

**Food Security Strategies for
the Kingdom of Tonga**

S.M. Halavatau and N.V. Halavatau

The CGPRT Centre

The Regional Co-ordination Centre for Research and Development of Coarse Grains, Pulses, Roots and Tuber Crops in the Humid Tropics of Asia and the Pacific (CGPRT Centre) was established in 1981 as a subsidiary body of UN/ESCAP.

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Food Security Strategies for the Kingdom of Tonga

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WORKING PAPER 57

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Humid Tropics of Asia and the Pacific

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Foreword

In consideration of the importance of stable supplies of food to meet the increasing population and the changing dietary pattern in those island countries located in the South Pacific, the CGPRT Centre implemented the research project “Food Security Strategies for Selected South Pacific Island Countries (SouthPIC)” in collaboration with four countries: Fiji, Papua New Guinea, Tonga and Vanuatu. The project started in July 1999 and was operationally completed in December 2000.

The national experts appointed in each participating country carried out country studies with back up by the related institutions, which covered a wide range of socio-economic aspects related to food security. Based on the analyses and findings achieved in the study, policy recommendations on food security strategies in both short term and mid-long term were proposed.

It is my pleasure to publish “**Food Security Strategies for the Kingdom of Tonga**” as the report of the country study of Tonga. I sincerely hope this report will contribute to the improvement of food security and nutrition conditions in Tonga, and to the further development of its agriculture.

I thank Dr. S. M. Halavatau and Ms. N.V. Halavatau for their intensive research, which enabled this report to provide useful information on possible food security strategies in the country. I am very much obliged to Dr. Euan Fleming, University of New England, Australia, and Dr. Pantjar Simatupang, Center for Agro-Socio Economic Research, Indonesia, for their contributions to the project as the regional advisor and the project leader, respectively. I also thank Dr. Douglas R. Stoltz for his editing services. Finally, I express my sincere appreciation to the Government of Japan for funding the project.

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- Staff of the Statistics Department for making available many of their annual reports to be used as sources of data for the study. The trade statistics, population, and employment figures were very useful.
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Siosuia M. Halavatau and Noeline V. Halavatau

Executive Summary

The Kingdom of Tonga is located in the South Pacific between latitudes 15° and 23° south, and longitudes 173° and 177° west. The Kingdom embraces a large area of the Pacific Ocean (362,000 km²) but has a land area of only 750 km² distributed over 171 islands of which only 41 are inhabited.

The population of Tonga according to the 1996 Population Census was 97,784 persons. The 1996 population census showed that 58.4% of those aged 15 years and above were economically active, of which 50.7% (29,406) were employed and 7.7% (4,502) were unemployed. A large percentage of the economically active population (58.4%) of Tonga rely on primary production for their livelihood

The most pressing food security problem in Tonga is not food insecurity/hunger or malnutrition but rather problems associated with too much eating especially of low quality imported food and consequently high incidences of non-communicable diseases.

The general objectives of the country study were to assess the food security situation in Tonga and the problems faced, to identify effective strategies, and to help formulate appropriate policy options for solving the respective problems.

The Government over the last four five year development plans (1975 to 1995) sought as its main objectives to achieve sustained increase in economic growth, employment, and the promotion of equitable distribution of income within the context of price stability.

The food available to the people is determined by many factors including environmental factors, cash cropping and food imports, food production, income levels, socio-cultural patterns, and personal factors including knowledge of nutrition.

The traditional food production systems are basically agroforestry systems including livestock rearing and were quite self-sustained, but with the advent of commercialization, the sustainability of the cash cropping systems had to be balanced by external inputs of improved cultivars, fertilizers, pesticides, and sometimes irrigation. The other sources of local food are fish and shell foods.

The available food was also shown to be adequate with healthy traditional diets only found in the outlying islands. In the bigger islands, low quality imported foods (fatty mutton flaps and chicken, and sugary bread type foods) constitute a big portion of the diet. People are also less active and consequently the incidences of non-communicable diseases are quite high. The low to medium income earners' expenditures were on average more than their incomes. Foreign remittances balanced out the expenses of many households.

Food security at the national, regional and household levels is most vulnerable to natural disasters of tropical cyclones, droughts, pest outbreaks, or combinations of these threats. At the national level, initiatives had been made to develop a disaster management plan. The Ministry of Agriculture and Forestry is also developing a plan. The households, however have their own coping systems which include private responses such as banking, accumulated assets, food sharing, and borrowing, and also community-based responses such as common fields (toutu'u), labor pool (toungeae), and women's development and nutrition groups.

Analysis of the current food security, nutrition, and health status of Tongans revealed various food security risks including: (i) employment risks; (ii) agricultural trade risks; (iii) food price risks; (iv) crop production risks; and (v) health and nutritional risks. In order to solve these risks, it is recommended that policies in these areas should be developed.

In order to develop appropriate policies, information is very important. The study identified information needs in the areas of: (i) household food consumption; (ii) household expenditures; (iii) national nutrition survey; (iv) agricultural census; and (v) fish statistics both

at the national and regional levels. Many of the information needs can be obtained through properly designed research projects.

The study also found that unless key players in many of the research areas and information needs are identified, the chance to implement many of the desired activities is very slim. It was also evident from the study that there might be a possibility for regional cooperation on strategies for food security or on aspects like coping systems or involvement of youths in food production.

1. Introduction

1.1 Background

1.1.1 Geography

The Kingdom of Tonga is located in the South Pacific between latitudes 15° and 23° south, and longitudes 173° and 177° west. The Kingdom embraces a large area of the Pacific Ocean (362,000 km²) but has a land area of only 750 km² distributed over 171 islands, only 41 of which are inhabited.

The Kingdom of Tonga may be divided into four island groups: Tongatapu in the south, which consists of Tongatapu and 'Eua islands; Ha'apai in the center; Vava'u in the north; and the Niuas which consist of Niuatoputapu, Tafahi, and Niuafu'ou in the extreme north. Tongatapu, which is the main island, lies about 1900 km northeast of New Zealand and about 760 km southeast of the Fiji islands.

The Kingdom consists mainly of two parallel chains (Figure 1.1) oriented in a NNE – SSW direction. The eastern chain consists of mainly raised coral islands, and the western chain of modern volcanoes including the islands of Tofua, Kao, Late, Niuatoputapu, and Tafahi. A further modern volcano, Niuafu'ou lies 200 km west of Niuatoputapu (Figure 1.1). Four of the volcanoes, namely Niuafu'ou, Niuatoputapu, Tafahi and Tofua, are inhabited.

The climate is generally warm to hot, usually with adequate rainfall, and a cooler climate in the winter months, which enables the production of a wide range of agricultural produce and products. There is, however, climatic variation between island groups. It is generally cooler and drier in the south. Tongatapu, in the south has an average rainfall of less than 1,800 mm and increases northward to an average of over 2,000 mm for Vava'u and about 2,300 mm for the Niuas in the extreme north. Most rain for the year occurs between January and April, with June to August being the driest months. The mean annual temperature is 23.7° C with a mean monthly minimum value of 17.8° C and a mean monthly maximum temperature of 29° C.

1.1.2 Demography

The population of Tonga according to the 1996 Population Census was 97,784 persons. The count was made up of 49,615 males and 48,169 females, or expressed in sex ratio, 103 males to every 100 females (Statistics Department 1999). About 30% of the total population, live in the capital area of Nuku'alofa, in the main island of Tongatapu. Table 1.1 gives the population of Tonga by division and average annual growth rates for 1986 and 1996.

