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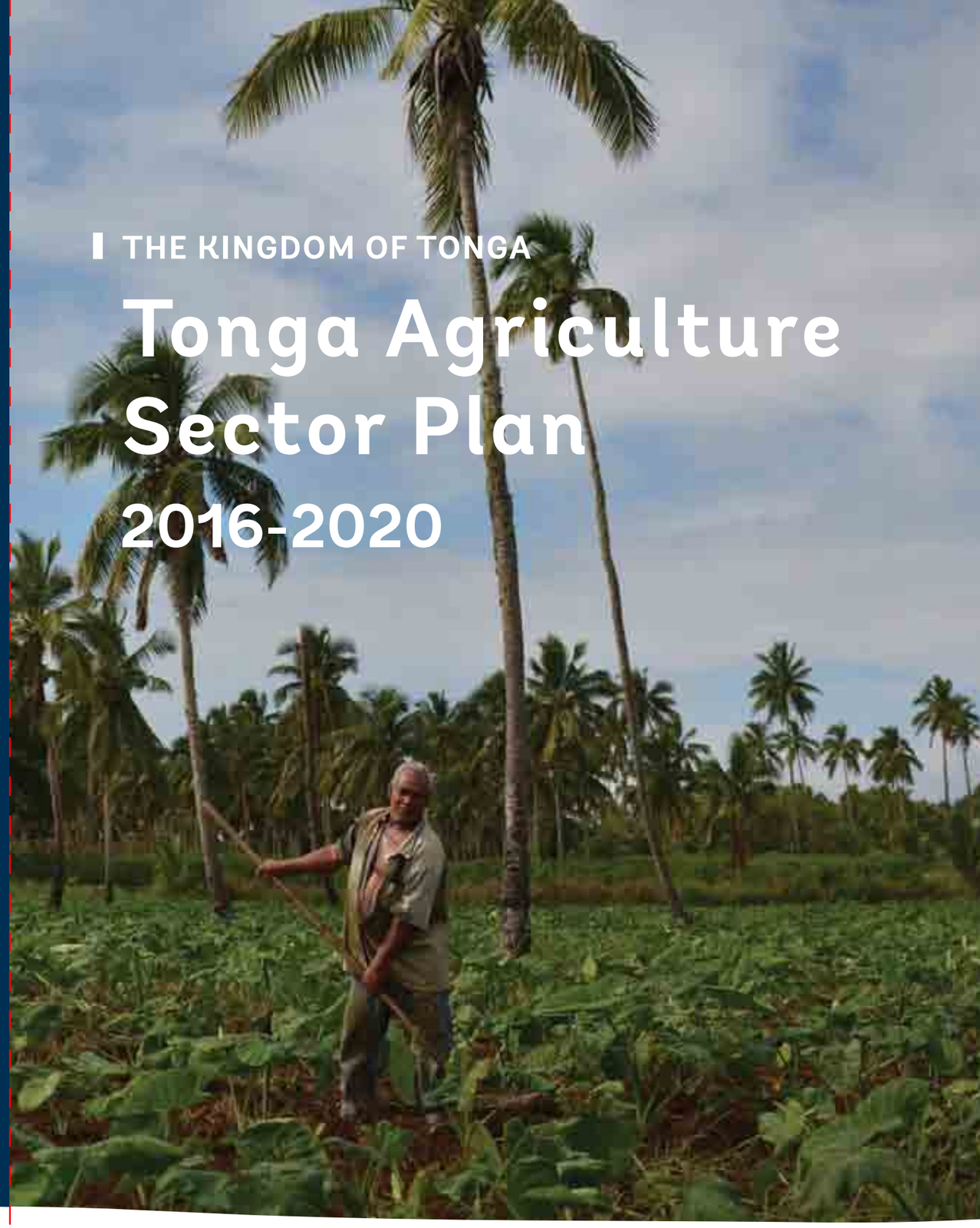

THE KINGDOM OF TONGA

Tonga Agriculture Sector Plan 2016-2020

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The Tonga Agriculture Sector Plan (TASP) is a framework for maximizing the contributions from the agriculture sector to the Kingdom's economic growth and food security in the face of a changing world economy and climate. The Government of Tonga extends its gratitude to the World Bank Group, IFAD and UNDP for their support in developing the TASP, as well as to all stakeholders who contributed to its design.

DISCLAIMER

The Kingdom of Tonga: Tonga Agriculture Sector Plan 2016-2020

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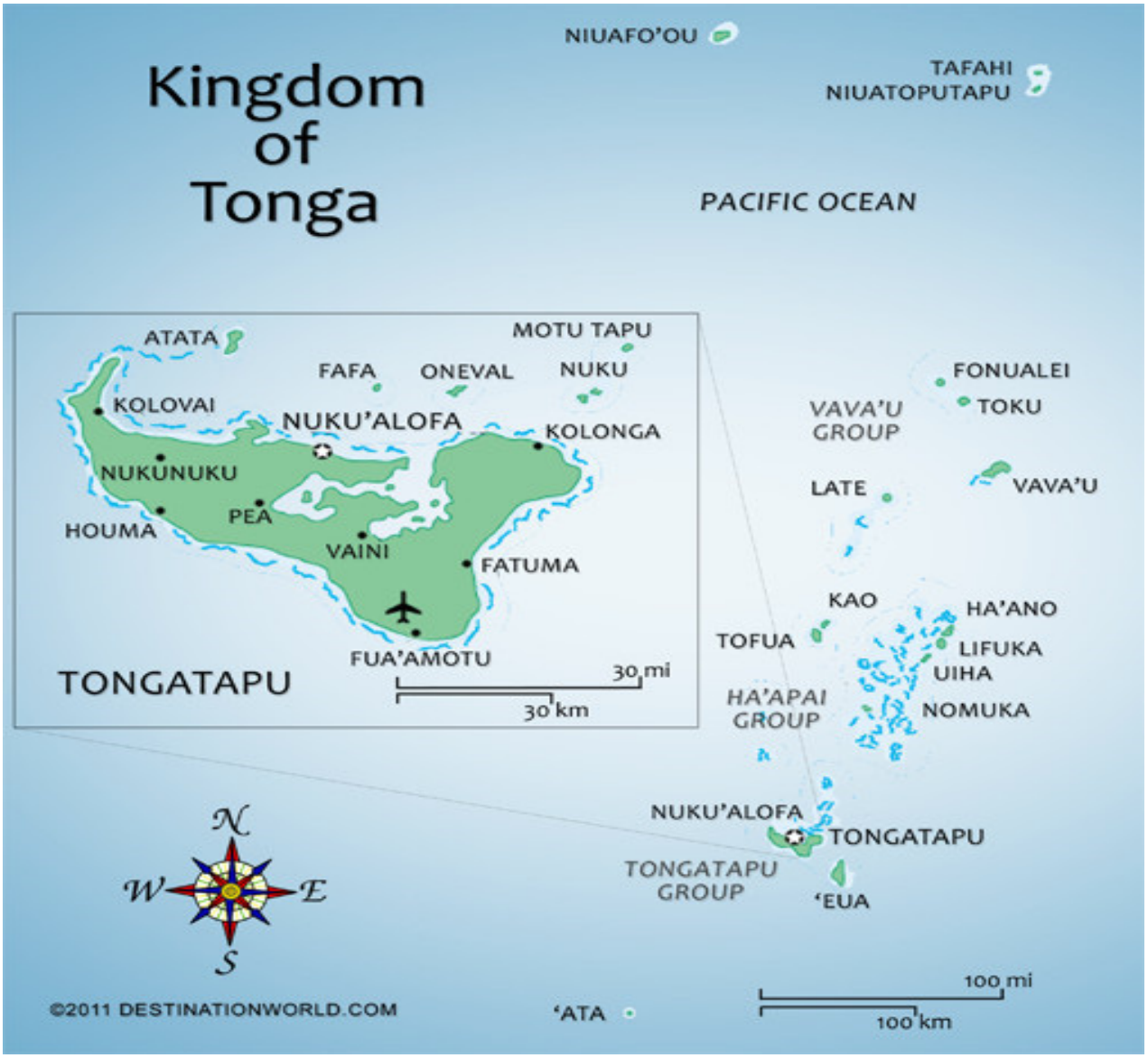
Abbreviations and Acronyms

ADB	Asian Development Bank
ADF	Agriculture Development Fund (Government of Tonga)
AMF	Agriculture Marketing Fund
APCC	APEC Climate Centre
AR5	Fifth Assessment Report
ASGC	Agriculture Sector Growth Committee
BSR	Business for Social Responsibility
CA	Conservation Agriculture
CCA	Climate Change Adaptation
CERs	Certified Emissions Reductions
CTA	Technical Centre for Agricultural and Rural Cooperation
DFAT	(Australian) Department of Foreign Affairs and Trade - incorporating the former AusAID

DIPECHO	Disaster Preparedness Programme of The European Commission's Humanitarian Aid Department (ECHO)
DRM	Disaster Risk Management
DRR	Disaster Risk Reduction
FLGs	Farmer Learning Groups
FMEAs	Farmer-Managed Extension Activities
GAFSP	Global Agricultural and Food Security Program – World Bank
GDP	Gross Domestic Product
GCMs	Global Climate Models
GEF	Global Environment Fund
GroFed	National Growers Federation
HACCP	Hazard Analysis at Critical Control Points
HIES	Household Income and Expenditure Survey
HLGs	Handicraft Learning Groups
HTFA	High Temperature Forced Air (facility)
IDF	Institutional Development Fund - World Bank
IPCC	International Panel on Climate Change
IUCN	International Union for Conservation of Nature
JNAP	Joint National Action Plan for Climate Change Adaptation and Disaster Risk Management
LCCRD	Low Carbon Climate Resilient Development
MAFFF	Ministry of Agriculture, Food, Forestry and Fisheries
MAT	Manufacturers Association of Tonga
MEIDECC	Ministry of Environment, Energy, Climate Change, Disaster Management, Meteorology, Information and Communications
MET	Ministry of Education and Training
MFNP	Ministry of Finance and National Planning
MORDI	Mainstreaming of Rural Development Innovation
MPI	(New Zealand) Ministry of Primary Industries
MDF	Market Development Facility -funded by DFAT
M&E	Monitoring and Evaluation
MIA	Ministry of Internal Affairs
NGO	Non-Governmental Organization
NEMO	National Emergency Management Office
NRBT	National Reserve Bank of Tonga
NSDF/TSDF	National/ Tonga Strategic Development Framework
NWRC	National Water Resources Committee
NZAid	New Zealand Aid Programme

PACC	Pacific Adaptation to Climate Change Programme
PACCSAP	Pacific-Australia Climate Change Science and Adaptation Planning Programme
PIPSO	Pacific Islands Private Sector Organisation
PPP	Public-Private Partnership
PRAC	Plan Review Advisory Committee - in ASGC
PRC	Peoples' Republic of China
SDVCs	Short Domestic Value Chains
SIDS	Small Island Developing States
SLR	Sea Level Rise
SMA	Special Management Area
SPBD	South Pacific Business Development
SPC	Secretariat of the Pacific Community
SPCR	Strategic Programme for Climate Resilience
SPREP	South Pacific Regional Environment Programme
TA	Technical Assistance
TASP	Tonga Agriculture Sector Plan
TASPICU	TASP Implementation and Coordination Unit
TBEC	Tonga Business Enterprise Centre
TCCI	Tonga Chamber of Commerce and Industry
TCDT	Tonga Community Development Trust
TDB	Tonga Development Bank
TEQM	Tonga Export Quality Management (Limited)
TFP	Tonga Forestry Products
TFSP	Tonga Fisheries Sector Plan
THCTSP	Tonga Handicraft and Tonga Tourism Support Programme
TMO	Tongan Meteorological Service
TRIP	Tonga Rural Improvement Project
TSDF	Tonga Strategic Development Framework
UNCBD	United Nations Convention on Biodiversity
UNCCD	United Nations Convention to Combat Desertification
UNFCCC	United Nations Framework Convention on Climate Change
UNFCCC CDM	United Nations Framework Convention on Climate Change: Clean Development Mechanism
VDPs	Village Development Plans - prepared with support from MIA
VRADs	Village Resilient Agriculture Demonstrations
VRAPs	Village Resilient Agriculture Plans
WHO	World Health Organization
WTO	World Trade Organization

MAP OF THE KINGDOM OF TONGA



1 INTRODUCTION

1. The need for the Tonga Agriculture Sector Plan (TASP) was identified as part of Tonga's national planning process. This Plan is expected to identify the Kingdom's vision and priorities for maximizing contributions from the agriculture sector both to its economic growth and to sustained food security in the face of a changing world economy, looming climate change, and natural disasters in the Pacific. The Plan is also expected to: (i) articulate specific programmes and activities which are required to achieve sector priorities; (ii) clarify the roles and responsibilities of the different sector stakeholders; (iii) estimate investment needs; and (iv) provide a framework for measuring progress over the short- and medium-terms[1].

2. A Background Report on Tonga's agriculture sector was prepared during the first Phase of the TASP work programme (see Section 10.1)[2]. Prior to the commencement of TASP design, considerable groundwork was completed in terms of defining broad objectives for the agriculture sector, including: (i) the National Reserve Bank of Tonga's Economic Dialogue (2012); (ii) the Tonga Strategic Development Framework I (TSDF I) (2011 – 2014)[3]; (iii) the Joint National Action Plan for Climate Change Adaptation and Disaster Risk Management (JNAP); (iv) establishment of separate Sector Growth Committees for Agriculture and Fisheries (the Agriculture Sector Growth Committee [ASGC] for agriculture); and (v) the Ministry of Agriculture, Food, Forestry and Fisheries' (MAFFF's) Corporate Plan (2014/15 - 2016/17). A process is also underway to facilitate the preparation of new corporate plans for all ministries, with support from the Asian Development Bank (ADB).

3. The work completed as part of the above-listed planning exercises provides a good basis for formulating the agriculture sector plan. As the main objectives have been broadly identified, the next steps are to: (i) identify and prioritize the programmes and activities needed to achieve the agreed objectives; (ii) define the logical roles and responsibilities of the different stakeholders in the sector; and (iii) estimate the cost of implementing the TASP.

4. The TASP is expected to promote a balance between export-oriented objectives, import substitution, and subsistence agriculture; and to incorporate a strong focus on sustainability and building resilience against climate change and natural disasters. The importance of: (i) integrating all stakeholders' views; (ii) considering the different circumstances in the Outer Islands; and (iii) identifying linkages with other related sectors also needed to be recognized.

5. The TASP design process has been actively overseen by the ASGC with cooperation from: (i) all of MAFFF's divisions; (ii) the Churches (four main denominations); (iii) a wide range of interested stakeholders from the private and public sectors; and (iv) about 600 men and women farmers who were interviewed in workshops to obtain their views on current sectoral constraints and issues, and their opinions on TASP's objectives, and possible programmes and activities. This very inclusive and responsive process means that all stakeholders have been included in the design process and have a high degree of ownership of the TASP.

[1] Note that the Tonga Fisheries Sector Plan has been prepared as a separate exercise and published independently.
[2] Readers are referred to this Background Report as a key source of information on which the TASP has been designed.
[3] This was updated during the TASP design process with a Draft Report being published on 3rd March, 2015.

2 COUNTRY BACKGROUND AND CONTEXT

2.1 Introducing the TASP's Four Strategic Objectives

6. At this point in the TASP document (as the background is set, linkages and compliance with various national plans and policies are described, and the sector is analyzed) it is relevant to introduce the TASP's four strategic objectives which were identified and agreed with the ASGC during Phase I of the TSASP planning exercise. This resulted in the Background Report (published as a standalone annex). These strategic objectives are listed below to enable readers to understand and interpret how they link with national objectives, and fit with and respond to the current situation in Tonga's agriculture sector. They form the basis of the four development Programmes set out later in this document:

7. The TASP is based on designing groups of activities (in the form of Programmes) which will achieve the following four strategic objectives:

   (i) **Strategic Objective 1**: To develop a climate-resilient environment;

   (ii) **Strategic Objective 2**: To improve the enabling environment;

   (iii) **Strategic Objective 3**: To develop diverse, climate-resilient farming systems for the Kingdom's islands; and

   (iv) **Strategic Objective 4**: To increase and sustain rural incomes across the Kingdom

2.2 Country Background

2.2.1 Population and Poverty[4]

8. About 75% of Tonga's population lives in rural areas,[5] with agriculture and fisheries as the main source of livelihoods. Tonga has one of the highest rates of subsistence food production amongst Pacific Island Countries. This is largely based on traditional production of root crops, which provide food security, employment and income for many households. Despite this underlying resilience, there are a number of factors which are increasing the vulnerability of the agricultural sector. There is also a need to identify more products which are suitable for semi-commercial production.

9. Generally, rural poverty is concentrated among smallholder farmers who practise mixed subsistence and cash-crop production[6]. About 25% of households in Tonga are estimated to currently live below the Basic Needs poverty line[7]. The severity and depth of poverty have increased significantly in the last decade, with the outer islands and non-urban areas of Tongatapu experiencing the sharpest rise. Historically, poverty and vulnerability have related more to geographic location than socio-economic characteristics. However, evidence now suggests that this situation is changing as remittances fluctuate, women's roles in income generation increase (mainly from handicrafts) and the number of unemployed youth grows.

10. Tonga's rural population is declining slowly, as a result of outmigration (in 2014 the net migration rate was estimated to be -17.85 people/1,000 population), and a lack of incentives (limited income-earning capacity, and the attraction of urban lifestyles) for young Tongans to remain in

[4] See Annex 1 (Background Report) for more details on Tonga's agriculture sector.
[5] In 2006 (the last census) 48,885 out of 64,597 households were classified as rural. Source: Kingdom of Tonga National Census - 2006. Of these families, 14,241 earned their livelihoods from the agriculture sector.
[6] http://asia.ifad.org/web/tonga/overview
[7] http://www.indexmundi.com/g/r.aspx?c=tn&v=69

rural areas[8]. This is leading to an aging farmer population, which faces farm labour shortages - a scenario which has implications in the longer term for staple food self-sufficiency.

2.2.2 The Agriculture Sector

11. Less than 10% of Tongan farmers are commercial producers who grow excess products for the formal market. The majority of Tonga's agriculture is still based on traditional/subsistence farming systems, some of which are under pressure from declining organic matter in the soils and declining crop diversity. Most farmers maintain multi-crop systems based on root crops, which satisfy their basic food needs. Some producers have the potential (with appropriate support) to graduate from subsistence to more commercial production activities, whilst others are expected to remain as small-scale subsistence farmers. The majority of land holdings are small (eight acres or about 3.24 ha). Table 1 lists household numbers and different sources of agricultural subsistence (not total) incomes, and shows the relative importance of income from handicrafts for rural households.

12. Most Tongan households keep livestock. Roaming livestock (mainly pigs) cause major crop losses, and even though this is a "community problem" there are few examples of communities being able to resolve this issue. Livestock productivity is very low, and cattle, in particular, suffer from inadequate supplies of feed and water. There are very few commercial livestock operations, mainly egg and small-scale pig production as livestock are kept primarily for home consumption, with the majority of "sales" being gifted as part of social obligations, and/or retained for important festivals and religious events. Given the current poor status of livestock production, there are some opportunities in selected areas to increase productivity to improve food security and diversity, and to generate livestock for sale, provided production and husbandry constraints are overcome.

TABLE 1: TOTAL SUBSISTENCE INCOME BY TYPE AND URBAN/RURAL (T$'000)

Income Source	Urban	Rural	Total
Agriculture	2,504	15,606	18,110
Livestock	1,727	12,046	13,773
Fish and seafood	2,724	4,639	7,363
Homemade produce	156	904	1,060
Handicrafts	4,870	21,658	26,528
Total Subsistence Income	**11,981**	**54,853**	**66,834**

Source: Kingdom of Tonga, HIES Survey, 2009.

13. Agriculture is the predominant economic activity in Tonga, although its relative importance has decreased in recent years. The sector's contribution to GDP declined from 26.3% in 2004/5 to about 19.2% in 2009/10. In the past agriculture has been an important contributor to Tonga's economy, but the performance of agricultural exports in recent years has been lacklustre. In 2009/10 about 90% of the country's exports comprised agricultural and fishery products, with a value estimated at T$13.8 million, a figure significantly lower than the levels achieved in the early/mid-2000s, of about T$20.0 million. However, a notable omission in terms of valuing exports is the failure to include perhaps as much as T$4.0 million from the private export of handicrafts. Table 2 lists Tonga's main agriculture exports other than handicrafts in 2011[9].

[8] See: FAO, Sub-regional Office for the Pacific Islands, TCP/TON/3302, "Migration, Remittance and Development", Tonga, April 2011, for details,

[9] Not all commodities are included in this table, hence the difference between the numbers in the table and those in the text.

TABLE 2: TONGA'S MAIN EXPORTS

Item	US$ million
Fish - fresh/ chilled	$3.2
Molluscs	$0.7
Plants	$2.9
Manioc, sweet potato, other roots	$1.4
Fish - dried/ salted	$0.7
Locust beans, seaweed, algae	$1.1
Other vegetables - fresh/chilled	$1.2
Coconuts, other nuts	$0.5
All Agriculture Commodities	**$11.7**

Source: FAOSTAT (2011)

14. Tonga's export vulnerability lies in its reliance on a very few export commodities. In fact until very recently, agricultural exports were dominated by a single commodity - squash. The recent decline of the squash industry is well-known and is often used as an example of how agricultural export markets can change and leave small-scale investors with large debts. Exports of squash declined from about 21,000 Mt in the early 2000s to only 846 Mt in 2010/11, although there has been some recovery since then. The decline in squash exports was a result of a complex set of factors, all of which needed to be taken into account when formulating the TASP[10].

TABLE 3: TONGA'S MAIN FOOD IMPORTS

Item	Mt	US$ million
Chicken meat	9,512	$12.46
Prepared food	1,470	$3.82
Sheep meat	595	$2.62
Beef and veal	425	$1.71
Butter	233	$1.63
Raw sugar	1,990	$1.24
Pastry	312	$0.96
Dried milk	65	$0.79
Ice cream/ice	267	$0.74
Fresh milk	580	$0.72
Food wastes	947	$0.71
Palm oil	316	$0.55
Wheat flour	760	$0.48
Macaroni	152	$0.36

Source: FAOSTAT (2011)

15. However, expanding Tonga's agriculture sector is not just about exports. Staple food self-sufficiency and food import replacement are equally important objectives in the longer term. Tonga has an "unwritten" objective of not becoming dependent on imported rice, not only because of the impact on the balance of trade, but also because of the "food vulnerability" element. Table 3 lists Tonga's main agriculture imports. There could be commercial opportunities to replace the importation of some chicken and mutton, and to a lesser extent, beef.

16. Continued and sustained self-sufficiency in staple foods is arguably as important as increasing exports, particularly in the face of greater weather extremes, such as the 2014-2015 drought and Cyclone Ian. Therefore, future agricultural development initiatives will need to heed the importance of including climate change adaptation (CCA) and disaster risk reduction (DRR) into programmes and projects that target the sector. The best way to achieve this is to focus on building resilience, with traditional production systems forming a strong foundation.

17. One of the immediate challenges faced by the agriculture sector is the identification of commodities which have market opportunities to replicate the scale and scope of squash

[10] The collapse of the squash market left many farmers with unpaid debts. There is an ongoing "debate" about past responsibility for this situation and how it developed, but it is beyond the scope of this Report to discuss.

production and exports. In this regard, farmers are considering alternative marketing structures such as the Eastern District Farmers Council. Past focus has been on addressing opportunities for the export of commodities such as watermelon, squash, butterkin pumpkins, zucchini, and frozen products markets in New Zealand, Australia, and other countries[11]. Compliance with market requirements, not only in terms of quality and consistency of supply, but increasingly in terms of biosecurity requirements, has become a clear priority. The Pacific Horticulture Agricultural Market Access Programme (PHAMA), which is funded by DFAT and NZAid, has an important ongoing role in this regard, as does direct support from NZAid for the provision of food export facilities.

18. In addition to meeting market access conditions, ensuring a consistent supply to satisfy potential market opportunities remains a significant challenge. The knowledge-base for the production of new export commodities is fragile, with dwindling expectations by farmers that MAFFF (through traditional adaptive research and extension services) has the capacity and skills to generate and transfer the knowledge required to introduce and produce new varieties. This situation led to the formation of the ASGC, which is a cross-sectoral organization with the objective of *"expanding the agriculture sector's contribution to employment, exports, and the annual growth of Tonga's GDP".* More recently, some export businesses have decided to fund their own product-specific grower outreach extension and crop production input services, as MAFFF has not been able to respond to such demands.

19. Another important driver for change is evolving market responses to climate change. A growing number of extreme weather events are increasingly impacting on global food supply chains. Leading international food companies are now actively factoring climate change responses into their business plans. This, along with new funding opportunities to address economic development needs, build climate resilience, and reduce and/or offset greenhouse gas emissions, provides strong incentives for a carefully designed strategic approach to agricultural sector development in Tonga. MAFFF Research is reported to be evaluating local food crop species/varieties for adaptability to climate change.

20. While there has been considerable emphasis on the revival of the export sector, less attention seems to have been paid in recent years to import substitution activities. In 2009/10, Tongan imports of agriculture products (mainly vegetables and animal products) were valued at T$48.8 million. MAFFF Research has small programmes on local meat production from sheep, poultry, and ducks. Small pilot, biogas/ piggery/ vegetable systems are also fledgling import substitution activities - some of which may have potential for scaling up, particularly if reliable supplies of domestically produced processed feed can be obtained. Domestic production of fruit trees and timber for construction are also import replacement products with potential, particularly tropical hardwoods.

21. The Background Report contains more agriculture statistics for Tonga (see Section 8.4 of that report).

2.3 National Development Plans and Policies

2.3.1 National Economic Dialogue

22. In March 2012 the National Reserve Bank of Tonga issued a National Economic Dialogue.[12] Key points of that Dialogue in relation to the TASP are the objectives of: (i) developing economic strategies and specific actions for inclusive economic growth which will raise livelihoods for all communities; and (ii) prioritizing economic strategies, given available resources and capacity. This Dialogue and the accompanying set of national objectives, prioritized strategies and specific

[11] 2014 exports were 179 Mt of butternut and 102 Mt of butterkin. Source: MAFFF Quarantine Database.
[12] http://www.reservebank.to/index.php/economicdialogue/61.html

actions is the single-most important policy document to "drive and guide" the formulation of the TASP.

2.3.2 Tonga Strategic Development Frameworks (TSDF) I and II

23. The TSDF I[13] (2011-2014) provided guiding principles and directions for the previous administration over its four-year term[14]. The NSDF I outlined a Vision, followed by nine Outcome Objectives and four Enabling Themes (grouped with their respective strategies). The National Development Vision was: *To develop and promote a just, equitable and progressive society in which the people of Tonga enjoy good health, peace, harmony and prosperity, in meeting their aspirations in life".* The following Outcome Objectives and corresponding Strategies from the TSDF I are directly relevant to the TASP:

    (i) Outcome Objective 1: *strong inclusive communities…….and* Strategy 1: *better formulation and implementation of outer island and rural development programmes through local communities*

    (ii) Outcome Objective 2: *dynamic public and private sector partnerships as the engine of growth….. and* Strategy 6: *improving output of the productive sectors …particularly (ii) agriculture, forestry and fisheries; and*

    (iii) Outcome Objective 7: *cultural awareness, environmental sustainability, disaster risk management and climate change adaptation, integrated into all planning and implementation of programmes …… and* Strategy 22: *ensuring sustainable use of the environment …. to create incentives for the use of resources.*

24. TSDF II was released as a draft in late 2014 and finalized in early 2015, just as the TASP was being prepared. TSDF II is not as specific about the agriculture sector as TSDF I, and it is more difficult to relate planned sectoral development interventions to this broad and general document. However, three of TSDF II's seven outcomes appear relevant to TASP: (i) urban and regional (agriculture) development; (ii) good governance (through MAFFF); and (iii) sustainable environment and climate resilience (cross-cutting for TASP). Figure 1 shows the linkages between the TSDF I and II Outcome Objectives, and TASP's four strategic objectives, listed in Section 2.1.

2.3.3 JNAP (2010-2015)

25. The Joint National Action Plan on Climate Change Adaptation and Disaster Risk Management (JNAP) complies with: (i) Tonga's NSDF I (2009–2014); (ii) the Pacific Islands' Framework of Action on Climate Change (2006–2015); (iii) the Pacific Disaster Risk Reduction and Disaster Management Framework for Action (2005–2015); (iv) the International Decade for Natural Disaster Reduction (IDNDR); (v) the Yokohama Plan for Action and the Hyogo Framework for Action (2005–2015); and (vi) the United Nations Framework Convention on Climate Change. The purpose of the JNAP is to ensure that related high priorities identified in the NSDF I are addressed and implemented at all levels. The JNAP comprises six priority goals, all of which are directly relevant to the formulation of the TASP.

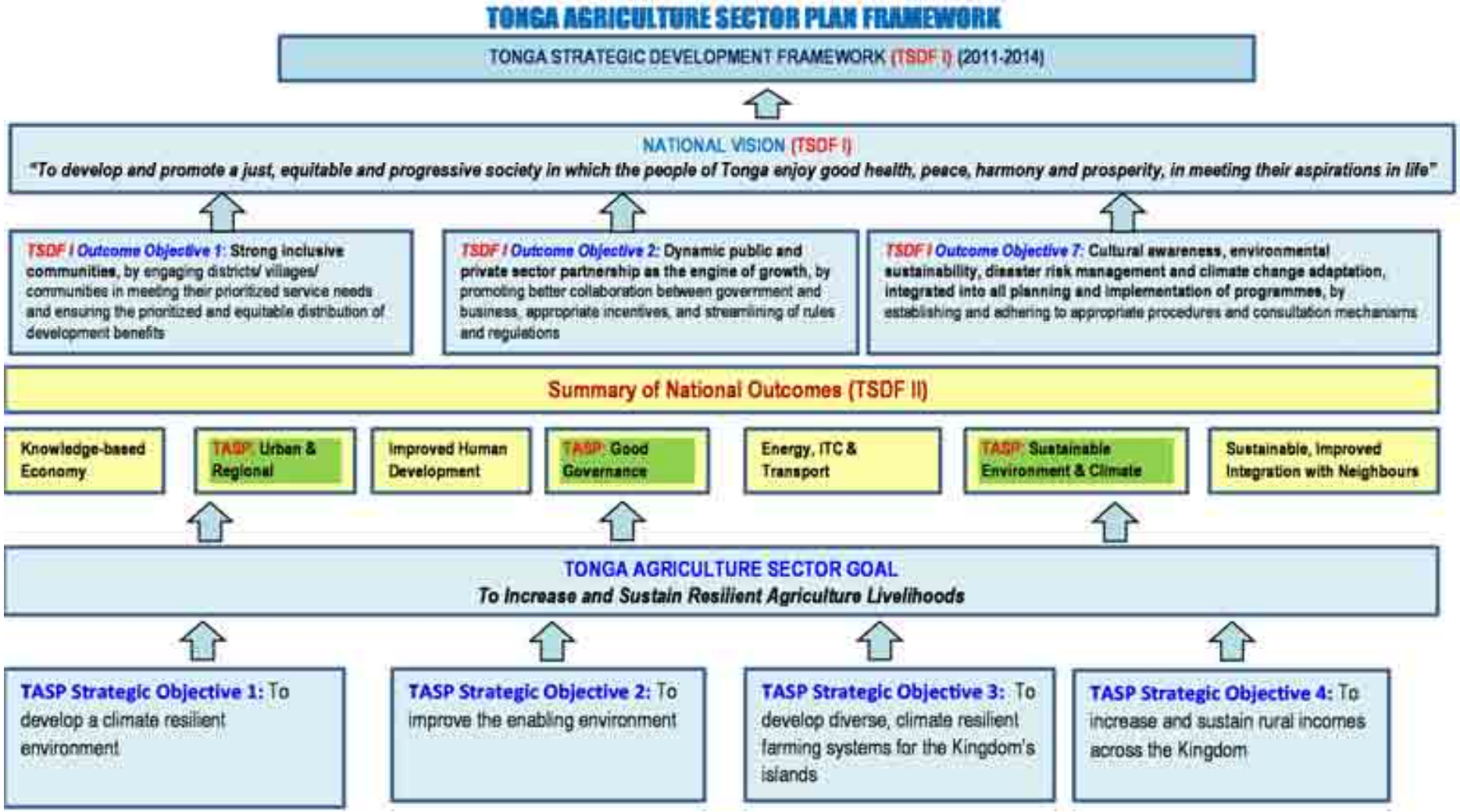
2.3.4 National Laws and Regulations - Agriculture Sector

26. There are about 60 laws and regulations that currently govern how Tonga's agriculture sector is managed. These are discussed in the Background Report. Many are well out of date and should be reviewed and upgraded with the objective of reducing the number.

[13] http://www.finance.gov.to/publications/tonga_strategic

[14] Note: at the time of preparing the TASP, Tonga was in the process of appointing a new Government following elections in late 2014; and the preparation of NSDF II.

FIGURE 1: LINKAGES BETWEEN TSDF I AND II OUTCOME OBJECTIVES AND TASP STRATEGIC OBJECTIVES



2.4 Climate Change

27. A consequence of agricultural and other development throughout the world is environmental degradation. This has occurred over the course of human history and has been linked to the decline of past civilisations with associated climatic shifts. Tonga is no exception. Historically, a form of swidden agriculture was practised with clearance of bush for cultivation of root and other crops, followed by periods of regeneration. Progressively, as with many countries, most of the original forest of Tonga has been destroyed. Fallow periods now occur by default, with many eight-acre blocks (as much as 80% of the land in some islands) unused for agriculture. Introduced plant species predominate. There are suggestions of overuse of agricultural chemicals but no strong evidence of groundwater pollution, although the death of the coral reef on the north side of Tongatapu suggests significant runoff and associated pollution.

28. Continuous cropping of some soils has probably led to loss of soil fertility and less production as a result. Water resources are variable across the islands with some having apparent abundance (e.g. Tongatapu and 'Eua) and others having shortages (e.g. Ha'apai). Following the recent drought (summer of 2014/15) there is strong interest in making greater use of groundwater for irrigation. At the same time there appears to be little knowledge and practice of soil and water conservation techniques. Additionally, use is not made of waste for its potential as a source of fertilizer and general soil improvers, thereby preventing pollution.

29. All of the above is increasingly brought into focus with climate change. Climate change is the single biggest issue that is likely to shape the future of agriculture in Tonga and the ability of the country to be self-reliant. As things stand Tongan agriculture is at a crossroads. With a narrow focus on addressing immediate needs for economic growth there could be an intensification of agriculture with consequent depletion of groundwater resources, long-term degradation of soils, and further pollution of lagoons. However, with a longer-term focus on the real threats associated with climate change, combined with a focus on short-term needs, a more balanced approach is possible, which addresses environmental, social and economic considerations in a fully integrated manner. This is the pathway of Climate-Resilient Adaptation.

2.5 Climate Change Adaptation and Disaster Risk Management

30. Climate-Resilient Adaptation is the overarching focus of the TASP. The Fifth Assessment Report (AR5) of the International Panel on Climate Change (IPCC) provides key relevant points. These are detailed in the TASP Background Report, as is the most recent report from the Pacific-Australia Climate Change Science and Adaptation Planning Programme (PACCSAP), which provides the following projections for Tonga to 2100: (i) El Niño and La Niña events will continue to occur in the future (*very high confidence*); (ii) it is not clear whether mean annual rainfall will increase or decrease and the model average indicates little change (*low confidence in this model average*), with more extreme rain events *(high confidence*); (iii) drought frequency is projected to decrease slightly (*low confidence*); (iv) ocean acidification is expected to continue *(very high confidence);* (v) the risk of coral bleaching will increase (*very high confidence);* and (vi) sea level will continue to rise *(very high confidence).*

30. Readers are referred to the Background Report for additional comments on how changes in rainfall are the most critical likely events for the future of agriculture in Tonga; and to the Tonga Country Risk Profile, generated from the Pacific Catastrophe Risk Assessment and Financing Initiative, for comments on possible economic losses from natural disasters.

2.6 Domestic and Irrigation Water

31. Aside from sea-level rise, which over time will have severe effects on low-lying islands and coastal areas of Tonga, water will increasingly be a critical issue for agriculture, which has historically relied on seasonal rainfall patterns with the timing of crop cycles well attuned to this seasonality. For the most part there has been, and continues to be, sufficient rainfall for

subsistence agriculture. However, the recent drought was a reminder that rainfall cannot be relied on and that enhancements to agricultural production systems may provide greater resilience. On Tongatapu there is some use of groundwater for the irrigation of commercial crops, and there is interest in expanding irrigation for vegetable production.

32. There have been at least four studies of relevance to the use of water for irrigation in Tonga. A comprehensive hydro-geological study for all of Tonga was published in 1993 and is due to be updated through the Asian Development Bank (ADB) Strategic Programme for Climate Resilience (SPCR). One of the main conclusions from an irrigation assessment for Tonga, completed in 2000, was that *"irrigation as a farming system is inappropriate for Tonga. The ground and surface water resources are considered to be insufficient to sustainably meet the needs of all water users"*[15]. A comprehensive report on the Vulnerability of Ground Water in Tongatapu was completed in 2009[16]. The main threat to groundwater was found to be institutional with *"no legal basis for protecting groundwater from harmful activity or over use*." This report provides key and detailed recommendations, some of which are of directly relevant to the TASP.

33. The 2009 report estimated that the total sustainable pumping rate of groundwater for Tongatapu was, "between 54 and 72 ML/day"[17]. The report further estimated that current (in 2009) water-extraction, "could be as high as 13.4 ML/day" equating to 25% of the sustainable yield based on the lower estimate of 54 ML/day. The implication is that 75% (up to 40ML/day) of groundwater is still available for household consumption and other purposes, including irrigation. The updated hydrogeological study, planned through the SPCR, will provide much more accurate and up-to-date information on the situation and potential in Tongatapu as well as providing accurate information for the other islands.

34. It is clear from the above that more research is needed to establish better estimates of how much water is available throughout Tonga within the context of a precautionary approach to unfolding climate change and sea level rise. The planned updated hydrogeological study will provide valuable information. However, there will need to be further dedicated research focusing on irrigation potential.

