated through external testing. It sees a critical role for SROS in the growing of food exports in general; in the MCIL Sector Plan, SROS is described as 'enhancing an enabling environment for the private sector (Volume 1, Ch 6, p. 59).

Unfortunately, it is not clear when the new regulations under the Food Bill and Food Standards will be developed, or implemented, nor what the extent of testing requirements will include.

3.3 SROS and Technical Services

Compared to other Pacific Island laboratory initiatives, SROS is in a unique position due to a number of factors:

- Strong financial support from Government, which regards having an accredited testing laboratory in Samoa as one of the key enabling factors for export growth;
- SROS is not solely a contract testing lab, but also performs relatively large technical, mostly food-related, research projects. This allows for general overheads and knowledge to be shared, staff to be used more efficiently (when workload in one area is low, they can move to another) and in general provides economies of scale. This situation is similar to the one in Fiji, where the Institute

of Applied Sciences laboratory (also accredited to ISO 17025) is part of the University of the South Pacific – Fiji campus); and

- Staff at SROS are in general of a high calibre, with sound tertiary training, and relatively stable.

SROS management is in the difficult position in which it has to try to grow the number of accredited tests, provide a timely service, and continuously improve its quality systems, all with restricted funds, and no long-term substantial testing contracts in place.

There is agreement within SROS that somehow the TS needs to be separated from the research divisions more than is currently the case; however, it is not clear what the best way forward is (and what is achievable).

3.4 Financial Considerations

SROS is receiving significant subsidies directly from the Samoan government (SAT$3.9 million, including SAT$1.0 million capital for building) in 2011/2012 and SAT$3.8 million in 2012/2013). These funds are used to work towards the goals set by the Government – one of which is the support of the food export industry through ISO 17025 accredited testing services.

In addition, SROS has in the past been able to secure funds through other means, ranging from foreign aid programs and testing services to providing a training course on HACCP (food hygiene standards in a production environment).

Overall, the financial situation of SROS is sound, with a SAT$846 thousand surplus forecast for the end of the 2012 financial year.

The testing volumes for routine testing, providing external (commercial) revenue streams for SROS TS, are low. While there is some scope for growth, it is highly unlikely that the Technical Services will be able to recover all costs in the future. Fixed costs to operate an accredited laboratory that provides a reasonable range of tests applicable to the local export industry are high (minimum staff levels, accreditation costs, depreciation of equipment, etc.).

This is shown in Table 3-5 by using a typical cost structure for contract laboratories, applied to the current situation of SROS TS (Scenario 1), using actuals for revenue, labour costs and ISO audit cost.

Table 3-5 Example profit/loss statement for existing situation at SROS Technical Services

SAT$		Scenario 1		Scenario 2		Scenario 3
Revenue		no change in testing volume		double the current testing volume		5 times testing volume
	testing	58090		116180		290450
Direct costs						
	labour	105000		122500		140000
	consumables / chemicals	78500		86350		103620
Total		**183500**		**208850**		**243620**
Indirect costs						
	ISO audits	16400		16400		16400
	ILCP particpation	2000		2000		2000
	QA manager labour	10000		10000		10000
	other (depreciation, R&M, training)	10000		10000		10000
Total Indirect costs		**38400**		**38400**		**38400**
Gross contribution		**-163810**		**-131070**		**8430**

Notes to Table 3-5:

- Labour cost scenario 1–3 at SAT$35,000 per full-time equivalent (FTE) (scientists)
- Indirect costs do not change with increase in volume
- Direct costs increase less than revenue through economies of scale (larger batches etc.)

Revenue for Technical Services (including the Ministry of Health drinking water testing and some HACCP consultancy fees) for the 6 months April–October 2012 was just SAT$29,045. Revenue would need to increase by approximately fivefold to cover all of the direct and indirect costs for the TS services unit.

A second way of increasing revenue, besides increasing the sample volume, is increasing the fee per test. Based on current sample numbers, in order to cover all costs related to the TS services, fees would also have to be increased significantly (i.e. fivefold). The current **average** fee structure is comparable with overseas laboratory testing costs, although current chemistry testing costs are relatively low and microbiological testing costs are relatively high.

Adjusting (i.e. lowering) the high cost per test for microbiological testing may increase the volume of testing, as tests would become more affordable for small businesses.