Table 1.1 Population of Tonga by division and average annual rates of growth, 1986 and 1996.

| Division | 1976 | 1986 | 1996 | Growth rate 1986 (%) | Growth rate 1996 (%) |
|-----------|--------|--------|--------|----------------------|----------------------|
| Tongatapu | 57,411 | 63,794 | 66,979 | 1.1 | 0.5 |
| Vava'u | 15,068 | 15,175 | 15,715 | 0.1 | 0.4 |
| Ha'apai | 10,792 | 8,919 | 8,138 | -1.9 | -0.9 |
| 'Eua | 4,486 | 4,393 | 4,934 | -0.2 | 1.2 |
| Niuas | 2,328 | 2,368 | 2,018 | 0.2 | -1.5 |
| Total | 90,085 | 94,649 | 97,784 | 0.5 | 0.3 |

Source: Statistics Department (1999).

The low annual growth rate of only 0.3% means that Tonga continues to lose people through overseas migration.

1.1.3 Employment

The 1996 population census showed that 58.4% of those aged 15 years and above were economically active, while 41.6% were not economically active. Of those economically active, 50.7% (29,406) were employed and 7.7% (4,502) were unemployed. The 41.6% non-economically active population consisted of people who were engaged in housework only, students, old or retired persons and the disabled. Of those employed, 54% were engaged either in agriculture, fishing or making handicrafts and 45% were engaged in paid employment. Most of the unemployed population reside in Tongatapu. Most of the farming population produce for their own consumption. A majority of those fishing occasionally sold their catch and more than half of those engaged in handicrafts produced for their own use. Of those engaged in paid employment, 31% worked in a family business without payment, 25.9% worked on their own account with no helpers, 17.7% were government employees, and 19% were private employees.

1.1.4 Primary production and food security

A large percentage of the economically active population (58.4%) of Tonga rely on primary production for their livelihood. Agriculture, forestry, and fisheries still provide the most important source of employment, foreign exchange earnings and food security. In contrast to the findings of the 1996 Census, which found 55% of people aged 15 to 19 years engaged in agriculture and fishing, the authors in conducting participatory rural appraisal workshops found that most youths are not involved much in food production activities. This can have an impact on food security in the future.

Root crops are the staple food of Tonga and occupy nearly two-thirds of the land in agricultural production. Most households in the rural areas tend to produce a high proportion of their own food consumption needs and for social and religious obligations, with excess being sold for cash. On the other hand, a large percentage of people living in the urban areas buy their food consumption needs. A large proportion of them are casual workers earning an average of about T\$50/week. For many this is far from enough to buy good quality foods.

Social obligations (weddings and funerals) demand a lot of food preparations and, for some of the population, this means a temporary subsequent period of food insecurity. Many of the church denominations hold annual church conferences for a period of 1 to 2 weeks. During these times, much food is consumed and this impacts on household food security in the periods following the conferences.

Traditionally the diets of Tongans were quite healthy, consisting mostly of traditional root crops, fish and shellfish (sometimes meat – mostly pigs). With increasing commercialization and sophisticated living in urban and peri-urban areas, the dietary patterns have changed to include a high percentage of fatty meat (mutton flaps and imported force-fed chicken), and low-quality processed products (white bread, tinned products). This has resulted in increasing incidences of non-communicable diseases in the past two decades. The most pressing food security problem in Tonga is not food insecurity/hunger or undernutrition but rather malnutrition problems associated with too much eating, especially of low-quality imported food, and consequently high incidences of non-communicable diseases.

1.1.5 Export production

The major export crops of Tonga are introduced crops such as squash or non-staple crops such as kava and vanilla. The introduced crops are still to find their ways into Tongan diets. The rejects from squash are in excess of 30% (Halavatau and Hausia 1999), presenting a big loss in terms of potentially consumable food for the people. Large areas, which could have been planted to food crops, are taken up by non-staple crops like kava and vanilla. Nevertheless, a part of the income from these crops finds its way into the diet in terms of food purchases.

1.2 Objectives

The general objectives of the country study were to assess the food security situation in Tonga and the problems faced, to identify effective strategies, and to help formulate appropriate policy options for solving the respective problems. The specific objectives were as follows:

- to analyze food availability and its related risks, distribution institutions, uses, aid and related strategies and policies at the national level;
- to analyze household food availability, access, consumption pattern, nutritional quality and sufficiency, risks, aid and related government policies;
- to identify strategy and help formulate policy options to improve food security in Tonga, including prospects of regional cooperation.

1.3 Scope of the study

Based on the objectives of the study, the study covered the following: (i) food security performance and its determinants (at the national and household levels); (ii) food security risk-coping institutions; and (iii) feasibility of regional food security cooperation.

The study covered all the main island groups of the Kingdom.

2. Methods and Data Sources

The study made use of several methods to acquire the necessary data.

- Secondary information was collected from various sources. The health information was collected from health annual reports and reports on studies undertaken under the Ministry of Health. The trade statistics were obtained from reports of the Statistics Department. Production data were collected from various reports of the Ministry of Agriculture and Forestry. Nutrition data were obtained from nutrition reports of the National Food and Nutrition Committee. Reports of other departments and organizations were consulted when needed.
- People were also interviewed as required. People out in the communities, technical people in various fields, and people at decision-making levels were interviewed to fill in gaps in the secondary information collected.
- Where data were not available, the authors did the appropriate calculations based on logical assumptions.
- Where necessary, the authors visited some of the communities and discussed with households some of the issues such as household consumption and expenditures.

3. National Objectives and Policies

There are several ministries, departments and non-governmental organizations involved in activities related to one aspect or the other of food security. Over the past four five-year development plans (1975 to 1995), the government sought as its main objectives to achieve a sustained rate of economic growth and employment, and the promotion of an equitable distribution of income within the context of price stability. The national economic strategy has been to diversify the economic base in order to minimize reliance on a few export crops; to create employment opportunities; and to foster private sector development.

The government also maintained special emphasis on the development of health services and access to education. Disparities in the distribution of incomes, public goods, and services among the island groups of Tonga have resulted in the establishment of Regional Integrated Development Programs to identify development priorities and coordinate development efforts in the outer island regions.

3.1 Sectoral objectives and policies

3.1.1 Ministry of Agriculture and Forestry

The Ministry of Agriculture and Forestry has developed a Strategic Plan which will guide its development activities and sets the following statement of vision, mission, and credo statements:

- **Vision:** Improve the level of prosperity of the people of Tonga through agriculture and forestry.
- **Mission:** Provide high quality and timely service to improve productivity, market access and profits, while sustaining the environment and agricultural security.
- **MAF credo statements**
 - (i) *For the farming community:* To provide timely and high quality service in the areas of technology development and transfer, skills development, provision of appropriate support infrastructure and facilities and market access in order to increase productivity and income.
 - (ii) *For the Government of Tonga:* To account for the use of resources in the delivery of services which are conducive to improved sector performance and increased revenues.
 - (iii) *For the donor community:* To identify areas for donor investment and assistance and be accountable for the use of donor resources.
 - (iv) *For partners in development:* To develop and maintain good working relations with other government agencies, financial institutions and private sector organizations, as important and equal partners in the development of agriculture sector.

MAF Strategic Plan and the Program Budget Estimates has six broad programs guiding the development activities of the Ministry:

- Leadership, policy advice and program administration
- Agricultural export expansion
- Food security and nutrition
- Livestock development
- Agroforestry development and conservation
- Commercial services.

Chapter 3

The agricultural export expansion program aims at maintaining and promoting the export of agricultural produce through diversification of the agricultural export base, maintaining and improving agricultural productivity, expansion of planted area of selected crops, protection of crops from pests and diseases, and the enhancement of capability to place quality produce on overseas markets.

The primary aim of the food security and nutrition program is to promote and support the production, distribution and transfer of new technologies with appropriate advice to farming communities. The program also aims to support district agricultural committees, women in development and nutrition groups both at village and district levels. The program also has a disaster management plan for response to natural disasters.