2.7 Soils

35. The last definitive soil survey of Tonga was completed by a team from the former New Zealand Department of Scientific and Industrial Research (DSIR) between 1975 and 1978[18]. Detailed soil maps (1:25,000) and reports were prepared on the status of soils and on nutrient deficiencies that limited plant growth. Recent studies on nutrient deficiencies, crop response to fertilizers, water and land preparations, fallow species, agroforestry, and pollution on the different soil types of Tonga by Halavatau (1996), Manu (2000) and Pochet (2003) van der Velde (2006) have expanded and updated the initial soil survey to changes in soil fertility as a result of changing intensity in crop production and changing climate, etc. Therefore it is important that MAFFF and Tonga's farmers understand the current status of the Kingdom's soil fertility, with the objectives of: (i) not overusing fertilizer when following general application recommendations and therefore contaminating shallow groundwater; and (ii) addressing deficiencies which may have developed since the 1970s. As Tonga's agriculture sector becomes subjected to increasing pressure to feed the Kingdom in the face of climate change and other global changes and pressures, it is essential that the status of its most fundamental agriculture resource (soils) is understood.

[15] Faber, G. 2000. Water Resource and Irrigation Assessment for Tonga. Report to the Food and Agriculture Organisation of the United Nations.

[16] White, I, Falkland, T., Fatai, T. 2009. Vulnerability of groundwater in Tongatapu, Kingdom of Tonga. Groundwater evaluation and monitoring assessment. Australian National University, Canberra, Australia.

[17] ML/day means million litres per day or 1,000 cubic metres.

2.8 Sustainable Food Supplies

35. In 2013, the last year for which full-year results are available, Tonga imported basic food products (animal and vegetable products) valued at about T$55.5 million, whereas the value of similar products exported was only T$18.9 million, a "food trade deficit" of about T$36.6 million - see Table 4. Some of these products or animals can be grown or reared in Tonga as import replacement items. Similarly, it should be possible for Tonga to increase production of import-replacement animal products (for example more poultry meat, mutton, pork, goat and beef) as well as vegetables (onions and potatoes) if production and market difficulties can be resolved.

TABLE 4: SELECTED NATIONAL TRADE STATISTICS, 2013

Product	Imports (T$)	Exports (T$)	Trade Balance (T$)
Live animals, animal products a/	$42,562,879	$6,464,065	-$36,098,814
Vegetable products	$10,711,053	$12,430,129	$1,719,076
Animal or vegetable oils and fats	$2,185,542	$1,000	-$2,184,542
Prepared foodstuffs b/	$49,665,836	$340,429	-$49,325,407
Total	**$105,125,310**	**$19,235,623**	**-$85,889,687**
Total (exc pepared food)	**$55,459,474**	**$18,895,194**	**-$36,564,280**

a/ Includes all fish products
b/ Including beverages, spirits and tobacco
Source: International Merchandise Trade Statistics, Annual (2013)
Statistics Department of Tonga, Series No SDT:31-34.

36. Table 4 has been included in the TASP with the intention of highlighting the importance of setting an objective of sustainable food supplies for Tonga in the foreseeable future. At present the Kingdom is not self-sufficient and whilst deficits can be met with imports, this may not always be the case in the future given looming climate change, and changes in world trade conditions and patterns. Additionally, as future climate and other crises unfold globally, the world's willingness and capacity to effectively fund at least a portion of the deficit in the form of increased aid is likely to diminish. In fact Tonga should consider a future when aid is no longer available and the country has to be self-reliant. Tonga should not simply assume the *status quo* when it comes to international supplies of foodstuffs that could be grown or reared domestically. Accordingly, the TASP has a firm policy of "Food for Tonga First".

3 TONGA'S AGRICULTURE SECTOR: STATUS AND ANALYSES

3.1 Agriculture Policy

37. The TASP is an initiative of the ASGC and therefore is broader in scope (in terms of targeted stakeholders) than the public sector-focused MAFFF Corporate Plan (2014/15 - 2016/17). However, MAFFF's Plan is relevant to the current sector planning exercise.

38. The Foreword in MAFFF's Corporate Plan states: *"fundamentally, there are no formal sector policies and plans for agriculture and fisheries. (However) Tonga's first ever National Forest Policy was approved by Cabinet in 2012, and the ASGC envisages an Agricultural Sector Plan/Policy (the TASP) by end of 2014".* MAFFF's Corporate Plan also summarizes the following challenges and expectations: (i) uncertainties in overseas markets and changing market demands, while Tonga's ability to respond positively is restricted; (ii) increasing costs of production due to high costs of inputs, freight, and marketing; (iii) unfavourable weather conditions impacted by climate-change factors; (iv) unreliable shipping schedules; (v) demanding quality standards and stricter quarantine requirements for Tonga's export produce; (vi) underestimation of informal markets and the true value of the sector's contribution; and (vii) MAFFF's (limited) capacities.

3.2 The State of Agriculture

3.2.1 The Smallholder Sector

39. Despite the underlying resilience of Tonga's agriculture sector, there are several previously discussed factors increasing its vulnerability, including rural poverty, outmigration of rural populations, an aging farmer population, and the impact of extreme weather events, which are likely to increase as a result of climate change. At the same time, there is unrealised potential to adopt a "food first" approach for households to reduce dependence on imported foods and provide surplus products for sale, thus enabling households to progress to semi-commercial production.

40. To better understand the impact of these and other issues on smallholders, a comprehensive community engagement process was undertaken during the TASP design. This involved conducting farmer workshops in Tongatapu (3 workshops), 'Eua (1), Ha'apai (2), and Vava'u (4). These half-day workshops involved men and women working in separate groups to identify: (i) key issues, constraints and problems; (ii) their understanding of associated causes; and (iii) possible solutions.

41. Common issues emerged from all workshops, with variations according to the island and even communities within an island. For example, there was much stronger emphasis on handicrafts as a key source of household income (as much as 50%) in Vava'u and Ha'apai. One community in Vava'u was particularly strong in terms of the number of youth remaining in the community and being mentored as young farmers by their elders. Common issues included the following:

- Markets – Many talked about the need for markets and the fact that everyone grows the same products and floods the local markets at the same time. There is clearly a lack of understanding that markets cannot simply be created by Government.
- Infrastructure – This included basic community infrastructure, access roads to farms, access to social services, evacuation access, and street lighting.
- Water Resources and Services – The main emphasis with water was the unreliability and poor quality of public water supply, and lack of alternative water sources. No communities raised the need for a regular supply of water for tethered cows, which is a serious animal-welfare issue.

- Food Security – This included lack of appropriate tools (many would like tractors for ploughing when simpler tools and different crop production systems may be more appropriate), poor access to planting materials, and generally low technological advancement.
- Climate-Change Resilience – Traditional farming systems cannot cope with the changes in weather patterns that are being experienced. Drought-tolerant varieties are not available, and current farming practices are not considered to be sustainable.
- Capacity Building – There is a widespread lack of knowledge on climate change, agribusiness, farming techniques, food preservation techniques, adding value through processing, and on how to improve crop and livestock productivity.

42. All of the above points highlight the need for an integrated approach aimed at building on the natural resource base, and current social situation of communities in order to develop and extend climate-resilient agriculture systems.

3.2.2 Climate Change

43. Climate change is increasingly an important driver of change and this is particularly so in Small Island Developing States (SIDS) which are considered amongst the most vulnerable. With a growing number of donor-funded climate change projects there is some evidence of the development agenda in Tonga being driven from the outside rather than from within the country. Many of these projects are either directly or indirectly linked to the agriculture sector and they now form the principal focus of development assistance. With the new Green Climate Fund coming on stream with a clear focus on supporting low-carbon, climate-resilient, development, and a similar focus emerging through the business plans and supply chains of multi-national companies, there is a clear opportunity for Tonga to proactively position itself through the TASP. In fact this move will be essential in order for the agriculture sector to shape the agenda for donor funding. The key point is the importance of an overarching focus on low-carbon, climate-resilient development for Tonga's agriculture sector as a whole. The location-specific directions outlined below need to be aligned with this overarching context.

3.2.3 Climate-Resilient Agriculture

44. The TASP includes strategies to support climate-resilient agricultural production systems that are driven by healthy soils, secure and sustainable water supplies, diverse farming systems, and adaptive rural communities. Ultimately, any country that ignores this will face problems related to: (i) self-sufficiency in staple foods; (ii) rural income sustainability; and (ii) export income generation and employment. Therefore, and given Tonga's current state of development in terms of achieving these three objectives, it is essential that the TASP includes strong elements of support to ensure that the Kingdom's: (i) soils are maintained in a state of productive health; (ii) crop/ livestock damage by pests is minimized as a result of integrated pest management, rotational and mixed cropping, biological control, and careful use of pesticides (iii) agricultural waste and surpluses are managed appropriately, including through the possible use of biogas; (iv) supplies of domestic and agriculture water are protected; (v) plant and livestock diversity is widened to enable climatic shocks to be withstood; and (vi) rural communities are equipped with the knowledge needed to enable them to continue living sustainable lifestyles.

45. **The use of biodigesters**[19] in Tonga to produce biogas and organic fertilisers is strongly aligned with the TASP goal to increase and sustain resilient agricultural livelihoods. Biodigesters can play a key role in an integrated farm system, providing waste-management services and fertiliser and energy inputs to cropping and crop processing. Use of this technology in Tonga has so far been limited to a limited number of biodigesters involving piggeries. However, Tonga has abundant

[19] The input of Murray Ward, Bioenceptionz (http://bioenceptionz.com/) to this section is gratefully acknowledged

potential feedstock for biodigesters, and therefore the possibility to produce significant amounts of bioenergy for use by farms, villages and plantation estates. This feedstock includes crop residues, food and beverage processing residues, invasive and overgrown weeds, and grasses and bushes, as well as purpose-grown energy crops, food waste, and animal waste.

46. TASP will focus on the expansion of the work done by the People's Republic of China/MAFFF Agro-tech Cooperation Project (since 2010) to establish the Piggery/Biogas/Vegetable production system in Tonga. Two biogas systems (30 cubic meter digester tank) were constructed for demonstration and training purposes, one each at the Vaini Research Station on Tongatapu and at the Vava'u Experimental Farm. Following training sessions for various groups of interested farmers in Tongatapu and Vava'u, 15 biogas systems (15 cubic meter digester tank) were constructed for 13 farmers in Tongatapu and 2 farmers in Vava'u. The piggery/biogas/vegetable system provides gas for a household's stove, light, and water heating, together with pig meat and organic fertilizer for vegetables. FAO is also implementing a project on Tonga Integrated Land and Agro-Ecosystem Management System, involving biodidigesters. The TASP will support expansion of these developments.

47. To ensure fully informed decisions on options for biodigesters in Tonga, which are not limited to the existing piggery model, the TASP will draw on knowledge and experience being developed elsewhere in the Pacific. Biodigester systems have also been developed and are under test in Samoa. Their performance will be monitored for transfer if they perform better than the systems in Tonga.

3.2.4 Subsistence-level Staple Food and Livestock Production

48. Not all rural families can, or want to, become exporters. Consequently, a good standard of subsistence living (adequate staple and nutritious food, and access to reasonable housing and domestic water supplies), supported by improved health and education services, is a reasonable objective. It is unrealistic to postulate that Government or the private sector will provide transport services at (the low) prices required to make agriculture exports of high-weight, low-value commodities from the more remote islands competitive. This would require heavy subsidies. Emphasis should, instead, be on high-value, low-weight, and long-storage crops such as kava and vanilla, which is already being grown in remote islands such as the 2 Niua's. Nevertheless, regional shipping services could be more efficient and affordable with improved coordination and better matching of ship sizes to the demand for sea freight. This important and restrictive aspect of Tonga's agriculture export sector warrants, as a minimum, further investigation under the TASP.

49. While there are rural development strategies that can assist Tonga's more isolated rural communities, expectations need to be moderated and tailored to realistic objectives that reflect the likely development of transport services. With regard to a specific strategy for Tonga's more isolated rural communities, who are probably destined to remain as subsistence farmers for the foreseeable future, there is, apart from the Tonga Rural Improvement Project (TRIP), which has until recently focused on small-scale rural infrastructure, no clear and focused strategy for the development of the outer islands. Smallholder-focused development initiatives are included in the TASP to promote the development of diverse and climate-resilient farming systems suitable for Tonga's various agro-ecological zones.

50. Lessons from Mainstreaming of Rural Development Innovation (MORDI) and TRIP indicate that there is one key approach that is essential if development is to be sustainable. This is the building of community cohesion and capacity before commencing to implement development activities. MORDI and TRIP take from nine to 15 months to instigate and then build rural community capacity and ownership as an essential precursor to activity implementation. In some cases it may take up to five years for development activities to be fully embedded, which creates tension with short-term projects and their M&E requirements.

51. It would be unwise for the TASP programmes to ignore this critical lesson. This recommendation is further reinforced by the IPCC's conclusion: "… *caution is needed to ensure such [development] assistance is not driving the climate change agenda in small islands, as there is a risk that critical challenges confronting island governments and communities may not be addressed. Opportunities for effective adaptation can be found by, for example, empowering communities and optimizing the benefits of local practices that have proven to be efficacious through time, and working synergistically to progress development agendas".*

3.2.5 Exports, and Import Replacement

Exports

52. Work to promote exports is currently underpinned by a range of strategies and has been the focus of numerous development initiatives over the past five years (see Table 7 in Annex 3 in the Background Report). The area is now led by the ASGC, with MAFFF playing an important quarantine and regulatory role, following transfer of the operation of the High Temperature Forced Air (HTFA) facility from MAFFF to Tonga Export Quality Management Limited (TEQM), which is a public enterprise supported by Australian and New Zealand aid. The HTFA operation was transferred to TEQM in 2010 with papaya and breadfruit as the main export products.

53. In terms of a specific strategy for exports, there is a need for a range of strategies to focus on overcoming constraints, identifying and opening export opportunities, and setting priorities. An important aspect will be the development of a programme to brand Tongan agriculture as "low carbon and climate resilient". ASGC's expected outcomes, reflected in the TASP, are a good reflection of the core strategies required to drive exports and import replacement over the life of the TASP. They are as follows:

(i) Identification of constraints to growth in the agricultural sector supply chain at all levels, including provision of inputs, production, processing, marketing and transport.

(ii) Timely identification of prioritised policies, strategies and initiatives to improve the growth and contribution of the agricultural sector, followed by implementation of these agreed interventions with better monitoring and reporting on progress.

(iii) Consultation, communication and coordination between the agricultural sector stakeholders and relevant Government agencies.

Import Replacements

54. At present there are no specific import-replacement development strategies in place, although MAFFF is promoting domestic production of poultry, ducks, pigs, sheep, vegetables, mushrooms and sweet potato noodles, as well as the replacement of some imported fruit and timber products. Local businesses have considered the potential to replace imported livestock products, but have not yet made necessary investments. The current work of the People's Republic of China/MAFFF Agro-tech Cooperation Project and past work by ACIAR and FAO suggests opportunities to produce more poultry meat and beef (the two main imported livestock products) but there are concerns about scale and commercial viability of abattoirs and meat-processing operations. Any import replacement should be driven by the private sector with Government playing a role of facilitation and policy support. There is a need for a specific strategy (and support for) this small but emerging area.

3.2.6 MAFFF Research and Extension Services

55. Recent experience indicates that MAFFF has neither adequate human resources nor the operational budget to be able to implement programmes and projects that are dependent for success on slow and steady community capacity building prior to activity implementation, as

presently carried out by TRIP. This follows a major retrenchment programme in 2008. In 2009/10 MAFFF's total budget was T$5.4 million (with T$4.3 allocated to salaries) and in 2014/15 the corresponding figures are T$8.4 million and T5.3 million, respectively, implying that the ratio of operational costs to total budget has increased from 20% to 37%, although it is lower in some Divisions, such as 21% for Crops Research and Development; and 16% for Livestock Production.

56. Despite these recent budget increases, MAFFF's capacity and capability remain limited at a time when the sector is under pressure to adapt in response to changing markets and climate change. At present MAFFF is unable to provide full services to farmers, consistent with its charter. This was noted by various heads of departments met by the design team and observed in the field when inspecting facilities and offices and talking to farmers.

57. In addition, the Ministry's budget is reported by senior staff to be inadequate (see Table), with 67% of funds being spent on salaries and other direct staff costs. This figure is even higher for some Divisions, for example: (i) 79% for Crops Research and Development; and (ii) 84% for Livestock Production. However it is important to note that MAFFF's total budget has increased by 55% since 2009/10, and that the ratio of operational costs to total budget has also increased from 20% to 33%.

58. This finding warrants further analysis during the proposed MAFFF institutional review as it is somewhat counter-intuitive that whilst MAFFF's budget has increased, the level of farmer services has declined. In terms of understanding MAFFF's current research and extension services, it should be acknowledged that:

    (i) Tonga has a limited budget and small population and it would be impossible for MAFFF to provide the fully fledged array of extension services that a "typical" Ministry of Agriculture would be expected to provide; and

    (ii) There is therefore a need to carefully prioritize the areas of extension services that MAFFF should engage in and, for the remainder, consider: (a) leveraging regional experience and expertise, and (b) encouraging the private provision of these services, as is already starting to occur.

TABLE 5: MAFFF'S BUDGET FOR 2014/15 - BY PROGRAMMEE AND SUB-PROGRAMMEE

MAFFF's 2014 Budget for Agriculture Sub-Program Totals (T$)				
Program	**Sub-Program**	**Staff Costs**	**Total Budget**	**Staff/Budget**
Fisheries Development		$1,086,084	$1,749,821	62%
Leadership and Policy Direction		$1,209,479	$1,848,514	65%
Agriculture & Forestry Development	Crops Research Development	$626,297	$790,249	79%
	Export Expansion, Food Security and Women Development	$1,055,766	$1,866,496	57%
	Forestry Development & Conservation	$465,247	$630,247	74%
	Livestock Production Development	$419,071	$499,531	84%
	Quarantine & Quality Management Support Services	$702,143	$932,096	75%
	Food Processing & Regulatory Services	$61,046	$86,046	71%
Sub-Total Agriculture and Forestry Development		**$3,268,524**	**$4,718,619**	**69%**
Total (T$)		**$5,564,086**	**$8,316,954**	**67%**

59. The move by members of the private sector to form their own product-specific extension services is indicative of this situation, as is the run-down state of the Ministry's research stations. Experience indicates that the key ingredients for success in terms of rural development, mitigating greenhouse gases, and building climate-resilient agriculture, are farmer participation, supported by appropriate investment in extension services (private or public), rural infrastructure and research on agro-ecological technologies.

60. Although public extension services are expected to continue to play a role in facilitating smallholders' access to information and technology, their role will need to be re-orientated

towards that of facilitating the inclusion of smallholders in multi-stakeholder innovation systems. This is both as beneficiaries of new technologies and practices, as well as contributors to their development. At the same time, attention will need to be provided to the development of enabling regulatory frameworks to support the provision of professional advisory services that cater for the needs of competitive and commercial producers[20].

3.2.7 Donor Activities

61. There are, and have been, many relatively small initiatives, funded by Government and a wide range of donors that have focused on Tonga's agriculture sector (see Background Report, Section 8.3.3 for details). However, more recently, with the exception of the IFAD-funded TRIP, which is implemented by MORDI, there have been no projects that specifically focus on improving subsistence families' livelihoods. Focus has changed from rural development and income generation per se, to one which now concentrates on environment and climate-change issues. These projects, for the most part, are implemented under the umbrella of the Environment Division of the Ministry of Environment, Energy, Climate Change, Disaster Management, Meteorology, Information and Communications (MEIDECC), although most, if not all, have relevance to the agriculture sector. In the handicraft and tourism sector, the important Tonga Handicraft and Tonga Tourism Support Programme (THCTSP), which is funded by NZAid, through the Ministry of Commerce and Labour, has the objective of enhancing sustainable livelihood opportunities from handicrafts as well as from cultural tourism.

62. TRIP is IFAD's current major rural development initiative in Tonga. There are two operational components: (i) Community Development, which focuses on supporting communities to develop community development plans, providing community economic infrastructure grant funds for rehabilitation or construction, and overseeing the operations and maintenance of infrastructure; and (ii) Business Development, which focuses on assisting commercial banks to publicise and promote financing, and provide supplementary equity grant funds to agriculture and rural businesses through commercial banks.

63. As many as possible of the growing number of projects and programmes in Tonga which are related to agriculture, climate change adaptation and disaster risk management are summarized in the Background Report. These projects and programmes involve multilateral, bilateral and regional agencies and donors. Aside from bilateral donors, much of the funding comes through multilateral actors such as IFAD, the World Bank, the Asian Development Bank, the United Nations Development Programme (UNDP), FAO, PACCSAP, and the International Union for Conservation of Nature (IUCN); as well as regional actors such as the South Pacific Regional Environment Programme (SPREP) and the Secretariat of the Pacific Community (SPC). The World Bank has noted that Tonga will be eligible to apply for funding of TASP activities from the Bank's Global Agricultural and Food Security Program (GAFSP). In addition to these is the new UN Green Climate Fund, which is specifically focused towards achieving low-carbon, climate-resilient development.

64. The picture that emerges from these diverse funding sources is referred to by some as the "spaghetti funding diagram" and is commonly described as being a "donor/project driven approach to funding". Key issues apparent from consultations, and the available information on relevant projects and programmes, are listed in the Background Report.

65. An important, agriculture-specific, project currently being implemented is the regional AusAid PHAMA Project (AUS$12 million) which aims to improve product quality, market access and export volumes. PHAMA Phase II is due to end in 2017, just as many of the TASP programmes are expected to be coming online. The end of PHAMA at this time would not be conducive to the

[20] The TASP Team acknowledges that MAFFF provided considerable historical information on extension, research and the failure of the export squash industry. This information has been very useful in formulating this Background Report.

level of ongoing support which Tonga's fledgling agriculture exports are expected to require. Therefore, the TASP recognises the need to either include a PHAMA follow-on project or a new "Export Support Programme". PHAMA has already initiated a sustainability initiative[21].

66. Similarly, whilst TRIP is about mid-way through implementation[22], it will also be important for its activities to continue, as the community-focussed implementation strategy used by TRIP is central to many activities proposed under the TASP.

3.2.8 Enabling Environment

67. Agricultural production is strongly influenced by the broad economic, governance and social environment in which it operates. Therefore, an important strategy will be to ensure that the TASP is implemented in an environment which is conducive to sectoral growth and does not contain major blockages or constraints. Accordingly, it will be important to:

(i) transform MAFFF into a more effective and efficient institution, following completion of an institutional review. This is the first priority identified by the TASP Design Team.

(ii) modernize Tonga's agriculture extension services, including by using the emerging private sector extension services;

(iii) leverage support for agricultural development from other stakeholders, with the Churches expected to have an expanded and more direct role in sectoral development;

(iv) monitor the impact of current land laws on land use intensity and be prepared to make changes to these laws if they are considered to be restrictive, with the objective of ensuring longer term food self-sufficiency and increased exports of high value products;

(v) ensure that small and commercial farmers have access to commercial investment and operating funds and review the impact of the current practice of allocating Government funds as subsidized grants for exporters, when smallholders are not able to access such funds[23];

(vi) improve the capacity of the agriculture high schools to graduate the next generation of farmers, and to provide skilled human resources for an expanding commercial sector;

(vii) improve systems for information dissemination on matters such as climate change, domestic and agriculture water supply issues, commodity volumes and prices;

(viii) strengthen sector policy reforms and international relationships with important trading partners; and

(ix) improve the regulatory environment, better comply with protocols, and increase support for quarantine services.

3.2.9 TASP Focus

68. There are four Areas on which the TASP will focus and these form the basis of the four development Programmes elaborated in Section 5:

(i) climate-resilient agricultural production systems, which are determined by healthy soils, secure and sustainable water supplies, diverse farming systems, and adaptive communities;

(ii) the enabling environment in which the sector operates, in terms of country systems and international relationships, human resource availability and capacity, regulations and compliance, quarantine, etc.;

[21] Pers. com; PHAMA's Tonga Coordinator.
[22] Completion date is June, 2017.
[23] Note that South Pacific Business Development (SPBD) is currently extending its loan services to male farmers on 'Eua.

(iii) subsistence-level staple food, cash crop and livestock production, associated with rural livelihoods, and including income from local domestic sales; and

(iv) increasingly active and export-orientated agriculture, with a strong focus on vegetables, plus import replacement.

69. Each Area has its own specific strategic directions (or objectives), depending on its focus and the resources and skills required for success. This means that different targeting and engagement mechanisms will be required. For example, engagement with isolated and relatively poor rural households on the outer islands will require an intensive community development process, whereas the approach required to successfully support emerging exporters and import replacers will need to be much more commercial and business focussed.

70. In addition, Tonga's particular geographical characteristics also determine how the implementation of different development initiatives is approached. For example, farmers on 'Eua, which is only 30 km from Tongatapu, have reasonable access to domestic and export markets, whereas farmers on Ha'apai and the Niuas are more isolated and therefore are more likely to remain as subsistence farmers, with some concentrating on high-value, long-storage products, such as vanilla.

71. Hence it seems reasonable to propose that future strategic directions for Tonga's four key areas should reflect: (i) a proactive focus on low-carbon, climate-resilient development for the sector as a whole; (ii) the varying agro-ecological resources, consisting of soils, rainfall, current levels of agro-biodiversity, etc.; (iii) access and market opportunities through proximity to sea transport services and pre-marketing processing and packaging facilities; (iv) location-specific constraints and opportunities, and (v) access to reliable technical advice and labour-saving machinery.

72. The above points have emerged from extensive consultations throughout the Kingdom, and from relevant literature. They were also raised by farmers and discussed in interviews with farmers in Vava'u, Ha'apai, 'Eua and Tongatapu. The results from these workshops are presented in Section 10.2 (Annex 2) and provide valuable overviews of current issues, constraints and opportunities in the agriculture sector, particularly those faced by subsistence farmers in the outer islands.

3.2.10 Options for Development and Change

Overview

73. There is a range of sectoral development options, which, if implemented under the TASP, will result in change and therefore improved livelihoods for Tonga's farming communities and private sector investors who rely on agricultural production. These options can be bundled into two broad categories: (i) those which are expected to benefit subsistence-level staple food and livestock producers (area 1); and (ii) those which are expected to benefit Tonga's commercial or semi-commercial farmers, exporters and import replacers (areas 2 and 3).

74. In the context of a Strategic Framework, these two groups of development options could be considered as the activities that need to be implemented to achieve two core Strategic Objectives: (i) a "food-first" strategy to develop diverse and climate-resilient farming systems which are applicable across all of Tonga's agro-ecological zones and islands, requiring considerable on-farm adaptive research (rather than research station-based research) and support from organizations such as ACIAR and USP, and (ii) a more commercial income-raising strategy which aims to increase farm incomes through increased export earnings and/or import replacement earnings.

Specific Development Options (Area 1)

75. Farmers' knowledge and delivery systems: Tongan farmers' knowledge base is not expanding, mainly because MAFFF's budget situation does not allow the extension system to function as planned. There are no field demonstrations and very few Farmer Field Schools. An aging farm population is not learning about coping with climate change or with constantly varying market signals, nor about how to introduce new technology. The technology transfer and farmer engagement systems are not functioning well, even though they are the keys to practice change initiation, innovation, and product diversification.

76. Farm Futures (land, labour and youth): Large areas of land are lying idle[24] for many reasons, including outmigration, lack of mechanization and the younger generation's lack of interest in farming. Therefore a "Future Farmers Programme", supported by incentive packages to entice young farmers who graduate from the agriculture colleges to return to family farms and to become climate resilient subsistence and/or commercial farmers and change agents within their communities is a viable development option.

77. Roles of Women in Agriculture: At present there is insufficient recognition of the indirect roles of women in Tonga's agriculture sector, not only as farmers but as the users of plants to produce handicrafts, most of which enter the informal market and therefore are not recognized in the National Accounts. The value of Tongan handicrafts produced each year appears to be growing rapidly and the TASP recognises this development opportunity by proposing support at two levels: (i) sustainable production of mulberry and pandanus, as a source of income for diversified farmers; and (ii) more direct support for rural women who elect to make weaving and tapa-making a more permanent occupation.

78. Natural Resource Conservation: Tonga is fortunate to have fertile soils, which have sustained diverse agricultural production systems for generations. However, some aspects of the country's agriculture resources are under threat and warrant close and immediate attention, such as declining organic matter in soils and, possibly, some nutrient deficiencies. In addition, the main water resource on Tongatapu may be under threat from pollution and overuse if not managed properly. Given that Tonga is currently self-sufficient in staple foods, and the unofficial policy position is of not wanting to rely on imported rice in event of future food shortages, there is an urgent need to ensure that the country's natural resource base is protected and nurtured for the longer term. This will require innovation and the introduction of new technical and resource-conservation packages, plus, in some cases, the re-introduction of traditional food storage systems.

79. Crop and Livestock Production and Diversity: Tonga is facing a national crisis in terms of food consumption habits, leading to poor human nutrition, and an increasing prevalence of non-communicable diseases (NCDs). Additionally, times of stress further highlight the need for greater agricultural diversity. A starting point for change should be on-farm, followed by links with the promotion of healthy food and eating patterns in primary schools. Such changes can also increase farm incomes once farmers have more diverse products to sell in local markets, and the population becomes aware of the importance of consuming a more varied diet.

80. Inputs and market connectivity (rural roads, ferries and jetties): Addressing basic infrastructure needs is essential for rural communities, to support their subsistence farming and the development of small-scale commercial activities - this is in fact a "food first" policy. Although infrastructure constraints are not linked just to agriculture, the competitiveness of import

[24] This varies from island to island, with Tongatapu being farmed reasonably intensively in some areas due to market access.

substitutes and export products is linked to inland and inter-island transportation availability and costs.

Specific Development Options (Areas 2 and 3)

81. Areas 2 and 3 have a stronger focus on rural incomes, compared with Area 1 which focuses more on diverse and climate-resilient farming systems for smaller and more subsistent farmers. Therefore, a second package of sectoral development initiatives comprises the more commercial interventions listed above for Area 1, plus support for increased exports, mainly for vegetables and fruit, which are competitive in Tonga's main export markets; and (ii) import replacement, such as commercial livestock production (poultry and beef), together with emerging opportunities for Tonga to benefit from a focus on climate-resilient and more diverse farming systems.

82. Exports: There is an emerging and dynamic private agricultural production and trading sector in Tonga. This needs to be nurtured by specific programmes with the understanding that the private sector will be expected to fund its share of the costs incurred to develop new market pathways and to maintain existing outlets.

83. Import Replacement: A successful import-substitution strategy could be viable if the production of non-ruminant livestock (poultry and pigs) has a reliable and competitively priced supply of high-quality, processed feed. As discussed earlier, this is an area where substantial effort has already been undertaken by FAO (and others) and where there may be scope for designing and piloting innovative solutions.

Cross-Cutting Options

84. Low-Carbon, Climate-Resilient Farming Systems: All of the preceding options will contribute to an overall farming systems approach. However, this needs to be implemented in an explicit manner to ensure that fragmentation doesn't emerge. There therefore needs to be some fundamental work on the design of low-carbon farming systems that are applicable to different island types and locations, and of relevance to both subsistence and commercial production. This will need to include establishing and adapting tools for determining carbon status and establishing criteria for determining what is climate resilient and what is not. This needs to be integrated with an education process to develop wider understanding of climate change and natural disasters, and the rationale for low carbon and climate resilient farming systems. Efforts will need to be made to align current and new programmes/projects as much as possible with this more integrated approach.

4 DEVELOPMENT OF THE TONGA AGRICULTURE SECTOR PLAN

4.1 The Development Process

85. The TASP design process followed a carefully planned and executed series of steps to ensure engagement with, and recognition of, the wide range of stakeholders who are actively engaged in Tonga's agriculture sector; and who are therefore expected to contribute to TASP's success, and to benefit from its expected outcomes. It recognizes the uniqueness of Tonga's agriculture sector and the constraints imposed by the Kingdom's location., and commenced with the preparation of a Background Report. Once confirmed by ASGC, the Background Report formed the basis on which the TASP was formulated. Phase II of the work concentrated on TASP formulation, after extensive stakeholder consultations and planning workshops.

86. The TASP takes into account the numerous donor-funded sectoral and cross-sectoral development initiatives (many of which focus on broad environmental issues), which are either being implemented or are in the planning pipeline. It also recognizes that an essential exercise has not been completed (the institutional review of MAFFF, a top-priority activity of this TASP). Therefore, in some cases (for example, the type of extension services needed in the future) it has not been possible to be definitive in terms of detailed recommendations on how the TASP should be implemented. Under these circumstances it has been necessary for the TASP Design Team to defer detailed recommendations until the MAFFF institutional review has been completed. The TASP will then be revised to reflect the final recommendations and outcomes.

87. This uncertainty is specifically related to: (i) the future of agriculture research in Tonga (whether it should be on-station or on-farm) and, more specifically, to the operational status of the soils laboratory; (ii) the most appropriate approach for agriculture extension, given that although there are only about 8,000 farmers who need these services, MAFFF is currently unable to meet their needs; and (iii) uncertainty around sustainable domestic and agricultural water supplies.

88. The TASP design process was actively overseen and guided by the ASGC, with excellent cooperation from: (i) all of MAFFF's divisions, and about 60 of the island-based technical staff; (ii) the Churches - the four main denominations; (iii) a wide range of interested stakeholders from the private and public sectors; and (iv) about 600 men and women farmers who were interviewed in workshops to obtain their views on sectoral constraints and issues and their opinions on TASP's objectives, and possible programmes and activities. This very inclusive process means that all stakeholders have been included and have a high degree of ownership. In addition, the TASP Design Team was invited to address Cabinet at the end of the Phase II field work. In summary, the Design Team is confident that the design reflects the views and aspirations of all stakeholders.

4.2 Rationale

89. Tonga's agriculture sector faces numerous challenges, which need to be addressed and overcome if the sector is to grow sustainably, and contribute to the Kingdom's wealth and future prosperity. These are summarized in Section 4.3, and importantly, "it's not all bad news". There are good opportunities for increased and sustained agriculture production, for which domestic and international markets exist. In essence, the rationale on which the TASP is based is on overcoming constraints and responding to opportunities through astute investments, whilst at the same time recognizing the importance of farm diversity, food-self-sufficiency, and the need to prepare for a more uncertain future.

4.3 Key Challenges

90. Constraints to agriculture development in Tonga are: (i) the transportation logistics of servicing many islands over a large expanse of ocean; (ii) remoteness; (iii) a narrow resource base; (iv) the small size of the economy; (v) population "drain" as young people travel overseas for employment[25]; and (vi) the drain on resources from the damage caused by frequent natural calamities. Within this context, Tonga's rural communities have nevertheless been able to sustain their food security and general livelihoods through an integrated approach to the management of a productive and natural ecosystem.

4.4 Opportunities for Agriculture

91. Tonga is well-placed to strengthen its self-sufficiency in traditional root and other food crops and have a sound export economy based around niche products that can exploit seasonal market windows, particularly in New Zealand and Japan, as well as crops such as vanilla and kava. The soils and climate mean that Tonga is well-suited to produce a wide range of tropical and subtropical horticultural crops, but a limited land area places constraints on production scale.

92. As it becomes increasingly important for Tongan agriculture to adapt to climate change and to increase preparedness for disasters, it will be vital for policymakers to maintain a strong focus on staple food self-sufficiency and crop diversity, and not focus too much on the export sector. To date, Tonga has been fortunate in that the country has surplus staple foodstuffs, but it would be a mistake to assume that this comfortable position will continue in perpetuity. Major changes in rainfall patterns and intensity, sometimes accompanied by cyclonic events, can tip staple food balances very quickly, and international experience[26] indicates that once a country becomes dependent on imported staple food (often rice) it is difficult to change food consumption patterns and to revert to previous practices. This means that it will be important to maintain the production and diversity of Tonga's agriculture sector.

93. Although there has been a decline in the total volume of crop exports since the 1990s, Tonga has a small group of committed and active horticultural exporters, who have continued to produce for markets around the Pacific region by gradually developing these markets under challenging circumstances. These exporters are active participants in PHAMA and the ASGC, and are key private sector leaders in the export rebuilding process, which is regaining momentum following recent initiatives to re-organize the production sector, and donor support for export-related infrastructure and processes. Recent infrastructure developments have included: (i) the High Temperature Forced Air (HTFA) facility at Tongatapu airport, funded by NZAid, including technical assistance; and (ii) the construction of new fumigation, cool store and blast freezer facilities on Tongatapu and Vava'u. These initiatives, along with positive approaches to open new market windows, to strengthen quarantine and quality control, and build on the lessons of the past, are positive indicators for the sector. A National Growers Federation (GroFed) has been established for the purpose of uniting farmers, and providing a collective voice and a framework through which technical support can be delivered and crop production and import replacement coordinated[27].

4.5 Stakeholders

94. There are three core groups of stakeholders involved with the TASP: (i) the approximately 8,000 farmers (2011 census), and the main exporting companies, who are the primary targets in terms of incremental benefits; (ii) those who have key roles in providing improved services and advice,

[25] Population growth was 0.5% in 2011.

[26] For example: in East Timor where about 80,000 Mt of rice are imported each year from Viet Nam. Source: various World Bank reports in East Timor's agriculture.

[27] GroFed was established in late 2008 and this resulted in the private sector's engagement with the design workshops for PHAMA in September, 2009.

in this case MAFFF, sector financiers, and the Churches; and (iii) donors, who are currently supporting the sector and are expected to continue this effort during the life of the TASP. Coordination between the stakeholders listed in (ii) and (iii) is not good at present and often leads to duplication of effort and/or the design and implementation of inappropriate projects.

4.6 Principles and Guidelines

4.6.1 Underlying Guidelines

95. A number of guiding principles were followed in preparing the TASP. They are:

(i) Secure the availability of sufficient nutritious and affordable food as a priority, and if possible do not become reliant on imported staples;
(ii) Enhance the capacities of rural communities for self-reliance in the face of climate change and increasing natural disasters;
(iii) Deliver essential services (such as extension and marketing support and farmer training, and assistance with market linkages) to rural communities, together with the private sector and non-governmental organizations, in an equitable manner;
(iv) Strengthen the integration between agriculture, livestock and natural resource management when planning rural development, and focus on sustainability when facilitating agricultural development;
(v) Build-in environmental sustainability as a genuine element in all programmes, and protect designated habitat and species;
(vi) Create an enabling environment for rural producers and the private sector and keep direct Government involvement to a minimum, with a focus on a facilitating role;
(vii) Be transparent and accountable, and form strategic partnerships for service delivery;
(viii) Use participatory planning and management processes when working with communities;
(ix) Cater for the specific needs of women, children, youth and disadvantaged groups; and
(x) Use a value chain approach to develop commodity markets, and focus on innovation.