The actual cost to perform a test in a laboratory is for most tests highly dependent on the number of samples in a batch (samples processed at the same time). As soon as fixed costs like calibration standards, depreciation of instrumentation, general overheads (insurance, rent) can be allocated to a larger number of samples, the cost per sample decreases dramatically. A good example is the Histamine test by HPLC, where the cost of analysing one sample is NZ$350, while the cost for five samples is closer to NZ$100 per sample.

A laboratory that is required to offer a lot of different tests, with only a few samples in a batch, is therefore less likely to be able to offer the tests at a low price in comparison to a laboratory that receives many samples for the same test.

According to the SROS corporate plan 2013–2015, there is opportunity to increase revenue by implementing a more commercial approach to business development and key account management.

Increasing the work for Technical Services will have several benefits, all supporting the sustainability of the service:

- Indirect costs (and some direct) will be relatively stable, with an increase in revenue providing a better return;
- Higher staffing levels will allow for better back-up in case of (sick) leave; and
- The scope of testing services offered will be larger, providing more opportunity for exporters to certify their products.

It should be noted here that the government of Samoa, at this stage, has set a target for all of SROS to generate external revenue of SAT$100,000 for the Financial Year 2012/13. In 2010/2011, SROS achieved SAT$87,870.

3.5 Organisational Structure and Capacity

SROS Technical Services does not have the right structure to operate as a commercial laboratory. It cannot meet the turnaround times required by industry, partly because of the low volume of work (reagents expire, need to be re-ordered), and partly because of the availability of technical staff to perform the tests on a timely basis.

This is more evident in the chemistry testing area than in the microbiological area. In most cases, the testing is done when a researcher is free, or can make time. Routine testing is not the researchers' prime responsibility.

This also has a negative effect on the maintenance of quality systems, and on stock control.

By implementing a different structure, with scientists providing technical support and laboratory assistants performing routine tests and tasks, the cost of running Technical Services would be reduced (Table 3-6). With this alternative structure, a just over fourfold increase in revenue would need to be achieved to break even.

Table 3-6 Alternative profit/loss for SROS TS

SAT$		Scenario 4		Scenario 5		Scenario 6
		no change in testing volume		double the current testing volume		5 times testing volume
Revenue						
	testing	58090		116180		290450
Direct costs						
	labour	75000		87500		100000
	consumables / chemicals	78500		86350		103620
Total		**153500**		**173850**		**203620**
Indirect costs						
	ISO audits	16400		16400		16400
	ILCP particpation	2000		2000		2000
	QA manager labour	10000		10000		10000
	other (depreciation, R&M, training)	10000		10000		10000
Total Indirect costs		**38400**		**38400**		**38400**
Gross contribution		-133810		-96070		48430

Notes to Table 3-6:

- Labour cost scenario 1–3 at SAT$25,000 per FTE (technicians and assistants)
- Indirect cost do not change with increase in volume
- Direct costs increase less than revenue through economies of scale (larger batches etc.)

In these scenarios, laboratory technicians (not scientists) would be routinely running the TS Laboratory, with supervision and support from scientists from the research groups. Ideally, the TS group would have a dedicated supervisor – a role that could be combined with a marketing and customer relationship role.

Importantly, these scenarios would also support the existing accreditation status, and allow for additional tests to be added to the scope of accreditation. Sufficient resources (mainly staff) would be available for the daily operation of the laboratory, including maintaining the Quality Systems and stock control. It would also enhance the marketing and customer relationship capabilities for TS.

Without dedicating more resources to the provision of testing services, maintaining the existing ISO 17025 accreditation status will be difficult, while adding more tests to the scope and maintaining the related Quality System additions will be even harder to achieve.

3.6 Capability

The technical capability of SROS staff is high. The existing knowledge and experience of microbiological methods is very good. For chemistry, there are at least two people fully qualified to work with HPLC, Gas Chromatography and Atomic Absorption instrumentation.

The mini-audit did not find any major deficiencies in the chemistry area. The extent and implementation of the ISO 17025 quality system is sufficient at this stage. There is, however, ample room for improvement – and the accreditation body (International Accreditation New Zealand) will expect improvements to be made on an ongoing basis.

Technical Services was audited in the week of 12 November by International Accreditation New Zealand. The audit report did raise a number of Corrective Actions, but did recommend ongoing accreditation.

The additional tests (see Table 4-1 and Table 4-2) potentially to be added to the scope are within the technical capability of the SROS staff. There is ample knowledge of ISO 17025 requirements for adding new tests.