The livestock development program aims at assisting livestock farmers in the proper husbanding of their livestock and includes upgrading and improving of local breeding stock, maintaining and improving livestock health, and assisting with the development of the local milk industry through upgrading and improving pastures. It also aims at improving local food supplies to households and import substitution for the imported meat supplies.

3.1.2 Ministry of Fisheries

The Ministry of Fisheries is responsible for the development of fisheries in Tonga. The Ministry concentrates its efforts on helping commercial fishermen both for export and local markets. The performance of fisheries over the years has improved, and the sector has contributed significantly to the economy of the country. A large proportion of the population of the outer islands of Tonga is dependent on fisheries as its main source of livelihood. Fish also accounts for a large part of the Tongan diet in the outer islands and rural coastal areas of larger islands like Tongatapu and Vava'u.

3.1.3 Food and nutrition

The goal of government in the area of food and nutrition is to achieve a satisfactory level of nutrition among the people of Tonga. Food security is also seen as a problem in certain areas and sectors of the population i.e. they either cannot produce or procure enough food. Access to sufficient food does not ensure adequate dietary intakes. People must also have knowledge and information about their nutritional needs and how these needs can be best met with the resources available. For these reasons, a National Food and Nutrition Policy Tonga and a National Plan of Action for Nutrition, had been approved by his Majesty's Cabinet in 1995.

The National Food and Nutrition Policy has the following objectives (National Food and Nutrition Committee 1995a):

- Ensure an adequate level of food supply to maintain good nutrition and dietary well being for all segments of the population, with particular emphasis on increasing availability of local food and decreasing food imports.
- Establish a National Food and Nutrition Education Program.
- Prevent and reduce nutrition-related diseases.
- Establish an appropriate food and nutrition data base and monitoring system.

The National Plan of Action for Nutrition is an integrated plan encompassing all nutrition related activities of all government and non-government organizations (Tonga National Food and Nutrition Committee 1995b). The plan is coordinated by the National Food and Nutrition Committee, which also advises Government on nutrition-related matters. The plan has 9 outputs:

1. Nutritional objectives, considerations and components incorporated into development policies and programs.
2. Household food security improved.
3. Consumers protected through improved food quality and safety.
4. Infectious diseases prevented and managed.

5. Breastfeeding promoted.
6. Socio-economically deprived and nutritionally vulnerable cared for.
7. Specific micronutrient deficiencies prevented and controlled.
8. Appropriate diets and healthy lifestyles promoted.
9. Nutrition situations assessed, analyzed, and monitored.

3.1.4 Ministry of Health

The national goal of the health sector has been *health for all by the year 2000*. With this goal, the sectoral objective of Tonga is to make essential health services available and readily accessible to all.

The main health challenge in Tonga is *while the incidence of communicable diseases has been decreasing, the number of deaths from non-communicable diseases has grown*. Health characteristics are now affected by changes in life-styles and nutrition. New concerns are arising from the increasing reliance on low quality imported foods and the growing consumption of alcohol and cigarettes.

3.1.5 Commerce and business services

The goal for the commerce and business services of the Ministry of Labour, Commerce and Industries is to develop an environment within which growth of the productive and commercial sectors—particularly, growth of the export sectors—can be facilitated in order to sustain foreign exchange earnings, increase employment opportunities and expand the income base of the economy.

The Ministry of Labour, Commerce and Industries also has responsibilities in the areas of food standards and quality assurance for processed food products. It also coordinates with the Ministry of Health the mechanism to recall food products, which pose risks to public health.

4. National and Regional Food Security

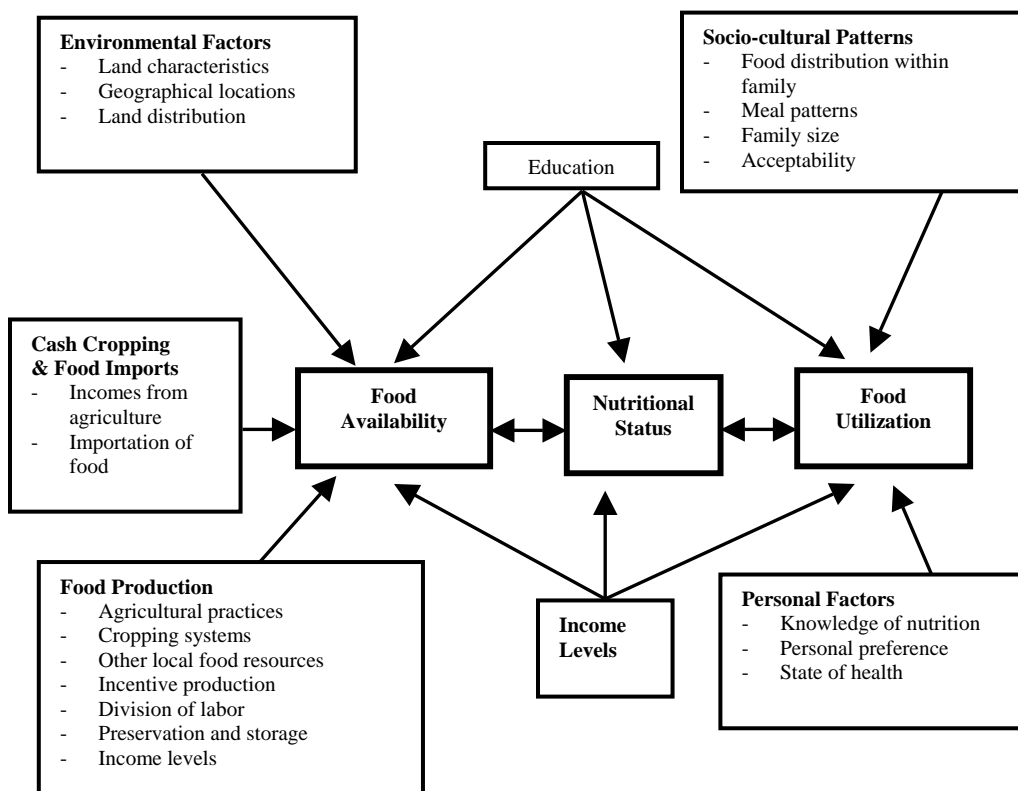
4.1 Description of national food systems

There are several factors that determine the kind and amount of food produced, accessed, and consumed by Tongans. Figure 4.1 shows that availability of enough good quality food is the first factor and the most important to impact on nutritional status of a community. Changing subsistence farmland to cash crops such as squash reduces available locally produced foods for family consumption.

4.1.1 Environmental factors

The most important environmental factors influencing the types and varieties of crops grown and the distribution of foods in Tonga are land characteristics (including climate), geographical location, and land distribution.

Figure 4.1 Food supply systems in Tonga.



4.1.1a Land characteristics

The most important land characteristics determining crop performance in Tonga are climate and soil types.

Chapter 4

Climate

A brief description of the climate of Tonga was given previously. However, in this section occurrences of droughts and cyclones will be discussed. Speremann (1987) reported that 14 droughts occurred between 1887 and 1987. At least three droughts have occurred since 1987, the last in 1998. Speremann's study concluded that beginning with the late 1970s the frequency of the droughts increased and the individual droughts became longer.

Tropical cyclones are experienced in Tonga mainly during the wet season from November to April. Between November 1939 and April 1985 there were 17 cyclones affecting the whole of Tonga, 41 affected only northern Tonga and 38 affected southern Tonga (Furness and Helu 1993). This worked out to an average of 1.3 cyclones per year. There had been at least 4 cyclones after the period reported by Furness and Helu.