4.6.2 Important Lessons

96. There are two key rural development planning and implementation lessons (from MORDI and TRIP) that are factored into the TASP. These are the importance of: (i) essential community preparedness and social cohesion (defined as community readiness), before planning commences, followed by the application of “bottom-up” and not “top-down” planning processes; and (ii) fostering complementary linkages between plan components in order to generate and sustain expected benefits. The TASP has been planned accordingly. All stakeholders have been consulted extensively and the four Programmes have been designed to ensure complementarity.

4.6.3 Essential Community Foundation

97. Through the course of visiting the different island groups (all except the Niuas) it became evident that each location has its own unique characteristics and problems and there is no one solution for all. At the same time it became apparent that different communities are in different states of readiness for engagement towards building climate-resilient agriculture.

98. Through the workshops with farmers it also became apparent that the key facilitators and community organisers are the District Officers who are employed through the Ministry of Internal Affairs (MIA). There is now a clearly defined planning process from the community to the island level. In ‘Eua, Ha’apai, and Vava’u meetings with the Government Representative and Governors reinforced the need for this community engagement and community-driven planning process.

99. This community-engagement work, which provides the essential community foundation, takes time and effort. To date much of this foundation work of applying the MIA planning process[28], has been undertaken through the TRIP project. This preparatory time involves building trust and addressing immediate needs of the community. Through such an approach, location-specific community plans are developed, providing the basis for island-by-island development plans.

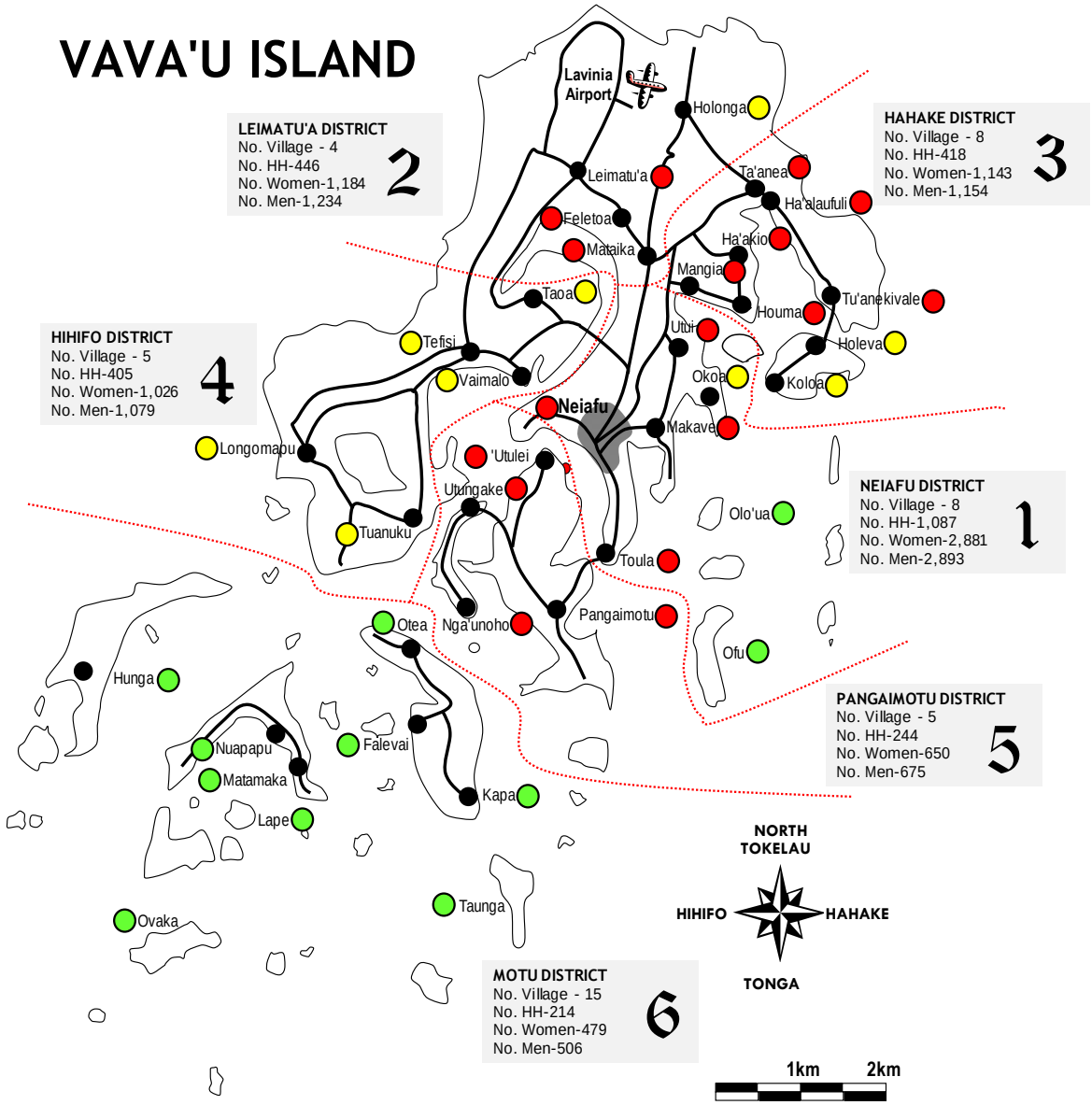
100. Based partly on observations from the consultation process and largely on MORDI's work in implementing the MIA planning process, community readiness maps were prepared for each island group in Tonga (see Section 10.3). The importance of community readiness in terms of willingness to work together with supportive development initiatives to jointly identify and solve problems cannot be over-emphasized. Experience from MORDI and TRIP indicates that it takes at least nine months (and sometimes 15 months) of community engagement and facilitation before isolated rural communities fully understand their shared obligations in terms of "who does what and who pays for what". The lesson is not to proceed with development activities (local infrastructure, agriculture development, etc.) until the community is ready, hence the term "community readiness".

101. The TASP design reflects these lessons. Figure 2 is an example of the community readiness maps prepared for all island groups of Tonga[29]. This classification of community readiness was completed using two sources of information and data: (i) provided by MORDI/TRIP which has worked across all outer islands; and (ii) collected and observed by the TASP Design Team during extensive rural community consultations. Three colours have been used to code villages in terms of their readiness for development support. Red = village is not ready and needs much more community engagement and facilitation; yellow = village is partially ready but still needs more engagement; and green = village is ready and has been through the complete MORDI/TRIP community engagement process, and is therefore ready to receive support under TASP. This village categorization process will allow the identification of priority islands and districts once TASP implementation commences.

[28] Note that this has been mistakenly referred to by some as the MORDI approach. It is in fact a Government planning process administered through the Ministry of Internal Affairs.

[29] Section 10.3 contains similar maps for all the island groups, and for Tonga as a whole.

FIGURE 2: COMMUNITY READINESS MAF OF VAVA'U



5 PROGRAMMES IN THE TONGA AGRICULTURE SECTOR PLAN

5.1 Overview

102. The foregoing analysis of Tonga's agriculture sector led to the decision that the TASP should be based on four distinct Programmes, as illustrated in Figure 3 which lists the Programmes and shows the inter-relationships between them. The objective was to keep the TASP simple and easy to understand, as Figure 3 shows below:

FIGURE 3: INTER-RELATIONSHIPS BETWEEEN TASP'S FOUR PROGRAMMES

(i) Programme 1 (climate resilient environment) can be considered as a "protective outer reef, or shell" which acts to ensure that Tonga's key natural resources (healthy soils, secure and sustainable water supply, diverse farming systems, and adaptive communities) are preserved, with a focus on building knowledge of the underlying environmental conditions that are required to support the development of climate-resilient agriculture;

(ii) Programme 2 (enabling environment) focuses on improving the environment in which Tonga's agriculture sector operates (governance, regulations and compliance, service delivery, quarantine, finance, etc.);

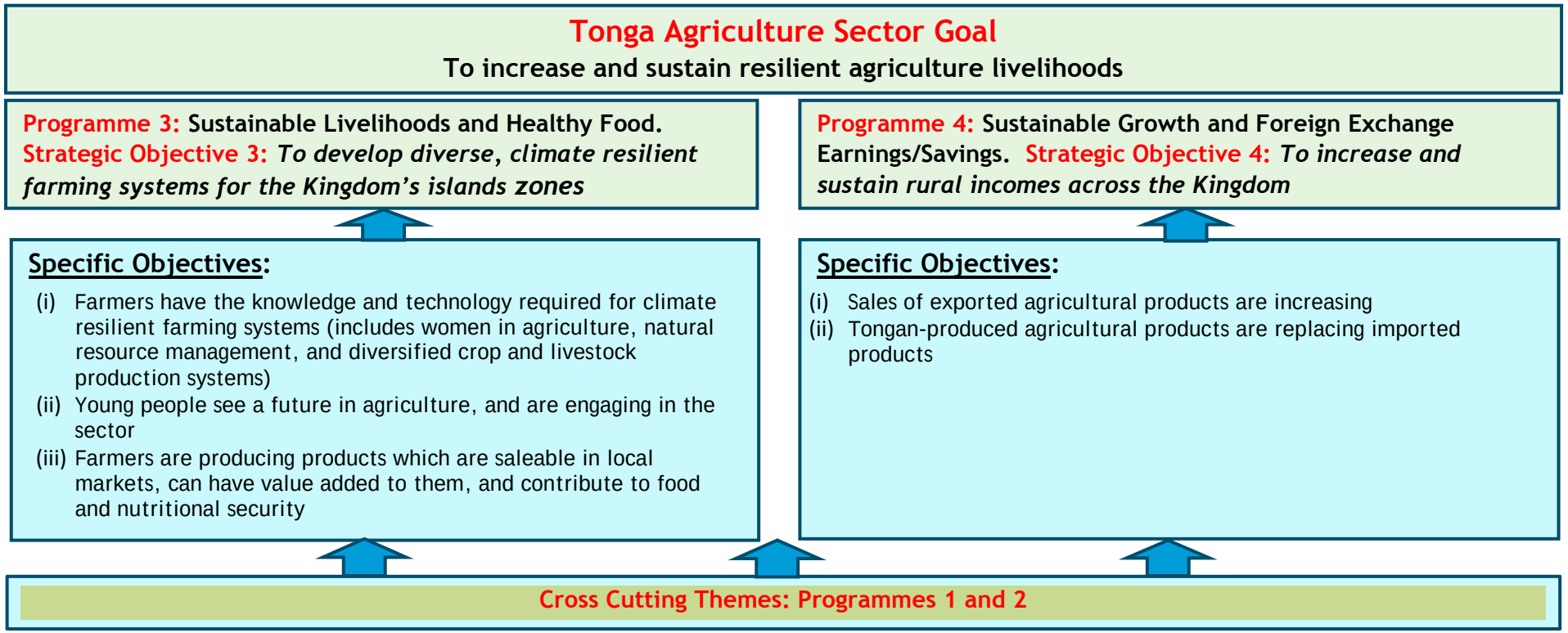
(iii) Programme 3 (sustainable livelihoods and healthy foods) focuses on improved farmers' knowledge and technologies for climate-resilient and diversified crop[30] and livestock production, and the marketing of these products; and

[30] The word "crop" should be interpreted as all types of food and cash crops, including forestry.

(iv) Programme 4 (sustainable growth and foreign exchange earnings) focuses on increased exports, as well as greater import replacement.

103. Figure 4 below is a Strategic Objectives Framework, which contains more details on TASP's strategic and specific objectives and shows how the cross-cutting themes associated with Programmes 1 and 2 are linked with and support the two production-oriented Programmes (3 and 4). The remainder of this section provides more details on how the TASP's specific objectives will be achieved, i.e. descriptions of the rational and logic which underlie the Programmes, followed by outlines of the activities, which can be used as a basis for donor-specific programmes. Section 7.2 gives suggestions on ways in which the activities in the four TASP Programmes might be combined into packages for funding by various donors in conjunction with funding from Government.

FIGURE 4: STRATEGIC OBJECTIVES FRAMEWORK



5.2 Programme 1: Climate Resilient Environment

5.2.1 Objectives

104. The strategic objective of Programme 1 is to establish the foundation for climate-resilient agriculture systems. The three specific objectives are to: (i) develop baseline knowledge for sustainable management of soil and water (for agriculture); (ii) develop climate-resilient guidelines and indicators for diverse farming systems; and (iii) build capacity for climate-resilient agriculture (diverse farming systems and adaptive communities) to impact on Programme 3. Accordingly, Programme 1 has three Sub-Programmes: (i) Healthy Soils and Sustainable Water; (ii) Climate-Resilient Guidelines and Indicators; and (iii) Capacity for Climate-Resilient Agriculture. These are outlined below.

5.2.2 Sub-Programme 1.1: Healthy Soils and Sustainable Water

Healthy Soils

Refurbish and Operate MAFFF's Soils Laboratory

105. MAFFF's main soils laboratory at the Vaini Research Station is not operational. The team conducting the institutional review of MAFFF will need to decide whether this facility should be refurbished, or closed down and have soil testing contracted offshore. In the meantime, the TASP budget includes an allowance for a laboratory upgrade, including developing capacity to measure particle size and soil organic matter content. If the laboratory is upgraded, there will be a need for ongoing maintenance and operations, and periodic staff training events. These activities will be funded under TASP and focus on ensuring that: (i) new equipment is maintained and serviced according to specifications; (ii) adequate supplies of chemicals and reagents are maintained to enable the required number of soil tests to be carried out (at least 50 per year); and (iii) core staff remains skilled in the techniques needed to operate the equipment and to complete soils tests to international standards[31]. If, after the MAFFF review, it is decided to retain this facility it will be important to develop and implement a staff succession plan.

Conduct National Soil Survey and Update National Soil Maps

106. The last national soil survey of Tonga was completed between 1975 and 1978 (see Section 2.7). Recent studies have updated information on nutrient deficiencies, crop response to fertilizers, water and land preparations, fallow species, agroforestry, and pollution on the different soil types of Tonga [Halavatau (1996), Manu (2000), Pochet (2003), Van der Velde (2006)]. These studies have expanded and updated the initial soil survey to incorporate changes in soil fertility, changing intensity in crop production, and changing climates. Digitised land suitability maps for subsistence crops, cash crops, tree cash crops, livestock pastures and forestry use on the various soil types of Tonga have been developed and are used by MAFFF for training, advice and for field surveys of farmers' production. What is missing is a soil survey of islands not included in the initial soil survey and the TASP proposes a soil survey of these islands. As export opportunities receive more attention and cropping becomes more intensive (and water resource pollution becomes a greater possibility) it will be essential for Tonga's farmers to have improved understanding of not only soil nutrient availability but also organic matter and soil carbon content.

Promotion/Awareness Raising of Soil Fertility Issues

107. Once the soil fertility "tools" are available, it will be important to ensure that MAFFF's technical field staff and members of farming communities are not only aware of these "tools", but also know how to use them, and to interpret the results. Therefore the TASP will fund two national soil fertility

[31] isric.org/isric/webdocs/docs/ISRIC_TechPap09_2002.

awareness-raising campaigns. Tonga has traditionally relied on the inherent fertility of the Kingdom's soils to feed the population, and to some extent there is a view that this situation will continue in perpetuity. However, this is a dangerous assumption, given the increasing use of inorganic fertiliser (mainly for export crops) and cropping becomes more intensive - especially on Tongatapu. The attitude of "complacency" about soils will be addressed by ensuring that Tonga has a good understanding of: (i) how soil fertility levels might be changing without the use of legumes in the rotation; and (ii) the implications of increased use of fertiliser. The starting point is to understand "where we are now" through soil testing, followed by awareness raising of soil fertility issues.

District-Level, On-Farm Fertilizer Trials and Ongoing Monitoring of Soil Fertility

108. A logical extension of a national soil survey is ongoing monitoring of soil fertility over time. This process will be based on district-level on-farm organic and inorganic fertilizer trials, with cooperating farmers and MAFFF's technical staff deciding on which elements to include in the trials. About 50 on-farm soil fertility trials each year are proposed, together with a similar number of soil samples being collected for analysis every second year. The results from these activities will be used as the basis for Farmer Field School (FFS) training.

109. There is strong support for the at least some island groups to be declared as "organic". For example, the current Governor of Vava'u has stated his intention to declare this island group as "organic". In principle this is a logical approach to internationally competitive markets, but care will need to be taken not to "impose" such a decision on farmers who could benefit from astute use of inorganic, or mineral, fertilizers, especially those containing elemental phosphorus which may be deficient in some soils.

Feasibility Study on Application/Use of Vermiculture and Trial

110. Tongatapu is currently facing problems related to the disposal of human faeces after they have passed through septic tanks, and Ha'apai's domestic water supply is contaminated with coliforms[32]. These situations need to be addressed as a matter of priority if more widespread contamination is to be avoided. An option worthy of testing is the use of vermiculture to convert human waste (and other forms of organic waste) into organic fertilizer that is safe to use on crops to be consumed by humans. The TASP will fund a feasibility study on the application and use of vermiculture, followed by the conduct of commercial trials on Tongatapu. The TASP is, of course, predicated on the explicit assumption that any feasibility study on vermiculture of any type must be safe. Current Chinese sterilisation technologies will be considered as part of the feasibility study.

Sustainable Water

111. Aside from sea-level rise, which over time will have severe effects on low lying islands and coastal areas of Tonga, fresh water will increasingly be a critical issue for the agriculture sector. Agriculture in Tonga has historically relied on seasonal rainfall patterns with the timing of crop cycles well attuned to this seasonality. For the most part there has been, and continues to be, sufficient rainfall for subsistence agriculture. The recent (2014/2015) drought is a reminder that reliance on rainfall cannot be taken for granted and enhancements to agricultural production systems could provide greater resilience. On Tongatapu there is some use of ground water for the irrigation of commercial crops (mainly vegetables) and there is interest in expanding irrigation for agricultural production. While a number of informative water resource studies have been

[32] Coliforms are bacteria which live in the intestines of warm-blooded animals (humans, pets, farm animals, and wildlife). Faecal coliform bacteria are a type of coliform associated with human or animal wastes. *Escherichia coli (E. coli)* is part of the group of faecal coliforms.

completed[33,34] it is clear that more research is needed to establish better estimates of how much water is available throughout Tonga, and what potential exists and where for irrigated agriculture. This potential needs to be considered along with the development of an improved understanding of soil moisture conservation practices. The TASP suggests increased use of: (i) conservation agriculture practices (including less ploughing); (ii) mulch around perennial crops; and (iii) increased use of legumes to control weeds and conserve moisture. For the more isolated islands, there is an issue of dry season food security. This work needs to be considered within the context of a precautionary approach to unfolding climate change and sea level rise. The activities identified to complete this research are described below.

112. During the TASP design process it became apparent that there are differing opinions on how to sustainably use Tonga's water resources. One popular strategy in terms of water supply for agriculture is to harvest and store (in dams) excess rainfall during the wet season, plus water from excess rainfall in La Niña years, for use in El Niño years. A study on the feasibility of such an approach to water conservation is desirable and this has been included.

113. Natural Resources Division of MEIDECC and its staff are located on Tongatapu, which means they require domestic transport costs and per diem allowances when working on other islands. If some of these staff are assigned responsibilities related to the activities described below, this situation will change. However, supervising staff from the Natural Resources Division will still need quarterly visits to support provincial staff, and/or provincial staff will need to be brought into Nuku'alofa for training.

Quantifying Existing Groundwater Resources

114. This activity involves both quantifying existing groundwater resources and understanding how they vary seasonally, and during drought and storm periods. Activities required to carry out this work are:

- Well and Coastal Spring Inventory (including the springs all around Tongatapu) – This will require transport arrangements, salinity and water-level equipment, and GPS and GIS inputs in order to map the extent of the freshwater lens area from existing abstractions. An important aspect of this work will be identification of existing bores being used for irrigation, particularly on Tongatapu. There will also be some parallel work by the SPCR. Provision of funds through the TASP will provide additional support for the establishment of four Water Resources Management Units, one each for Tongatapu, Ha'apai, Vava'u and 'Eua.
- Drilling of Salinity Monitoring Boreholes (SMBs) – The TASP will fund an additional 20 SMBs. As a priority, these will be located in areas on Tongatapu, 'Eua and elsewhere where greater exploitation of groundwater for agriculture is likely.
- Recharge Estimation - Technical Assistance (TA) will be provided to build capacity of staff of the Natural Resources Division on recharge estimation.
- GIS Data Capture and Application to Recharge Estimation – This will involve TA using the existing land characterization (soil and vegetation) GIS database to estimate recharge across the Kingdom, using soil moisture deficit spreadsheets and correlations with groundwater salinity. This data will be collected by the Well and Coastal Spring Inventory.

Estimating Current Exploitation of Groundwater Resources

115. At present, exploitation of groundwater resources is principally for domestic purposes. However groundwater is used for irrigation in Tongatapu, probably from unmonitored bores in a number of

[33] Furness, L.J. and Helu, S.P. 1993. The hydrogeology and water supply of the Kingdom of Tonga.
[34] White, I, Falkland, T., Fatai, T. 2009. Vulnerability of groundwater in Tongatapu, Kingdom of Tonga. Groundwater evaluation and monitoring assessment. Australian National University, Canberra, Australia.

cases. Water is also commonly transported to livestock. The well inventory will identify where wells are, depth to water, and water salinity, but would not calibrate the amounts being abstracted. Therefore this next activity will focus on water use estimation. A variety of techniques can be used including: (i) dependent population, including the need for strategically located points for access to water; (ii) land areas and crop types irrigated (if any); and (iii) diesel purchase, together with the use of short-term clamp-on flowmeters and mini-pumping tests. Pumping tests of existing bores can target a range of water uses, pump types, pump head lifts, etc., to provide flow rates and flow durations for a range of uses, and to attempt to define per capita and per hectare water consumption figures. These tasks will require a dedicated team, with transport, access to power, communications, and flow-meters. Alongside a national testing programme (assuming 10 tests per week over three years), a few selected sites representing a range of use and pump types will be instrumented automatically with data-loggers and monitored year-round to provide seasonal water use data. Data collected from this activity will be included in the national GIS database.

Determining Groundwater Resource Locations Available for Greater Use; and Fragile Locations for Protection and/or Rehabilitation

116. Outputs from the above two activities will be used to identify water balance recharge/abstraction ratios for the main islands. The islands will be divided into sub-units to attempt to identify areas of stress, where saline intrusion may be occurring or could occur, and to compare sustainable yields with existing rates of exploitation. Additional simple alternative approaches could use GIS spatial analyses to compare groundwater levels with abstraction rates to assess the risk of groundwater levels falling below the mean sea level.

117. The above information will be compared with water salinity readings, SMB salinity profiles and outputs from technical assistance, which will use simple analytical tools to predict saline up-coning risks, which then need to be rolled out across the well-inventory database. The TA will include a plan on how to do this and will involve consideration of individual borehole risks as well as well-field risks.

118. Two-dimensional slice models will be used to demonstrate the sensitivity of the groundwater regime to: (i) borehole depth; (ii) abstraction rate; and (iii) recharge reduction, in order to support the preparation of awareness-raising materials on optimum borehole design and/or pumping arrangements. Periods of reduced rainfall increase water demand at a time when water availability is reduced, and saline up-coning is greater. Providing warnings of these events is important as drought develops. Therefore TA is proposed for the Natural Resources Division to develop a drought warning system for farmers. Note that this activity is closely related to the agro-met activities in Section 5.3.9.

Pollution Risks to Groundwater

119. Pollution risks to groundwater and how to mitigate these risks need to be considered, with particular emphasis on agricultural practices and communities. Pollution risk is also likely to be increased with more cyclones and can also be caused by tsunamis. Agriculture poses a significant risk to groundwater quality through a range of activities, including: (i) inappropriate chemical storage; (ii) over-application of agri-chemicals; (iii) diesel fuel leakages; and (iv) pig waste. Therefore this activity will focus on best-practice use, storage and disposal of agricultural chemicals and waste, as well as best-practice wellhead construction, operation and maintenance. The activity will also include developing awareness-raising materials, capacity building of agricultural extension staff, and direct community training.

Estimating Future Climate Change Impacts and Water Demands

120. The preceding activities will provide a comprehensive understanding of the current water situation and potential for greater use of water for irrigation. However, this work would be incomplete without considering future climate change (including changes in drought risk and intensity) and future changes in water demand (for domestic and other uses). This activity requires TA to undertake modelling of groundwater lenses where the demand for irrigation water is likely to be greatest (Tongatapu, 'Eua, and possibly Vava'u). A relevant model will be developed and calibrated, and once agreed will provide guidance on the maximum areas that can be irrigated at any one time. Future simulations will be completed using output from transient Global Climate Models (GCMs) so that time-dependent effects on groundwater can be determined. This will probably require evaluation with approximately six GCMs. Additionally, a future drought risk assessment will be carried out to examine (for example) the impacts on groundwater of more intense and/or longer droughts. All simulations will also consider future scenarios of changes in water demand, with outputs being compared with results from the assessment of locations available for greater exploitation and in need of greater protection. This will enable refinement of the identification of areas to be avoided, and areas to be focussed on, should irrigated agriculture be proposed for expansion.

Community Engagement on Future Water Use for Agriculture

121. Any changes to water use likely to have consequences for farmers require a comprehensive community-engagement process. This should be aligned as much as possible with MIA's planning process, as Village Resilient Agriculture Plans (VRAPs), described under Programme 3, Section 5.3.9, will need to incorporate a focus on water for agriculture. Funds have been allocated to support any additional community engagement work which might be required, particularly in relation to decisions on water use which might impact on communities (e.g. greater use for commercial agriculture).

5.2.3 Sub-Programme 1.2: Agricultural Resilience to Climate Change

122. Programme 1 aims at achieving: (i) healthy soils; (ii) secure and sustainable water; (iii) diverse farming systems; and (iv) adaptive communities. The foundation work for healthy soils and secure and sustainable water supplies is described above in Section 5.2.2, and diverse farming systems and adaptive communities are the principal focus of Programme 3. Work will be required to support the more detailed activities in Programme 3. This work should be focused on the development, implementation and monitoring of climate-resilient guidelines and indicators, which will provide the national-level context for the development of climate-resilient agriculture, and will be complementary to and supportive of the more comprehensive practical guidelines for climate-resilient agriculture, which will be developed in Programme 3. In other words the focus in Programme 1 is on building knowledge of the underlying environmental conditions that are required to support the development of climate-resilient agriculture production systems.

123. Working from a definition of climate resilience, key resilience guidelines will be developed to encompass the three specific objectives of Programme 1, as listed above. These need to encompass environmental, social and economic factors at the national scale and should draw on relevant information from Programme 1's healthy soils and sustainable water work, as well as indicators drawn from Programmes 3 and 4.

5.2.4 Sub-Programme 1.3: Building Agriculture Resilience to the Impact of Climate Change

124. Extensive consultations during the TASP design revealed an essential and urgent need for capacity building on climate-resilient agriculture and its systems. In the context of the TASP, this type of capacity building is defined as, ensuring that Government, the private sector, NGOs, Church representatives, and communities all have a common understanding of what climate change is, how it might impact on their agriculture-based livelihoods, and how communities might proactively respond to ensure that their agriculture is as resilient as possible (environmentally, socially, and economically) to the unfolding effects of climate change.

125. Implementation of the TASP will not succeed without this essential work. Such capacity development needs to focus on a wide range of people who will be engaging with rural communities, either directly or indirectly, including the NEMO (National Emergency Management Office) groups. The purpose of this capacity building is to ensure that everyone in Tonga is on the same page in terms of understanding what "climate-resilient agriculture" means; and people are therefore enabled to work with communities in an informed and consistent manner (rather than the fragmented, piecemeal, approaches that often prevail). Following on from this, there is also need for sound linkages to be formed with other relevant Government departments and agencies. This capacity-building process will be participatory, with a balance of approximately 75% information delivery and 25% small group exercises.

126. Capacity building workshops of this type take about three days to implement and require a strong commitment by trainers and participants. Such workshops allow for the development of in-depth understanding through key presentations and group work. These workshops need to cover: (i) the science of climate change; (ii) impacts and adaptation; (iii) vulnerability; (iv) resilience; and (v) designing and implementing climate-resilient agriculture systems. It is essential to recognize how important handicrafts are in terms of earning household income[35] and mainstream them into a climate-resilient approach.

127. The Governor of Vava'u has suggested that if the Vava'u islands are declared organic and farmers practise "climate-resilient agriculture", it should be possible to extract premiums for agricultural produce grown on Vava'u[36]. However, before proceeding to implement this scheme, there needs to be a feasibility study to value this "whole of island approach to resilient agriculture production" in order to determine if the substantial compliance costs are less than the estimated benefits. The TASP allocates funds to cover this cost in Programme 1.

128. Other activities proposed for funding under this Sub-programme include: (i) feasibility studies and small-scale trials on the sterilisation process, application and use of vermiculture; and (ii) similar studies for biogas. The TASP recognizes that vermiculture technology may not be acceptable in Tonga (at least at present) and therefore care will be taken to ensure that all opinions are considered before the trials are designed. However, it seems that the potential for biogas production is substantial (as demonstrated by the Chinese-funded piggery/ vegetable and biogas project).

[35] In 2015, an HCTSP survey of Ha'apai revealed that 84% of households rely on handicrafts (mainly weaving) as their main source of income.

[36] Note: Niuafo'ou' is already organic.

5.3 Programme 2: Enabling Environment

5.3.1 Objectives

129. The strategic objective of Programme 2 is to improve Tonga's enabling environment for agriculture. This influences and controls sector efficiency and growth. There are ten specific objectives that relate directly to the Sub-Programmes discussed below. These are to ensure that:

(i) MAFFF's roles and responsibilities are appropriate, resourced and implemented;
(ii) Bio-physical policies (water, soils, biodiversity, NRM, climate change, etc.) are in place and are conducive to sector growth;
(iii) Government's policies on the export and import of agricultural products (mainly food products) are up-to-date and relevant; and the new Food Act is supportive of the sector;
(iv) Farmers have access to land, labour and farm finance;
(v) International relationships with important trading partners are maintained;
(vi) Tonga's agriculture sector complies with national regulatory/ compliance conditions and requirements;
(vii) The agriculture sector is protected from incursions from pests and diseases, and is able to comply with international quarantine requirements;
(viii) The agriculture sector is supported by functional and effective industry organizations;
(ix) There is a functional and effective market information system in place; and
(x) Improved agro-meteorological services are also in place.

5.3.2 Sub-Programme 2.1: Sector Institutional Policy

130. The TASP Background Report raises the major issue of MAFFF's functionality, efficiency and impact. In summary, MAFFF has struggled to fulfil its mandate since 2008 when nearly half the ministry's staff were made redundant. At present many employees are under-resourced and their bases (in some cases research stations) are in need of repairs and upgrading. Transport is limited, as are operational funds. The main research centre at Vaini is not fully functional and its 23 staff are under-employed. Extension services are depleted and contact with farming communities is infrequent.

131. *The TASP Background Report raises the major issue of MAFFF's functionality, efficiency and impact. In summary, MAFFF as a key Tongan institution has struggled to fulfil its mandate since 2008 when nearly half the ministry's staff where made redundant. At present many island-based staff are under-resourced and their bases (in some cases research stations) are in need of repairs and up-grading. Transport is limited, as are operational funds. The main research centre at Vaini is not fully functional and its 23 staff are "under-employed". Extension services are depleted and contact with farming communities is infrequent.*

132. *This scenario is not sustainable and does not auger well for the future of the sector. Therefore the TASP Design Team recommends a full MAFFF institutional review before Government makes decisions on possible restructuring and staff re-deployment options in order to implement the TASP. At the time of designing the TASP, the Minister of MAFFF indicated his support for additional staff and budget as the preferred option, and the splitting of the Fisheries Division off from MAFFF into a new Fisheries Ministry. However, no other options have been considered, or reviewed and analyzed, hence the recommendation for a review. Ideally this review would have been completed before the design of the TASP as the high level of uncertainty surrounding staffing levels and operational budgets means that to some extent it has not been possible to be definitive when designing development initiatives and implementation modalities.*

133. *Therefore the number one priority activity in the TASP is an institutional review of MAFFF. Terms of reference for this exercise will be prepared as soon as the TASP is approved by ASGC, and additional post-TASP design funding has been secured. It is expected that the review will take*

no more than three months to complete, and once approved by Cabinet it will be necessary to review some aspects of the TASP design, and the suggested budgets.

134. It is expected that the greatest impact in terms of how the TASP might be affected will relate to MAFFF's current field staff (technical and extension), as well as to the Ministry's research stations. Both these parts of MAFFF will undergo some restructuring and re-orientation. Key activities to be completed under this Sub-Programme include: (i) preparation of the review terms of reference; (ii) the main review activity, to be carried out by three specialists over one month; (iii) discussion of the main findings and recommendations with key Government officials and national stakeholders; (iv) approval of the recommendations by Cabinet, and, if required, the allocation of additional budgetary resources; (v) preparation of an Institutional Change Paper for use by MAFFF as a guide on how to respond to the review's recommendations; (vi) support for MAFFF to implement the recommended changes; and (vii) provision of a one-off budget allowance to fund any recommended restructuring. The cost schedules in Section 8.2 contain more details.

5.3.3 Sub-Programme 2.2: Bio-Physical Policies

135. As outlined in Section 5.2.2, healthy soils and sustainable water supplies are critical for the long-term survival of Tonga's agriculture. Considerable resources have been proposed in the TASP to ensure that all stakeholders understand the current status of these resources, and the possible limitations to their sustainable use. However, this is only the first step. Once reliable soil and water information is available it is important that new policies and strategies on how to use these resources sustainably are planned and promoted, and then backed-up with appropriate legislation. There is a need to consider existing bio-physical policies to determine which remain relevant, and which need review and alteration.

136. It will be necessary to implement the following activities related to a new soil fertility policy for Tonga: (i) interpret the soil tests completed under Sub-Programme 1.1 and prepare recommendations based on the results; (ii) prepare and publish a soil fertility policy, including consideration of declaring at least some islands of Tonga as "organic"; and (iii) promote the new soil fertility policy through all types of media, and at events attended by farming communities.

137. In terms of designing a new agriculture water policy for Tonga, the main activities to be funded under the TASP will be: (i) interpretation of the hydro-geological review work and studies completed under Sub-Programme 1.1; (ii) preparation of recommendations on water allocation for both domestic and agricultural uses; (iii) gaining approval in principle from Cabinet for changes to Tonga's water use legislation; (iv) drafting and publishing a new water policy (perhaps in place of the Water Bill which is currently with Cabinet[37]); (v) promoting and explaining the new policy to all who rely on underground water for domestic and livestock watering purposes; and (vi) updating NRM and climate-change adaptation strategies, based on the new legislation.

138. From the extensive meetings and consultations conducted as the basis for TASP planning, it is apparent that work on both soil and water is critical. Soil fertility is often ignored by countries which are striving to expand agriculture production (and exports) but, inevitably, deficiencies and/or imbalances appear as soils are used more intensively, often at the expense of sustainable production. Tonga is in the fortunate position of not (yet) having to be too concerned about declining soil fertility, but this is no time to be complacent.

139. In terms of potable and agriculture water supplies, it is the unknown which is of greatest concern. Until Tonga's sustainable water resources are defined and their use managed and controlled through appropriate legislation, the Kingdom remains vulnerable at a time when the demand for

[37] This Bill was drafted in the early 2000s.

irrigation water is increasing and more commercial-scale agriculture results in increased demand for agricultural water.

5.3.4 Sub-Programme 2.3: Export and Import Policies

140. There are three key activities that a supportive Government needs to implement in order to promote exports and manage imports (without contravening World Trade Organization [WTO[38]] protocols). These are: (i) regular surveys of how current policies are impacting on exports and imports[39]; (ii) regular updating and publication of policies; and (iii) ongoing promotion of updated and relevant policies to exporters and importers. The TASP budget proposes annual allowances for these activities. The recommended review of MAFFF will need to consider existing export and import policies to determine which remain relevant, and which need review and alteration.

141. There is a "rule" that all Governments should follow. "Get the policies and support programmes right and then stand back". In other words - "do not be tempted to intervene in non-functioning markets by thinking that Governments are better-able to run export and import operations than a well-resourced and trained private sector". This view is reasonably well entrenched in Tonga, but there are still many groups of farmers (particularly on the outer islands) who are of the firm belief that it is Government's role to "create markets" and to then assist (subsidize) with exports.

142. Specific activities to be funded under this Sub-programme include: (i) regular policy up-dates, approval and publication; (ii) following this step, promotion of new or updated sectoral policies and strategies to all stakeholders; and (iii) regular surveys on the impact of various new and revised policies on sector performance.

5.3.5 Sub-Programme 2.4: Land and Rural Finance Policies

143. The policies which govern these two important aspects of Tonga's agriculture sector are almost as important as those associated with soil and water. This is because all sector stakeholders are concerned about declining land use intensity due to a number of interrelated factors, of which two, access to land and to rural finance, are probably the most important. Land allocation, and the laws which govern how land belonging to absentee owners is used, are complicated. Any plan for agriculture's future must recognize the constraints imposed by such systems and customs, and include funding to allow decision-makers to be able to track the impact on agricultural productivity of existing land laws and regulations, together with availability of rural finance.

144. The TASP proposes: (i) a study of the feasibility of extending land-leases to allow longer-term crops such as tropical hardwoods thereby expanding Tonga's forestry industry[40]; and (ii) support for Government to monitor the impact of its current land use and allocation policies on sustainable agricultural production.

145. Farmers' access to rural finance for investment and operational purposes is a further concern. However, a discussion paper prepared on "Agricultural Value Chain Development in Tonga"[41], which forms part of the background review and analyses prepared in support of the TASP, concludes that supplies and availability (conditions under which loans are advanced) of credit are not major constraints to sectoral development. However, the report also raises the issue that many farmers and smaller exporters do not understand how rural finance services work, nor the associated borrowers' obligations. This is why budget for training in this topic has been included under Programme 4.

[38] Tonga joined the WTO in 2005.