Method development in an ISO 17025 environment is different and more demanding than in a research laboratory. This goes even more so for method validation. There is a need for further training in these areas. This could be provided at the same time as the actual development and validation of new tests to be added to the ISO scope.

A second area that requires further training is the calibration function. While currently there are sufficiently trained staff present, it is likely that in the near future these staff will further their education overseas, leaving a gap in this area.

Instrumentation available is generally sufficient and is well maintained. A second-hand mercury analyser is currently being set up, but may need to be replaced should testing volume increase.

A final consideration is the potential implementation of a LIMS (Laboratory Information Management System) – a software package that is specifically designed for managing the information flow in a laboratory. This includes, for example, the recording of sample details, customer details, tests requirements, test results, test reports and invoicing. A LIMS contributes strongly to better systems and faster processing of samples and reporting, resulting in a faster turnaround time, with fewer errors during the process. Commercial packages are available for small to medium size laboratories. LIMS software packages applicable to small to medium laboratories retail at about A$25,000–50,000 (including installation and implementation).

4 Conclusions

4.1 Economic Situation and Outlook

With food products as a major export product, and with significant potential to add value to the commodity materials produced at the moment, the outlook for long-term food exports from Samoa to existing and emerging markets is good.

Combined with a government that is clearly focussed on improving export earnings, and willing to invest in this in the medium to long term, and with an industry that is looking for new opportunities, both in products as in markets, Samoa seems to be on the right path.

Both industry and government show strong support for SROS, with commitment from industry to use SROS where possible. In effect, the Samoan government is subsidising the testing services for industry indirectly through its funding of SROS.

Unfortunately, there is no guarantee that the extra testing work as mentioned by industry and government will actually eventuate.

The economy is projected grow by 2.5 percent this year despite the effects of cyclone Evan, according to Asian Development Bank forecasts (28 December 2012). Post-cyclone rebuilding will help stimulate the economy.

Asian Development Bank also expected to see a continued rise in remittances as overseas Samoans step in to help friends and family.

4.2 Costing Model for Improved Diagnostic Services

From Table 3-5 and Table 3-6, it is clear that it is not likely that SROS TS will be able to sustainably offer analytical testing services without the subsidy it receives from the government. There is not enough volume now, or likely to be in the future, for any tests to recover all the direct and indirect costs without this subsidy.

While the overall outlook for food exports from Samoa is good, none of the businesses and other organisations spoken to could guarantee an increase in work for SROS – although all said it was highly likely. Even if all the predictions of increased testing volumes come true, it would still be insufficient for full cost recovery.

Any addition of tests to the scope of accreditation will, in the short term, need to be funded from sources outside of SROS – either through aid or direct government support. Reflecting the existing capability within SROS, it can be expected that after the initial assistance required, significantly less, if any, external technical support will be required to add new tests to the scope. SROS staff would be able to do it themselves.

4.3 SROS Development Capability

In general, the laboratory equipment present at SROS is adequate to provide the testing services currently required by industry, with a second-hand standalone mercury analyser currently being set up. Except for potentially replacing this instrument (as it is quite old) at a cost of around A$60,000, there is no need for any major additional equipment to service the future requirements of the industry in the next 2–3 years (the only exception is for soil testing – see below).

In the following two tables, the tests indicated in the assignment terms of reference, as well as some new ones indicated by industry to be of interest, are listed. For each of these, an assessment is made as to whether it will be achievable to add the tests to the scope of accreditation in the next 11 months, with an estimate of costs (training, method development and validation support).

The tests related to the bacterial levels associated with noni juice fermentation and the optimum fermentation and drying requirements for cocoa, both on the preliminary list in the Tasking Note, have been excluded as these were related to research projects within SROS, and not directly to the requirements of Samoan exporters.

Table 4-1 Potential chemistry tests to be added to SROS TS scope of accreditation

	Chemistry			Within existing capability			
Test	Priority	Matrix	Export requirement	Support required	New Instrumentation required	Accreditation in December 2013	Estimated cost of technical support
Mercury	High	Fish / seafood	Yes	method validation 1-2 weeks		yes	AU$10000-15000
					Mercury analyser		AU$55000
heavy metals (Cd, Pb, Cu, Zn)	High	biological (food, fish)	yes	method development and validation 1-2 weeks		yes, limited matrices in first instance	AU$10,000 - 20,000
					None		
Histamine	Medium	Seafood	yes	method validation 1 week		yes	AU$10,000
					none		
Aflatoxins	high	Copra meal	yes	method set-up and validation		yes	AU$5000
					none		
Fatty acid profile	Low	foods	yes	method set-up and validation		maybe	AU$8000
					None		
Kavalactones / Flavokavin B	Low	Kava	not yet	method set-up and validation	none	No	AU$10,000-20,000

For mercury, ideally a new dedicated analyser would be required; however, accreditation can be achieved by using existing equipment.