Soils of Tonga

Most soils of Tonga have formed on fine-grained andesitic tephra which erupted from sources to the west and north (Figure 1.1), possibly Tofua and Kao, or from submarine volcanoes along the western side of the Tonga ridge (Orbell 1992; Cowie et al. 1991). The ash mantle is often quite deep, sometimes as deep as 10 m. It appears that there were two major periods of ash accumulation, but they were not necessarily everywhere contemporaneous. The older ash is about 20,000 years old and the younger ash has probably accumulated since about 5,000 to 10,000 years up to the present day as some volcanoes are still active (Cowie et al. 1991; Orbell 1992). Soils of the atolls/sand cays and coastal areas of larger raised coral islands formed on coralline sands are sandy in texture and present problems of much poorer fertility and much less available water.

Halavatau (1998) studied 22 major soils of Tonga and found that all soils were limiting in N, 19 in P, 3 in K and 6 in S. One soil was limiting in Mn and one in Zn and Fe. Zn deficiency seems to be quite widespread as observed in sweet potato in several areas in Vava'u, Ha'apai, and Tongatapu. Field experiments have also shown that sweet potato and taro responded significantly to applications of N and P on several of the study soils (Halavatau, 1998).

4.1.1b Geographical location

The location of the islands and villages on larger islands like Tongatapu and Vava'u has an impact on the availability of foods. The smaller islands of Ha'apai, Niuafo'ou, Niuatoputapu, and villages in coastal areas of Tongatapu and Vava'u have better access to seafoods, whereas villages in the central Tongatapu and Vava'u have poorer access to fish. The isolated islands of Ha'apai, on the other hand, have poor access to both processed foods and agricultural inputs that may be needed to improve food availability through increased production.

4.1.1c Land distribution

Access to land can improve food availability. Tonga, however, has very limited land left for distribution. A large percentage of arable land is owned by absentee landholders. People can access land by renting or leasing from landowners. This practice usually results in environmental degradation because many tenants try to get as much as possible out of the land during the leased or rented period.

In many parts of Tonga where the extended family is still the household unit, land use decisions are still made by the head of the extended family, the *'ulumotu'a*. This is one of the reasons why there is little involvement of youths of Tonga in agricultural activities.

Land use on town allotments is of particular importance in terms of household-grown food. Urban dwellers can grow some of their food needs in their residential areas (town allotments).

4.1.2 Food production

4.1.2a Agricultural practices

Availability of foods is affected by agricultural practices. The yield of a crop grown is a result of good land preparation, optimum fertilizer rates, the right variety selected, good pest and disease control, and good water management. Post-harvest handling and storage also affect what will be available after harvest.

4.1.2b Cropping systems

The amounts and types of foods produced and the seasonality of different foods, as well as yields obtained, strongly affect food availability and the nutritional status of people. Traditional food systems have a very wide range of plant types and many species and cultivars of root crops such as yams, taro, sweet potato and cassava. Different fruits, vegetables and root crops mature at different times, making sure that there is some food available at all times of the year.

4.1.2c Other local food resources

Traditionally when domesticated crops or animals are in short supply, foods from forest lands, edible weeds and a wide range of sea foods become more important. The wild food resources are becoming scarce due to the ever-increasing trend of deforestation. Conservation is necessary before they become extinct.

4.1.2d Incentives to production

Motivation to increase food production is often hindered by inadequate infrastructure. Inadequate marketing facilities, poor transportation and limited access to credit can have very negative effects on food availability. There has been a lot of progress in these areas in Tonga. Domestic markets are being built in main centers, farmers have more access to loans from banks, and many of the roads to the rural areas have been improved. Overemphasis on export crops like squash can also have negative effects on food availability.

4.1.2e Division of labour

In Tonga men do most of the agricultural work, although women are increasingly involved in activities such as planting, weeding, watering, pollination and harvest of vanilla, and harvest of other crops. Women do most of the post-harvest handling of export crops such as squash. In urban areas, they also do most of the work in the home gardens.

4.1.2f Preservation and storage

Poor food preservation and storage can often result in large food losses and deterioration in food quality. Methods of food preservation and storage include washing, cleaning, salting, fermenting, drying, sacking, and burying. Preservation of sea foods can be done by salting, drying or smoking. Preservation and storage ensure that the maximum amount of food produced will be made available for consumption. Post-harvest food losses to insects, rats, birds, fungi and spoilage can often approach as high as 30% if proper preservation and storage techniques are not used.

4.1.2g Income levels

Income level is important when it comes to food entitlement. Food can be available in the market, but if the households do not have enough income, then such households can become food insecure. Income is also important for many semi-subsistence growers if they are required to purchase production inputs. A large number of heads of households in Tonga are casual workers.

4.1.3 Cash cropping and food imports

4.1.3a Emphasis on incomes from agriculture

Agriculture has become a business today, emphasizing profits, with little emphasis given to the quality of the diets of people growing export crops. Many families grow new export crops like squash and have to buy their traditional crops or rely on imported foods, some of which are of poor quality.

4.1.3b Importation of foods

Tongans have become richer over the years but not without a cost. Many Tongans' diets now rely on imported foods such as highly refined flour and flour products, meat products (mutton flaps, turkey tails and fatty chicken pieces), and processed foods with salt and other additives. This increasing reliance on low-quality imported foods is associated with the increasing incidence of non-communicable diseases in Tonga.

4.1.4 Socio-cultural patterns

4.1.4a Food distribution within the family

Accessing the available food does not mean that everyone in the family is eating nutritious food. In many households, the head of the family gets the best food. If there is not enough food, then surely some members of the family are not getting enough good food.

4.1.4b Meal patterns

The quantities of food eaten by Tongans appear to be more than adequate, but the variety and frequency throughout the day is limited. This is a problem, particularly with children as food are utilized best by the body when meals are equally distributed throughout the day.

Many Tongans eat far more than required. The most important nutritional problems in Tonga are related to malnutrition caused by eating too much rather than undernutrition.

4.1.4c Family size

Generally, family size influences the amount of food consumed by individual members in the poorer sector of the population. In Tonga, this is true for families with household heads who do not own land and do not have secure jobs. Such families are unable to produce or purchase their food needs. Whatever the household can acquire is shared by the family and usually the mothers do not have enough as they are usually the last to eat.

4.1.4d Acceptability

Food preferences are sometimes determined by customs or religious beliefs. This may result in people having to abstain from eating some very nutritious foods. The Seventh Day Adventist Church does not allow their believers to eat pork and some traditional medicine forbids eating certain foods. Vegetables are also not eaten as much as they should be despite their abundance during specific seasons.

4.1.5 Personal factors

4.1.5a Knowledge of nutrition

Knowledge of nutrition is a major factor influencing food consumption, availability and nutritional status of a community, household or an individual. Some of the nutritional problems prevailing in Tonga such as high blood pressure and diabetes are associated with lack of nutrition knowledge of the patients.

4.1.5b Personal preference

Personal preference is another factor that influences the availability of food, and nutritional status of people. Colour and flavour influence the choice of food. Some people like fried food, boiled food in coconut milk, some like their food overcooked, and some prefer it undercooked or even raw.

4.1.5c State of health

A sick person cannot utilize food as well as a healthy person. Infections and fever often cause loss of appetite or create difficulty in metabolizing food. The sick, the convalescent and elderly all have special food needs due to their poor state of health. Pregnant and lactating mothers have higher food needs.

4.1.6 Eating habits and dietary patterns

In the past, traditional Tongan diets were considered to be remarkably healthy and nutritionally sound. All the foods eaten in Tonga were those provided by the earth and the sea—foods from the bush, garden, plantation, sea and raised animals. This type of diet contributed to the well being of the people who were healthy, fit and strong.

But as the wheel of development rolled along, changes took place amongst which were the changes in food consumption patterns. Diets started to contain an increasing proportion of nutritionally poor-quality imported foods. The changes in dietary patterns and eating habits resulted in the appearance of nutrition and dietary-related problems, the so-called non-communicable diseases (heart diseases, high blood pressure, hypertension, diabetes), which with time have become the most threatening causes of death amongst Tongans.