[39] Note: the Ministry of Foreign Affairs is now responsible for trade policies.

[40] See Section 5.5.1 (Export Sales) which include funding for a study of Tonga's national forestry industry.

[41] See: "Value Chain Development in Tonga", Andrew Shepherd, April, 2015. Prepared for the World Bank

146. At present, rural finance services are available through the Tonga Development Bank (TDB), South Pacific Business Development (SPBD), to a certain extent through Tonga's commercial banks, and through the Government's Agriculture Development Fund (ADF). The legacy of the collapse of the export squash market is still impacting on commercial banks' willingness to lend. SPBD has mainly loaned money to women for crop and handicraft production but has recently started lending to men in 'Eua, under the umbrella of TRIP. One area which needs closer attention in terms of its need for financial services is the important handicraft sector, simply because so many families are reliant on handicraft sales to fund daily household purchases.

147. On balance, there do not seem be any sound reasons why the TASP should include specific rural finance-supply activities, including funding for handicraft manufacture. However, there are four rural finance activities which have been built into Sub-Programme 2.4: (i) ongoing monitoring of the current results from farmer and exporter use of various sources of finance (the TASPCU will be able to coordinate this work); (ii) based on the outcomes from (i), recommendations of changes in rural finance policies and support services (particularly related to direct Government interventions such as the ADF); (iii) promotion of any changes to ensure that all categories of borrowers are aware of new opportunities to access rural finance; and (iv) practical training for farmers and small exporters on how rural finance systems work, how to prepare and present simple business plans which include sources and uses of finance tables as an integral part, and how to manage cash flows so that periodic financial obligations can be accommodated and met on time.

148. Programme 4 will support a Market Development Fund for emerging entrepreneurs in domestic and international markets. This includes some assistance with funding. In addition, the following specific activities will be implemented under this Sub-programme: (i) a National Inventory of Forest and Tree Resources is a priority to determine the current status of the resource, and to collect appropriate data and information required for the formulation of a National Forestry Strategic Development Plan for the sustainable harvesting, marketing, and management of the resource; ii) a study to determine values of forest and fruit tree products such as sandalwood, copra and emerging coconut products and coconut timber, as well as locally grown premium timber species, for local sale and export; iii) a major upgrading and expansion of existing forestry nursery facilities on the main islands to cater for the timely and sufficient production of quality seedling stock required for the national replanting programme, together with provision of nursery supplies, technical equipment, expertise, and appropriate management capabilities; iv) strengthening of Forestry extension services to promote reforestation, forest restoration, and tree plantings, involving staff recruitment and training, establishment of forestry district councils, an extensive public awareness programme, an educational programme, and an effective community extension network; v); a study on formulating Regulations to legalise tree plantings on registered 'api and private land; and vi) reviving of forestry sawmilling operations on the main islands to utilize the available log volumes from woodlots and senile palms that are otherwise wasted as fuelwood or clearing for other land uses. Currently, landowners are discouraged from tree planting because there is no sawmill operation to utilise the merchantable logs for timber production. At the same time, the majority of the coconut population is senile, and therefore needs to be removed for replanting. It is estimated that over 60% of the total volumes of local timber consumption could be supplied locally from forestry plantation, private woodlots, and senile coconut palms.

5.3.6 Sub-Programme 2.5: International Relationships

149. Tonga is very dependent on international donors for a wide range of support[42]. This means that Government is obliged to allocate considerable human resources and associated costs to maintaining cordial relationships with the Kingdom's main donors; and to the cost of ministerial

[42] See Background Report, Section 10.5

staff having to spend considerable time with many donors who visit Tonga regularly and therefore require time from local staff.

150. As Tonga strives to increase agricultural exports there is a need to maintain and constantly improve international relations with the Kingdom's trading partners, particularly New Zealand, Australia, Japan and the USA. This obligation imposes a large burden on the agriculture sector in terms of the direct and indirect costs of international travel. The TASP recognises the importance of international relations to the growth of agriculture and therefore proposes funding for increased international travel, subject to approval by the ASGC, which is necessary to avoid unnecessary international travel and conference participation.

151. The TASP also proposes funding to cover the cost of: (i) monitoring the status of international relationships with major donors and export recipient countries[43]; and (ii) preparing (if required) and promoting papers/reports on recommended changes to Tonga's position in the world of international trade. The latter activity will be implemented in coordination with work completed by the Tonga Business Enterprise Centre (TBEC), which is supported by NZAid. The Value Chain background paper concluded that "Tonga is ill-equipped to promote itself to outside investors, and that the Ministry of Commerce and Labour's TradeInvest and Business Development section is under-resourced". Funding through TASP will address this constraint and support efforts to open up new markets in Asia, in particular those countries where SPS is less strict and therefore could be a better fit for Tonga's capacity in term of compliance, particularly for smallholders.

5.3.7 Sub-Programme 2.6: Compliance and Regulations

152. Tonga is a member of numerous international organizations, governing bodies, etc., and consequently is required to allocate considerable financial and human resources to various forms of statutory reporting and updates of compliance situations. Some of these obligations relate directly to agriculture and the TASP proposes additional resources to cover at least some of these essential costs, in the form of three activities: (i) monitoring and reporting on compliance with international regulations and obligations, including estimating the costs of compliance; (ii) reviewing whether national regulations are hindering sectoral development and export growth, and, if so, preparing and promoting recommended changes; and (iii) providing an allowance for unforeseen costs as Tonga's agriculture sector faces new challenges, such as the imposition of import controls by an importing country, and internal changes such as drought and the inability to produce and supply.

5.3.6 Sub-Programme 2.7: Quarantine

153. Tonga's agriculture sector is very dependent on effective and efficient quarantine services, in terms of: (i) keeping the Kingdom free of pests and diseases that could decimate some crops (such as taro leaf blight); and (ii) preventing the export of other products due to non-compliance with international quarantine requirements. Considerable investment has been made in facilities such as the High-temperature, Forced-air (HTFA) facility at Fua'amotu international airport, which is now a Government-owned public enterprise; and the Methyl Bromide fumigation unit at the Nuku'alofa wharf.

154. Over the years Tonga has struggled to comply with overseas quarantine regulations, which have tended to become stricter and more costly (high transaction costs for smallholders) as time progresses. Whether a product requires quarantine treatment or not, if it is to be exported fresh it must now follow an approved quarantine protocol which specifies pathways that involve registration of the farmer and farm, inspection of the crop on the farm, and monitoring of the harvest and post-harvest process, including cleaning. This pathway requirement is causing significant problems for MAFFF, which is required to oversee spraying, harvesting and washing,

[43] See Footnote 39 -the Ministry of Foreign Affairs is responsible for the "Trade Policy Framework".

but the Ministry has limited staff available for this purpose although the PHAMA project has provided funding for an Export Pathway Manager. One option which warrants consideration is to develop "landscape approaches" whereby groups of smallholders can be certified at a lower cost. This entails the certification of whole areas of Tonga (islands) as, say, fruit fly-free through protocols which would make it easier for quarantine to work with smallholders. In addition, it will be important to provide ongoing quarantine compliance support for the export of handicrafts. Biosecurity has been identified as a key issue for this sector and while some progress has been made with New Zealand's Ministry of Primary Industries, this needs to be ongoing and formalized.

155. The considerable work required to support the quarantine requirements of importing countries, particularly New Zealand, suggests the need for a detailed cost-benefit analysis of the value to Tonga of continuing to support the export of certain crops, particularly those which require HTFA treatment, and for which supply has been relatively limited in recent years. However, there is a strong political commitment in New Zealand for the promotion of food exports from Pacific Islands. Any intervention to strengthen the skills of MAFFF in this area would, however, need to be accompanied by a programme of support to farmers wishing to produce those crops, conducted together with the potential exporters.

156. Tonga is fortunate to be free of many serious pests and diseases that have already infested its close Pacific neighbours, e.g., Giant African Snail and Taro Leaf Blight in Samoa, and Taro Beatle in Fiji. New pests and diseases would adversely affect agricultural production for both local supply and export. At present MAFFF's Quarantine Division does not have sufficient resources to adequately monitor and prevent the entry of new pests and diseases. Substantial funds are proposed under the TASP to assist Quarantine in achieving its twin functions of keeping export-pathways open and preventing new pests and diseases from entering Tonga.

5.3.7 Sub-Programme 2.8: Industry Organisations

157. Tonga has a number of industry organizations such as the Livestock Council, GroFed, GROCOM, the Manufacturers Association of Tonga, the Youth Council (which has a role in agro-processing of coconut oil), the Tongan National Arts and Handicrafts Association, and various Farmers' Councils. Some are well-established and have or are receiving donor support (mainly form NZAid and DFAT), while others, such as the Livestock Council, are more reliant on their members and on direct Government funding. As Tonga's agriculture and handicraft sectors grow, these organizations and grower bodies are expected to play more important and influential roles, and therefore warrant additional support under the TASP, provided they satisfy basic operational guidelines and comply with simple funding criteria - to be determined once TASP implementation commences. Accordingly, the TASP budget has provision for: (i) general one-off support in the form of funding for meetings and promotional events; (ii) business training for key industry representatives (in addition to the TASP budget allocation to support export sales under Programme 4 - Section 5.5.1); and (iii) planning and running industry-specific field days and learning events. Ultimately it will be the sector leaders (members of ASGC) who decide how these funds should be allocated and who should be the recipients.

5.3.8 Sub-Programme 2.9: Market Information

158. **Domestic Market:** MAFFF domestic market surveys have been conducted for decades. Unfortunately, the quality of data collected and provided to farmers and other industry participants, to assist better-informed production and supply decisions, has been less than satisfactory. A comprehensive database of available commodities, specified varieties, quality standards and accurate unit prices (weight based) is a baseline requirement to be established over the initial 24 months. Integrity of data needs to be the initial focus, with accuracy of recording the paramount requirement.

159. Established market locations should be surveyed as supply dictates. Implementation is recommended to be carried out by MAFFF in cooperation with an industry organisation such as the Growers Federation, for applicable locations. MAFFF is recognised as having available capacity in relevant island groups and the industry organisation would provide feedback from users. Information collected will significantly improve the quality of submissions to the Statistics department which will continue to serve as a data reserve.

160. Dissemination of information will be monthly by print (alternating between the 2 major newspapers) and available (as a table) from both MAFFF district offices and the industry organisation as a broadsheet or email and for specific enquiries by phone, SMS or email. A review of the outputs and systems of this sub-programme is recommended at 12 months to confirm its relevance, effectiveness and efficiency and to make improvements.

161. **Export Market.** In October 2014, the Growers Federation initiated monthly publishing of Tongatapu farmgate unit prices for a comprehensive range of fresh export commodities. This is regarded as the most relevant price information for farmers growing for export (or considering growing for export). Information is available for the latest export shipments with historical farm gate pricing recorded for the last several years. The initiative should be supported and expanded to include the Vava'u international port and those commodities not currently listed (e.g. vanilla, kava and frozen commodities) with comparisons covering the last two export years. Participation by significant and active exporters should be encouraged by MAFFF to increase competitive tension with the intent to improve grower returns.

162. Dissemination of Information should continue monthly by print (alternating between the 2 major newspapers) and be expanded to be available (as a table) from both MAFFF district offices and GroFed as a broadsheet or email and for specific enquiries by phone, SMS or email. A review of the outputs and systems of this sub-programme is recommended at 12 months to confirm its relevance, effectiveness and efficiency and to make improvements.

5.3.9 Sub-Programme 2.10: Agro-Meteorology

Agricultural Meteorology Capability

163. Through a Partnership Project between Tonga and the APEC Climate Center (APCC), Korea, to improve agriculture production through proved data availability and meteorological information, an Agro-meteorology (AGRO-MET) working group, consisting of MAFFF Extension staff, the Tonga Meteorological Service and farmers has been established to advise on climate matters. A work-plan (Annex 7) of activities has been developed by the AGRO-MET working group and the work-plan has been approved. Whilst the Tonga Meteorological Service operates a Climate Programme and produces monthly climate outlooks and predictions, a key limitation is the lack of Agro-met capability. Under the Agro-Met work-plan therefore, it is proposed to establish a new technical assistant position within the Tonga Meteorological Service. This person will have a number of responsibilities, but will principally be required to review the requirements for and to establish an Agro-Meteorology Programme within the Tonga Meteorological Service, review and provide guidance on the activities of the AGRO-MET working group and provide essential technical input into the ongoing development and delivery of agro-met services to farmers.

164. One of the first tasks of the technical assistant will be to continue the needs-assessment that has been instigated by the APCC and the Agro-Met group to ensure that activities are addressing the needs of farmers. This will take account of the results of current and/or ongoing work of the Tonga Meteorological Service, MAFFF, the AGRO-MET working group and the APCC, and identify the key gaps that remain and need to be addressed. It is likely that refinements to ongoing activities will be made as a result of this needs-assessment.

165. To ensure wider understanding of agro-met knowledge and information, training workshops will be developed and facilitated. These will be targeted at MAFFF extension staff, private sector extension providers, NGOs, lead farmers, and district officers and would be ongoing to ensure that up-to-date knowledge and information are regularly imparted to those who are working with farmers and farming communities. It is envisaged that these training workshops will also contribute to a review and assessment of the AGRO-MET Working Group to ensure wider representation for monitoring and feedback and to serve as the expert body to provide AGRO-met advice to a National Climate Outlook Forum (NCOF).

Data, knowledge and information

166. The current climate station network in Tonga provides valuable local weather data and the basis for long-term climatological records. However, these stations have not been specifically located and some lack the specific parameters required for the purposes of supporting agricultural decision making. To support improved agricultural decision making, dedicated agro-met stations will be established in consultation with the Technical Expert. Relevant technical support will also be provided along with integration with relevant data management systems. An agro-met database to manage contacts, information needs, and data has been developed at MAFFF through the APCC Project but will need to be further developed as more stations, data streams and other functionality are included. Mirror databases will also need to be established, both at the Tonga Meteorological Service and offshore for data security.

167. Targeted research will be undertaken to support improved agro-met advice and decision-making. This will include development of a soil-moisture balance for Tonga. A semi-quantitative approach will be used based on deriving relevant soil parameters from existing soils data (in particular available water-holding capacity) and linking this with derived Potential Evapotranspiration (PET). This soil moisture balance will be linked to a Geographic Information System (GIS) to allow mapping of soil moisture deficits and drought risks. Also proposed is further development and refinement of crop models, which can be linked to current and future analyses of climate risks, including climate change impact assessment. A multiple-user licence for the SIMCLIM software will be obtained to enable integration of relevant crop models with a capacity to generate and analyse current climate risks as well as the effects of future climate change scenarios on agriculture. This licence will allow linkages to the DSSAT models and the Plantgro software. Support will be provided to enable ongoing development, calibration and refinement of crop models (as well as other models), with a strong focus on outputs that can be used by farmers.

168. Traditionally farmers have relied on their accumulated knowledge (through generational sharing with others) to guide them in their seasonal planting decisions and on how to respond in times of climate crisis. This knowledge is not completely lost, but is not as prominent in supporting farmer decisions as it was in the past. Additionally, climate change means that what was relied on in the past will not necessarily be a good indicator for what may unfold in the future. Therefore a dynamic knowledge system is required, supported by modern information technology. A first step is to develop a Tonga-wide database of traditional knowledge and indicators relating to climate, and then link this with modern weather and climate forecasting. This work will link with, and learn from, relevant work already being undertaken by the Australian Bureau of Meteorology in Niue, Samoa, Solomon Islands and Vanuatu.[44]

169. Due to the scattered geography of Tonga, communications are an ongoing challenge. Reaching the last farmer on the furthest island will form the foundation of an information dissemination strategy for communicating relevant agro-met warning and farming information. Currently the Tonga Meteorological Service disseminates relevant information through the internet, phone, fax, email and radio. With the introduction of other technologies, such as mobile and ICT technologies,

[44] see http://cosppac.bom.gov.au/traditional-knowledge/

relevant agro-met information and communication services will be developed, including by using mobile phones.

5.4 Programme 3: Sustainable Livelihoods and Healthy Food

5.4.1 Objectives

170. The strategic objective for Programme 3 is to develop diverse, climate-resilient farming systems for Tonga's geographical zones (island groups). There are three specific objectives, to: (i) improve farmers' knowledge and practices of natural resource management, and diversified crop, livestock and handicraft production systems; (ii) revitalize Tonga's farming future and encourage young farmers to return to the land; and (iii) support farmers and handicraft producers to produce products that are marketable in local markets, can have valued added to them, and which contribute to food and nutritional security.

Overview

171. A "food first" approach for Tongan agriculture, founded on climate-resilient farming systems, is the primary focus of Programme 3. There are a number of issues that highlight the need for this approach, including:

(i) growing reliance on imported foods, despite a high degree of self-sufficiency in staple root crops;
(ii) an aging farmer population with relatively few young people becoming farmers;
(iii) relatively little of the available land used for food production, with estimates as low as 20% of the available land being cropped;
(iv) some evidence of reduced soil fertility;
(v) poor management of waste, which has potential to provide a source of agricultural fertilizer, biochar, crop mulch, and household energy supply; and
(vi) relatively poor understanding and management of climate risk (e.g. droughts and cyclones) and a poor knowledge of climate change.

172. There is no simple, or immediate, solution to these issues. Therefore the "food first/climate-resilient farming systems" approach aims to address them primarily through the introduction and development of functionally diverse farming systems (see Figure 5 for a pictorial description). These need to be tailored to the specific geography, soils, climate and social circumstances of each island group. Even within islands there are variations in soils that will influence the design of systems suited to local conditions.

173. There are three main components to these systems: (i) crop and livestock diversity; (ii) management of waste streams; and (iii) sustainable soil and water management. The rationale for these components is first discussed below, followed by a description of the activities to be implemented under the TASP in order to achieve Programme 3's specific objectives

Crop and Livestock Diversity

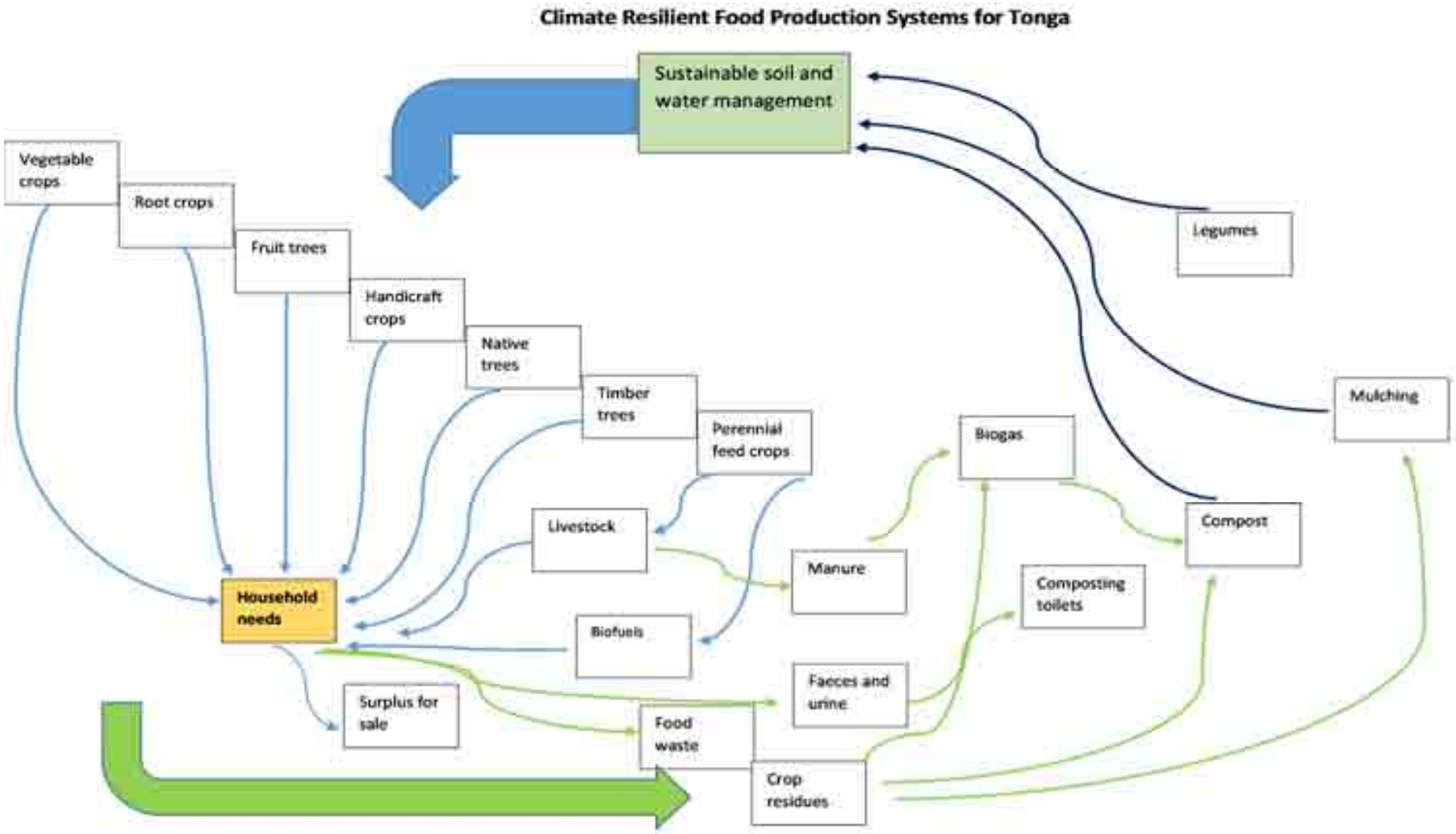
174. This is focused on the development of multi-tiered agroforestry systems. All elements of such systems already exist in Tonga. Therefore, the focus is to build on what already exists to develop a high degree of functional diversity. This emphasis on functional diversity is aimed at developing environmental, social and economic resilience in Tongan agriculture, and includes:

(i) High-value tropical hardwood timber trees planted around the perimeter of a standard eight-acre block, or in dedicated woodlots where sufficient land is available. These trees will provide a future high-value timber resource as well as firewood, mulch material, and raw materials for biofuel and biochar (a valuable soil conditioner) production.

(ii) Feed crops for livestock, including sugar cane, oil palm, sugar palm, and coconut palm. These perennial crops will provide a high-value source of animal feed as well as by-products which can be used for production of biofuels[45]. In addition, improved permanent pastures and annual crops such as maize and legumes can be used for livestock feeding.

[45]See Preston T R 1995: Research, extension and training for sustainable farming systems in the tropics**.** Livestock Research for Rural Development. Volume 7, Article #13. Retrieved April 7, 2015, from http://www.lrrd.org/lrrd7/2/1.htm

FIGURE 5: CLIMATE RESILIENT FOOD PRODUCTION SYSTEMS FOR TONGA



(iii) A national inventory of forest and tree resources (including coconut and fruit trees) must be implemented to determine the current status of the resources, and to collect relevant information and data for the strategic and sustainable harvesting, export, and development of forest and tree resources.

(iv) Diverse fruit crops based on improved varieties. An ACIAR project is currently underway to introduce new fruit crops to Tonga. Recent work (March 2015) on this project has involved consultations with rural communities in 'Eua on the possible new fruit varieties to be introduced.

(v) Traditional root crops need to be sustained as a core component of Tongan farming systems. Connections with existing regional research programmes (e.g. breeding/ selection for drought and salt water tolerance, pest and weed management) need to be strengthened to ensure that farmers are well-informed and systems are in place to support rapid uptake of new introductions. For example, current relevant regional projects that could be tapped include the ACIAR project entitled "Integrated crop management strategies for root and tuber crops: strengthening national and regional capacities in Papua New Guinea, Fiji, Samoa, Solomon Islands and Tonga"[46]. An important way to maintain crop diversity is to have access to tissue culture facilities, and to maintain a seed and planting material reserve. The forthcoming MAFFF review will therefore consider the need for these aspects of crop diversity

(vi) Production of vegetable crops such as onions, potatoes and tomatoes provides potential to meet household needs (if grown in home gardens) and to be scaled up commercially for import substitution. A greater diversity of vegetable crops is already being promoted in Tonga to encourage healthier diets. There is some supporting research through another ACIAR project which is focusing on "Strengthening integrated crop management research in the Pacific islands in support of sustainable intensification of high-value crop production"[47]. In addition, the Chinese-funded piggery/ biogas/ vegetables production system is relevant, provided that it is proven to be financially viable and affordable by small farmers.

(vii) Livestock includes penned and free-range pigs, tethered and fenced cattle, goats, free-range and caged chickens and ducks, together with lesser numbers of Fiji Fantastic sheep. The sector needs to be supported by the introduction of new genetics for all types of livestock. Practical and affordable systems are required to enclose pigs. Availability of stock water is a huge animal welfare and production issue for cattle. There is a need for legislation to cover this important point. In the absence of reticulated water supplies to the vast majority of rural lots, there is no simple solution to this issue.

177. Processing and food storage technologies need to be linked to the above where relevant. This includes, for example, solar dehydrators and revival of traditional fermented pit storage systems to ensure that there is food in times of shortage (e.g. post cyclone). A team from Tokyo University has been working with rural communities in 'Eua to introduce simple processing technologies for breadfruit, a crop which is seasonally abundant but is currently not processed and stored. Another relevant example of simple local food processing and value addition is the extraction of coconut

[46]See http://aciar.gov.au/project/hort/2010/065
[47]See http://aciar.gov.au/project/hort/2010/090

oil by students at Tupou College for local use and export through the National Youth Council to Heilala Vanilla and other processing companies.

Management of Waste Streams

178. This activity will focus on ensuring that plant and animal waste is recycled to generate benefits for agriculture and produce healthy food, rather than becoming sources of pollution. Crop residues are a source of mulch to assist with weed suppression and soil moisture retention, and mulching is sometimes used with coconut husks. Normal composting methods provide potential for the management of crop and animal waste, and the production of fertiliser. Relevant technologies for further processing of waste products are already being successfully trialled and implemented in some Pacific Island Countries, including biogas systems[48] which provide organic fertiliser as outputs. Biogas systems most suited for gas production are those based on biomass (eg, crop residues, weeds, animal manure etc).

179. Once a targeted programme has been designed around the proven concepts outlined above, with inclusions and deletions for specific locations and conditions, various ways to improve management of waste streams in Tonga would be trialled with a series of volunteers scattered across the Kingdom. The results will be designed into the Village Resilient Agriculture Demonstrations (VRADs), as described in Section 5.4.3.

Sustainable Soil and Water Management

180. This involves an integrated approach including: (i) introduction of legumes as an integral part of no-till agriculture systems; (ii) mulching to help retain soil moisture, build soil organic matter and enhance important biological activity; and (iii) returning products from waste-stream management (including compost, vermicast and biochar) to help maintain soil fertility and productivity, and to enhance water-holding capacity.

181. Legumes such as Leucaena (*Leucaena leucocephala*), known as sialemohe in Tonga, and Mucuna (likely to be *Mucuna pruriens*) have already been introduced to Tonga, probably through previous agriculture projects. Leucaena/sialemohe grows widely on unused or abandoned agricultural land throughout Tonga. Mucuna is being used by some farmers as a nitrogen fixer between crops. However, neither leucaena nor mucuna are commonly used by farmers as integral parts of agriculture production systems although both have potential as sources of nitrogen, as cover and (weed) smother crops, as an animal fodder, and as material for use in waste management systems.

182. The potential to use mulch, compost and vermicast has already been mentioned. Biochar production is also worthy of exploration. The International Biochar Initiative states that research is confirming the following benefits from biochar[49]: (i) reduced leaching of nitrogen into ground water; (ii) possible reduced emissions of nitrous oxide; (iii) increased cation-exchange capacity resulting in improved soil fertility; (iv) moderation of soil acidity; (v) increased water retention; and (vi) increased beneficial soil microbes.

[48]See for example successful work being undertaken in Samoa on biodigesters for biogas and organic fertilizer production http://bioenceptionz.com/our-projects/, with further developments proposed in a feasibility study prepared for the FAO http://bioenceptionz.com/wordpress/wp-content/uploads/2013/09/FAO-Biodigester-Project-_-Final-Report.pdf

[49]See http://www.biochar-international.org/biochar/soils

5.4.2 Specific Objectives - Programme 3

Overview

183. Programme 3's three specific objectives are listed at the beginning of Section 5.4. Significant effort will be required to: (i) draw together relevant information on the above-listed topics; (ii) develop appropriate documents and resources for dissemination to farmers and MAFFF's technical staff; (iii) establish demonstration farms; (iv) conduct FFS training; and (v) facilitate integration of resilient farm systems design into Village Resilient Agriculture Plans (VRAPs). Rather than discrete packages which tend to be delivered separately, the resilient farm systems approach will be developed as an ongoing and adaptive process. The core element will be the establishment of 10 Village Resilient Agriculture Demonstrations (VRADs) on all island groups, in association with identified Champion Farmers. These will become "living research stations" with progressive introduction, development, monitoring and refinement of different farming system components.

184. In effect, Programme 3 could be considered as an "agriculture version of TRIP" as it uses the same community-focussed planning processes and has similar objectives. Therefore Programme 3 could be entitled "Tonga Resilient Agriculture Scheme", or TRAS. Once detailed planning is underway it will be clear whether this is a realistic approach, but the extensive rural community consultation process completed as the basis for planning the TASP indicates that, irrespective of the final design of TASP programmes, the approach to Programme implementation will need to be similar to that used by MORDI for TRIP.

5.4.3 Sub-Programme 3.1: Farmers' Knowledge and Practices

Development of Farmer-Friendly Resilient Farming Guidelines

185. The preceding systems component descriptions were prepared with relevant, but relatively minimal research of what is known and what is being done. Therefore, there will need to be a comprehensive study to draw together all relevant information into a set of guidelines, which will then need to be described in "farmer friendly form" in the Tongan language. This will be funded by the TASP under Programme 1 - see Section 5.2.4.

Village Resilient Agriculture Demonstrations (VRADs)

186. At least ten VRADs will be planned and implemented in Tongatapu, 'Eua, Ha'apai, Vava'u and the Niuas[50]. Ten Champion Farmers (based on one per VRAD to begin with, but this number could increase as TASP implementation gathers momentum) will be identified to implement the VRADs on their farms. The VRADs will be developed progressively over five years. As a minimum each will incorporate elements of the three main resilient farming system components.

These include:

(i) Enhanced crop and livestock diversity with the introduction of new species of the different crop types, together with some food processing capabilities (eg, a village fermentation pit for processing excess crops, a village drying facility for excess breadfruit and other fruit, a village coconut cream/oil press);

[50] Based on following number of VRADs: N (2), VV (2), HP (2), E (1), TT (3) = 10.

(ii) Management of waste streams through mulching and the introduction of at least one waste management technology which is relevant to local conditions, e.g. (a) household biodigester where there is ample water; (b) a compost toilet; and (c) a vermicast system or composting system where water is limiting and there are issues with faecal coliform contamination of groundwater;

(iii) Introduction of legumes and use of processed organic waste, with at least some of the VRADs containing an appropriate-to-scale biochar system.

An addition to this approach to resilient agriculture demonstrations could be to use this approach for the promotion of improved handicraft production techniques.

Operate and Maintain the VRADs

187. Support will be required to operate and maintain the VRADs. As "living" research stations they will need to be monitored by the Champion Farmers with support from MAFFF's technical staff. It will be important to incorporate relevant resilience indicators into this process as the 10 VRAD's will provide timely evidence of the impact of climate change on agricultural production, and of the outcomes from adaptive responses to climate change and other factors such as changing markets and varying terms of trade.

Design and Implementation of Village Resilient Agriculture Plans (VRAPs)

188. Establishment of resilient farming guidelines (see Section 5.2.3 for details) and the development of VRADs will be important prerequisites for the design and implementation of VRAPs. These VRAPs will be developed by MAFFF in conjunction with the Ministry of Internal Affairs' island development planning process. Officers from MAFFF will work with Island, District and Village Facilitators who will be appointed and supported under the TASP (refer to Section 7 for details on implementation arrangements and responsibilities).

189. It is expected that the VRAPs will be "living" plans, which are changed and adapted as local knowledge of resilient agriculture systems increases and as conditions change over time. A total of 44 VRAPS (based on about one plan for two neighbouring villages = total of 88 villages, with approximately 50% implemented by the end of TASP Year 5) will be developed over a five-year period, covering about 50% of the villages in Tonga. Table 6 provides details[51]. Start-up funding will be provided to support implementation of VRAPs aimed at progressive development of resilient farming systems throughout Tonga.

190. MORDI's community development approach (which is now officially embedded in MIA) will be used to prepare the VRAPs. In fact, it is expected that the VRAPs will be "by-products" from broader community development planning which is now an integral part of island planning in Tonga, given the Government's instruction for all island groups to prepare Island Development Plans[52]. MIA's planning process encompasses all aspects of rural communities' lives and has a broader focus than just agriculture. However, and as demonstrated during the TASP community-based consultations, once villagers satisfy their needs for basic infrastructure, their next set of needs is invariably related to agriculture. Therefore, it is logical to, develop the VRAPs on the basis of the MIA-supported Village Development Plans (VDPs), as priorities will have already been expressed and communities are experienced in working together for plan preparation.

[51] Eventually it is anticipated that all villages will be covered - perhaps over a 10-year period or two five-year TASP phases.
[52] See the Plan for 'Eua as an example.

191. District and Town/Village Officers (who are part of MIA's administrative system) are currently responsible for preparing VDPs with support from MAFFF's island-based technical staff. MAFFF staff will work closely with the District and Town/Village Officers to formulate the all-important VRAPs.

5.4.4 Sub-Programme 3.2: Young People in Agriculture

Overview

192. Fundamental issues impacting on the long-term resilience of agriculture in Tonga are the aging farmer population and the lack of young people engaged in agriculture. The ambitious solution to these issues is to support the education of young farmers for the future. At least three existing school in Tonga, Tupou College (Tongatapu), Hango Agricultural Institute ('Eua) and Fokololo Technical Institute (Tongatapu), have potential to set up young-farmer training programmes within these schools. There may also be potential for young-farmer training programmes to be set up within existing schools in Ha'apai and Vava'u.

Feasibility Study of suitable schools for young-farmer training

193. A feasibility study will be carried out to evaluate setting up young-farmer training programmes in the three schools (Tupou College, Hango and Fokololo), and to also evaluate setting up young-farmer training programmes in schools in Ha'apai and Vava'u. This will be completed in TASP Year 1 as a high priority. The study will include consideration of how to encourage more young women to participate, with the objective of encouraging them to return to rural areas to engage in agriculture and handicraft production. Consideration of curriculum reform within the secondary and tertiary agriculture education systems will be an important task for the feasibility study team.

Student Awards and Graduate Support Packages

194. These will be important incentives for young men and women farmers to: (i) remain at the college and complete their secondary education; (ii) be able to withstand the risks associated with "start-up" agriculture production ventures after graduation; and (iii) ensure awardees that they are equipped with the technical, financial and marketing skills required for viable and sustainable small-scale farming operations.

195. Awards will be in the form of scholarships (relief from fees) and be awarded to the 10 most-promising final year student in terms of their potential to become climate-resilient subsistence and/or commercial farmers and change agents (Champion Farmers) within their home communities. In addition, each year 50 of the most promising graduates will be supported with "farming start-up" packages, which will variously comprise: (i) funds (in the form of micro-credit loans) for the purchase of small tools and machines and production inputs (fertilizer and chemicals); (ii) technical support packages such as free soil testing and assistance to construct farm access roads; and (iii) special services in the form of intensive attendance at relevant FFSs, and regular one-on-one farm visits by MAFFF's technical staff. This activity could learn some lessons from HCTSP which is currently supporting Handicraft Champions.

5.4.5 Sub-Programme 3.3: Marketable Agriculture Products

196. This is the core of the TASP. It involves increased and sustained production and sale of healthy agriculture products that are in demand in domestic markets, are suitable for local processing and village-level value-adding (and, over time, will lead to an expected increase in exports and/or reduced imports - see Programme 4) and which contribute to food and nutritional security. All other groups of activities focus directly or indirectly on this objective, with strong

elements of sustainability and resilience, and consideration of the long-term future of Tonga's agriculture sector.

197. It is important to note that the TASP does not define which agriculture products are the highest priorities, because these rankings will vary from island to island and from village to village. This means that islands and villages will need to prioritise their most important crop and livestock products themselves, with assistance and coordination from MAFFF's technical staff. TASP's target population will decide on local priorities when formulating their VDPs and associated VRAPs and therefore it would be inappropriate for the TASP to prescribe product-specific priorities for Tonga's different island groups. However, it is important to note that the term "agricultural products" should be interpreted as all-embracing; it includes annual and perennial food and cash crops, handcraft crops, all types of livestock, forestry, and local-processed goods such as fermented crops, dried crops, and coconut cream or oil.

Farmer Field Schools (FFSs)

198. FFSs will be basis on which Tonga's farmers are trained and understand new technologies in the future (see Section 10.5 for a description of FFS and how they operate). MAFFF's extension system has almost ceased to function due to budget constraints and MAFFF staff report that they now simply wait for farmers to visit their district offices and request help and assistance; or they call farmers and ask them to attend training based on on-station research plots. This situation is not sustainable and will be one of the main topics to be considered by the MAFFF institutional review team. However, in the meantime the TASP has been based on the assumption that MAFFF's extension system will be upgraded so that its staff can fulfil their mandate and assist Tonga's farmers to learn new production techniques and adapt to changing circumstances.

199. Table 6 outlines the estimated phasing of target farmer training for men and women farmers with training for the latter expected to focus on the production of raw materials for handicraft manufacture. About 4,000 men and women farmers, and 3,500 female handicraft manufacturers will be targeted over the first five years of what is expected to be a 10-year TASP. The farmers will be divided into about 100 Farmer Learning Groups (FLGs) and there will be 88 Handicraft Learning Groups (HLGs). FFS events will focus on both of these groups (farmers and handicraft manufacturers), which will each comprise about 40 people. This approach to extension will be carefully tested and validated before being scaled-up.

200. The FFSs will incorporate the successes of the practical examples set up by Nishi Trading under a private initiative to train contract vegetable growers[53]. Based on the 100 FLGs and 88 HLGs, there will be about 1,150 FFSs for the FLGs and 612 FFSs for the HLGs over a five-year period. Table 6 provides details and calculations of target numbers. Note that the TASP costings (see Section 8.2) are based on these estimated numbers of target farmers and handicraft manufacturers.