The histamine test could, once accredited, be offered to other Pacific Nations requiring this test on fish for export to the European Union (EU) – and provide some additional revenue.

Table 4-2 Potential microbiological tests to be added to SROS TS scope of accreditation

	Microbiology			Within existing capability			
Test	Priority	Matrix	Export requirement	Support required	Consumables/ Media/control cultures	Accreditation in December 2013	Estimated costs of technical support
Campylobacter	High	Chicken	Yes	method validation 1-2 weeks		yes	AU$10000-15000
					Some		AU$3000
Clostridium *botulinium*	?	Canned food	?	method development and validation 1-2 weeks		No	
					Some		AU$3000
vibrio to species level	High	Seafood	yes	method validation 2 weeks		yes	AU$15,000
					Some		AU$2000

In addition, there is an opportunity to develop **soil testing services** for the agricultural industry in Samoa (Soil Health Pacific, MAF-Crops). Should the expectations of several industry players come to fruition, there could be significant sample volumes for soil fertility testing and, at later stage, foliage testing services. This testing does not directly relate to the certification of products for exports, but it does support the growth and development of the production of raw materials that are either exported or used to add value to before export.

The cost of having samples tested in Australia is A$450 per sample, A$150 for test costs and A$300 for transport / import permits etc. (Soil Health Pacific).

Additional equipment (a FAST Atomic Absorption Spectrometer – approximately SAT$90,000) would be required should sample numbers for this testing service be high enough. Based on 700 samples per year (predicted by industry), and a cost per sample of SAT$300, this purchase would have a payback period of 1 year. With direct costs estimated at 65%, and an overdraft interest rate of 9%, the net present value becomes positive at around 200 samples per year. The 700 samples per year would generate a revenue of SAT$210,000, contributing significantly to full cost recovery.

Performing the range of tests required would be within the capability of SROS. However, it does not have the capacity, and would require some medium to long term support from an expert in this field (potentially through Volunteer Services Abroad) to set up the tests.

Outside the existing capability are **residue screen tests**, like Dioxin-testing or non-specific herbicide and pesticide residue determinations.

Dioxin and ultra-low level of residue testing requires very expensive equipment (US$500,000 plus), specialised laboratories and staff. Even if funds would be available to purchase the equipment and build the laboratories, sustaining this capability with very few samples each year will be impossible.

While SROS has the capability to set up and validate a test for one or more specific residues (for example Benzo-(a)-pyrene), it cannot develop or sustain, for similar reasons as mentioned above, the capability to screen for any residues (i.e. provide evidence that the product is residue free). The number of potential compounds that would need to be screened for is very high – some food products imported into Japan required 1200 compounds to be tested for.

This testing will need to be sub-contracted to overseas laboratories.

None of the tests listed in Table 3-5 and Table 3-6 on their own will be ‘sustainable’. Adding tests to the scope will, however, make it more attractive for industry to send samples to the laboratory, increasing the volume of other tests as well.

It may also facilitate industry to develop new products for new and existing markets that without this more comprehensive laboratory support would not be possible.

5 Recommendations

Taking into consideration that:

- SROS is heavily subsidised by the Samoan government to provide ISO 17025 accredited tests to the food export industry;
- Without this subsidy, the SROS TS would not be sustainable;
- The industry is already using SROS TS for its food safety and food export related testing requirements and is supportive and willing to continue to use its services; and
- The structure of SROS is not conducive to operate as a commercial contract laboratory, delivering a service the industry requires

The following recommendations are made:

(i) SROS should be restructured to ensure its Technical Services have dedicated resources to maintain and grow the ISO 17025 accredited testing services. This would allow improvement of the turnaround time of results, and allow expansion of accredited tests offered.

(ii) SROS should work more closely with industry and government to maintain an up-to-date view on their customer needs. In particular, SROS should follow-up on the likelihood and timing of the potential work in the soil testing area, as well as the new Food Bill, as these two opportunities will potentially provide a significant and ongoing source of revenue.