4.1.7 Nutrition and health institutions

Health is certainly the mandate of the Ministry of Health but nutrition is a cross-sectoral issue involving many organizations. At the national level there is the National Food and Nutrition Committee (NFNC), which is an interdepartmental committee advising government on nutritional policies and matters. The NFNC also coordinates the National Plan of Action for Nutrition (NPAN), which is a compilation of all nutrition activities carried out by ministries, departments, and NGOs.

4.2 Domestic food production

4.2.1 Resources

Tonga is endowed with rich natural resources, which its people need to utilize to meet their needs while at the same time maintaining the balance of the environment.

4.2.1a Land

All land in Tonga belongs to the Crown with four tenurial categories: hereditary estates of (i) the king, (ii) the Royal family, and (iii) the nobles and chiefs; with the fourth category (iv) as government land. Tax allotments are drawn only from categories (iii) and (iv), but land from any of the categories can be leased. The 1882 Act established the entitlement of each Tongan male over 16 years of age to both town allotment not exceeding 0.4 acre and a tax allotment not exceeding 8.25 acres.

Most of the arable and allocable land has been distributed and much of the remaining government land consists of lakes, marsh or mangrove swamps, cliffs, small islands with little or no water, and volcanic islands with little access.

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4.2.1b Forest resources

Only limited areas of indigenous forests remain in the Kingdom, primarily in very steep or otherwise inaccessible areas, in coastal littoral areas and swamps, or in mangrove swamps. The total area has been estimated at 4,000 ha, the bulk of which is found in 'Eua. Due to limited availability of land, mangrove areas in Tongatapu and Vava'u have been subdivided and some already cleared and filled to make home sites. This has resulted in a reduction in volumes of fish caught from these areas and also inadequate sewerages are severe health hazards due to the flooding of pit latrines and septic tanks.

A strong reforestation policy towards providing local timber needs and reducing overall loss of foreign exchange has resulted in over 300 ha of exotic trees being planted in 'Eua. A plan to commercialize the plantation is currently being discussed.

4.2.1c Marine resources

The coastal areas below high tide mark are crown property and the rights to all resources (sand, dead coral, marine life) are vested in the Crown. The reefs and lagoons are the prime fishery for subsistence supplies. In addition to fishing, a wide range of shellfish and other marine life is harvested from tidal flats at low tide for consumption or for production of shell handicrafts for sale to tourists.

There are also inshore pelagic zones, which vary in depth from about 70 m to more than 600 m at distances not exceeding 30 km from land. These zones are rich in small pelagic species of tuna, dolphin, mackerel, and sardines. Resources of this zone comprise the large tuna species of albacore, yellowfin, bigeye, and skipjack. Marlin and sailfish are also common.

4.2.1d Water resources

Water is vital to the life of the people of Tonga. People access water either as rainwater harvested in tanks, or from a thin lens of freshwater on a highly porous limestone substrate. Volcanic islands have small groundwater aquifers, and some freshwater lakes and springs. 'Eua island has ephemeral lakes and a spring along its eastern ridge in addition to its groundwater supplies which come from caves high above sea level. In Tongatapu, the groundwater potential is estimated at 5.1 million cubic metres per year of drinking water that can be pumped from a water lens lying on top of seawater. The lens is about 20m thick in the interior of the island.

4.2.1e Mineral resources

Tonga has no commercial mineral deposits. Sand and limestone quarries constitute the only minerals of commercial value. There are about 12 quarries in Tongatapu and 6 in Vava'u.

4.2.1f Energy resources

Tonga relies heavily on imported liquid fuel and liquefied petroleum gas to supply its energy requirements. Importation of petroleum accounts for about 35% to 45% of the total energy consumption. Fuelwood, and limited use of wind and solar energy, comprise the remainder. Fuelwood has become a rare commodity in Tongatapu with small bundles of firewood sold at very high prices of as much as T\$10 (T\$1 = US\$0.54).

4.2.2 Farming systems

The Tongan farming systems are complex and have proven to be robust and productive (World Bank 1990). They are fundamentally agroforestry systems utilizing bush or grass fallow followed after several years by a series of root crops intercropped with coconuts and other trees to create rotational, multistoreyed fallow systems (Kunzel 1989, World Bank 1990).

Halavatau and Asgher (1989) characterized cropping systems of Tonga in terms of the R-factor specified by Ruthenberg (1983) [$R = \text{cropping period} / (\text{cropping} + \text{fallow period} \times 100)$].

On this basis, the farming systems of Tonga could be divided into sedentary shifting cultivation systems ($R < 33\%$), fallow systems ($33 < R < 66\%$), and permanent cultivation systems ($R > 66\%$). Schroder et al. (1983) reported that a piece of cultivated land in Tonga should revert to fallow at a land utilization index (R-factor) of 37.5%. Plate 1 shows a traditional Tongan farming system.

Plate 1: A traditional multistoreyed agroforestry system.



4.2.2a Sedentary shifting cultivation

Shifting cultivation is the oldest form of cultivation and it is still practised in Tonga, especially in Niuafu'ou, Niuatoputapu, and some of the volcanic islands like Tofua, Kao, and Tafahi. It involves the selective cutting of trees, following which the sun-dried biomass is burnt to clear the area and return the nutrients to the soil. A series of root crops are sequentially and/or relay cropped (usually yam – taro – sweet potato – cassava) for several years before the land is abandoned to fallow. Taller crops such as kava, banana/plantain, giant taro, and paper mulberry are relayed into the system during periods of root crop rotation, resulting in a multistoreyed system.

The fallow period is usually longer than necessary, as indicated by an R-factor of below 33%. We prefer to call the system sedentary shifting cultivation because the farmers reside in one place and rotate fields.

4.2.2b Bush fallow systems

The major difference between shifting cultivation and bush fallow systems is in the length of the fallow. In a bush fallow system the fallow vegetation climaxes with grasses (*Panicum maxima* and *Sorghum halepense*) and shrubs such as *Sida rhombifolia*, *Stachytarpheta urticifolia*, and *Lantana camara*. The woody trees in bush fallow systems are usually coconuts and some trees that are selectively left because of their usefulness. Examples include breadfruit, mangoes, oranges, heilala (*Garcinia sessilis*), and koka (*Bischofia javanica*).

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The R-factors for bush fallow systems are between 33% and 66%. The cropping patterns in the fallow systems are similar to those in the shifting cultivation systems except that there is more use of mechanical land preparation in the bush fallow systems. Bush fallow systems are found in all islands of the Tonga group.

4.2.2c Other systems

Other systems have evolved because of the economic importance of the major crop or the best time for planting of a particular crop. Examples of systems evolved because of the economic importance of crops are: various vanilla systems, coffee under coconuts, and various kava systems. Examples of a system that evolved because of the time for planting of a crop are: the various vegetable systems, and the recently evolved European potato systems that precede or follow the usual crop rotations. These are semi-permanent agricultural systems, but are the same as the shifting and bush fallow systems in that they all rely on some fallow periods and/or external inputs of fertilizers (organic or inorganic) to regenerate soil fertility.

Various monocropping practices should be mentioned because of their importance to the national economy. They include squash pumpkin, vanilla, watermelon, kava, papaya, eggplant, and other vegetable systems. These systems are characterized by the heavy use of machinery, agricultural chemicals, and sometimes water. Plate 2 shows a commercial monocropping high-input taro plot.

Plate 2: A commercial monocropping plot of taro.



4.2.2d Livestock

Livestock are an integral part of all the above systems. They provide sources of protein for the households and are also used for cultural presentations and social obligations. Pigs and

chickens are left free ranging or penned. Goats, cows, and horses are either tethered or kept in paddocks.