Printing and Distribution of Technical Brochures

201. The FFS programme will be supported with simple technical brochures and training materials to assist farmers in the learning and understanding process. At present MAFFF has very few visual learning materials for distribution to farmers and therefore TASP proposes to address this deficiency. Skilled information-transfer specialists will be employed to prepare these materials, which are expected to be based on diagrams and pictures with minimal use of text. There are many sources of practical technical brochures in the Pacific and as most of the important crops and livestock species are grown and raised across the region, it is expected that TASP will be able to refer to other projects and programmes, which have already designed and published these

[53] With contracted assistance from a Venezuelan Professor of Agronomy who is a recognized international expert on the design and use of FFSs.

essential farmer-training materials, including the Handicraft Association. Note that these brochures will also be used for Programme 4 (export promotion and import replacement), with all costs being allocated to Programme 3.

Learning Grants for FLGs

202. The TASP operational budget includes an allocation for the award of learning grants to worthy and qualified FLGs who demonstrate commitment to learning through regular attendance at FFSs. Award of the learning grants would be competitive, and applications would be assessed against an agreed set of criteria by staff from the TASPICU. A small facilitation unit would be established within the TASPICU (Programme 3) to assist farmers to prepare and present grant applications. Grant implementation would be supervised by TASP District Facilitators from MAFFF's technical staff if required. The aim would be to assist FLGs to continue to learn and adopt new technologies after awareness raising and technology introduction through the FFSs. For example, an FLG (comprising about 40 individual farmers) might decide that before expanding their areas of vanilla they needed to visit another island to observe and learn from other vanilla farmers who are known to be progressive and successful. Therefore the FLG would prepare a short application for a learning grant and submit it to the TASPICU for consideration. If approved, the funds could be used to cover the cost of local transport and living costs (not for all members, but, say, five democratically elected farmers). In addition, a percentage of the learning grant funds could be used to pay private sector actors to train farmers in particular technologies, provided this use of funds is approved in advance by the TASPICU.

203. The detailed design of the various TASP programmes (expected to be supported by donor assistance) will describe in considerably more detail how this particular activity will be planned and implemented. Given the current state of agriculture extension in Tonga (see the Background Report) this approach to farmer learning is likely to be very important in the future.

Matching Grants for FLGs

204. In addition to learning grants for FLGs, the TASP will also provide competitive matching grants to enable farmer members of FLGs to expand their particular enterprises, after successful use of learning grants. Successful applicants will be required to submit a simple business plan to the TASPICU to demonstrate a willingness to share farm development and operational costs with the funding project. A facilitation unit will be set up within TASPICU to assist the applicants in writing simple business plans. The aim would be to empower farmers to drive the agricultural extension agenda and to improve their capacity to: (i) adopt new technology to better respond to market demand; (ii) develop simple agribusiness management skills; and (iii) engage in PPPs at the village and district levels[54].

[54] Adapted from: worldbank.org/projects/P083742/farmer-empowerment-through-agricultural-technology-information

TABLE 6: PHASING OF FARMER TRAINING

		2017	2018	2019	2020	2021	
		Year 1	Year 2	Year 3	Year 4	Year 5	Total c/
No of Village Resilient Agriculture Demonstrations (VRADs) a/	10	10					**10**
No of villages in Kingdom	170						**170**
No of villages per Village Resilient Agriculture Plans (VRAPs)	2						
Number of VRAPs b/	85		17	17	26	26	**86**
Percent of VRAPs implemented by end Year 5	50%						
No of VRAPs implemented by end Year 5	43		9	9	13	13	**44**
Total number of farmers	8,000						**8,000**
Target percent of farmers	50%						
Incremental number of farmers per year	4,000		800	800	1,200	1,200	**4,000**
Cumulative number of farmers involved in TASP			800	1,600	2,800	4,000	**4,000**
Number of farmers per VRAP	93						
Number of farmers per VRAD	400						
Number of farmers per Learning Group (FLG), using VRADs	40						
Number of FLGs per VRAD	10						
Total FLGs	100						
Cumulative number of FLGs			20	40	70	100	
Number Farmer Field School (FFS)events/FLG/year)	5						
Number of FFS events per year - for FLGs			**100**	**200**	**350**	**500**	**1,150**
Number of women farmers	7,000						
Percent assisted to grow handicraft raw materials	50%						
Number of women farmers assisted	3,500						
Incremental number of women assisted			700	700	1,050	1,050	**3,500**
Cumulative number of women assisted			700	1,400	2,450	3,500	**3,500**
Number of women farmers per Handicraft LG (HLG)	40						
Number of HLGs			18	18	26	26	**88**
Cumulative number of HLGs			18	36	62	88	
Number Farmer Field School (FFS)events/HLG/year)	3						
Number of FFS events per year - for HLGs			**54**	**108**	**186**	**264**	**612**

a/ Based on following number of VRADs: N (2), VV (2), HP (2), E (1), TT (3) = 10. Used for farmer training, based on Farmer Field Schools.
a/ Excludes VRAD on Tupou College.
b/ Based on assumption that one VRAP covers two villages.
c/ All figures rounded to nearest one.
Minor errors due to rounding.

205. It is expected that these outcomes will be achieved by: (i) strengthening farmers' capacity to become organized and accountable - through the FFS approach; (ii) facilitating productive PPPs with service providers through grants for Farmer-Managed Extension Activities (FMEAs), with-these funds being included in the matching grants; and (iii) developing public and private extension capacity to facilitate farmers' access to technology, markets, and knowledge. Activities would include: (i) organizational support for the more progressive FLGs; and (ii) monitoring and training of producer organizations' leaders and members (funded under Programme 4).

Matching Grants for Women Handicraft Materials Farmers

206. Matching grants will be provided to credible and qualified HLGs on the same basis. These grants will be simpler to implement and monitor as their use will be restricted to investment in increased production and basic processing of tree-based handicraft materials, primarily tree mulberry for tapa and pandanus for weaving. The grant approval conditions will be the same as those for farming matching grants. The facilitation unit at TASPCU will help women in writing their proposals and preparing simple business plans

Short Value Chains for Local Products

207. At times, the understandable focus on agriculture exports and associated international value chains diverts attention away from "closer-to-home" opportunities to supply local domestic

markets with raw or semi-processed products. These systems are, in effect, Short Domestic Value Chains (SDVCs) and are suitable for a wide range of products that might eventually enter the more formal, export-focussed value chains with increased scale and processing/value-adding/packaging; or simply satisfy the demand for products presently imported, such as onions, potatoes, some fruits, and livestock products and by-products. Other examples are local production of fermented silage from excess crops for feeding livestock, dried breadfruit and fruit, and coconut cream or oil as a replacement of imported coconut cream or vegetable oil.

208. In recognition of the opportunities to supply domestic markets, and in support of the import-replacement initiatives under Programme 4 (see Section 5.5), the TASP proposes funding for the conduct and promotion of SDVC analysis. This could be as simple as compiling individual crop gross margins and then scaling-up to whole-farm financial budgets. The latter could then be used as part of the FFS system to assist farmers to make seasonal production decisions (different crops and varying cropped areas) based on financial and, importantly, marketing criteria which include estimates of local seasonal production by island and throughout the Kingdom. Trained MAFFF staff, in conjunction with the private sector, will help farmers to understand and apply crop gross-margins and farm financial budgets.

Farm Access Roads - Feasibility Study and Matching Grants

209. Tonga's farmers rank farm access problems very highly and often report that lack of all-weather access roads is their single largest agriculture production issue. Most farmers use small trucks or tractors as transport to their farms, which even on the smaller islands can be some distance (2-3 km) from their villages. Access can be a major problem, particularly during harvest when large volumes of crops need to be collected and transported. Therefore, in recognition of the production-related problems caused by lack of farm access, the TASP includes funding for farm access road feasibility studies as a basis for subsidized construction of roads in the form of matching grants. If the proposal proves feasible, it is expected that cooperating farmers would fund about half the cost of access roads (in the form of local materials and labour) with the TASP funding machinery hire and any necessary non-farming skills such as simple road and drainage design.

Livestock: Disease Survey and Water Supplies - Survey and Matching Grants

210. There is an urgent requirement for a national livestock disease survey. The most recent survey was completed in 1995. There is no information on sheep, which were introduced in 2005, and there is no up-to-date information on any of the livestock species present in Tonga. Several important zoonotic diseases have emerged since 1995 (Avian influenza, Hendra virus, NIPAH virus, Lyssa viruses) and the situation in Tonga with regard to these is unknown. There are frequent epidemics of disease, causing high mortality in backyard poultry and this has significant effects on village households. Without current knowledge of disease status it is not possible to mount realistic extension programmes, and nor can priorities for disease control programmes be established. Provision has been made for this activity in the TASP budget.

211. Reliable supplies of water for all livestock are a major animal welfare issue in Tonga. Few Tongan farmers understand how much water various species of livestock require per day[55] and some only water their tethered cattle on odd days - or even weekly. This factor alone explains to a considerable extent why livestock experience slow growth rates and low annual breeding percentages.

[55] For example, well-adapted *Bos indicus* cross cattle require about 40 litres per day; and poorly adapted *Bos taurus* cattle require more - and most of Tonga's cattle are the latter breed.

212. There is growing interest in cattle production in Tonga as a way of replacing imported beef, but this will not eventuate on a commercial scale until the problem of water for cattle is solved. Part of the problem relates to a lack of knowledge, but the other more practical issue is that most small farms do not have access to regular supplies of water - for irrigation or livestock. Therefore the TASP proposes funding for a livestock water supply feasibility study under the same matching grant conditions as for access roads.

Micro-Irrigation Systems and Matching Grants

213. As mentioned in Section 2.6, there is growing demand for irrigation water in Tonga, at a time when water resources are not well-understood, the impact of climate change is becoming more and more evident and Tonga has just experienced its worst drought since 2008. There is some evidence that vegetable growers on Tongatapu are tapping local aquifers and using free and un-monitored water for irrigation. In recognition of this unsustainable situation the TASP will provide considerable support to Tonga's water sector (see Section 5.2.2), plus support under Programme 3 for a micro-irrigation systems and associated matching grants - again under the same conditions are described for the other grant programmes. This activity will be guided closely by the results from the water supply-related activities to be funded under Programme 1 - see Section 5.2.2.

Cross-Visits to Vanuatu

214. After VRADs have been set up and are functioning under the TASP, a group of key representatives from one island group, including a District Officer, a District Facilitator, a MAFFF extension officer, a Champion Farmer, and a Women's Representative may be taken to Vanuatu for a five-day training and farm learning course. The trainees will learn from, and share with, Santo Island farmers in Vanuatu about community organisation and planning, climate resilient agriculture practices, agriculture education in schools, and rural training. On return of the group to Tonga, implementation of the Vanuatu training will be monitored for improvements in farming. If improvements occur, further groups may be sent to Vanuatu for similar training.

Support for Churches to Assist Farmers

215. It became apparent during the TASP design mission that the Churches in Tonga[56] are a significant resource in terms of their ability to engage with and influence the thinking of Tonga's farming population. At present, all major Churches have agriculture-focussed support programmes for their parishioners, with most supporting the production of staple food. Therefore the TASP Design Team met with the leaders of Tonga's four main Churches and gained unanimous approval for inclusion of their Churches as supporting partners for TASP implementation. It is therefore proposed to provide Church ministers with training in climate-resilient agriculture, and improved and more productive cropping and livestock production systems, in return for the Ministers acting as "awareness raising agents" when working amongst and addressing their parishioners. The intention is to use the Church as an "informal extension channel" to raise awareness of climate change, and the various climate-resilient production options which are available for farmers to test. This concept will take some time to develop and therefore some early "trials" are warranted. However, it does seem logical for the TASP to engage with the Churches because of their influence on farmer-parishioners and their ability to engage regularly, and to deliver messages.

216. This broad-scale partnership between the TASP and Tonga's main Churches will be in-valuable and warrants considerable support. At a time when MAFFF is struggling to provide services to its constituent farmers, the Churches have a "captive" audience at least once a week,

[56] Defined as the four main denominations: (i) Catholic; (ii) Church of Tonga; (iii) Church of Latter Day Saints; and (iv) the Free Wesleyan Church - and who represent more than 90% of the population.

and across the whole Kingdom. Therefore it is logical that the TASP taps into this large resource with considerable funding ability for the right types of agricultural production activities. At this stage, Tonga's main Churches are not being asked to commit counterpart funds for TASP implementation but this option should not be ignored. Carefully planned and focussed joint Church and TASP agriculture development programmes, which are based on each partners' strengths and ability to harness resources (funds and labour), could have a huge impact on Tonga's agriculture sector.

5.5 Programme 4: Sustainable Economic Growth and Foreign Exchange Earnings

5.5.1 Sub-Programme 4.1: Export Sales

Introduction

217. The TASP has an underlying principle of not over-emphasizing agricultural exports at the expense of providing adequate support for the development of Tonga's domestic agriculture sector. The Background Report reflects this understanding and the TASP cost schedules indicate that the bulk of support is proposed for the smallholder sector and the domestic agriculture economy. However, this does not mean that support for exports has been understated. The TASP Design Team was presented with many proposals and the World Bank-funded value chain report contains logical recommendations for value chain development in Tonga. Some of these have been included in the TASP design.

Details

Study of National Forestry Industry

218. Of all the products which might have some Kingdom-wide opportunity for export, tropical hardwoods seem to be the stand-out. There are good examples of a wide range of introduced timber species growing well in all island groups[57] and there are also native timber species with promise[58]. PPP-type forestry investments could work under some form of long-term lease system, and experience from 'Eua indicates that domestic forestry products can replace imported lumber, fence posts and power poles. Whilst the threat of cyclones needs to be factored into any forestry development plans, this export and import replacement opportunity (which has many secondary benefits such as high rates of local employment, and, with the right mix of species, environmental protection) warrants further analysis and assessment with a view to encouraging international forestry-related businesses to invest in Tongan forestry. Therefore the TASP includes funding for a study of the potential for a Tongan National Forestry Industry. This work could be undertaken with Tonga Forestry Products (TFP) as a partner, and/or there maybe opportunities to partner with a New Zealand forestry company.

Export Shipping Requirements

219. Tonga's main exporters report that many ships which service Tongatapu are over-sized and therefore charge uncompetitive, high freight rates for return trips which ship Tongan products. Smaller ships that could run more frequent services are required, and such services would result in reduced sea freight rates. The TASP includes funds to address this issue and to identify specific solutions for export shipping requirements from Tongatapu to Tonga's main export markets. This activity would be welcomed by Tonga's main exporters and it is expected that they would cooperate fully, and would make some financial commitment towards such a study through their

[57] Usually as border trees around eight-acre farms.

[58] For comprehensive descriptions of the native plants of Tonga see: A. Whistler, 2011, The Rare Plants of Tonga, a report prepared for the Tonga Trust Ltd.

representative bodies. In the past, the Government provided infrastructure for exporting activities, but private-sector exporters have set up alternative export-infrastructure and continue to do so.

Study of Farm to Pack-house Access Constraints

220. Another constraint to exports is the poor state of access roads which link farms with pack-houses. This situation not only adds to transport costs but also results in damage to products and consequent quality downgrading. This problem is closely related to farmers' access to their farms, discussed above, and therefore should be addressed as a single package with the objective of improving both access to farms and the transport of farm products to processing facilities. The TASP funding proposed for the study of farm access roads and the expected follow-on competitive matching grants is adequate and therefore no additional funds have been proposed for a study of farm to pack-house access constraints.

Training for all Stakeholders[59]

221. Value Chain and Business Training. There is little understanding of value chains or sound business practices amongst most Tongans active in agriculture. Exporters and processors admit to mistakes involving financing, cost control, market relationships, and linkages with farmers. While TBEC is actively working to redress this situation, additional business and value chain training is required. Specific proposals to be supported by the TASP are:

(i) *Awareness Training for Farmers Interested in Export -* Awareness training will be provided to farmers and others interested in exporting, to develop appreciation and knowledge of the activities, costs and risks involved. Participants will include: (a) MAFFF staff; (b) representatives from financial organizations, exporters, and processors; and (c) representatives from farmer groups, handicraft producers (stand-alone courses due to the specific nature of handicraft marketing) and market traders. The courses would be held at suitable training facilities, with supplementary funding from TASP, and would be supported by the weekly publication of commodity prices in local newspapers.

(ii) *Business Mentoring*. At least one exporter has benefited from short-term business development and management mentoring, which was arranged through TBEC using New Zealand volunteers. This programme is not running at the moment but such mentoring provides business development support and can also be used in association with loan or matching grant applications. A good model comes from Fiji where the Market Development Facility (MDF) is funded by DFAT. The Facility places emphasis on supporting the private sector to make investments that ultimately benefit small farmers. Mentoring is undertaken by MDF staff and continues through the life of the grant. Under the TASP, extra funding will be provided for additional mentoring for the agricultural and agricultural processing sectors, over and above the funding already allocated under the TBEC Project.

Training in Post-Harvest Practices

222. Post-harvest handling is relatively poor and the condition of much produce on sale is not good. Various papers on this topic have recorded that there are significant weaknesses at the post-harvest stage for both domestic and export produce[60]. Therefore the TASP will support training in basic post-harvest practices for extension staff, exporters, and farmers who sell on the domestic market. While there is a plethora of guides available on the topic these are often unnecessarily theoretical. The TASP will therefore develop a practical approach for this form of training. In order

[59] Extracted from the World Bank Value Chain report recommendations.

[60] http://www.egfar.org/egfar/lfm/gphi_documents/02_Region_specific_documents/D_Asia_and_the_Pacific_Islands_%28APAARI%29/02_Background_Documents/01_General_issues/D-1-0033_Ph_in_Pacific_Islands.pdf

to ensure maximum "hands on" training, the courses on Tongatapu will be held at suitable training facilities.

Technical Support for Value Chain Development

223. Technical support is required for a range of value chain development activities, as indicated below. Such support will be required on an ongoing basis as new technical problems emerge as businesses expand. Key topics for training programmes to be funded under the TASP include: (i) off-season and import replacement production; (ii) export production; (iii) value adding through processing; (iv) product marketing; (v) animal feed production; and (vi) certification. The TASP also includes a fund for technical support to farmers, exporters, agro-processors and other stakeholders to enable them to improve their technical capabilities in order to increase their ability to supply both domestic and export markets. It is likely that the funds will be mainly used to hire external expertise to work with relevant businesses. Note that this support programme is different from the Programme 3 set of activities, which focuses on FFSs.

224. Criteria to decide which businesses would qualify should include: (i) potential benefits to Tonga in terms of export revenue, import replacement or nutritional improvement; (ii) evidence of collaboration between several businesses, and evidence of their financial and management capacity to fully utilize this expertise; and (iii) maximum impact on enabling smallholder farmers to become more progressive, and on making available affordable and nutritious products to consumers. The fund will be disbursed over several years in order to provide for assistance which may not be identified at the outset. Decisions regarding fund allocation will be made by ASGC members on the basis that the main requirement is to ensure open and equal access to technical assistance for all who require this type of support.

Financing Value Chain Development

225. Financing of agriculture has been a controversial issue for many years in Tonga. Problems have included the widespread failure to repay loans and some allegations of favouritism in allocating the loans. Furthermore, despite the financial resources that have been provided for the agriculture sector, there is little evidence of the sector moving forward, at least when judged by the level of exports.

226. Loans or grants provided to agriculture therefore need to both be rigorously examined from the outset and supported by a programme of mentoring which provides assistance to borrowers to maximize the profitability of their businesses. The DFAT-funded MDF in Fiji and Timor Leste is a possible model. This pays particular attention to encouraging private companies to support farmers with extension advice and other information, and to ensure they have access to appropriate equipment and production inputs. The Facility provides start-up funding for investments in processing, cold chains, packaging facility improvement; and in investments necessary to achieve certification, such as HACCP. Emphasis is on promoting year-round production and identifying new crops with market potential. Support is provided on a cost-sharing basis, with MDF meeting up to 50% of the total investment cost. The Facility completes detailed business case assessments and due-diligence tests and stresses that investments must translate into benefits for farmers. Applicant companies must initially meet all costs and are subsequently reimbursed MDF's share, thus avoiding the possibility that funds are used for non-approved purposes.

227. The TASP includes proposed funding for a similar Facility in Tonga (about US$1.5 million). The Facility will: (i) support both the development of export-oriented infrastructure and necessary investments for import replacement (with similar selection criteria as those listed above for the provision of technical support); (ii) establish a technical risks facility which farmers can consult online with the objective of targeting priority products; and (iii) provide venture capital (as is the case in Fiji) by scaling up the PHAMA Export Development Grant Facility. Although mentoring in

Fiji is provided by MDF staff, the smaller size of Facility in Tonga means that the use of outside mentors on an as-required basis would be more appropriate, rather than the retention of full-time staff.

Support for Service Provision

228. MAFFF has had to take on additional responsibilities as a result of export pathway requirements to meet New Zealand's quarantine regulations for a range of agricultural and handicraft products. Therefore the proposed institutional review of MAFFF should consider MAFFF's obligations in this regard. If continued emphasis on accessing the New Zealand market with fruit fly-host fruits and vegetables (particularly those requiring HTFA treatment) is, together with the wider market for handicrafts, considered a priority, appropriate resources will need to be allocated to provide pathway support. Following problems regarding the functionality and efficiency of the HTFA export pathways in 2015, an MPI audit has been completed and remedial actions have been/are being implemented by TEQM and MAFFF.

229. There have been tentative steps by a few exporters to provide their own extension services to small-scale farmers. The TASP proposes support to these initiatives by providing assistance with simple, generic training material production. These materials will be provided to all smallholders, and not just those who work closely with the few exporters who are presently providing extension services. Assistance with preparation of these materials could be provided by TBEC. A good example of the type of training material required comes from Vanuatu, where Venui Vanilla prepared a well-illustrated guide on vanilla production and processing for use by all farmers[61]. The TASP funding for this activity has been included in Programme 3, noting that PHAMA has already implemented such an activity for vanilla in Vava'u.

Investment Promotion

230. With the exception of some recent investment from Australia in the vanilla sector and investments in fisheries, most foreign direct investment in Tongan agriculture is relatively small-scale and not of the type required to promote significant growth in the agricultural economy. However, there would appear to be scope for further investment in the vanilla, kava and coffee industries, and animal feed production may attract an outside investor. The general consensus is that land on Tongatapu is underutilised and could provide the resource base for additional production if suitable products can be identified. Commercial livestock production may present one opportunity. However, reliable investors are unlikely to come to Tonga unless they are actively courted. The Ministry of Commerce is now completing a Tourism Investment Strategy to provide a framework for attracting investors to this sector, and the TASP will provide support for a similar strategy for the agriculture sector, which would concentrate on identifying areas that may be of interest to outside investors. Assistance will include funding for a series of meetings in target countries, to which representatives from leading companies in the identified areas would be invited.

Infrastructure

231. In general, specific infrastructure for value chains and markets should be developed through private sector investment. Clearly, transport infrastructure should be provided as a public good but equipment such as packhouses and cold stores is often better-provided by the private sector, and tends to last longer when it is. In Tonga, however, the small-scale of many economic activities in the agricultural sector means that it is not always cost-efficient for exporters and other businesses to construct their own facilities. Only a few exporters have their own packing infrastructure and it is not realistic to expect a business which exports, say, one container of frozen cassava a month, to make the necessary investment. If private investment does not offer this

[61] http://publications.cta.int/en/publications/publication/1697/

service on a commercial basis to numerous small exporters, it then has to be provided by Government or the smaller exporters will be unable to operate.

232. The EU-Stabex facilities[62] on the wharf next to MAFFF's head office play an important role for small-scale exporters of frozen produce as they have space to peel, wash and pack roots and tubers, and to then either freeze at the facility or to load directly into containers for freezing. A number of weaknesses in this system are in the process of being addressed, but successful resolution of the problems, including the need to relocate quarantine inspection for handicrafts and to provide a back-up generator for additional reefer container sockets already installed will be funded through the TASP. In addition, if proven necessary, the TASP will also fund additional container storage space on the wharf.

233. A longer term requirement is for the facilities to become HACCP compliant, as part of a programme to assist exporters to meet HACCP standards from the farm through to the loading of containers onto ships. A proposal for technical support to enable individual exporters to become HACCP-certified is proposed and, in addition the TASP has allocated funds to ensure that the wharf facility meets HACCP standards.

234. Several requests were made to the TASP Design Team to recommend funding for a new pack-house in the Eastern Districts of Tongatapu. This is the main horticultural production area of the island but all production is presently consolidated in Nuku'alofa. As with the wharf facility, it is proposed that this new facility would be available to all interested exporters, on a rotational basis. In addition to container packing, it would also be suitable for air freight packing as it would be close to the airport. A Business Plan for the proposed facility has been developed with assistance from PHAMA and the facility is a priority under the TASP. Funding will be sought from PHAMA and other donors, plus the Tonga Government Managed Fund.

Private Sector Collaboration

235. There is scope for greater collaboration amongst the private sector in several agricultural commodity areas. Tonga is too small, with too many diseconomies of scale, for the various actors not to work together to aim for maximisation of both their profits, and benefits to farmers and the broader economy. GroFed aims to engage in policy dialogue to promote the agriculture sector, and stresses that its role is to strengthen private sector representation. Grofed is currently working on its Strategic Plan for the next five years, aiming to be a strong industry organisation representing growers, exporters and any affiliated agricultural organisation in the private sector.

236. ASGC is steadily and actively expanding representation from both the public and private sectors. ASGC representatives from the Public Sector include MAFFF, MCL, Tonga Met., MFNP and NRBT, while ASGC representatives from the Private Sector include GroFed (farmers), Growers Export Network (exporters and processors), kava processors and exporters, Tonga Handicraft Association, TCCI and domestic market suppliers. In addition, ASGC has NGO Representatives including PHAMA/Tonga Market Access Working Group (TMAWG) and MORDI. ASGC will continue to expand representation by seeking active and contributing members from MIA, the livestock industry, vanilla processors/exporters, the manufacturing sector and the smaller exporters who use the Queen Salote Wharf Processing Facility.

237. There is a need for all the existing associations to agree on a collaborative approach and preferably a single representation for the Kingdom's agriculture sector. Therefore the TASP will provide assistance to establish such an organization/association through the funding of a position which will be responsible for identifying and contacting potential members, organising meetings

[62] Note that PHAMA is already assisting with a range of these activities, and is preparing a business plan for the proposed new pack house in the Eastern Districts

and identifying potential ways of increasing collaboration. Any new industry-wide association should consider joining the Pacific Islands Private Sector Organisation (PIPSO).

Priority Products for Export[63]

238. The TASP aims to create the enabling conditions under which the private sector is able to move the country's agriculture forward to the ultimate benefit of the Kingdom's small farmers. Products to produce, process and market (either domestically or for export) should not be determined by planners or Government, but by companies and individuals who are prepared to risk their resources by making the necessary investments. Policies and plans should aim to minimise constraints by creating an enabling environment of supportive services, rules and regulations, etc., as detailed in Programme 2 (Section 5.3).

239. However there is an expectation that the TASP will, to a limited extent at least, identify priority products for investment. Therefore the following appear to be products or sectors that may offer the greatest short and medium-term benefits. However, exporters and farmers need to avoid "putting all their eggs in one basket" and should concentrate on producing and marketing a diversified range of products including forestry resources.

240. *Watermelon.* Tonga has demonstrated in the past that it has the capacity to produce large quantities of watermelons for export to New Zealand at the time when demand is high. PHAMA's research has confirmed that significant market opportunities still exist. Possible constraints include declining yields, MAFFF's inability to support the export pathway, and the limited capacity of the fumigation facility. On the other hand, a limitation on the number of containers which can be fumigated is likely to reduce the possibility of exporters flooding the market, leading to a price collapse. While the private sector is fully capable of supplying the market, assistance is required to strengthen export pathway support provided by MAFFF, and to provide other services such as soil testing.

241. *Beans*. PHAMA's survey in 2013 identified beans has having considerable potential in the New Zealand market at certain times of the year. Unfortunately, there is no quarantine agreement in place between the two countries for this crop. This should be relatively easy to develop as beans are not fruit fly hosts. Work by MAFFF to advance an agreement is required, as is on-farm adaptive research to identify varieties that are suitable for the New Zealand market, and which grow well in Tonga.

242. *Vanilla*. This is a crop with which farmers have considerable experience. It used to provide an important source of income for the Outer Islands, which are generally less well-off than Tongatapu. The industry is now supported by three companies from three different markets who all produce processed vanilla products, and thus have a strong incentive to work with farmers to maximise quality and quantity. This may provide industry sustainability despite the volatile world market. Potential areas for support include training material production and advice on linkages between companies and farmers. It is important that the industry is not disrupted by "fly-by-night" individuals and companies who seek to enter the vanilla industry to take advantage of high prices, without playing a sector developmental role.

243. *Value Adding.* Adding value to export produce as a result of primary processing not only increases returns from overseas sale but also reduces the risk associated with biosecurity requirements in the receiving market. The export of frozen cassava is one example of the latter. Further development of consumer-ready products should be encouraged. The greatest scope for increasing sales appears to be by developing markets that are not dependent on the Tongan and Pacific Island diaspora. This can probably only be done by promoting sales through supermarket chains. In turn, this requires that exports are HACCP-certified. As a first step, as proposed above,

[63] This list is not comprehensive but rather an example of some priority products which might be exported.

it will be essential to obtain HACCP certification for the Queen Salote Wharf packing facilities, and to support exporters to obtain their own certification and develop their own primary-processing facilities.

244. *Squash.* There seems to be a tendency in Tonga to "write-off" squash. While it may not be desirable for production to return to earlier levels, with all the associated problems discussed in various reports, squash has been a significant export earner in recent years and could continue to be so, given that there appear to be remaining market opportunities in China, Japan and Korea.

245. The TASP contains a budget (for Technical Assistance) to assist growers and exporters to identity products with export potential on a biennial basis. This process would commence with a review of how the previous priority list of products had performed in the various markets, followed by value chain analysis of newly identified and promising products. The results from this exercise would be shared with all stakeholders with an interest in exporting agricultural commodities from Tonga.

5.5.2 Sub-Programme 4.2: Import Replacement

Introduction

Food Imports

246. Tonga continues to import considerable volumes (and value) of food. Table 7 shows that animal products (mainly meat) and vegetable products (including fresh vegetables) are major imports, with a combined value of about T$53.3 million in 2013. Agribusiness investors in Tonga are aware of the market opportunities associated with the domestic production of at least some of the foodstuffs imported into the Kingdom, including livestock products and vegetables such as onions and potatoes. In summary there is potential for replacement of imports of selected, widely consumed food crops, and also for the seasonal export of products such as potatoes and onions.

TABLE 7: IMPORTS OF FOOD INTO TONGA (2013)

Product	Imports (T$)
Live animals, animal products a/	$42,562,879
Vegetable products	$10,711,053
Animal or vegetable oils and fats	$2,185,542
Prepared foodstuffs b/	$49,665,836
Total	**$105,125,310**
Total (exc pepared food)	**$55,459,474**

a/ Includes all fish products
b/ Including beverages, spirits and tobacco
Source: International Merchandise Trade Statistics, Annual (2013)
Statistics Department of Tonga, Series No SDT:31-34.

Opportunities for Vegetables

247. Support in the form of on-farm adaptive research to resolve production difficulties will be necessary for vegetable import replacements. This should be based on priority involvement of smallholders and should not be limited to one or two large farmers. There is a period in the first half of the year when vegetables such as capsicum, tomatoes and beans, are in short supply, prices are high, and limited local supply is supplemented by imports. While supplying this off-season market may not result in the same returns as successful import replacement for potatoes or onions, there should be opportunities for profitable production. The technically-proven production of vegetables from the piggery/biogas/vegetable system (PRC/MAFFF Collaboration Project) warrants a review in terms of its financial, economic and environmental sustainability, before consideration of scaling up on a country-wide basis. In principle, however, there is good

potential to produce import replacement (and opportunity export) vegetables in Tonga, assuming that the irrigation water supply investigations under Programme 1 (see Section 5.2.2) produce positive results. In addition, there are also import substitution opportunities under the SPC/PAPP project to link farmers to the tourism sector.

Opportunities for Livestock Products

248. Similarly, there is potential to replace imported livestock meat and by-products with domestically produced products. However, there are considerably more production risks associated with livestock production and processing, and a domestic animal feed supply industry would need to be established, at least for poultry and pigs. One of the main constraints is the lack of hygienic and quality-controlled slaughter and processing facilities, which are expensive to build and need a constant, year-round supply of live animals if these facilities are to operate efficiently and profitably. Another issue is the lack of a national feed reserve to call on in times of drought and other natural disasters. Furthermore, cattle production indices in Tonga (calving and growth rates, etc.) are very low but there are opportunities to increase production (eg, by using a combination of luceana with grass pasture). One opportunity which is ready for expansion is the domestic supply of chicks and ducklings from the PRC/MAFFF Collaboration Hatchery Project.

249. The TASP will support a series of studies and training courses that focus on Tonga's domestic livestock industries (see Table and the detailed costs for Programme 4, for details). This will include consideration of the viability of domestic slaughter and processing facilities and associated marketing infrastructure for the sale of meat and live animals. These activities will be supported with training in hygienic livestock product processing, HACCP and meat inspection.

250. Developing a domestic cattle industry along the lines of the one in Vanuatu is theoretically possible, but would take considerable private sector and Government investment. Furthermore, such an industry would have to produce beef of sufficient quality and regular supply to be able to compete with the price of imported beef. Similarly, domestic poultry meat production would have to compete with very cheap imports from North and South America and also be capable of meeting demand on a regular basis as irregular production will not capture markets that demand constant volume and quality. Therefore, domestic beef and poultry meat production seem, at this stage of enquiry, to have less potential (and more risks) than the import replacement (and opportunistic export) vegetable industry. However, as outlined below, these opportunities require further detailed analysis of individual product value chains and preparation of business plans that can withstand the scrutiny of bankers.

Details

Training, General Support, and Promising Value Chains

251. *Training on Domestic Markets and Import Replacement*. There appear to be good opportunities for Tongan agribusinesses to invest in the production of import replacement products. However, such ventures are always risky and business plans are often too optimistic. Therefore, the TASP includes funding to cover the cost of appointing volunteers to work with small groups to train potential investors in how to: (i) review opportunities in domestic markets for import replacement products; (ii) prepare production, marketing and financial plans (including the use of borrowed funds); and (iii) present business cases to bankers and potential investors such as market outlets and input suppliers. This informal training could be coordinated by TBEC using additional funds from the TASP, or by specific industry groups such as the Livestock Council and GroFed. Overall coordination would be by the TASPICU.

252. *General Support for the Livestock Industry*. There are several aspects of Tonga's livestock industry which require support. Some of these are covered in Programme 3 - see Section 5.4.2 and others tend to be one-off and more focused on import replacement and therefore have been

included in Programme 4. For example, much of the work carried out by the Chinese-funded intensive livestock production projects (focusing on pigs and various types of poultry) is due to end in 2015. The more practical and relevant aspects of these pilots should be continued after further adaptation to Tongan conditions, and testing of financial and economic viability. In general, there needs to be more farm-based adaptive research on semi-intensive pig and poultry industries, including the marketing and processing of the end products.

253. There also needs to be an infusion of new genetics for all important livestock species in Tonga as the impacts of in-breeding are becoming more obvious, with reduced fertility, reduced production and, in some cases, multiple physical defects. Therefore genetic import activities are required for all species. In support of improved livestock genetics, there is a need for more improved pasture species[64] (grasses and legumes) for grazing, fodder banks, cut and carry feeding systems, and silage production, together with soil improvement through the use of legumes and crop/ livestock rotations. In addition, there is need for improved fencing systems to protect crops and improve pasture-grazing management. Solar electric-fencing systems should be trialled.

254. Expansion of the sheep industry by building on the successful introduction of the Fiji Fantastic breed requires the introduction of new genetic material, as has been done recently through a World Bank project in Samoa. Breeds worthy of testing include the new Fiji Fantastic (from Fiji), and the Wiltshire and Dorper (from New Zealand or Australia). However, breeds are not the main determinant of animal productivity. Generally, good year-round nutrition and improved management (e.g. time of lambing and weaning) are the two most important production factors. If Tonga's sheep industry is to grow and fulfil its potential, all elements of the production package will need to be improved, in addition to the breed. That said, there are good opportunities to increase sheep meat production and as these small ruminants are easier to slaughter and process, this part of Tonga's livestock industry warrants additional attention and investment.

255. There is only limited knowledge of village-level, livestock-based production systems which incorporate pigs. Admittedly, roaming pigs cause large and constant damage to village gardens, and problem-census meetings with villagers invariably focus on this issue. However, only the communities themselves can solve this problem. Some have banned free range pigs, and/or constructed pig-proof fences to protect village gardens. Despite this solvable livestock management problem (which is the focus of the Chinese-funded penned pig and biogas project) it seems that very little is known about the productivity of free range pigs in Tonga, and, in fact, MAFFF has very little information on crop, livestock or whole farm gross margins. Some argue that pigs are ideal for Tonga because of their reproduction rates; and because they can be fed (or at least exist) on readily available crops such as coconuts. However, very little is known about the reproductive efficiency of sows, or the survival rate of piglets. In fact, there is limited knowledge of the production parameters for all livestock species, or of the main factors which impact on production, such as nutrition, potable water supplies, disease prevalence, morbidity and mortality.

256. Therefore the TASP includes funding to cover: (i) ongoing farm-based adaptive research, and financial and economic analyses of the piggery/biogas/vegetable system, plus domestic poultry/duck production; (ii) the introduction of new sheep breed genetic materials, such as Fiji Fantastic and/or other breeds which are suitable for cross-breeding, as well as new breed genetics for back-yard poultry (chickens and ducks) and for cattle, pigs and goats (iii) support for farmers to improve the management of all species of livestock, covering feeding, general livestock husbandry, and, in particular, livestock water supplies; and (iv) a study of village-level, livestock-based production systems that incorporate pigs.

257. *Promising Value Chains*. The sectoral analysis completed as part of the Background Report and subsequent assessments by the TASP Design Team and the World Bank's value chain specialist

[64] Noting the need to ensure that invasive species are not introduced and then become weeds in cropping systems.

identified a number of commodities which are worthy of additional analysis in terms of their potential for export, and/or import replacement. In addition, the TASP Design Team also identified some larger, industry-wide analytical studies which need to be completed - including one on the forestry sector and one on the valuation of the "resilient island" approach (see Programme 1, Section 5.2.4)[65].