The review of the structure of the laboratory should be aimed at optimising the service delivery to the industry, and incorporate a mechanism to remain in close contact with all main players – both in industry as in government.

(iii) SROS should review its existing fee structure with the aim to align better with fee structures commonly used in contract laboratories. This would allow industry to compare the SROS services with other providers and to make an informed choice. The current fee for chemistry tests could be increased, while the fee for microbiological tests would need to be reduced.

It is strongly recommended that SROS implement recommendations (i)–(iii) before PHAMA commits to further support. This support could include the following, providing government support continues at current levels.

(iv) A limited, relatively easy suite of tests could be added to the scope once the structure is in place to support this. Tests that are the most useful to industry should be prioritised (see Table 3-5 and Table 3-6). It is recommended that, in the first instance, support to accredit the analyses for mercury, lead, cadmium, copper and zinc, and campylobacter and vibrio to species level should be provided.

(v) Additional training should be considered in the areas of calibration, method development and validation, business development, key account management and customer relations.

On a long-term basis, SROS has the potential to develop as a customer-focussed contract laboratory offering a relatively wide range of tests required for food safety and export certification purposes. It also has the potential to sell testing services to American Samoa. However, demand for services is likely to increase only slowly over time. Ongoing support from the government is likely to be required for the foreseeable future.

6 Limitations

URS Corporation Pty Ltd (URS) has prepared this report in accordance with the usual care and thoroughness of the consulting profession for the use of AusAID and only those third parties who have been authorised in writing by URS to rely on the report. It is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this report. It is prepared in accordance with the scope of work and for the purpose outlined in the Contract dated 20 January 2011.

The methodology adopted and sources of information used by URS are outlined in this report. URS has made no independent verification of this information beyond the agreed scope of works and URS assumes no responsibility for any inaccuracies or omissions. No indications were found during our investigations that information contained in this report as provided to URS was false.

This report was prepared between 17 November and 15 December 2012 and is based on the conditions encountered and information reviewed at the time of preparation. URS disclaims responsibility for any changes that may have occurred after this time.

This report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties.

Appendix A

Chemistry tests

2.31 Foods

(a) Cereals and cereal products

(b) Edible oils, fats and their products

(c) Nuts, fruits and vegetables and derived products

(e) Sugars and sugar confectionery

(f) Dairy products

(g) Meat, poultry and derived products

(h) Fish and fish products

Ash *Association of Analytical Communities* (AOAC) 900.02A
Ash AOAC 920.153
Ash AOAC 923.03
Ash AOAC 942.05
Ash AOAC 972.15
Calcium AOAC 965.09
Carbohydrates Calculation (by difference)
Fat *American Oil Chemists' Society* (AOCS) Ba3-38
Fat AOAC 989.05
Fat AOAC 995.19
Moisture AOAC 925.40
Moisture AOAC 925.45
Moisture AOAC 926.12
Moisture AOAC 930.04
Moisture AOAC 934.01
Moisture AOAC 934.06
Moisture AOAC 936.09
Moisture AOAC 969.35
Potassium AOAC 987.03A
Protein AOAC 928.08
Protein AOAC 991.20
Sodium AOAC 987.02A

Microbiological tests

1.11 Foods

(f) Dairy products

(g) Meat, poultry and derived products

(h) Fish and fish products

(n) Other specified fresh foods (salads)

In accordance with American Public Health Association (APHA) "Compendium of Methods for the Microbiological Examination of Foods" (4th Edition) and United States Food and Drug Administration (FDA) "Bacteriological Analytical Manual" (8th Edition) except where otherwise indicated.

Aerobic Plate Count APHA Ch. 7.72 (Petrifilm)
Aerobic Plate Count AOAC 989.10
Aerobic Plate Count AOAC 990.12
Coliforms APHA Ch. 8.935 (Petrifilm)
Coliforms AOAC
E coli APHA Ch. 8.935 (Petrifilm)

Appendix A

E coli AOAC 989.10
E coli AOAC 990.12
Listeria Neogen Listeria Reveal Screening
Listeria monocytogenes FDA Bacteriological Analytical Manual
Salmonella ISO 6579:2002E

1.12 Waters

(a) Potable waters

The following tests are in accordance with APHA "Standard Methods for the Examination of Water and Wastewater" (21st Edition) 2005 except where otherwise indicated.
Coliforms – Presence/Absence Colitag
Coliforms 9222 B
E coli – Presence/Absence Colitag
E coli 9222 G
Faecal coliforms 9222 D





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