4.2.2e Sustainability

Halavatau (1992) reported that the land management systems in the Kingdom of Tonga are the results of interacting sociological, environmental, technical, economic, and political issues. He highlighted (i) the importance of availability of land under secure title for investing in agricultural production; (ii) the fact that market forces determine where, when, and the volume of a crop that can be grown; (iii) the impacts of agricultural development on the environment; (iv) maintenance of soil fertility; and (v) the importance and the pressing need for appropriate land use policies and legislation.

Halavatau and Asgher (1989) reported the following features that ensure ecological stability in the indigenous cultivation systems:

- Resilience to variable weather conditions is achieved by phased planting (staggered planting). This assures that different age structures of the same crop exist on the same field, spreading the risk of damage due to adverse weather conditions.
- Resilience to pest, disease and weed infestations is achieved by multiple cropping, since crops differ in their susceptibility to these threats.
- Soil degradation can be minimized through practices such as limited ploughing (once per crop or per crop rotation), mulching (e.g. vanilla), leaving selected trees in the site, and maintaining ground cover through combinations of sequential and relay intercropping.
- Soil fertility is conserved through the recycling of organic matter such as weeds, crop and other residues, leaving residues *in situ*, and the use of fallow to regenerate fertility.
- Water is conserved by using mulch and maintaining ground cover.
- Multiple cropping also serves as protection against soil erosion.

4.2.2f Production

The data for domestic food production vary in accuracy and coverage of the whole country. Crop area and livestock data for some years were collected for each island group. Fisheries data were difficult to obtain, however, at both the national and regional level. Tables 4.2 to 4.4 give data on crop production, livestock population, and fish landings.

Table 4.1 Crop areas and production by island group for 1986.

| Crop | Tongatapu | | Vava'u | | Ha'apai | | 'Eua | | Niuas | | Total | |
|---------------|-----------|--------|--------|-------|---------|-------|-------|-------|-------|-------|--------|--------|
| | Acres | Tons | Acres | Tons | Acres | Tons | Acres | Tons | Acres | Tons | Acres | Tons |
| Yam | 5,050 | 6,060 | 1,636 | 1,963 | 754 | 905 | 829 | 995 | 259 | 311 | 8,528 | 10,234 |
| Colocasia | 1,114 | 1,501 | 102 | 137 | 27 | 36 | 149 | 201 | 83 | 111 | 1,475 | 1,987 |
| Xanthosoma | 5,090 | 6,617 | 841 | 1,093 | 554 | 720 | 773 | 1,005 | 80 | 104 | 7,338 | 9,539 |
| Sweet potato | 462 | 835 | 17 | 31 | 67 | 121 | 49 | 88 | 2 | 4 | 597 | 1,079 |
| Cassava | 6,894 | 17,235 | 1,522 | 3,805 | 1,616 | 4,040 | 413 | 1,032 | 163 | 407 | 10,608 | 26,519 |
| Alocasia | 3,148 | 5,666 | 2,442 | 4,395 | 668 | 1,202 | 643 | 1,157 | 555 | 999 | 7,456 | 13,419 |
| Musa family | 2,340 | 9,584 | 341 | 1,397 | 387 | 1,585 | 234 | 958 | 93 | 381 | 3,395 | 13,905 |
| Total | 24,098 | 47,498 | 6,901 | 1,282 | 3,723 | 8,609 | 3,090 | 5,436 | 1,235 | 2,317 | 39,397 | 76,682 |
| Capita/year | 0.34 | 0.744 | 0.45 | 0.845 | 0.42 | 0.965 | 0.70 | 1.24 | 0.52 | 0.978 | 0.42 | 0.810 |
| Kg/capita/day | - | 2.04 | - | 2.31 | - | 2.64 | - | 3.39 | - | 2.68 | - | 2.22 |

Table 4.2 Crop areas and production by island group for 1996.

| Crop | Tongatapu | | Vava'u | | Ha'apai | | 'Eua | | Niuas | | Total | |
|--------------|-----------|--------|--------|--------|---------|--------|-------|-------|-------|-------|--------|--------|
| | Acres | Tons | Acres | Tons | Acres | Tons | Acres | Tons | Acres | Tons | Acres | Tons |
| Yam | 2,768 | 6,090 | 1,600 | 3,520 | 505 | 1,111 | 589 | 1,295 | 75 | 165 | 5,537 | 12,181 |
| Colocasia | 665 | 1,995 | 100 | 300 | 20 | 81 | 123 | 369 | 31 | 93 | 939 | 2,838 |
| Xanthosoma | 1,153 | 7,495 | 840 | 4,200 | 550 | 2,216 | 677 | 2,001 | 9 | 54 | 3,229 | 15,966 |
| Sweet potato | 1,684 | 4,210 | 17 | 43 | 67 | 167 | 681 | 1,702 | 18 | 45 | 2,467 | 6,167 |
| Cassava | 2,237 | 17,896 | 1,500 | 7,500 | 1,600 | 6,400 | 226 | 1,356 | 27 | 105 | 5,590 | 33,257 |
| Alocasia | 400 | 2,800 | 2,400 | 7,200 | 600 | 2,400 | 27 | 189 | 15 | 105 | 3,442 | 12,694 |
| Musa family | 584 | 3,000 | 340 | 2,000 | 380 | 2,280 | 353 | 2,110 | 100 | 600 | 1,757 | 9,980 |
| Total | 9,491 | 43,486 | 6,797 | 24,763 | 3,722 | 15,175 | 2,676 | 9,002 | 275 | 1,167 | 22,958 | 93,083 |
| Capita/year | 0.14 | 0.649 | 0.43 | 1.57 | 0.46 | 1.86 | 0.54 | 1.83 | 0.17 | 0.578 | 0.23 | 0.952 |

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| | | | | | | | | | | | | |
|---------------|---|------|---|------|---|------|---|------|---|------|---|------|
| Kg/capita/day | - | 1.78 | - | 4.30 | - | 50.9 | - | 5.01 | - | 1.58 | - | 2.61 |
|---------------|---|------|---|------|---|------|---|------|---|------|---|------|

Tables 4.1 and 4.2 show that, in most years, there is enough staple root crop production to provide the energy requirements of Tongans unless there is a cyclone or drought. The yield estimations took into consideration the waste, amounts sent overseas and the amounts used for seed. The decline in production for Tongatapu and Niuaus in 1996 compared with 1986 can be attributed to an error in the estimation of the cropped areas during the crop surveys. For Tongatapu, the decline in area of root crops can also be seen as the effect of the production of export crops like squash. The crop surveys were conducted towards the end of the squash season (before December), at the time when many squash growers had not planted their staple root crops. It should be noted that the 1986 data were taken from the report of the 1985 Agricultural Census. The coverage of the census was more accurate than the annual crop and livestock surveys by MAF as it was designed to avoid the problem of estimation of area of components of mixed cropping.

Table 4.3 gives the number of livestock by type and by island group. The data show that there are enough domestic livestock animals in Tonga. Animals such as cattle and pigs are slaughtered mainly for social events (weddings, birthdays, and funerals) and religious functions. In a week of church conferences, 250 to 500 piglets can be slaughtered in a day. Such mass slaughtering has impacts on food availability.