Therefore the TASP has budget to complete the following Value Chain Analysis Feasibility Studies, some of which might be able to build on work already completed by PHAMA and other projects, because these options have been under discussion for some time: (i) vegetable import replacement; (ii) animal feed mills for pig and poultry feed production, including an assessment on how to increase the supply of high protein and essential micro-nutrient ingredients in animal feeds; (iii) implementation of the recommendations in the 2008 FAO report on the potential for maize production; (iv) beef raising and domestic processing; and (v) options for the introduction of mobile slaughter units for cattle, sheep and pig processing. This analytical work will be completed during TASP Year 1 as Tonga's agribusiness community has been waiting for assistance with these studies for some time.

[65] Note that the latter two are funded through other TASP activities, and not these specific value chain activities.

6 EXPECTED RESULTS FROM THE AGRICULTURE SECTOR PLAN

6.1 Measurable Results

258. It is expected that the TASP will contribute to four types of measurable results based on the TASP Goal which *is to increase and sustain resilient agriculture livelihoods.* These are: (i) a climate-resilient environment (ii) an improved enabling environment; (iii) sustainable livelihoods and healthy food; and (iv) sustainable growth in foreign exchange earnings/savings. Figures 3 and 4 described these inter-relationships in more detail and Table 9.1 in the Annex is a Preliminary Results Framework which contains indicators and milestones, and the TASP Five-Year Targets.

259. At the Goal level, the key indicators are:

(i) *A climate-resilient environment* in Tonga which would have: (i) greater buffering capacity against external shocks (climatic and other); (ii) a much greater degree of self-organization (less reliance on external support in times of crisis); and (iii) more inherent adaptability (able to respond and adapt as conditions change). These would be measured by the indicators related to: (i) knowledge and understanding of key natural resources (water and soils); (ii) development of indicators of and guidelines on diverse farming systems; and (iii) the capacity developed to support farmers to adapt.

(ii) *An improved enabling environment* in Tonga would result in more efficient agriculture production and export/import replacement, measured by indicators related to rural incomes and exports/import replacements;

(iii) *Sustainable livelihoods and healthy food* would result in increased rural incomes, measured by increased annual household incomes for the rural sector, and improved health indices (these are not quantified).. The increase in annual incomes is assumed to be 5% compound growth per year from Year 1 of the TASP (2017), using a 2017 base of T$7,550. The latter figure was derived from the 2009 HIES figure of T$6,444, and increased by 2% p.a. from 2009 to 2017. The 2017 rural income figure of $7,550 was then increased by the targeted 5% p.a. over the five year life of the TASP to derive the income target figure of T$9,566 in 2021.

(iv) *Sustained growth and foreign exchange earnings/savings* would result in: (a) increased agriculture exports (mainly vegetables) - assumed to be 10% compound per year from a base of T$12,430 million in 2017 to T$19.669 million in 2021; and (b) decreased meat (mainly beef and chicken) imports, declining by 10% per year from a base of T$32.144 million in 2017 to T$22.828 million in 2021. These targets should be considered to be flexible and preferably should be set each year taking into account prevailing domestic and regional economic conditions. Note that the targets have been set as financial values and not volumes (tonnages), as increased volumes of exports (or "saved" imports) may not have the desired financial and economic impact in the event of falling commodity prices or gluts in the target markets.

260. The increase in measurable benefits from effective implementation of the TASP (assuming that Programmes 1 and 2 can successfully provide enabling and favourable environments for Programmes 3 and 4) are listed below. These are closely linked to outcomes from the two "production-focused Programmes", i.e. 3 and 4.

(i) Stable and sustained supplies of healthy staple foods for the Kingdom as a result of the "food first" policy, and avoidance of the "trap" of becoming reliant on imported food, such as rice, which can be expensive in times of international shortage.

(ii) An increase in the sector's contribution to national GDP, and to net foreign exchange earnings, recognizing that it will take some time before exports are restored to previous levels (and imports decline), and for Programmes 3 and 4 to "kick-in" and have a sustainable impact.

(iii) Increased incomes for sectoral investors (small- and large-scale farmers) and workers, including women handicraft producers.

(iv) As more commercial value chains are developed and young farmers begin to return to farming as a career, rural employment opportunities should improve and perhaps reduce the need for large numbers of people to leave rural areas to seek overseas employment.

(v) Increased value-addition along value chains as agriculture becomes more commercial and, as a result of the implementation of Programmes 3 and 4, more and more smallholder farmers "graduate" from reliance on subsistence agriculture with a few local sales, to greater participation in national domestic sales and, eventually, increased involvement in Programme 4 areas (exports and import replacement).

(vi) Increased and more profitable rural enterprise should result in increased Government returns in the form of taxes.

(vii) An increase in human and natural resource capital as farmers learn new skills and production techniques, and their farming resources are used sustainably.

(viii) An increase in productive wealth (on farm investments, soil fertility, livestock water, farm access roads, etc.).

(ix) An increase in intangible rural social wealth in the form of social structures, as a result of learning together using the VRADs and applying new skills learned from FFSs when implementing VRAPs.

261. It is more difficult to identify tangible and quantifiable benefits generated by Programmes 1 and 2 as these are less measurable social, economic and environmental benefits. However, as described, it is expected that the these two Programmes will:

(i) Safeguard Tonga's agriculture sector by ensuring long-term sustainable production of crucial food and export products, by implementing measures to ensure that core resources (water and soils), are protected and maintained under Programme 1; and then backing up these outcomes with appropriate policies and legislation under Programme 2.

(ii) Increase rural community resilience to climate change and associated shocks by promoting diverse, mixed-product farming systems, and supporting rural communities to become more adaptive to change.

(iii) Once reviewed, increase MAFFF's capacity to deliver services to its constituent farmers, through an expected rebuilding and refocusing of agriculture research and extension services, and allocation of extra budgetary resources to farmer services.

(iv) Use incremental TASP resources to focus on key enabling-environment topics; (a) bio-physical policies and legislation, (b) increased support for exports and import replacement, (c) improved farmer access to land and financial resources, (d) strengthened and ongoing international relationships with important trading partners, (e) strengthened and ongoing quarantine services, (f) increased support for industry organizations, and (g) improved market information services.

(v) The above-listed outcomes are also expected to result in: (i) improved transport logistics and more foreign direct investment; (ii) improved ecosystem services in the form of protecting agriculture, and other contributions to climate-change adaptation and mitigation (use of less fuel for agriculture, cover cropping and less ploughing) and maintenance of soil-based carbon sinks; (iii) some cost savings in the form of more-efficient public and private sectors, and less duplication amongst donor-funded projects; and (iv) more effective regional cooperation between Tonga and its main agriculture-product trading partners resulting in increased economic returns and cost savings.

6.2 Beneficiaries

262. Broadly speaking, the main TASP beneficiaries will be Tonga's: (i) smallholder men and women farmers (and handicraft makers) who will benefit from increased and more diverse production, as well as associated health benefits. Beneficiaries are estimated to be 4,000 men and women farmers and 3,500 handicraft producers, by the end of TASP Year 5; (ii) the more commercial and export and import-replacement focused farmers (numbers not specified); (iii) the rural economy, from sales of staple foods and healthy foods; and (iv) the Kingdom's overall economy, from increased exports, plus import replacement in the longer-term. In addition there will be a range of secondary beneficiaries, including: (i) MIA and MAFFF staff, who will have increased skills and knowledge; (ii) the general population who will benefit from reliable supplies of healthy "home-grown" food; and (iii) Tonga's rural environment, which is expected to become more resilient to impending challenges and therefore capable of sustaining the population for generations to come.

263. This is an ambitious set of objectives and one which will require support from all Tongan stakeholders and donors if the identified benefits are to be generated and the target beneficiaries are to gain from the TASP. But, if these benefits are not realized, the longer-term scenario for Tonga's agriculture sector may not be very positive. Complacency can be dangerous in the face of looming change, but, fortunately, Tonga has time on its side in that its natural resources are generally still in good condition. In addition, the Kingdom has ample supplies of staple food and is therefore not dependent on imported staples. Now is the time to act to protect core national assets (water and soils) and to put in place a sectoral support programme that addresses major constraints and issues, and thereby supports the sector's potential to generate the benefits listed above.

6.3 Cost-Benefit Analyses

264. The TASP Design Team has not completed preliminary cost-benefit analyses of the recommended sectoral development interventions. This was because it was not possible to obtain crop or whole farm budgets, and the Mission did not have the time to prepare these budgets from scratch. It was anticipated that the TASP design process would be supported with independent design and analysis of promising value chains[66], but this exercise has now been factored in the TASP design as a matter of priority..

265. However, from first principles and experience in other similar parts of the world, it is not unreasonable to conclude that whilst farm-level financial returns (FIRRs) are usually attractive, the economic rates of return (EIRRs) are generally lower due to high economic costs and low returns. It is expected that such analyses will be completed when donors begin to fund programme designs once the TASP has been approved, and its various programmes are supported by different donors.

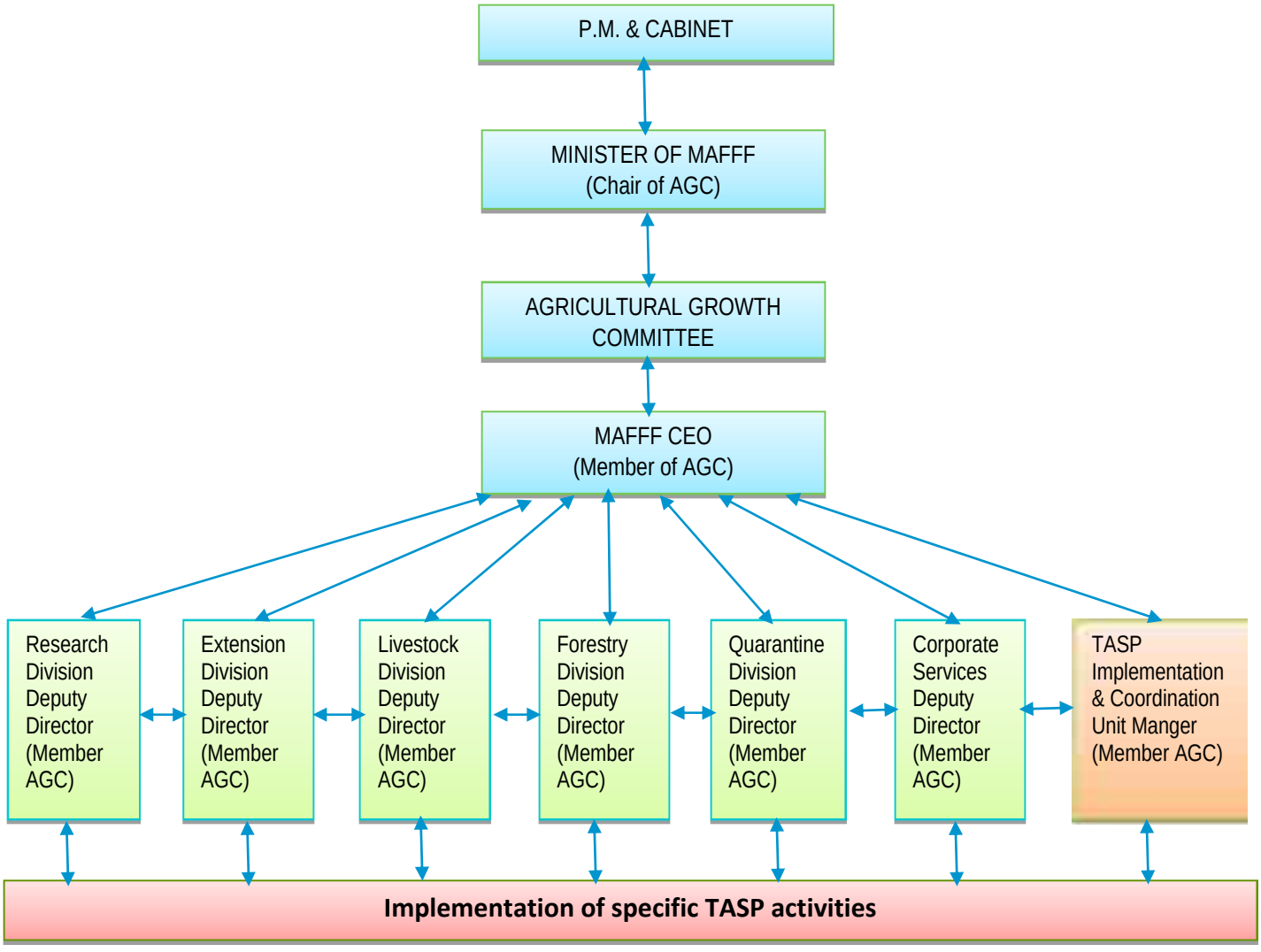
7 TASP IMPLEMENTATION ARRANGEMENTS

7.1 TASP Management and Implementation

7.1.1 Management and Implementation Structure

266. Figure 6 sets out the management structure for implementation of the TASP. A new TASP Implementation and Coordination Unit (TASPICU) will be set up within MAFFF to assist and coordinate implementation of TASP activities within the 6 existing Divisions of MAFFF. The new unit will also assist and coordinate TASP activities outside MAFFF (e.g., setting up of weather stations by Tonga Met). It is envisaged that the TASPICU will operate for up to 5 years during the 5 years of this first TASP, after which its functions will be taken over by MAFFF's Corporate Division.

Figure 6: TASP Planning, Implementation and Organization - who and how



The proposed TASP Implementation and Coordination Unit will be a small unit within MAFFF, with a Manager and Assistant plus a small secretariat and staff to facilitate funding applications. The Manager will be a member of AGC. The Manager will also work closely with the Deputy-Directors and CEO of MAFFF to enable and monitor implementation of TASP activities within MAFFF. The Manager will also enable and monitor implementation of TASP activities outside MAFFF. Reporting on implementation of TASP activities will be made regularly to AGC.

267. The management structure agreed by ASGC does not include details of how TASP activities will be implemented by MAFFF's six current Divisions and MAFFF's new TASP Implementation and Coordination Unit (TASPICU). The Institutional Review of MAFFF will provide advice and recommendations about how TASP activities can be implemented, by whom, and with what resources and costs. Existing MAFFF staff and resources will be used, but extra resources, including personnel, will be needed to successfully implement TASP activities. MAFFF staff will receive appropriate training to implement TASP activities. The World Bank has agreed to fund the Institutional Review. Terms of reference for the Review have been developed by ASGC (in conjunction with the World Bank) and it is intended for the review to be completed before the end of 2015. Following the review, MAFFF divisions may be restructured and will be properly resourced to enable implementation of TASP activities. The TASPICU will also be provided with adequate resources.

268. While many TASP activities will need to wait for implementation until the conclusion of the MAFFF institutional review, there are other activities that do not, such as the preparation of the Agro-Met work-plan, the proposed hydrological study of water availability, a feasibility study for Future-farmer training centres, and the proposed Eastern District Processing Facility on Tongatapu. ASGC will work to implement activities that do not need to wait for the conclusion of the MAFFF review.

7.2 Donors and Possible Funding

269. The TASP has been designed and presented as four specific Programmes, each with a series of Sub-programmes and associated activities (see Table : Detailed TASP Cost Schedules for details). This means that it should be possible for donors and development agencies to "mix and match" in terms of which areas/aspects of the TASP they might wish to fund and provide technical assistance for. Such decisions will probably require a donor coordination meeting once the TASP has been approved, at which the TASP is presented by its proponents, followed by discussions on how to fund it. Note that prior to this it will be important for Government to have a clear message in terms of its intended funding for the sector in the future, so that "budget gaps" can be identified for potential filling by donors.

270. A budget for TASPICU over 5 years is included in Table 12, with total investment costs of TOP 5.57 million plus recurrent costs of T$ 7.15 million, leading to a total of T$ 12.72 million. This was a budget for a proposed 'stand-alone' TASPICU outside MAFFF, which was not accepted by ASGC. A revised budget for TASPICU will be prepared on conclusion of the MAFFF institutional review.

7.3 Priority Activities

7.3.1 Next Steps

271. Once the TASP has been approved by ASGC and Cabinet, it will be necessary to complete one further planning exercise before implementation can commence. This is the detailed programme and/or project planning by cooperating donors. It is unlikely that one donor will offer to fund all of the TASP and therefore ASGC and Government will need to hold an agriculture sector donor coordination meeting at which the TASP and its associated budgets are presented, with the objective of obtaining commitments from participants to use the TASP as the basis for detailed programme planning.

7.3.2 Priorities

272. In anticipation that Tonga's donor community will be willing to fund the TASP, there are a number of activities that could be "fast-tracked" with the objective of being ready once detailed planning has been completed. These are subject to revision but could include, for Programme 1: (i) commencement of the resource definition work associated with Tonga's water supplies and soil

fertility; and (ii) preparation of the climate-resilient guidelines and indicators, and initial capacity building for climate-resilient agriculture. Programme 2 priorities are: (i) completion of the MAFFF institutional review; and (ii) immediate follow-up from Programme 1's resource definition work with policy reform work.

273. Programme 3 priorities are: (i) the design and location decisions for the 10 VRADs; (ii) the feasibility study to determine appropriate training centres for future farmers; and (iii) the feasibility study on the provision of livestock water and the study of micro-irrigation options/costs. The Programme 4 priorities are: (i) the study on the National Forestry Industry; (ii) the various studies on addressing constraints which are limiting exports; (iii) initial provision of business mentoring and training; and (iv) value chain analyses on specific products which have potential for export and/or import substitution.

7.3.3 Programme Phasing

274. The expected phasing for each activity planned for the individual TASP Programmes will depend on donors agreeing to assist with funding. Note that there are few activities planned for Year 1 as it will take some time to establish the TASPICU, to restructure MAFFF's Divisions, and to provide adequate resources. The activities listed are for the first five years of what is expected to be a 10-year TASP, as only about 50% of Tonga's farmers would have been assisted by the end of Year 5.

7.4 Monitoring and Evaluation

275. TASP monitoring and evaluation will be the responsibility of an M&E Officer who will be based in the TASPICU and who will provide monthly reports. As TASP will be a Kingdom-wide Programme, the size and complexity of this task should not be underestimated and this is why some dedicated TA has been allocated to M&E.

7.5 Risks and Risk Mitigation

276. Tonga's agriculture sector is exposed to and influenced by a range of both "generic" and "specific" risks. The generic risks relate to: (i) climate change, e.g. rainfall variation, sea level rises, and cyclones; and (ii) changes in international market conditions and regulations/requirements, and impacts on exports. Risks more specific to Tonga include: (i) environmental risks (sustainable water supplies, healthy soils, and forest protection); and (ii) social and cultural risks, such as the impact of out-migration and the practice of free grazing and roaming livestock.

277. On a Programme-by-Programme basis, the main "specific" risks, and the strategies designed into the TASP to mitigate, are:

(i) Programme 1: *the concept of a climate resilient environment is not grasped and fully-understood.* This undermines knowledge building on the environmental conditions required to support the development of climate-resilient agriculture. This risk has been addressed through the allocation of sufficient resources to ensure that all key stakeholders have the opportunity to learn about and understand this essential and overriding concept.

(ii) Programme 1: *failure to address the possible looming crisis of over-exploitation of underground water resources; and a steady decline in soil fertility.* This could result in severe domestic water shortages in times of (increasing) drought and, in the longer term, in declining staple food production and dependence on imported staples. This risk has been addressed by allocating sufficient resources for: (i) improved understanding and interpretation of current water supply and soil fertility statuses; and (ii) subsequent policy and legislation revision (under Programme 2).

(iii) Programme 2: *failure to respond to the recommendations from the MAFFF review.* Tonga's smallholder agriculture would continue to be under-serviced in terms of extension and results from adaptive research. This is a limited risk, which has been addressed by: (i) ensuring that there is adequate budget to fund recommended changes to the way MAFFF operates and services its constituents; and (ii) building and supporting new island-based VRAP planning teams, which are linked to MIA's institutional structure and the ministry's mandate for local planning.

(iv) Programme 2: *access to land and rural finance continues to constrain sectoral development.* This is an ongoing and significant risk that has the potential to limit the TASP's impact if not addressed appropriately. Therefore sufficient resources have been proposed to ensure that this risk is not overriding, and that there are continued assessments of opportunities: (i) to simplify access to land owned but unused by owners; and (ii) for sectoral investors (large and small) to access investment and operational finance.

(v) Programme 2: *quarantine issues cause breakdowns of export pathways.* This is an ongoing risk (e.g. the recent issue with fruit fly-contaminated watermelon) and one which has to be managed on a daily basis. Extra resources are also needed to keep unwanted pests and diseases from entering Tonga and adversely affecting agricultural production and exports. Additional support under the TASP for quarantine has not been finalized, but once this information is available it will be factored into the final design and cost schedules. In the meantime, it is clear that this aspect of Tonga's agriculture warrants the highest level of support and adequate resourcing.

(vi) Programme 3: *the concept of using matching grants to stimulate smallholder agriculture production is new to Tonga.* It may take some time for potential beneficiaries to respond to this opportunity. However, as the TASP is based on the use of such grants to address the main production constraints reported by farmers (e.g. farm access, agriculture water supplies, and working capital) it is expected that farmers will take advantage of the opportunities afforded by these matching grants, once they become familiar with how the system works and of recipients' obligations.

(vii) Programme 3: *the suggested value chain analyses fail to identify viable investment options for increased production for the domestic market, and/or import replacements.* This risk is not so significant for the former target, but is considerable for the latter.

(viii) TASP Management and Implementation: *the recommended use of MIA's planning process as the basis for designing the VRAPs is new to Tonga, and therefore it could take some time for the system to become functional.* There is considerable MORDI experience with this type of community-based planning, and the TASP will be well-served with the current availability of "community readiness" maps.

8 INDICATIVE BUDGET AND TIMING

8.1 MAFFF's Current Budget Situation

278. Table 8 details MAFFF's budget for 2014-15, amounting to T$6.653 million, which excludes the budget for the Fisheries Division and the one-off funding of the ADF. At present, MAFFF is allocating about 28% of its non-fisheries annual budget to Leadership and Policy Direction (T$1.849 million) with the remaining 72% being spent on Agriculture and Forestry and Development (T$4.805 million). Within the latter, export expansion, food security, extension and women's development is allocated 39% (T$1.866 million) and quarantine and quality management support services 19% (T$0.932 million). Of the T$4.805 million allocated to agriculture and forestry development, 72% or T$3.330 million is allocated to salaries; and only 28% or T$1.475 million is allocated to other cost areas, the development-related activities.

8.2 TASP Budget Requirements

279. TAble 9 summarises the TASP's budget requirements over the first five years of implementation, by Programme and Strategic Objective. The detailed cost schedules are listed in Table (Section 10.5, Annex 5). In summary, it is estimated that the first five-year phase of the TASP will cost T$42.169 million, with 34% or T$14.498 million allocated to Programme 3 (the "action" Programme which focuses on smallholder agriculture). As noted above, the 30% or T$12.720 million for Programme Management, including TA and substantial training costs, is for a stand-alone TASPICU, which was not accepted by ASGC. A revised budget for TASPICU and TASP management and implementation costs will be determined after the MAFFF institutional review has been completed.

TABLE 8: MAFFF 2014-15 BUDGET

MAFFF's 2014-15 Budget for Leadership and Agriculture and Forestry (T$)						
Program	**Code a/**	**Sub-Program**	**Staff Costs**	**Total Budget**	**Staff/Budget**	**% Budget**
Leadership and Policy Direction	**A 2**	Administration, Human Resource & Training Development	$378,378	$584,828	65%	**32%**
	A 3	Financial Support Services	$244,985	$400,094	61%	**22%**
	A 5	Information Technology Support Services	$83,146	$146,785	57%	**8%**
	A 1	Leadership and Direction	$273,705	$423,216	65%	**23%**
	A 4	Policy Advice & Planning Development	$229,265	$293,590	78%	**16%**
Sub-total Leadership/Policy			**$1,209,479**	**$1,848,514**	**65%**	**28%**
Agriculture & Forestry Development	**B 2**	Crops Research Development	$626,297	$790,249	79%	**16%**
	B 1	Export Expansion, Food Security and Women Development	$1,055,766	$1,866,496	57%	**39%**
	B 6	Forestry Development & Conservation	$465,247	$630,247	74%	**13%**
	B 3	Livestock Production Development	$419,071	$499,531	84%	**10%**
	B 4	Quarantine & Quality Management Support Services	$702,143	$932,096	75%	**19%**
	B 5	Food Processing & Regulatory Services	$61,046	$86,046	71%	**2%**
Sub-Total Agriculture and Forestry			**$3,329,570**	**$4,804,665**	**69%**	**72%**
Total (T$) b/			**$4,539,049**	**$6,653,179**	**68%**	**100%**

a/ Used to allocate current MAFFF budget across TASP Programme budgets

b/ Excludes the one-off T$1.0 million for grants to emerging agr-businesses.

b/ Exclude Fisheries Division.

TABLE 9: TASP BUDGET SUMMARY

Detailed TASP Costs	(T$'000)						
	Year 1	Year 2	Year 3	Year 4	Year 5	Total	%
Programme 1: Climate Resilient Agriculture							
SO 1.1: Healthy Soils and Sustainable Water	$895	$922	$515	$139	$150	$2,621	
SO 1.2: Climate Resilient (CR) Guidelines and Indicators	$95	$60	$55	$5	$5	$220	
SO 1.3: Building Agriculture Resilience to Impact of Climate Change	$513	$343	$343	$5	$5	$1,208	
Subtotal	**$1,503**	**$1,325**	**$913**	**$149**	**$160**	**$4,049**	**10%**
Programme 2: Improved Enabling Environment							
SO 2.1: Sector Institutional Policy	$503	$50	$0	$0	$0	$553	
SO 2.2: Bio-Physical Policies	$278	$15	$15	$15	$105	$428	
SO 2.3: Export and Import Policies	$0	$63	$18	$63	$18	$160	
SO 2.4: Land and Rural Finance Policies	$98	$25	$75	$25	$75	$298	
SO 2.5: International Relationships	$38	$38	$38	$38	$38	$188	
SO 2.6: Compliance and Regulations	$23	$23	$23	$23	$23	$113	
SO 2.7: Quarantine	$250	$250	$250	$250	$250	$1,250	
SO 2.8: Industry Organizations	$63	$63	$63	$63	$63	$313	
SO 2.9: Market Information Support	$75	$75	$75	$75	$75	$375	
SO 2.10: Agro-Met Services	$259	$492	$242	$242	$242	$1,477	
Subtotal	**$1,584**	**$1,092**	**$797**	**$792**	**$887**	**$5,152**	**12%**
Programme 3: Sustainable Livelihoods and Healthy Food							
SO 3.1: Farmers' knowledge and practices	$350	$95	$118	$160	$193	$915	
SO 3.2: Young people in agriculture	$948	$350	$350	$350	$350	$2,348	
SO 3.3: Saleable agriculture products	$0	$1,974	$2,315	$3,032	$3,914	$11,235	
Subtotal	**$1,298**	**$2,419**	**$2,782**	**$3,542**	**$4,457**	**$14,498**	**34%**
Programme 4: Sustainable Growth and Foreign Exchange Earnings							
SO 4.1: Export sales	$90	$1,247	$957	$912	$912	$4,118	
SO 4.2: Import replacement	$0	$713	$510	$310	$100	$1,633	
Subtotal	**$90**	**$1,960**	**$1,467**	**$1,222**	**$1,012**	**$5,751**	**14%**
TASP Programme Management							
Vehicles, Equipment and Materials	$1,211	$0	$0	$0	$927	$2,138	
Training and Technical Assistance	$1,420	$1,008	$1,008	$0	$0	$3,437	
Salaries and Allowances	$843	$843	$843	$843	$843	$4,215	
Office Operating Costs	$398	$353	$353	$353	$398	$1,854	
Vehicle Operation and Maintenance	$215	$215	$215	$215	$215	$1,077	
Subtotal	**$4,088**	**$2,419**	**$2,419**	**$1,411**	**$2,383**	**$12,720**	**30%**
Total	**$8,562**	**$9,214**	**$8,378**	**$7,116**	**$8,899**	**$42,169**	**100%**

9 ATTACHMENTS

9.1 Results Framework

TABLE 10: RESULTS FRAMEWORK

Objectives	Key Indicators and Milestones	Five-Year Target	Means of Verification	Responsible Agency
Tonga Agriculture Sector Goal				
Increased and sustained climate-resilient agricultural livelihoods	• **A climate-resilient environment in Tonga would**: (i) have greater buffering capacity against external shocks (climatic and other); (ii) have a much greater degree of self-organization (less reliant on external support in times of crisis); and (iii) have much more inherent adaptability (able to respond and change as conditions change), measured by the indicators related to knowledge and understanding of key natural resources (water and soils), development of indicators of and guidelines on diverse farming systems, and the capacity developed to support farmers to adapt • **An Improved enabling environment in Tonga would**: result in more efficient agricultural production and export, measured by the indicators related to rural incomes, exports and import replacements.			
Increased and sustained climate-resilient agricultural livelihoods	• Average annual household income - rural sector	• Base (2009 HIES) of T$18,056, of which T$3,973 from sale of agriculture products and T$2,471 the value of home produce consumed - total T$6,444 • By end Year 5, expect rural incomes (sales and consumption) to have increased to T$9,177 (5% compound for Years 2-5	• TASP Base-line Survey, compared with next HIES, and end of Year 5 survey	• TASP Coordination Unit • Department of Statistics in Ministry of Information and Communications
	• Increased agriculture (vegetable) exports	• Base (2013) - 9,835 Mt vegetable products valued at T$12,430,000 • By end Year 5, expect vegetable exports to have increased to Mt15,590 valued at T$19,699,000 (10% compound, Years 2-5	• Statistics published by Tonga Department of Statistics	• TASP Coordination Unit • Department of Statistics in Ministry of Information and Communications
	• Decreased meat imports			• TASP Coordination Unit

Objectives	Key Indicators and Milestones	Five-Year Target	Means of Verification	Responsible Agency
		• Base (2013) - 6,475 Mt meat products valued at T$32,144,000 • By end Year 5, expect meat imports decreased to T$22,828,000 (4,600 Mt) (10% compound, Years 2-5)	• Statistics published by Tonga Department of Statistics	• Department of Statistics in Ministry of Information and Communications
	•			
Programme 1: Climate Resilient Environment				
Strategic Objective 1: Establish a climate resilient environment				
Specific Objective 1.1: **To develop baseline knowledge for sustainable management of soil and water resources (for agriculture)**	• Number of salinity monitoring bores • Number of rain gauges • Knowledge of status of water availability for domestic and irrigation uses; interpretation of updated hydrogeological study - to inform Programme 2 • Knowledge of status of soil fertility for all important agriculture products - to inform Programme 2	• 50 by end Year 3 • 50 by end Year 3 • Information/ data to enable decisions on water allocations for domestic and irrigation use, available by end Year 2 • No over-use of water for irrigation • Information available on soil fertility by end Year 2 • No decline in key soil fertility indicators (e.g. phosphorus and organic matter levels)	• Ministry of Lands, Survey & Natural Resources (MLSNR) records • MLSNR records • MLSNR records • MLSNR records • MAFFF records • Soil surveys and Ministry records - research division	• MLSNR • MLSNR • MSNR • MLSNR • MAFFF • MAFFF
Specific Objective 1.2: **To develop climate resilience guidelines and indicators for diverse farming systems**	• Island-specific guidelines for and indicators of resilient agriculture - for use when preparing Village Resilient Agriculture Plans (VRAPs) (SO 3.1)	• Five sets (one per island group) by end Year 1	• Booklets on Guidelines designed and published by TASP Coordination Unit	• TASP Coordination Unit

Objectives	Key Indicators and Milestones	Five-Year Target	Means of Verification	Responsible Agency
Specific Objective 1.3: **To build capacity for climate resilient agriculture - diverse farming systems, and adaptive communities - to impact on Programme 3**	• Improved awareness and understanding of the need for climate-resilient agriculture - diverse farming systems and adaptive communities; achieved through series of national-, island- and district-level workshops using demonstration farms as basis for training	• Seven key TASP Coordination Unit, and 90 MAFFF extension staff, have improved understanding of these topics - through training at district-level demonstrations • Seven Island and 23 District Facilitators have improved understanding of these topics (similar training) • 50% of Tonga's farmers (4,000) have improved understanding of these topics (similar training) • Approx 250 (50%) Church ministers) have improved understanding of these topics (similar training)	• TASP Coordination Unit capacity change surveys - baseline Year 1 and end of Year 5 survey	• TASP Coordination Unit
Programme 2: Enabling Environment				
Strategic Objective: Improve the enabling environment				
Specific Objective 2.1: **To ensure that the sector's key institutional policy (MAFFF's roles and responsibilities) is appropriate, resourced and implemented**	• Completed and acted on Institutional Review of MAFFF	• By end of Year 1	• Review presented to Cabinet, approved and acted on; with changes to MAFFF's roles, responsibilities and resources reflected in new MAFFF Strategic Plan based on the TASP design	• TASP Coordination Unit and cooperating Donors
Specific Objective 2.2: **To ensure that Bio-Physical Policies (water, soils, biodiversity, NRM, climate**	• Water Bill based on up-dated hydro-geological survey, and interpretation of results, is passed	• By end of Year 2 • By end of Year 2	• Bill approved by Cabinet	• MLSNR • MAFFF

Objectives	Key Indicators and Milestones	Five-Year Target	Means of Verification	Responsible Agency
change, etc.) are in place and are conducive to (or govern) sector growth	• New MAFFF policy and strategies on maintenance of soil fertility • Biodiversity and NRM policies remain relevant • New climate change policy	• Updated at end of Year 4 • Drafted during Year 1, approved and legislated by end of Year 2	• Revised polices approved by Cabinet • Policy approved by Cabinet	• Ministry of Environment, Energy, Climate Change, Disaster Management, Meteorology, Information and Communications (MEECCDMMIC)
Specific Objective 2.3: **To ensure that Government's policies on the export and import of agriculture products (mainly food products) are up-to-date and relevant; and that the new Food Bill is supportive of the sector**	• None	• Monitor effectiveness/ impact of policies on export and import of food, plus outcomes from expected approval of Food Bill (2012)	• Periodic reviews of relevant policy documents	• TASP Coordination Unit
Specific Objective 2.4: **To ensure that Tonga's farmers have access to land, labour and farm finance**	• Whilst access to land is beyond the remit of the TASP, this is an ongoing constraint and therefore should be monitored • Increased access to investment and working capital	• General freeing-up of access (by men and women) to unused land and/or land owned by absentee owners • 50% decrease in number of farmers reporting financing constraints	• Farmer reports from the field, anecdotal evidence, reports from projects and NGOs, etc. • TASP baseline survey; compared with end of Year 5 survey	• None, but should be monitored by the TASP Coordination Unit • TASP Coordination Unit • TASP Coordination Unit
Specific Objective 2.5: **To ensure that international relationships with important trading partners are maintained**	• None	• Monitor effectiveness/ impact of international relationships with key Tongan agriculture product importing countries	• Anecdotal evidence from all sector stakeholders	• TASP Coordination Unit

Objectives	Key Indicators and Milestones	Five-Year Target	Means of Verification	Responsible Agency
Specific Objective 2.6: **To ensure that Tonga's agriculture sector complies with national regulatory/ compliance conditions and requirements**	• None	• Monitor effectiveness/ impact of national regulatory/ compliance conditions and requirements	• Reports of non-compliance collated by MAFFF • Anecdotal evidence from all sector stakeholders	• TASP Coordination Unit
Specific Objective 2.7: **To ensure that Tonga's agriculture sector is protected from incursions from pests and diseases; and is able to comply with international quarantine requirements**	• Zero quarantine-related events which impact on Tonga's ability to export agriculture products	• No quarantine-related events which restrict or prevent exports of agriculture products	• MAFFF's Quarantine Division's reports	• MAFFF
Specific Objective 2.8: **To ensure that Tonga's agriculture sector is supported by functional and effective industry organizations**	• Organizations such as GroFed and the Livestock Council are influencing sector policy and investment programmes	• GroFed and the Livestock Council are financially viable through grower levies	• Organizations' financial records	• Individual organizations and TASP Coordination Unit
Specific Objective 2.9: **To provide the agriculture sector with improved product marketing information**	• To be determined	• To be determined	• To be determined	• To be determined
Specific Objective 2.10:	• Refer Appendix 7	• Refer Appendix 7	• Refer Appendix 7	• Refer Appendix 7

Objectives	Key Indicators and Milestones	Five-Year Target	Means of Verification	Responsible Agency
To improve Tonga's Agro-Met services to all farmers				
Programme 3: Sustainable Livelihoods and Healthy Food				
Strategic Objective: Diverse, climate resilient farming systems for the Kingdom's island				
Specific Objective 3.1: **To improve farmer's knowledge and practices - includes women in agriculture (handicrafts), natural resource management, and diversified crop (all types) and livestock production systems**	• Number of village resilient agriculture plans (VRAPs) prepared	• 44 VRAPs (50% of total)	• TASP AWPBs, records and reports	• TASP Coordination Unit
	• Number of VRAPs implemented	• 44 VRAPs	• TASP AWPBs, records and reports	• TASP Coordination Unit
	• Number of Village Resilient Agriculture Demos (VRADs)	• 10 VRADs	• TASP AWPBs, records and reports	• TASP Coordination Unit
	• Number of champion farmers involved with VRADs	• 10 champion farmers	• TASP AWPBs, records and reports	• TASP Coordination Unit
	• Changes in on-farm crop and livestock diversity, waste management systems introduced, increased use of legumes, enhanced soil fertility and water conservation	• 50% VRAPs of with increased product diversity and enhanced soil and water management after five years	• Baseline survey in Year 1; follow-up survey in Year 5	• TASP Coordination Unit
	• Number of farmers trained in resilient farming practices - NRM and diversity, crop and livestock production, using FFS approach	• 4,000 men and women farmers - 1,150 FFS events	• TASP AWPBs, records and reports	• TASP Coordination Unit
	• Number of women assisted with production of handicraft raw materials, and reporting adequate supplies	• 3,500 (50% of 7,000) women assisted - 612 FFSs run for handicraft raw material production	• TASP AWPBs, records and reports	• TASP Coordination Unit