Table 4.3 Number of livestock animals by type and by island groups.

| Livestock | Tongatapu | | Vava'u | | Ha'apai | | 'Eua | | Niuaus | |
|-----------|-----------|--------|--------|--------|---------|-------|--------|--------|--------|-------|
| | 1986 | 1999 | 1986 | 1999 | 1986 | 1999 | 1986 | 1999 | 1986 | 1999 |
| Cattle | 6,083 | 3,927 | 1,533 | 1,680 | 374 | 638 | 1,274 | 856 | 54 | 91 |
| Pigs | 49,387 | 12,706 | 13,715 | 9,071 | 8,341 | 7,200 | 494 | 6,404 | 4,416 | 3,819 |
| Horses | 5,148 | 800 | 2,587 | 323 | 1,387 | 433 | 986 | 535 | 467 | 309 |
| Goats | 7,061 | 1,868 | 2,942 | 224 | 2,421 | 350 | 900 | 112 | 615 | 146 |
| Chickens | 170,817 | 34,500 | 42,193 | 14,270 | 31,339 | 4,233 | 10,508 | 13,127 | 11,254 | 8,470 |

The decline in livestock numbers in 1999 can also be attributed to underestimation of the different livestock populations.

There are no available statistics on fish and shellfish landings for the whole of Tonga or by island group. Table 4.4, however, shows the fish and shellfish landings at two sampling sites in Tongatapu. The difference in catch between the years is partly due to the number of days of bad weather and missing days in which fishermen did not go to sea.

Table 4.4 Fish and shellfish landings at Fua and Vuna wharf in Tongatapu.

| | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 |
|---------------------------|------|------|------|------|------|------|
| Fish landing (tons) | 165 | 318 | 170 | 78 | 137 | 190 |
| Shell fish landing (tons) | 100 | 75 | 47 | 45 | - | - |

Tropical cyclones, droughts and disease outbreaks are the major threats to agriculture and food production. On average, Tonga is hit by a tropical cyclone every four years. Recovery from the aftermath of a cyclone is usually quite rapid, and food production can return to the pre-cyclone level within six months. It is when two cyclones hit the country in consecutive years that agriculture and food production takes longer to recover and can be compounded by disease outbreaks such as anthracnose in yams. Droughts have a longer-term impact on agriculture and food production than cyclones due to impacts on the supply of planting materials as well as production. There are also instances when a cyclone follows a drought as in the case of Cyclone Cora in December 1998, causing severe damage to the remaining crops after the drought. The damages to agriculture caused by Cyclone Cora were estimated at US\$10 million.

The supply of domestic food items in the local markets can be used as an indication of the vulnerability of production. Figures 4.2 and 4.3 show that the fluctuations in supply of crops

to the market are related to the effects of the prolonged drought followed by Cyclone Cora in 1998. Figure 4.2 clearly shows a sharp drop in supply of the three selected crops of Xanthosoma taro, yam and cassava in 1998 because of the prolonged drought. Because of the good weather in the aftermath of the cyclone, there was a quick recovery in production and supply to the market in 1999.

Figure 4.2 Supply of crops at Talamahu market, 1990-1999.

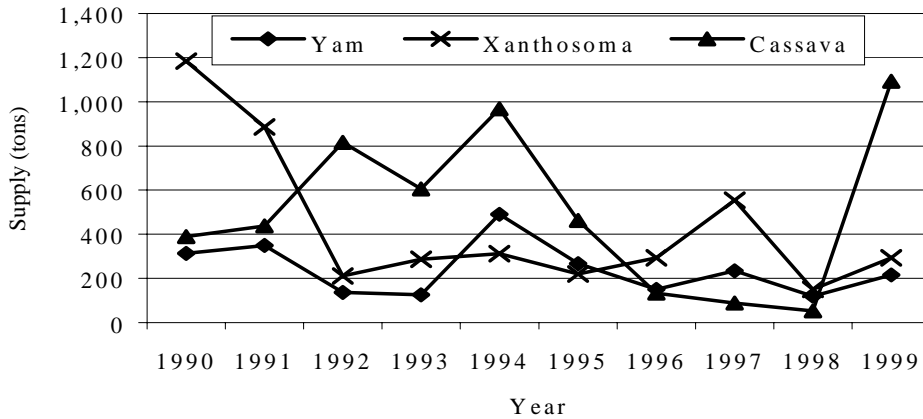
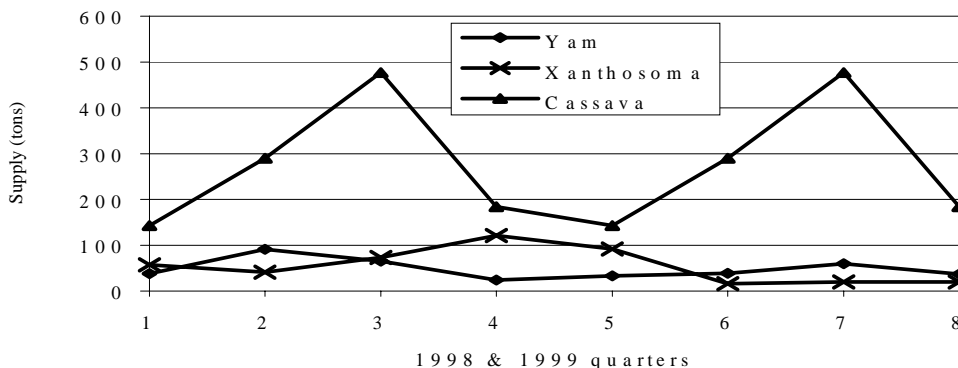


Figure 4.3, however, shows that the supplies of the three root crops were lowest between the last quarter of 1998 and the second quarter of 1999, laying support for the theory that the declines in supplies of these crops were caused by the combined impacts of a drought and a cyclone. The supply of cassava declined after the third quarter of 1998 probably because of the effect of the drought, but it could have been because most of the standing cassava plants were unproductive. The supply of cassava picked up after the first quarter of 1999 because of the availability of matured cassava (some were immature when the supply declined). Supplies to the market of Xanthosoma taro, on the other hand, continued until the first quarter of 1999 and then declined. This indicates that matured Xanthosoma was still available for sale and the effects of the drought and cyclone was only felt after the first quarter of 1999. The normal yam supply peaks in the second to third quarters of every year and then the supply starts declining. Figure 4.3 shows that yam supply did pick up as in the normal years, but the magnitude was lower indicating the impacts of the 1998 drought and cyclone.

Figure 4.3 Quarterly supply of crops to Talamahu market in 1998 and 1999.



4.3 Roles of agricultural trade in the economy

4.3.1 Structure of the economy

Agricultural production is still the predominant activity in the economy of Tonga and continues to dominate the value-added contribution to GDP. The contribution was more than 40% in the 1980s, but it fell below 40% from 1993/94 to the present.

The percentages each sector contributed to GDP during the six-year period from 1993/94 to 1998/99 are depicted in Table 4.5. The contribution of agriculture to GDP has fallen from a peak for the study period of 34% achieved in 1994/95. The services sector, on the other hand, recorded increases in its contribution to the level of GDP indicating a gradual diversification from the agricultural sector to the services sector. This gradual diversification from a heavy reliance on one sector will assist in diversifying and broadening the economic base in order to strengthen the economy against future exogenous shocks. Moreover, with services, the problems associated with isolation, weather and economies of scale are mitigated.

Table 4.5 Annual share of GDP at constant prices, by sector.

| Sector | 1993/94 | 1994/95 | 1995/96 | 1996/97 | 1997/98 | 1998/99 |
|--|---------|---------|---------|---------|---------|---------|
| | % | % | % | % | % | % |
| Agriculture, forestry, and fishery | 32.2 | 34.0 | 32.0 | 31.5 | 30.8 | 29.9 |
| Mining and quarrying | 0.3 | 0.5 | 0.4 | 0.4 | 0.4 | 0.4 |
| Manufacturing | 3.2 | 2.7 | 3.1 | 3.2 | 2.9 | 3.2 |
| Electricity and water | 1.7 | 1.7 | 1.8 | 1.8 | 1.8 | 1.8 |
| Construction | 5.6 | 5.6 | 6.0 | 5.2 | 4.9 | 5.3 |
| Commerce, hotel, and restaurants | 11.7 | 10.8 | 10.5 | 10.1 | 10.8 | 11.0 |
| Transport and communications | 6.1 | 6.0 | 6.3 | 6.5 | 6.7 | 6.9 |
| Finance and business services | 5.4 | 5.4 | 5.3 | 5.5 | 5.9 | 6.1 |
| Government administration and community services | 14.6 | 14.6 | 15.6 | 16.5 | 16.5 | 16.2 |
| Ownership of dwellings | 3.0 | 2.8 | 2.9 | 3.0 | 3.0 | 2.9 |
| Entertainment, recreation and personal service | 4.0 | 3.8 | 4.0 | 4.2 | 4.2 | 4.2 |

Source: Statistics Department, 1999.