Objectives	Key Indicators and Milestones	Five-Year Target	Means of Verification	Responsible Agency
Specific Objective 3.2: **To revitalize Tonga's farming future and encourage young farmers to return to the land**	• Operational demonstration farm • Operational learning and production nodes in at least 2 institutes - some on demo farms • Operational Learning Centre at Tupou College • Young farmers still farming five years after graduation	• 1 x eight acre VRAD - in addition to 10 in districts • Eight learning and production nodes • One new Centre and four new trained staff end Year 3 • 70% of graduates (returning to farms) are still farming after five years	• TASP Coordination Unit and Tupou College records • TASP Coordination Unit and College records • TASP Coordination Unit and College records • TASP District Facilitator records	• TASP Coordination Unit and Tupou College records • TASP Coordination Unit and Institute records • TASP Coordination Unit and Institute records • TASP Coordination Unit and Institute records • TASP Coordination Unit and Institute records
Specific Objective 3.3: To support farmers to produce products which are marketable in local markets; can be value-added; and which contribute to food and nutritional security	• Number of farmers trained in crop production and value added processing • Number of farmers trained in livestock production	• 6,000 men and women farmers attended 750 FFSs • 6,000 men and women farmers attended 750 FFSs	• TASP AWPBs, records and reports	• TASP Coordination Unit
Programme 4:Sustainable Growth and Foreign Exchange Earnings				
Strategic Objective: Increased and sustained rural incomes across the Kingdom				
Specific Objective 4.1: **To increase and sustain export sales of agriculture products**	• See indicators for Plan Goal	• See targets for Plan Goal	• Government and Reserve Bank statistics and figures	• MAFFF - for collation and publication
Specific Objective 4.2: **To increase domestic agriculture production as import replacement**	• See indicators for Plan Goal • Pilot animal feed mill	See targets for Plan Goal • One established and operational	• Government and Reserve Bank statistics and figures • Business records	• MAFFF - for collation and publication • TASP Coordination Unit

10 ANNEXES

10.1 Annex 1: Background Report

280. This is a stand-alone document.

10.2 Annex 2: Results from Community Consultations

281. This is a stand-alone document, with the exception that Table presents a list of the non-farmer stakeholders met during the Background and the Design Phase of the TASP preparation

TABLE 11: LIST OF OFFICIALS MET DURING THE TASP DESIGN PROCESS

NAMES	ORGANISATION	CONTACT
Taniela Hoponoa (Cooperative), Viliami Kami (Quarantine), Viliami Manu (Research), 'Ana Pifeleti (Livestock), Tevita Faka'osi (Forestry), Manuele Mo'ale (Extension), Mana'ia Halafihi (Agr. Census)	Ministry of Agriculture and Food, Forests and Fisheries	N: Taniela Hoponoa P: (676) 23 038 E: taniela_hoponoa@yahoo.com
Meeting with the Agriculture Growth Committee	Meeting with the Agriculture Growth Committee[67] Conference Room MAFFF Headquarters Queen Salote Wharf	N: Barbara Wilkinson
Tatafu Moeaki (CEO), Balwyn Fa'otusia (AMD), Tufui Faletau (Planning)	Meeting with the Ministry of Finance and National Planning	N: Tatafu Moeaki P: (676) 23 066 E: tatafum@gmail.com E :sfifita@finance.gov.to : (+676)24463 E: bfaotusia@finance.gov.to P: (+676)23066 M: (+676)7718284 E: ifaletau@finance@gov.to
Mr. Saia Faletau	World Bank Liaison Officer-Tonga, World Bank Office, Tonga Development Bank Building.	Saia Faletau P: (+676)28290 M: (+676)7777546 E: sfaletau@finance.gov.to
Drew Havea (Chairman), Vanessa Lolohea (Executive Director)	Meeting with the Tonga National Youth Congress	Vanessa Lolohea M: (+676)7714751 E: vanessa_lolohea@hotmail.com
Mr. Tsutomu NAKAO	PHAMA Project, Exporter (Ha'amo Grower)	N: Tsutomu NAKAO P: (676)23232 E: t.nakao@phama.com.au
To'imoana Takataka (President) Lamipeti Havea (Director) Sinai Tuitahi (Director)	Meeting with the Grower Federation	N: To'imoana Takataka M: (676) 7795292 E: grokolofoou@gmail.com

NAMES	ORGANISATION	CONTACT
Taniela Hamala (Director)		
Mr. Pousima AFEAKI	Tinopai Farm, Exporter (Tinopai Farm) ……	N: Pousima Afeaki M: (676) 8783729 E: tinopai@kalianet.to
Ms. Amy Lofgren	Executive Director SPBD Fanga-'o-Pilolevu, Nuku'alofa	Amy Lofgren M: (+676)8773094 E: amy@spbdtonga.com
Mr. Sevanaia TAWAKE	Acting Chief Executive Officer, Tonga Forest Product Limited, TFP Headquarter - Tokomololo	N: Sevanaia Tawake M: (676) 7863401 E: sevanaia.tawake@tongaforest.to
Mr. Minoru NISHI Snr. Mr. Hugo Ramirez	Nishi Trading, Nishi Foundation, Nishi Pack house, Exporter (Nishi Trading), Nishi Training Facility, Nishi Shop (Chemical & Seeds & Agr Tools – Pea) ……. Nishi Trading Headquarter - 'Utulau	C: Telumi Nishi P : P: (676)43384 E: telumi.nishitrading@gmail.com
Mr. Pau Molevuka LIKILIKI	Assistance FAO Representative for Tonga Food and Agriculture Organization of the United Nations, MAFFF Office, Vuna Road	N: Pau Likiliki P: (+676) 843528 E: pau.likiliki@fao.org
Ms. Amanda RICKMAN	Second Secretary Australia High Commission Office Nuku'alofa	C: Lilika Fusimalohi P: (+676)23 244 E: Lilika.Fusimalohi@dfat.gov.au
Mr. Jordan GREEN	Second Secretary New Zealand High Commission Office Nuku'alofa	N: Jordan Green P: (+676)23 122 E: Jordan.green@mfat.govt.nz
Ms. Moana TAUKOLO	Chief Executive Officer Ministry of Commerce & Labour Cnr Tupoulahi Rd & Salote Rd	C: Tevita Lautaha P: (676) 23 688 E: tevital@mctl.gov.to
Ms. Lita KAMI	Managing Director Tonga Development Bank	
Ms. Luisa MALOLO	JNAP Coordinator	
Mr. Morrison Dansey	Head of Lending, ANZ Bank, Vuna Road-MA'UFANGA	
Mr. 'Ofa FA'ANUNU –Tonga Met	Tonga Met	
Mr. Mafua Maka	National Emergency Management Office	Mafua Maka P: (+676)26340
Meeting with the Livestock Council	Conference Room MAFFF Headquarters Queen Salote Wharf	N: Taniela Hoponoa P: (676) 23 038 E: taniela_hoponoa@yahoo.com

NAMES	ORGANISATION	CONTACT
Meeting with the Handicraft Council	Langa-fonua-'a-fonua-ma'a-Fefine-Tonga Taufa'ahau Road, Nuku'alofa	
Ms. Leody VAINIKOLO	OIC MAFFF Vava'u Fatai Station - MAFFF HQ VAV	N: Ms. Leody Vainikolo P: (676) 70 401 E: leody.vainikolo@mafff.gov.to
Meeting with Mr. Salesi KAITU'U	OIC MAFFF Ha'apai Pangai Station	N: Mr. Salesi Kaitu'u P: (676) E: salengafa@yahoo.com
Meeting with Mr. Solomone VAIKELI	OIC MAFFF 'Eua Molipeli Station	N: Solomone Vaikeli M: (676) 8884459 E: s.vaikeli@yahoo.com
Hon. Sangstar Saulala	Minister-MAFFF	MAFFF Office P: (+676)23038
Ms. Chase Palmeri	IFAD, Regional Programme Manager for Tonga	
Mr. Soane Patolo	Manager-MORDI Tonga Trust	MORDI Officer P: (+676)24354 E: soanejr@morditonga.to
Hon Fulivai	Governor of Vava'u	Governor's Officer P: (+676)70070
Mr. Sunia Napa'a	MAFFF Ha'apai	Sunia Napa'a P: (+676)60213
Hon Mo'ale Finau	Governor of Ha'apai	Governor's Office P: (+676)60005
Mr. Maloni Havea	OIC, 'Eua MAFFF	Maloni Havea P: (+676)50122
Ms. Losaline MA'ASI, Chief Executive Officer – MAFFF		
Mr. 'Inoke F. KUPU (MIA)		
Mr. Sione VAKA (UNDP), UNDP Office – Molisi		
Mr. Taniela KULA, Geology Unit, Ministry of Land & Survey		
Rev. 'Alifeleti 'ATIOLA and Mr Ron Simpson, Tupou College		
Sir. Semisi FAKAHAU, Hon. Minister - MAFFF		
Mr. Sione FOLIAKI, Research Station - Vaini		
Deputy Headmistress, Queen Salote College		
Ms. Lu'isa MALOLO, Environment – Nuku'alofa		
Ms. Tuna FILAKEPA, Tonga Handicraft		
Rev. Tevita HAVEA, FWC Church		
Cardinal Paini MAFI, Toutaimana – Nuku'alofa		
All Members of Parliament		
Mr. Kofi Nouve, World Bank - Sydney Office		
Ms. Brenna Moore, World Bank - Sydney Office		
Mr. Andrew Shepherd, Value Chain and Marketing Specialist		
Mr. Kieran Kelleher, Fisheries Specialist		

10.3 Annex 3: Community Readiness Maps

282. Community Readiness Maps are shown below for all the main island groups, with the exception of Togatapu for which at community readiness assessment had not been completed at the time of the team's missions. The maps use a basic 'traffic light' system on a village-by-village basis to identify: (i) ready to go (green); (ii) needs some work (amber); and (iii) needs basic community engagement work (red). The current status is that the Niuas and 'Eua are green and ready to go, as are parts of Vava'u (communities in outlying islands) and some outlying islands in Ha'apai. Communities on the main island of Vava'u need varying amounts of additional engagement (amber, red). Tongatapu as a whole is amber and Ha'apai needs considerable basic community engagement work.

FIGURE 7: MAP OF TONGATAPU - SHOWING DISTRICTS, VILLAGES AND POPULATIONS

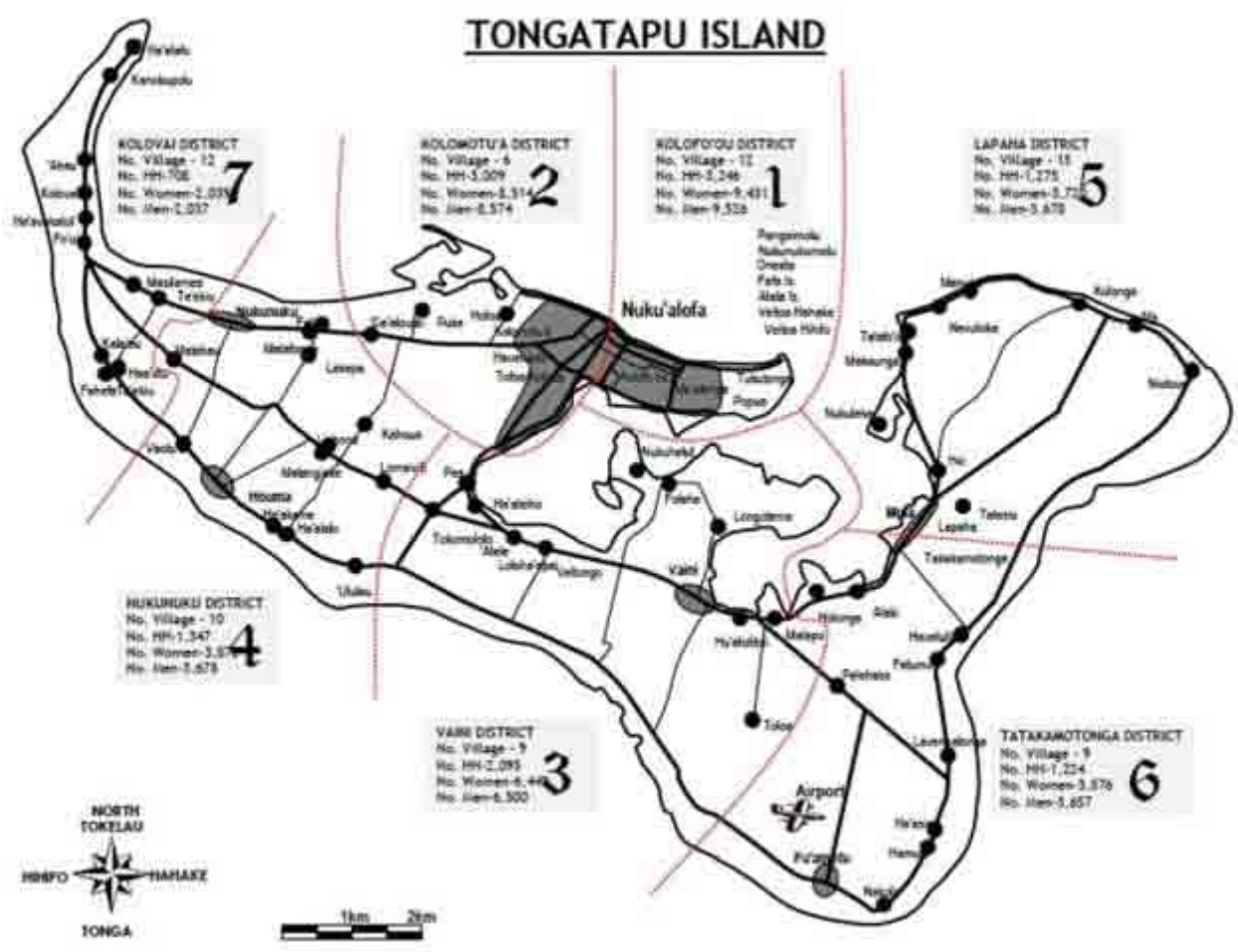


FIGURE 8: MAP OF HA'APAI ISLAND - SHOWING DISTRICTS, VILLAGES, POPULATIONS AND COMMUNITY READINESS

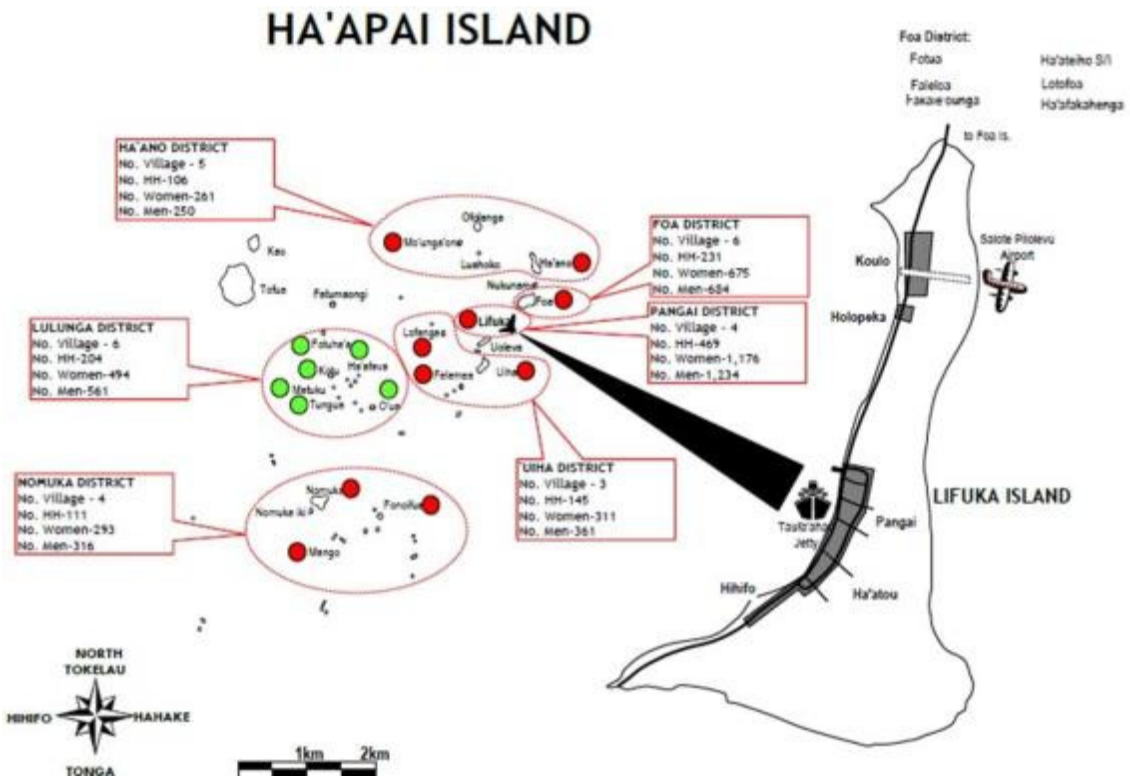


FIGURE 9: MAP OF VAV'AU ISLAND - SHOWING DISTRICTS, VILLAGES, POPULATIONS AND COMMUNITY READINESS

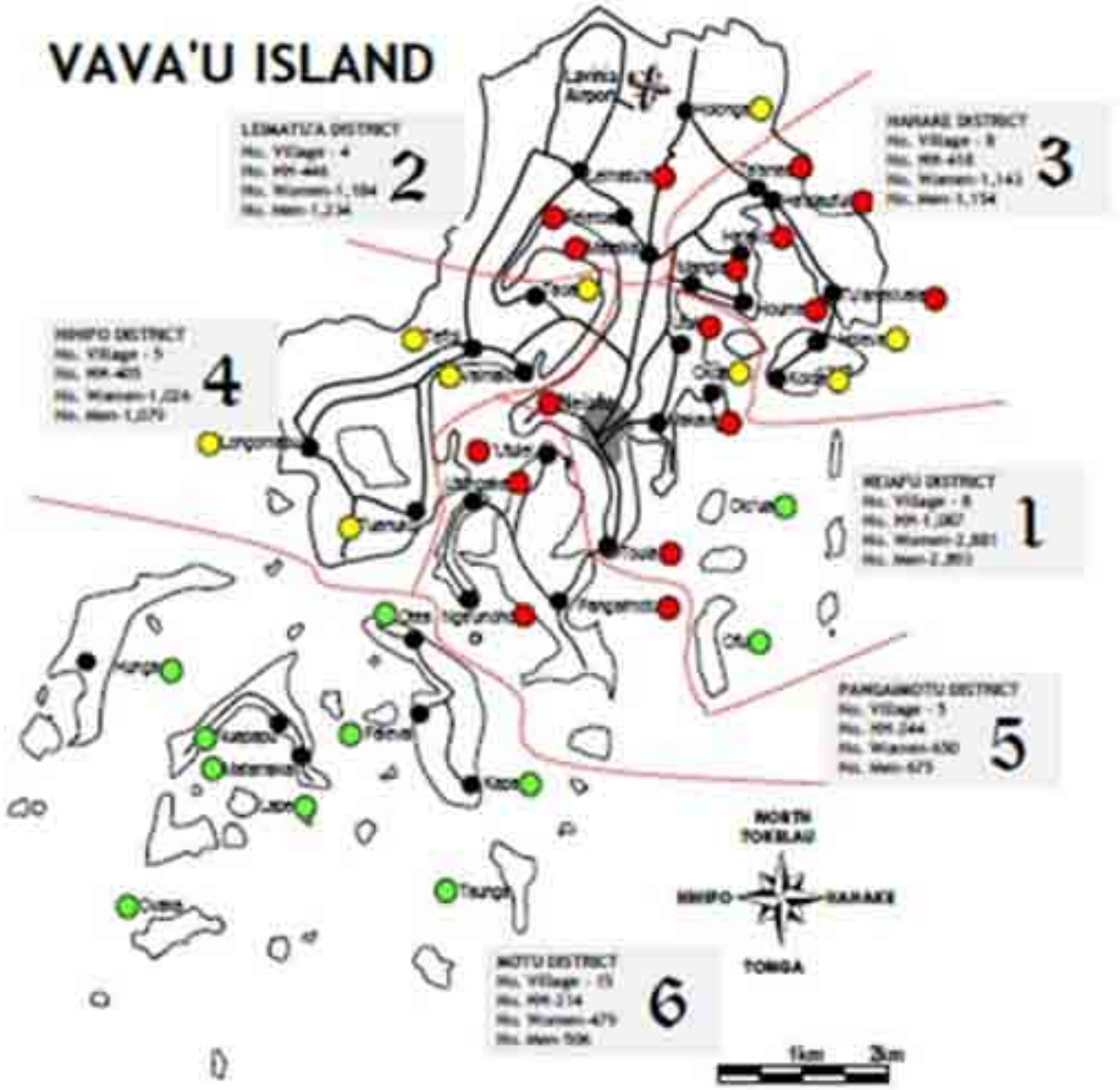


FIGURE 10: MAP OF 'EUA ISLAND - SHOWING DISTRICTS, VILLAGES, POPULATIONS AND COMMUNITY READINESS

FIGURE 11: MAP OF NIUATOPUTAPU ISLAND - SHOWING DISTRICTS, VILLAGES, POPULATIONS AND COMMUNITY READINESS

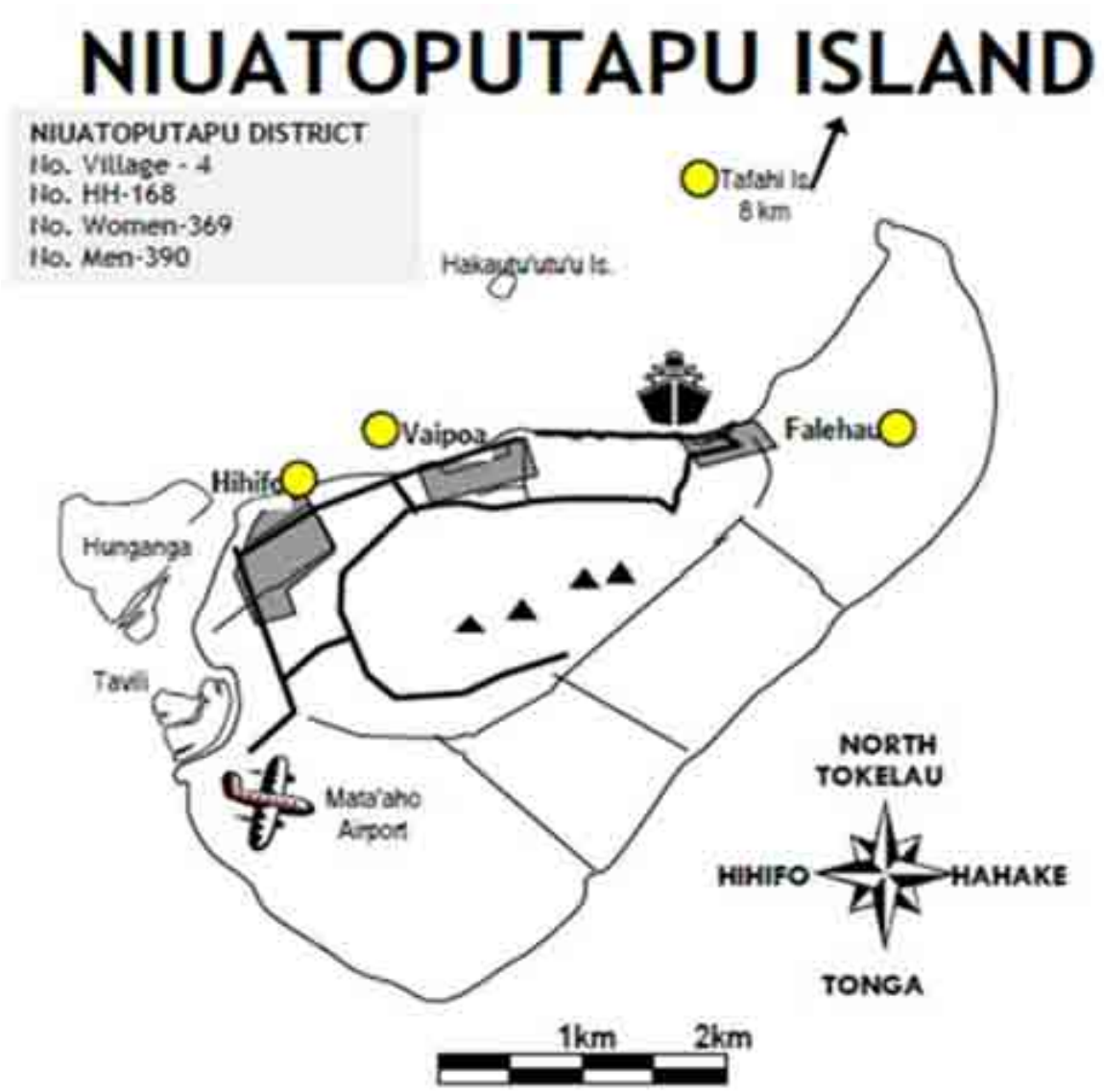
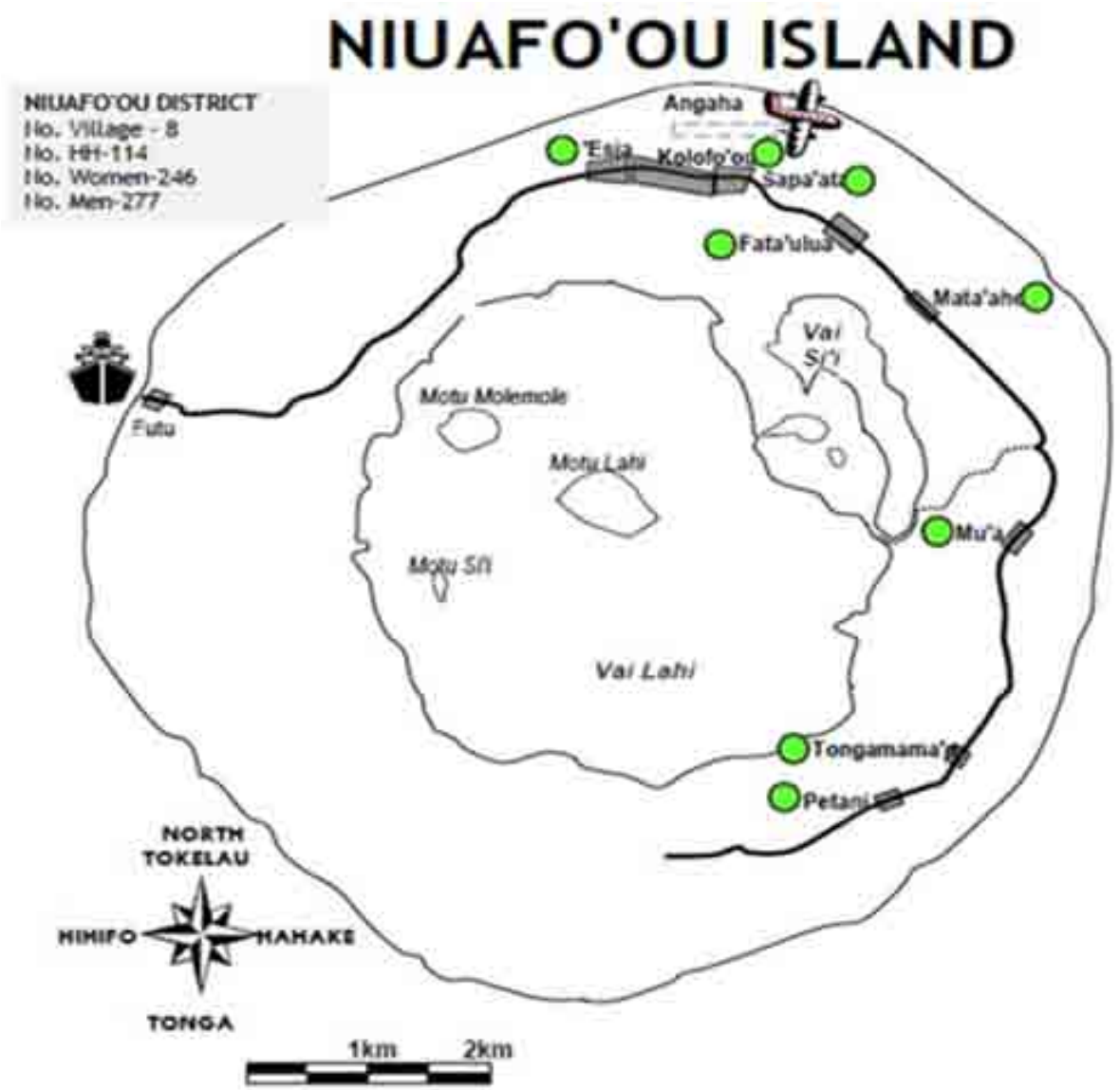


FIGURE12: MAP OF NIUAFO'OU ISLAND SHOWING DISTRICTS, VILLAGES, POPULATIONS AND COMMUNITY READINESS



10.4 Annex 4: MAFFF Current Staffing and Budget

10.4.1 Current Staffing

TABLE 12: CURRENT MAFFF STAFFING SCHEDULE

Qualifications & Gender	Corp. Serv.	Livestock	Fisheries	Research & Info.	Forestry	Extension & Women	Quarant. & Qual. Mgt	VAV	HAP	Eua	NTT	NF	Total
PhD	0	0	2	1	0	0	1	0	0	0	0	0	**4**
MA	3	1	2	1	1	0	0	1	0	1	0	0	**10**
Degree	9	1	7	4	1	3	2	1	0	0	0	0	**28**
Diploma	**14**	**10**	**5**	**13**	**4**	**19**	**15**	**6**	**1**	**2**	**1**	**1**	**91**
Certificate	1	1	5	3	1	0	1	2	1	0	0	0	**15**
Other	3	0	16	3	4	7	2	15	10	7	2	2	**71**
Total	**30**	**13**	**37**	**25**	**11**	**29**	**21**	**25**	**12**	**10**	**3**	**3**	**219**
Male	**10**	**11**	**23**	**17**	**9**	**15**	**12**	**9**	**8**	**8**	**1**	**3**	**126**
Female	**20**	**2**	**14**	**8**	**2**	**14**	**9**	**16**	**4**	**2**	**2**	**0**	**93**

10.5 Annex 5: Detailed TASP Cost Schedules

TABLE 13: DETAILED TASP COST SCHEDULES

	Unit	Quantity						Unit Cost	Cost (T$)					Total (T$)
Programme 1: Climate Resilient Agriculture		**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Total**	**(T$)**	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	
SO 1.1: Healthy Soils and Sustainable Water														
Soils														
Refurbish MAFFF's soils laboratory	L/sum	1					1	$40,000	$40,000	$0	$0	$0	$0	$40,000
New equipment	Set	1					1	$260,000	$260,000	$0	$0	$0	$0	$260,000
Operation of MAFFF's soils laboratory	L/sum/yr	1	1	1	1	1	5	$4,000	$4,000	$4,000	$4,000	$4,000	$4,000	$20,000
National soil survey	sample	55					55	$200	$11,000	$0	$0	$0	$0	$11,000
Updating national soil maps	publication	50					50	$200	$10,000	$0	$0	$0	$0	$10,000
Promotion/ awareness raising of soil fertility issues	campaign (L/sum)		1	1			2	$5,000	$0	$5,000	$5,000	$0	$0	$10,000
District-level on-farm fertilizer trials	trial		50	50	50	50	200	$200	$0	$10,000	$10,000	$10,000	$10,000	$40,000
Ongoing monitoring of soil fertility	sample			55		55	110	$200	$0	$0	$11,000	$0	$11,000	$22,000
Feasibility study on application/ use of vermiculture, and trial	study and trial		1				1	$8,000	$0	$8,000	$0	$0	$0	$8,000
							Total Soils		***$325,000***	***$27,000***	***$30,000***	***$14,000***	***$25,000***	***$421,000***
Water														
Staff and domestic travel	per year	1	1	1	1	1	5	$75,000	$75,000	$75,000	$75,000	$75,000	$75,000	$375,000
Quantify existing groundwater resources	month	4	10	4			18	$45,000	$180,000	$450,000	$180,000	$0	$0	$810,000
Estimate current exploitation of groundwater resources	month	4	2				6	$45,000	$180,000	$90,000	$0	$0	$0	$270,000
Determine locations for greater use, and protection	month	3	4				7	$45,000	$135,000	$180,000	$0	$0	$0	$315,000
Assess pollution risks to groundwater	month			1			1	$45,000	$0	$0	$45,000	$0	$0	$45,000
Estimate future climate change impacts and water demands	month			3			3	$45,000	$0	$0	$135,000	$0	$0	$135,000
Feasibility study on collection of "surplus" water in large dams	study		1				1	$100,000	$0	$100,000	$0	$0	$0	$100,000
Community engagement - water efficiency and conservation	per year			1	1	1	3	$50,000	$0	$0	$50,000	$50,000	$50,000	$150,000
							Total Water		***$570,000***	***$895,000***	***$485,000***	***$125,000***	***$125,000***	***$2,200,000***
	Sub-Total								**$895,000**	**$922,000**	**$515,000**	**$139,000**	**$150,000**	**$2,621,000**
SO 1.2: Climate Resilient (CR) Guidelines and Indicators														
Identification of key guidelines and indicators	workshop	1					1	$5,000	$5,000	$0	$0	$0	$0	$5,000
Prepare guidelines and indicators	pers month	1					1	$45,000	$45,000	$0	$0	$0	$0	$45,000
Publication of guidelines and indicators	publication	200					200	$200	$40,000	$0	$0	$0	$0	$40,000
Promotion of guidelines and indicators	campaign (L/sum)	1	1				2	$5,000	$5,000	$5,000	$0	$0	$0	$10,000
Farmer-friendly publication on CR agriculture	publication		1,000	1,000			2,000	$50	$0	$50,000	$50,000	$0	$0	$100,000
Monitoring use of guidelines and indicators	year		1	1	1	1	4	$5,000	$0	$5,000	$5,000	$5,000	$5,000	$20,000
	Sub-Total								**$95,000**	**$60,000**	**$55,000**	**$5,000**	**$5,000**	**$220,000**
SO 1.3: Building Agriculture Resilience to Impact of Climate Change														
Training for seven key TASPCU staff	staff event	7	7	7			21	$2,500	$17,500	$17,500	$17,500	$0	$0	$52,500
Training for 90 MAFFF extension staff - all disciplines	staff event	90	90	90			270	$500	$45,000	$45,000	$45,000	$0	$0	$135,000
Training for seven Island and 23 District Facilitators	staff event	30	30	30			90	$500	$15,000	$15,000	$15,000	$0	$0	$45,000
Training for 250 Church ministers	minister event	250	250	250			750	$500	$125,000	$125,000	$125,000	$0	$0	$375,000
Ongoing training for MAFFF's technical staff	staff event	270	270	270			810	$500	$135,000	$135,000	$135,000	$0	$0	$405,000
Feasibility study - valuation of "resilient island" approach	study	1					1	$45,000	$45,000	$0	$0	$0	$0	$45,000
Feasibility study/trial on application/ use of vermiculture	study/trial	1					1	$65,000	$65,000	$0	$0	$0	$0	$65,000
Feasibility study/trial on application/ use of biogas	study/trial	1					1	$65,000	$65,000	$0	$0	$0	$0	$65,000
Monitoring impact of training in CRA	L/sum per yr		1	1	1	1	4	$5,000	$0	$5,000	$5,000	$5,000	$5,000	$20,000
	Sub-Total								**$512,500**	**$342,500**	**$342,500**	**$5,000**	**$5,000**	**$1,207,500**
	Total								**$1,502,500**	**$1,324,500**	**$912,500**	**$149,000**	**$160,000**	**$4,048,500**

	Unit	Quantity						Unit Cost	Cost (T$)					Total (T$)
Programme 2: Improved Enabling Environment		**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Total**	**(T$)**	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	
SO 2.1: Sector Institutional Policy														
Prepare and workshop TOR for MAFFF review	pers month	0.5					0.5	$45,000	$22,500	$0	$0	$0	$0	$22,500
Conduct Institutional Review of MAFFF	pers month	3					3	$45,000	$135,000	$0	$0	$0	$0	$135,000
Workshop main findings and recommendations	pers month	0.5					0.5	$45,000	$22,500	$0	$0	$0	$0	$22,500
Prepare Inst. Change Paper for use by MAFFF	pers month	0.5					0.5	$45,000	$22,500	$0	$0	$0	$0	$22,500
Support for MAFFF to implement changes	L/sum	1	1				2	$50,000	$50,000	$50,000	$0	$0	$0	$100,000
Allowance for cost of changes	L/sum	1					1	$250,000	$250,000	$0	$0	$0	$0	$250,000
	Sub-Total								**$502,500**	**$50,000**	**$0**	**$0**	**$0**	**$552,500**
SO 2.2: Bio-Physical Policies														
Soils														
Interpret soil tests & prepare recommendations	pers month	0.5					0.5	$45,000	$22,500	$0	$0	$0	$0	$22,500
Prepare soil fertility policy, including organics	pers month	0.5					0.5	$45,000	$22,500	$0	$0	$0	$0	$22,500
Publish new soil fertility policy	publication	100					100	$100	$10,000	$0	$0	$0	$0	$10,000
Promote new soil fertility policy	L/sum/yr		1	1	1	1	4	$5,000	$0	$5,000	$5,000	$5,000	$5,000	$20,000
							Total Soils		***$55,000***	***$5,000***	***$5,000***	***$5,000***	***$5,000***	***$75,000***
Water														
Interpretation of hydrogeological review	pers month	0.5					0.5	$45,000	$22,500	$0	$0	$0	$0	$22,500
Prepare recommendations on water allocation	pers month	1					1	$45,000	$45,000	$0	$0	$0	$0	$45,000
Drafting of new water policy	pers month	1.0					1.0	$45,000	$45,000	$0	$0	$0	$0	$45,000
Publish new water policy	publication	200					200	$100	$20,000	$0	$0	$0	$0	$20,000
Promote new water policy	L/sum/yr		1	1	1	1	4	$10,000	$0	$10,000	$10,000	$10,000	$10,000	$40,000
							Total Water		***$132,500***	***$10,000***	***$10,000***	***$10,000***	***$10,000***	***$172,500***
Update/NRM and Climate Change Strategies	L/sum	2				2	4	*$45,000*	***$90,000***	***$0***	***$0***	***$0***	***$0***	***$180,000***
	Sub-Total								**$277,500**	**$15,000**	**$15,000**	**$15,000**	**$105,000**	**$427,500**
SO 2.3: Export and Import Policies														
Keep policies updated, and published	review/publish		2		2		4	$22,500	$0	$45,000	$0	$45,000	$0	$90,000
Promote policies to importers and exporters	campaign		5	5	5	5	20	$2,500	$0	$12,500	$12,500	$12,500	$12,500	$50,000
Survey impact of policies on sector performance	survey		1	1	1	1	4	$5,000	$0	$5,000	$5,000	$5,000	$5,000	$20,000
	Sub-Total								**$0**	**$62,500**	**$17,500**	**$62,500**	**$17,500**	**$160,000**
SO 2.4: Land and Rural Finance Policies														
Feasibility study on Toutu'u for forestry production		1					1	$22,500	$22,500	$0	$0	$0	$0	$22,500
Monitor impact of current land policy on sector	event	1		1		1	3	$22,500	$22,500	$0	$22,500	$0	$22,500	$67,500
Recommend changes in land policy if required	event	1		1		1	3	$22,500	$22,500	$0	$22,500	$0	$22,500	$67,500
Promote/discuss suggested changes in land policy	event	1	1	1	1	1	5	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	$25,000
Monitor results from current financial services	event	1	1	1	1	1	5	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	$25,000
Recommend changes in rural finance policy	event	1		1		1	3	$5,000	$5,000	$0	$5,000	$0	$5,000	$15,000
Promote changes in rural finance policy	event	1	1	1	1	1	5	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	$25,000
Training - farmers and exporters in rural finance	event	2	2	2	2	2	10	$5,000	$10,000	$10,000	$10,000	$10,000	$10,000	$50,000
	Sub-Total								**$97,500**	**$25,000**	**$75,000**	**$25,000**	**$75,000**	**$297,500**
SO 2.5: International Relationships														
Monitor status of international relationships	event	1	1	1	1	1	5	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$12,500
Recommend changes in Tonga's position (if required)	event	1	1	1	1	1	5	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	$25,000
Promote/discuss new position	event	2	2	2	2	2	10	$5,000	$10,000	$10,000	$10,000	$10,000	$10,000	$50,000
Allowance for international travel	year	2	2	2	2	2	10	$10,000	$20,000	$20,000	$20,000	$20,000	$20,000	$100,000
	Sub-Total								**$37,500**	**$37,500**	**$37,500**	**$37,500**	**$37,500**	**$187,500**
SO 2.6: Compliance and Regulations														
Monitor compliance with regulations	event	1	1	1	1	1	5	$2,500	$2,500	$2,500	$2,500	$2,500	$2,500	$12,500
Recommend changes in regulations (if required)	event	1	1	1	1	1	5	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	$25,000
Promote/discuss new regulations	event	2	2	2	2	2	10	$5,000	$10,000	$10,000	$10,000	$10,000	$10,000	$50,000
Allowance for unforeseen costs	event	1	1	1	1	1	5	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	$25,000
	Sub-Total								**$22,500**	**$22,500**	**$22,500**	**$22,500**	**$22,500**	**$112,500**
SO 2.7: Quarantine														
Estimate only - details to come		1	1	1	1	1	1	$250,000	$250,000	$250,000	$250,000	$250,000	$250,000	$1,250,000
	Sub-Total								**$250,000**	**$250,000**	**$250,000**	**$250,000**	**$250,000**	**$1,250,000**
SO 2.8: Industry Organizations														
General support for industry organizations	L/sum/yr	1	1	1	1	1	5	$25,000	$25,000	$25,000	$25,000	$25,000	$25,000	$125,000
Business training for key representatives	event	2	2	2	2	2	10	$12,500	$25,000	$25,000	$25,000	$25,000	$25,000	$125,000
Field days and learning events	event	2	2	2	2	2	2	$6,250	$12,500	$12,500	$12,500	$12,500	$12,500	$62,500
	Sub-Total								**$62,500**	**$62,500**	**$62,500**	**$62,500**	**$62,500**	**$312,500**
SO 2.9: Market Information Support														
Estimate only - details to come		1	1	1	1	1	5	$75,000	$75,000	$75,000	$75,000	$75,000	$75,000	$375,000
	Sub-Total								**$75,000**	**$75,000**	**$75,000**	**$75,000**	**$75,000**	**$375,000**
SO 2.10: Agro-Met Services														
Agro-met station assistant	year	1	1	1	1	1	5	$40,000	$40,000	$40,000	$40,000	$40,000	$40,000	$200,000
Needs assessment	event	1					1	$17,000	$17,000	$0	$0	$0	$0	$17,000
Agro-met workshops	workshop	1	1	1	1	1	5	$17,000	$17,000	$17,000	$17,000	$17,000	$17,000	$85,000
Agro-met climate stations	station		5				5	$40,000	$0	$200,000	$0	$0	$0	$200,000
Tech training/support and data management	event		1				1	$50,000	$0	$50,000	$0	$0	$0	$50,000
Applied research	year	1	1	1	1	1	5	$100,000	$100,000	$100,000	$100,000	$100,000	$100,000	$500,000
Traditional knowledge data-base	year	1	1	1	1	1	5	$50,000	$50,000	$50,000	$50,000	$50,000	$50,000	$250,000
Information and communication services	year	1	1	1	1	1	5	$35,000	$35,000	$35,000	$35,000	$35,000	$35,000	$175,000
	Sub-Total								**$259,000**	**$492,000**	**$242,000**	**$242,000**	**$242,000**	**$1,477,000**
	Total								**$1,584,000**	**$1,092,000**	**$797,000**	**$792,000**	**$887,000**	**$5,152,000**

	Unit	Quantity						Unit Cost	Cost (T$)					Total (T$)
Programme 3: Sustainable Livelihoods and Healthy Food		**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Total**	**(T$)**	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	
SO 3.1: Farmers' knowledge and practices														
Plan Village Resilient Agriculture Demonstrations (VRADs)	VRAD	10					10	$30,000	$300,000	$0	$0	$0	$0	$300,000
Operate and maintain VRADs	VRAD/year	10	10	10	10	10	50	$5,000	$50,000	$50,000	$50,000	$50,000	$50,000	$250,000
Design Village Resilient Agriculture Plans (VRAPs)	VRAP		9	9	13	13	44	$2,500	$0	$22,500	$22,500	$32,500	$32,500	$110,000
Assist with implementation of VRAPs	VRAP/year		9	18	31	44		$2,500	$0	$22,500	$45,000	$77,500	$110,000	$255,000
	Sub-Total								**$350,000**	**$95,000**	**$117,500**	**$160,000**	**$192,500**	**$915,000**
SO 3.2: Young people in agriculture														
Feasibility study of proposed upgrading of Tupou College	Study	1					1	$45,000	$45,000	$0	$0	$0	$0	$45,000
Plan Village Resilient Agriculture Demonstration (VRAD) for Tupo	VRAD	1					1	$2,500	$2,500	$0	$0	$0	$0	$2,500
Operate and maintain VRAD for Tupo	VRAD/year	1	1	1	1	1	5	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$50,000
Plan and build eight learning and production nodes	nodes	8					8	$50,000	$400,000	$0	$0	$0	$0	$400,000
Operate learning and production nodes (incremental cost)	node/year	8	8	8	8	8	40	$20,000	$160,000	$160,000	$160,000	$160,000	$160,000	$800,000
Plan and build new Learning Centre	centre	1					1	$300,000	$300,000	$0	$0	$0	$0	$300,000
Operate Learning Centre	l/sum/yr	1	1	1	1	1	5	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000	$150,000
Student awards	no/yr		10	10	10	10	40	$2,500	$0	$25,000	$25,000	$25,000	$25,000	$100,000
Graduate support packages	no/yr		50	50	50	50	200	$2,500	$0	$125,000	$125,000	$125,000	$125,000	$500,000
	Sub-Total								**$947,500**	**$350,000**	**$350,000**	**$350,000**	**$350,000**	**$2,347,500**
SO 3.3: Saleable agriculture products														
FFSs 4,000 men and women farmers in FLGs	FFSs		100	200	350	500	1,150	$4,000	$0	$400,000	$800,000	$1,400,000	$2,000,000	$4,600,000
FFSs for 3,500 women's handicraft - raw materials - in HLGs	FFSs		54	108	186	264	612	$4,000	$0	$216,000	$432,000	$744,000	$1,056,000	$2,448,000
Printing and distribution of technical brochures	Sets		770	770	1910	1910	5,360	$75	$0	$57,750	$57,750	$143,250	$143,250	$402,000
Learning grants for commercial farmers	per FFS		20	20	30	30	100	$5,000	$0	$100,000	$100,000	$150,000	$150,000	$500,000
Matching grants for commercial farmers	per FFS		20	20	30	30	100	$10,000	$0	$200,000	$200,000	$300,000	$300,000	$1,000,000
Matching grants for women handicraft materials farmers	per FFS		18	18	26	26	88	$5,000	$0	$90,000	$90,000	$130,000	$130,000	$440,000
Support for farm access to markets - feasibility study	study		1				1	$30,000	$0	$30,000	$0	$0	$0	$30,000
Matching grants for farm access roads	per 50% of FLGs		10	10	15	15	50	$5,000	$0	$50,000	$50,000	$75,000	$75,000	$250,000
Livestock water supply - feasibility study	study		1				1	$15,000	$0	$15,000	$0	$0	$0	$15,000
Matching grants for livestock water supplies	per 5 FLGs		2	2	3	3	10	$10,000	$0	$20,000	$20,000	$30,000	$30,000	$100,000
Micro-irrigation - feasibility study	study		1				1	$30,000	$0	$30,000	$0	$0	$0	$30,000
Matching grants for micro-irrigation systems - subject to SO 1.1	per 5 FLGs		2	2	3	3	10	$10,000	$0	$20,000	$20,000	$30,000	$30,000	$100,000
Assessment of short VCAs for local products	local study		3	3	2		8	$15,000	$0	$45,000	$45,000	$30,000	$0	$120,000
Livestock disease status survey	survey		1				1	$200,000	$0	$200,000	$0	$0	$0	$200,000
Support for Church to assist farmers	L/sum/yr/minister		250	250			500	$2,000	$0	$500,000	$500,000	$0	$0	$1,000,000
	Sub-Total								**$0**	**$1,973,750**	**$2,314,750**	**$3,032,250**	**$3,914,250**	**$11,235,000**
	Total								**$1,297,500**	**$2,418,750**	**$2,782,250**	**$3,542,250**	**$4,456,750**	**$14,497,500**

	Unit	Quantity						Unit Cost	Cost (T$)					Total (T$)
Programme 4: Sustainable Growth and Foreign Exchange Earnings		**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Total**	**(T$)**	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	
SO 4.1: Export sales														
Study: National Forestry Industry	study	1					1	$45,000	$45,000	$0	$0	$0	$0	$45,000
Study: export shipping requirements - smaller ships	study	1					1	$45,000	$45,000	$0	$0	$0	$0	$45,000
Study: access constraints (farms to pack houses)		Included in Programme 3 costs												
Guidelines and training on value chains	L/sum/yr		2	2	2	2	8	$10,000	$0	$20,000	$20,000	$20,000	$20,000	$80,000
Training in contract farming	L/sum/yr		2	2	2	2	8	$10,000	$0	$20,000	$20,000	$20,000	$20,000	$80,000
Business mentoring	L/sum/yr		2	2	2	2	8	$20,000	$0	$40,000	$40,000	$40,000	$40,000	$160,000
Training in post-harvest practices	L/sum/yr		2	2	2	2	8	$8,500	$0	$17,000	$17,000	$17,000	$17,000	$68,000
Technical support for Value Chain development	L/sum/yr		2	2	2	2	8	$45,000	$0	$90,000	$90,000	$90,000	$90,000	$360,000
Market Development Fund for exporters	L/sum/yr		1	1	1	1	4	$600,000	$0	$600,000	$600,000	$600,000	$600,000	$2,400,000
Support to identify potential export crops, followed by pathway development	L/sum/yr		1	1	1	1	4	$50,000	$0	$50,000	$50,000	$50,000	$50,000	$200,000
Printing and distribution of technical brochures		Included in Programme 3 costs												
Investment promotion	L/sum/yr		1	1	1	1	4	$40,000	$0	$40,000	$40,000	$40,000	$40,000	$160,000
Upgrade EU-Stabex facilities	L/sum		1				1	$250,000	$0	$250,000				$250,000
HACCP standards for Queen Salote Wharf	L/sum		1				1	$85,000	$0	$85,000				$85,000
Support for Tonga Agribusiness Association	L/sum/yr		1	1	1	1	4	$35,000	$0	$35,000	$35,000	$35,000	$35,000	$140,000
Feasibility/business studies - additional pack houses	study			1			1	$45,000	$0	$0	$45,000	$0	$0	$45,000
	Sub-Total								**$90,000**	**$1,247,000**	**$957,000**	**$912,000**	**$912,000**	**$4,118,000**
SO 4.2: Import replacement														
Training - developing domestic markets, import replacement	event		1	1	1		3	$25,000	$0	$25,000	$25,000	$25,000	$0	$75,000
Research, pig and poultry production, and viability	L/sum/yr		1	1	1		3	$50,000	$0	$50,000	$50,000	$50,000	$0	$150,000
Expand duckling and chicken supplies	L/sum/yr		1	1	1		3	$30,000	$0	$30,000	$30,000	$30,000	$0	$90,000
Adaptive research on import replacement vegetables	L/sum/yr		1	1	1		3	$50,000	$0	$50,000	$50,000	$50,000	$0	$150,000
Implementatioin of 2008 FAO suggested maize testing programme	L/sum/yr		1	1	1		3	$25,000	$0	$25,000	$25,000	$25,000	$0	$75,000
Introduction of new sheep breeds	L/sum/yr		1	1			2	$100,000	$0	$100,000	$100,000	$0	$0	$200,000
Support for improved sheep management	L/sum/yr		1	1	1	1	4	$50,000	$0	$50,000	$50,000	$50,000	$50,000	$200,000
Introduction of new cattle breeds	L/sum/yr		1	1			2	$100,000	$0	$100,000	$100,000	$0	$0	$200,000
Support for improved cattle management	L/sum/yr		1	1	1	1	4	$50,000	$0	$50,000	$50,000	$50,000	$50,000	$200,000
Review - financial, economic and technical viability of pig/vegetable/biogas model	study		1				1	$45,000	$0	$45,000	$0	$0	$0	$45,000
Training in l/stock prod'n, HACCP, meat inspection, domestic markets and VCs	L/sum/yr		1	1	1		3	$30,000	$0	$30,000	$30,000	$30,000	$0	$90,000
Feasibility study on national feed reserve for drought management	study		1				1	$45,000	$0	$45,000	$0	$0	$0	$45,000
VCA/ feasibility study, vegetable import replacement	study		1				1	$22,500	$0	$22,500	$0	$0	$0	$22,500
VCA/ feasibility study for animal feed mill	study		1				1	$22,500	$0	$22,500	$0	$0	$0	$22,500
VCA/ feasibility study for chicken raising and processing	study		1				1	$22,500	$0	$22,500	$0	$0	$0	$22,500
VCA/ feasibility study for beef raising and processing	study		1				1	$22,500	$0	$22,500	$0	$0	$0	$22,500
VCA/ feasibility study for mobile cattle/pig abattoirs	study		1				1	$22,500	$0	$22,500	$0	$0	$0	$22,500
	Sub-Total								**$0**	**$712,500**	**$510,000**	**$310,000**	**$100,000**	**$1,632,500**
	Total								**$90,000**	**$1,959,500**	**$1,467,000**	**$1,222,000**	**$1,012,000**	**$5,750,500**

TASP Coordination Unit Costs	Unit	Quantity						Unit Cost	Total (T$)					Total (T$)
		Year 1	Year 2	Year 3	Year 4	Year 5	Total	(T$)	Year 1	Year 2	Year 3	Year 4	Year 5	
I. Investment Costs														
Vehicles, Equipment and Materials														
Main Office (x1)														
Minivan	no	1	-	-	-	1	2	77,000	77,000	-	-	-	77,000	154,000
4 Wheel-drive	no	3	-	-	-	3	6	60,000	180,000	-	-	-	180,000	360,000
Sedan	no	2	-	-	-	2	4	50,000	100,000	-	-	-	100,000	200,000
Printer/Photocopier	no	2	-	-	-	-	2	8,000	16,000	-	-	-	-	16,000
Laptop computer and screen	no	8	-	-	-	-	8	3,000	24,000	-	-	-	-	24,000
Office desk	no	8	-	-	-	-	8	500	4,000	-	-	-	-	4,000
Cabinet	no	8	-	-	-	-	8	1,000	8,000	-	-	-	-	8,000
Office chair	no	8	-	-	-	-	8	500	4,000	-	-	-	-	4,000
UPS	no	8	-	-	-	-	8	350	2,800	-	-	-	-	2,800
Computer Server	no	2	-	-	-	-	2	3,000	6,000	-	-	-	-	6,000
Camera	no	3	-	-	-	-	3	300	900	-	-	-	-	900
Safety equipment	no	1	-	-	-	-	1	2,500	2,500	-	-	-	-	2,500
Island Offices (x7)														
4 Wheel-drive	no	7	-	-	-	7	14	60,000	420,000	-	-	-	420,000	840,000
Motor-bike	no	30	-	-	-	30	60	5,000	150,000	-	-	-	150,000	300,000
Printer/Photocopier	no	7	-	-	-	-	7	8,000	56,000	-	-	-	-	56,000
Laptop computer and screen	no	23	-	-	-	-	23	3,000	69,000	-	-	-	-	69,000
Office desk	no	23	-	-	-	-	23	500	11,500	-	-	-	-	11,500
Cabinet	no	23	-	-	-	-	23	1,000	23,000	-	-	-	-	23,000
Office chair	no	23	-	-	-	-	23	500	11,500	-	-	-	-	11,500
UPS	no	7	-	-	-	-	7	350	2,450	-	-	-	-	2,450
Computer Server	no	7	-	-	-	-	7	3,000	21,000	-	-	-	-	21,000
Camera	no	14	-	-	-	-	14	300	4,200	-	-	-	-	4,200
Safety equipment	no	7	-	-	-	-	7	2,500	17,500	-	-	-	-	17,500
Subtotal									**1,211,350**	**-**	**-**	**-**	**927,000**	**2,138,350**
Training and Technical Assistance														
Detailed design of TASP projects	mth	9	-	-	-	-	9	43,000	387,000	-	-	-	-	387,000
TA Coordination Unit Manager	mth	12	12	12			36	23,800	285,600	285,600	285,600	-	-	856,800
TA Prog 1 and Prog 2 Coordination	mth	3	3	3			9	43,000	129,000	129,000	129,000	-	-	387,000
TA Prog 3 Coordination	mth	12	12	12	-	-	36	23,800	285,600	285,600	285,600	-	-	856,800
TA Prog 4 Coordination	mth	3	3	3	-	-	9	43,000	129,000	129,000	129,000	-	-	387,000
TA Monitoring and Evaluation	mth	3	3	3	-	-	9	43,000	129,000	129,000	129,000	-	-	387,000
TASPCU staff training (7 pp)	ls	2	2	2			6	5,000	10,000	10,000	10,000	-	-	30,000
TASPCU staff recruitment costs	ls	1	-	-	-	-	1	5,000	5,000	-	-	-	-	5,000
Island Office staff training (30 pp)	ls	2	2	2	-	-	6	20,000	40,000	40,000	40,000	-	-	120,000
Island Office staff recruitment costs	ls	1	-	-	-	-	1	20,000	20,000			-	-	20,000
Subtotal									**1,420,200**	**1,008,200**	**1,008,200**	**-**	**-**	**3,436,600**
Total Investment Costs									**2,631,550**	**1,008,200**	**1,008,200**	**-**	**927,000**	**5,574,950**

TASP Coordination Unit Costs	Unit	Quantity						Unit Cost	Total (T$)]					Total (T$)
		Year 1	Year 2	Year 3	Year 4	Year 5	Total	(T$)	Year 1	Year 2	Year 3	Year 4	Year 5	
II. Recurrent Costs														
Salaries and Allowances														
Main Office (x1)														
TASPCU Manager	yr	1	1	1	1	1	5	25,000	25,000	25,000	25,000	25,000	25,000	125,000
TASPCU Finance and Admin. Manager	yr	1	1	1	1	1	5	20,000	20,000	20,000	20,000	20,000	20,000	100,000
TASPCU Finance Officer	yr	1	1	1	1	1	5	20,000	20,000	20,000	20,000	20,000	20,000	100,000
TASPCU Administration Officer	yr	2	2	2	2	2	10	20,000	40,000	40,000	40,000	40,000	40,000	200,000
TASPCU Operations Manager	yr	2	2	2	2	2	10	20,000	40,000	40,000	40,000	40,000	40,000	200,000
Prog 1 and Prog 2 Coordinator	yr	1	1	1	1	1	5	15,000	15,000	15,000	15,000	15,000	15,000	75,000
Prog 3 Coordinator	yr	1	1	1	1	1	5	15,000	15,000	15,000	15,000	15,000	15,000	75,000
Prog 4 Coordinator	yr	1	1	1	1	1	5	15,000	15,000	15,000	15,000	15,000	15,000	75,000
Monitoring and Evaluation Officer	yr	1	1	1	1	1	5	15,000	15,000	15,000	15,000	15,000	15,000	75,000
Island Offices (x7)														
Island Coordinators (7 pp)	yr	7	7	7	7	7	35	20,000	140,000	140,000	140,000	140,000	140,000	700,000
District Coordinators (23 pp)	yr	23	23	23	23	23	115	15,000	345,000	345,000	345,000	345,000	345,000	1,725,000
Village Coordinators (volunteers' allow ance)	yr	77	77	77	77	77	383	2,000	153,000	153,000	153,000	153,000	153,000	765,000
Subtotal									**843,000**	**843,000**	**843,000**	**843,000**	**843,000**	**4,215,000**
Office Operating Costs														
Main Office (x1) (7 pp)														
Office rent	yr	1	1	1	1	1	5	36,000	36,000	36,000	36,000	36,000	36,000	180,000
Electricity	yr	1	1	1	1	1	5	5,000	5,000	5,000	5,000	5,000	5,000	25,000
Water	yr	1	1	1	1	1	5	5,000	5,000	5,000	5,000	5,000	5,000	25,000
Phone	yr	1	1	1	1	1	5	5,000	5,000	5,000	5,000	5,000	5,000	25,000
Internet	yr	1	1	1	1	1	5	10,000	10,000	10,000	10,000	10,000	10,000	50,000
Office consumables	yr	1	1	1	1	1	5	12,000	12,000	12,000	12,000	12,000	12,000	60,000
Equipment maintenance	yr	1	1	1	1	1	5	3,000	3,000	3,000	3,000	3,000	3,000	15,000
Kick-off/completion w orkshop	ls	1	-	-	-	1	2	10,000	10,000	-	-	-	10,000	20,000
PRAC meetings	yr	4	4	4	4	4	20	2,000	8,000	8,000	8,000	8,000	8,000	40,000
Insurance	yr	1	1	1	1	1	5	8,000	8,000	8,000	8,000	8,000	8,000	40,000
Bank fees and charges	yr	1	1	1	1	1	5	1,200	1,200	1,200	1,200	1,200	1,200	6,000
Annual audit	yr	1	1	1	1	1	5	7,000	7,000	7,000	7,000	7,000	7,000	35,000
Staff travel - all main office	pp/yr	5	5	5	5	5	25	10,000	50,000	50,000	50,000	50,000	50,000	250,000
Printing	yr	1	1	1	1	1	5	10,000	10,000	10,000	10,000	10,000	10,000	50,000
Island Offices (x7)														
Office rent - in Governors' offices	yr	7	7	7	7	7	35	6,000	42,000	42,000	42,000	42,000	42,000	210,000
Electricity	yr	7	7	7	7	7	35	2,000	14,000	14,000	14,000	14,000	14,000	70,000
Water	yr	7	7	7	7	7	35	2,000	14,000	14,000	14,000	14,000	14,000	70,000
Phone	yr	7	7	7	7	7	35	2,000	14,000	14,000	14,000	14,000	14,000	70,000
Internet	yr	7	7	7	7	7	35	5,000	35,000	35,000	35,000	35,000	35,000	175,000
Office consumables	yr	7	7	7	7	7	35	5,000	35,000	35,000	35,000	35,000	35,000	175,000
Equipment maintenance	yr	7	7	7	7	7	35	2,000	14,000	14,000	14,000	14,000	14,000	70,000
Kick-off/completion w orkshop	ls	7				7	14	5,000	35,000	-	-	-	35,000	70,000
Insurance	yr	7	7	7	7	7	35	1,000	7,000	7,000	7,000	7,000	7,000	35,000
Staff travel (to TT)	pp/yr	7	7	7	7	7	35	2,500	17,500	17,500	17,500	17,500	17,500	87,500
Subtotal									**397,700**	**352,700**	**352,700**	**352,700**	**397,700**	**1,853,500**
Vehicle Operation and Maintenance														
Main Office (x1) (7 pp)														
Fuel & oil (5% of capital value)	yr	1	1	1	1	1	5	35,700	35,700	35,700	35,700	35,700	35,700	178,500
Repairs & maintenance (5% capital value)	yr	1	1	1	1	1	5	35,700	35,700	35,700	35,700	35,700	35,700	178,500
Insurance	yr	1	1	1	1	1	5	5,000	5,000	5,000	5,000	5,000	5,000	25,000
Registration	yr	1	1	1	1	1	5	5,000	5,000	5,000	5,000	5,000	5,000	25,000
Island Offices (x7)														
Fuel & oil (5% of capital value)	yr	1	1	1	1	1	5	57,000	57,000	57,000	57,000	57,000	57,000	285,000
Repairs & maintenance (5% capital value)	yr	1	1	1	1	1	5	57,000	57,000	57,000	57,000	57,000	57,000	285,000
Insurance	yr	1	1	1	1	1	5	10,000	10,000	10,000	10,000	10,000	10,000	50,000
Registration	yr	1	1	1	1	1	5	10,000	10,000	10,000	10,000	10,000	10,000	50,000
Subtotal									**215,400**	**215,400**	**215,400**	**215,400**	**215,400**	**1,077,000**
Total Recurrent Costs									**1,456,100**	**1,411,100**	**1,411,100**	**1,411,100**	**1,456,100**	**7,145,500**
Total									**4,087,650**	**2,419,300**	**2,419,300**	**1,411,100**	**2,383,100**	**12,720,450**

Detailed TASP Costs	(T$'000)						
	Year 1	Year 2	Year 3	Year 4	Year 5	Total	%
Programme 1: Climate Resilient Agriculture							
SO 1.1: Healthy Soils and Sustainable Water	$895	$922	$515	$139	$150	$2,621	
SO 1.2: Climate Resilient (CR) Guidelines and Indicators	$95	$60	$55	$5	$5	$220	
SO 1.3: Building Agriculture Resilience to Impact of Climate Change	$513	$343	$343	$5	$5	$1,208	
Subtotal	**$1,503**	**$1,325**	**$913**	**$149**	**$160**	**$4,049**	**10%**
Programme 2: Improved Enabling Environment							
SO 2.1: Sector Institutional Policy	$503	$50	$0	$0	$0	$553	
SO 2.2: Bio-Physical Policies	$278	$15	$15	$15	$105	$428	
SO 2.3: Export and Import Policies	$0	$63	$18	$63	$18	$160	
SO 2.4: Land and Rural Finance Policies	$98	$25	$75	$25	$75	$298	
SO 2.5: International Relationships	$38	$38	$38	$38	$38	$188	
SO 2.6: Compliance and Regulations	$23	$23	$23	$23	$23	$113	
SO 2.7: Quarantine	$250	$250	$250	$250	$250	$1,250	
SO 2.8: Industry Organizations	$63	$63	$63	$63	$63	$313	
SO 2.9: Market Information Support	$75	$75	$75	$75	$75	$375	
SO 2.10: Agro-Met Services	$259	$492	$242	$242	$242	$1,477	
Subtotal	**$1,584**	**$1,092**	**$797**	**$792**	**$887**	**$5,152**	**12%**
Programme 3: Sustainable Livelihoods and Healthy Food							
SO 3.1: Farmers' knowledge and practices	$350	$95	$118	$160	$193	$915	
SO 3.2: Young people in agriculture	$948	$350	$350	$350	$350	$2,348	
SO 3.3: Saleable agriculture products	$0	$1,974	$2,315	$3,032	$3,914	$11,235	
Subtotal	**$1,298**	**$2,419**	**$2,782**	**$3,542**	**$4,457**	**$14,498**	**34%**
Programme 4: Sustainable Growth and Foreign Exchange Earnings							
SO 4.1: Export sales	$90	$1,247	$957	$912	$912	$4,118	
SO 4.2: Import replacement	$0	$713	$510	$310	$100	$1,633	
Subtotal	**$90**	**$1,960**	**$1,467**	**$1,222**	**$1,012**	**$5,751**	**14%**
TASP Programme Management							
Vehicles, Equipment and Materials	$1,211	$0	$0	$0	$927	$2,138	
Training and Technical Assistance	$1,420	$1,008	$1,008	$0	$0	$3,437	
Salaries and Allowances	$843	$843	$843	$843	$843	$4,215	
Office Operating Costs	$398	$353	$353	$353	$398	$1,854	
Vehicle Operation and Maintenance	$215	$215	$215	$215	$215	$1,077	
Subtotal	**$4,088**	**$2,419**	**$2,419**	**$1,411**	**$2,383**	**$12,720**	**30%**
Total	**$8,562**	**$9,214**	**$8,378**	**$7,116**	**$8,899**	**$42,169**	**100%**

10.6 Annex 6: Farmer Field Schools

10.6.1 Brief Description

283. A Farmer Field School (FFS) is a school without walls[68]. A group of farmers gets together in one of their own fields to learn about their crops and things that affect them. They learn how to farm better by observing, analysing and trying out new ideas on their own fields.

284. FAO and other development organizations have been promoting farmer field schools, which represent an innovative approach to adult education, first developed in Southeast Asia for pest management purposes, to improve land and water management in Africa. Unlike traditional approaches to agricultural extension, which rely on extension workers providing advice to farmers, farmer field schools enable groups of farmers to find out the answers for themselves. That means the farmers can develop solutions to their own problems.

285. The FFS approach is based on the concepts and principles of people-centred learning, and was developed as an alternative to the conventional top-down test and verification (T&V) extension approach. It uses participatory methods to create a learning environment, including learning networks, in which the land users have the opportunity to learn for themselves about particular crop production problems, and ways to address them, through their own observation, discussion and participation in practical learning-by-doing field exercises. The approach is now being used to enable farmers to investigate, and overcome, a wider range of land-use problems, including soil productivity improvement, conservation agriculture, control of surface runoff, water harvesting and improved irrigation.

286. The FFS approach was originally developed for training rice farmers on integrated pest management, but programmes and projects have now been initiated to integrate soil productivity improvement in the FFS curriculum. A limited experience of pilot testing of the FFS methodology on integrated soil management took place through the FARM Programme in four Asian countries at the end of the 1990s but, more recently, FFS programmes on soil productivity improvement have started applying, improvising, validating and/or adapting the FFS approach for soil productivity improvement in East and Southern Africa. One critical success factor that has been identified for the FFS approach for improved land management is the need for capacity building of facilitators and curriculum development, especially for farmer-led FFS that are seen as the key to scaling-out the approach. Therefore, service providers (farmer group facilitators, extension providers, NGOs, etc.) need supportive materials to illustrate good soil and water management practices that can be tested through participatory technology development and demonstrations, and to help in identifying the most appropriate options for different farm types and contexts. They also need information to highlight and understand aspects of decreasing soil productivity and its' improvement.

287. The farmers meet regularly from planting to harvest, to check on how the crops are growing, look at the amount of moisture in the soil, and count the numbers of pests and beneficial creatures such as earthworms and spiders. They conduct their own experiments in the field.

288. The facilitator of an FFS is normally an extension worker or another farmer who has graduated from another FFS. The facilitator guides the group, helps them decide what they

[68] Extracted from: fao.org/nr/land/sustainable-land-management/farmer-field-school/en/

want to learn and to think of possible solutions, and advises them if they have questions. The farmers draw on their own experience and observations, and make decisions about how to manage the crop. The group is expected to hold two or more field days to show other farmers what they are doing.

289. The farmers also host exchange visits for members of other FFSs, and visit the other field schools themselves. This allows them to share ideas and see how others are dealing with similar problems. At the end of the crop season, the farmers “graduate”: they receive a certificate from the field school organizer. The members are then qualified to start a new field school as a facilitator. The field school includes team building and organization skills, as well as special topics suggested by the field school members themselves. The field schools are a way for farming communities to improve their decision making and stimulate local innovation for sustainable agriculture. The emphasis is on empowering farmers to implement their own decisions in their own fields.

10.7. ANNEX 7. WORK PLAN FOR AGROMET WORKING GROUP

Mandate: To deliver relevant and applicable weather/climate information and services to farmers and other agricultural stakeholders

ACTIVITIES	OUTPUT	OUTCOME	IMPACT	DATE	RESOURCES
1. **Review weather and climate information and services being provided to farmers and other agricultural stakeholders**					
1a .Identify gaps in climate products, services and content	Revised list of climate products and services	Comprehensive climate products and services	Update of products and services for needs assessment	Identify gaps by **30/09/15**	Agro-met WG
1b. Advocate use of climate information within policy, research and practice	Promotion and awareness campaigns	Increased awareness of products & services	Agriculture sector supports use of climate products & services	Ongoing	Agro-met WG/MAFFF
1c. Develop a Agro-Met database to manage contacts, information needs, and data	Agro-Met information & services database	User-friendly database	Business processes for delivering products & services are efficient & up-to-date	30 June 2015	Agro-met WG
2. **Carry out regular stakeholder weather and climate information and services needs assessments**					
2a. Develop a needs assessment that includes collection of agricultural Traditional Knowledge (TK)	Needs assessment forms and process	Successful completion of needs assessment with relevant information	Needs assessment provides basis to start discussions to improve products & services	29 Feb 2016	Agro-met WG
2b. Conduct a media campaign to encourage farmers' participation	Media briefing, release and other media activities	Stakeholders and famers participate in needs assessment	Comprehensive understanding of agricultural stakeholders' and farmers' needs	Ongoing	Agro-met WG
2c. Conduct needs assessment workshops with MAFFF extension officers and NGOs	District training workshops for MAFFF extension officers and NGOs	Clear needs of farmers and communication methods	Targeted useable Agro-Met information and services	31 Mar 2016	Agro-met WG
2d. Monitor the quality and use of climate information and services	Field trip reports, survey results, analysis of changes, Agro-Met champions	Progress report outcomes support management of activities	Improvements in delivery	Ongoing	Agro-met WG
3. **Consider and develop more effective ways to convey weather and climate information and services to farmers and agricultural stakeholders**					
3a. Promote best practice and good news stories with media and contribute to relevant forums	Media, stories, presentation, web/social media and networks, and NDCR event	Positive public and professional reception of activities	Support from donors and participation of stakeholders	Oct 2015 (date yet to be confirmed)	Met
4. **Consider and find ways for farmers and agricultural stakeholders to provide feedback on information and services provided**					

4a. Upgrade communication systems for disseminating and receiving information	On line mail (mail chimp), web, email & sms, extension services agreement with MAFFF & district officers	Reliable communication methods result in extensive outreach	Wide range of farmers and stakeholders have access to up-to-date information	30 Aug 2015	Met
4b. Establish feedback channels on products and services for farmers	Agro-Met WG meetings , generic met email, radio talk back & NDCR Forums	Improved Agro-Met products and services	Farmers continue to participate in Agro-Met activities	Ongoing	Met/MAFFF/ Agro-met WG
5. **Develop weather and climate information and services for farmers and other agricultural stakeholders, which is reliable, simple, and accessible, and is delivered in a timely manner and relevant for decision making**					
5a. Conduct communication training workshop/s	Service providers and users understand how to communicate effectively	Improved Agro-Met services	Increased collaboration and participation in Agro-Met activities	31 March 2016 together with Wkshop in Act 1	APCC/Agro-met WG
5b. Undertake site assessments for new Agro-Met stations	Site assessment report	Suitable sites for new Agro-Met stations	Sites provide accurate data	30 May 2015	Emanuele
5c. Design, purchase and install monitoring stations or equipment	A good network of Agro-Met stations	Available Agro-Met data	Improved accuracy and coverage of Agro-Met data	31 Dec 2015	'Ofa (PPCR project/APCC)
5d. Develop parameters for a crop soil moisture index	Soil moisture threshold index	Information for productive generation of data	Information that guides crop management	31 July 2015	Agro-met WG
5e. Undertake desktop research on the impact of climate on agriculture	Meteorological/agriculture impact report	Basis for workshop with stakeholder about impacts	Increased agricultural production due to improved preparedness and decision making	30 Nov 2015	APCC/Extension (Eman)/Met (SF)
5f. Hold stakeholder workshop to analyse results of research	Report of impacts of weather events on agriculture	Stakeholders have greater understanding of impacts		31 Mar 2016	APCC/ Agro-met WG
5g. Integrate impacts into climate products and services	Relevant and targeted messages about impacts	Client friendly information		Sep 2016	Agro-met WG
6. **Review, compile and verify Traditional Knowledge (TK) regarding weather/climate and farming practices**					
6a. Undertake a TK desktop study	TK status report	Understanding available information	Integration of TK into products provide relevance to farmers	30 Sep 2015	MAFF/(Emanuel)
6b. Conduct a stakeholder workshop on TK	Key criteria and guidelines for recording and using of agricultural TK	Understanding of how to collect and record agricultural TK	Agro-Met services and products user friendly	Dec 31 2015	Agro-met WG
6c. Hold community workshops to collect agricultural TK	Collection of agricultural TK	Understanding of knowledge available for use	Farmers and stakeholders contribute to TK base		

7. **Seek and acquire funding for carrying out Agro-Met services and product activities**					
Develop funding proposals: 1. Agro-Met stations 2. Database development 3. Traditional knowledge 4. Needs assessment 5. Information & services production 6. Training activities 7. Technical Assistant – Agro-met Specialist	Project proposals	Adequate funding	Effective and targeted delivery	To be discussed at APCC meeting	1.Proposal approved. 2. APCC/Met/MAFF