4.3.2 Agriculture

The contribution of traditional farming systems to the economy of Tonga should be judged on the foreign exchange earnings from export and also from the food supply in the local markets. The contribution from export can be seen from the volumes of produce/products exported over the past few years (1991 to 1997) and the foreign currency earned from the exports in 1997 (Tables 4.6 and 4.7). It is quite clear from Table 4.6 that the export volumes of traditional crops are quite high, but more market research and involvement of exporters are required. Table 4.7 shows that a large percentage of agricultural export earnings (about 50%) comes from the export of traditional crops. However, squash, vanilla, and recently kava are the main foreign currency earners.

Table 4.6 Volumes of agricultural exports for 1992 to 1997.

| Produce/ Product | 1992 (tons) | 1993 (tons) | 1994 (tons) | 1995 (tons) | 1996 (tons) | 1997 (tons) |
|------------------|----------------|----------------|----------------|----------------|----------------|----------------|
| Xanthosoma | 56 | 90 | 77 | 927 | 219 | 186 |
| Colocasia | 16 | 46 | 111 | 50 | 551 | 131 |
| Giant taro | 39 | 61 | 59 | 116 | 147 | 65 |
| Cassava | 1,065 | 1,768 | 867 | 372 | 814 | 598 |
| Yam | 31 | 68 | 193 | 744 | 551 | 620 |
| Gr. coconuts | - | 215 | 54 | 24 | 40 | 34 |
| Br. coconuts | - | 755 | 262 | 468 | 855 | 847 |
| Copra | - | 0 | 0 | 0 | 101 | 783 |
| Kava | - | - | - | - | 127 | 132 |
| Taro leaves | - | - | - | - | 16 | 28 |
| Squash | 10,460 | 17,564 | 17,248 | 8,403 | 12,956 | 11,844 |
| Watermelon | 127 | 133 | 90 | 215 | 212 | 67 |
| Vanilla | 37 | 45 | 33 | 53 | 15 | 12 |
| Sandal wood | 15 | 33 | 189 | 113 | 35 | 40 |

Source: MAF Quarantine, 1998.

Table 4.7 Estimated values of agricultural exports, 1997.

| Produce/ Product | Volume (kg) | Price (T\$/kg) | Value (T\$) |
|---------------------|----------------|-------------------|----------------|
| Xanthosoma | 186,140 | 0.75 | 139,605 |
| Colocasia | 131,282 | 1.00 | 131,282 |
| Giant taro | 64,949 | 0.50 | 32,474 |
| Cassava | 597,992 | 0.50 | 298,996 |
| Mixed root crops | 1,030,061 | 0.70 | 721,043 |
| Yam | 619,799 | 1.00 | 619,799 |
| Brown coconuts | 847,508 | 0.22 | 186,452 |
| Green coconuts | 33,580 | 0.50 | 16,790 |
| Copra | 783,004 | 0.30 | 234,901 |
| Kava | 131,511 | 18.00 | 2,367,194 |
| Taro leaves | 28,432 | 3.50 | 99,511 |
| Squash | 11,874,800 | 0.50 | 5,937,400 |
| Watermelon | 66,681 | 0.50 | 234,901 |
| Sandalwood | 40,000 | 6.00 | 240,000 |
| Tomatoes | 69 | 2.00 | 138 |
| Carrots | 40 | 1.00 | 40 |
| Lettuce | 55 | 2.00 | 110 |
| Cabbage | 72 | 1.50 | 108 |
| Mixed vegetables | 13 | 1.50 | 19 |
| Ginger | 204 | 2.50 | 510 |
| Plantain | 98 | 2.50 | 245 |
| Pineapple | 408 | 2.00 | 815 |
| Tongan medicine | 2,380 | 10.00 | 23,799 |
| Handicrafts | 2,429 | 15.00 | 36,435 |
| Total | | | 11,706,682 |

Source: Quarantine and Quality Management Division, 1998.

4.3.3 Food imports

The volume and value of food imports have been a concern in Tonga for many years. The value of food imports is currently over T\$20 million per annum (Statistics Department 1999b) and in 1999 accounted for more than the total value of exports. Meat accounts for most of the food imports followed by cereal products, dairy products, and sugar and confectionery.

The ratio of the value of agricultural exports to the value of food imports is probably the most useful indicator of Tongan agricultural performance over time. The ratio had declined from 0.5 in 1986 (Hardaker et al. 1988) to 0.27 in 1988 (Figure 4.4) but picked up after that to peak at 0.86 in 1993. Thereafter, it declined to a low of 0.23 in 1998 before picking up again to 0.45 in 1999. The recovery of the ratio after 1987 can be explained by the introduction of squash pumpkin to the economy. After 1989, squash became the major export for Tonga with an increasing contribution to the economy. The low ratio in 1998 was caused by the poor squash crop because of the drought and the very low contribution by vanilla to the export economy in that year. Kava export was second to squash pumpkin in 1998, contributing over T\$2 million. Figure 4.5, which shows the proportion of food imports to GDP, displays the opposite trend to the proportion of agricultural exports to food imports in Figure 4.4. The years in which the economy was doing well had lower ratios.

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Figure 4.4 Agricultural performance in Tonga,
Figure 4.4 Agricultural

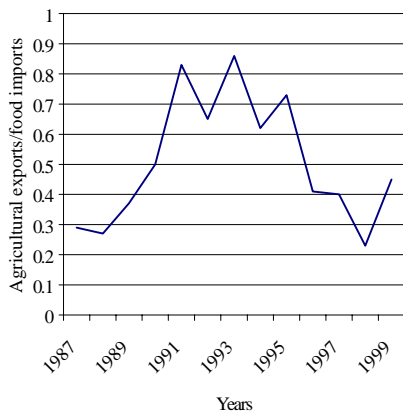
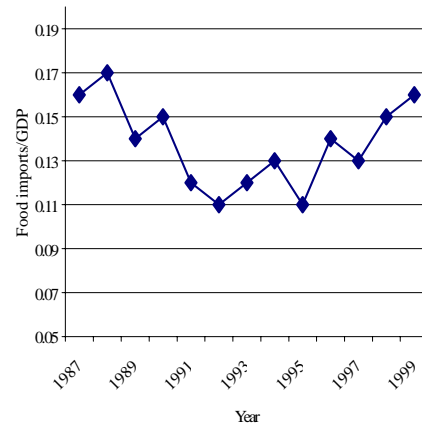


Figure 4.5 Agricultural performance in Tonga.



4.3.4 Transfers

The government rarely implements transfer payments to the food-insecure sector of the population. Food aid is sometimes distributed after severe cyclones or during droughts to the worst hit areas. But in terms of government intervention to increase the long-term purchasing power of any poor or affected sector, there has been very little in the way of either explicit or implicit transfer payments exercised by the Government.

The other area of transfer that is very important for Tongans is private transfer in the form of foreign remittances. Remittances have helped households cover much of their household expenditure. Annual remittances run into millions of dollars.

4.4 Food marketing and distribution

The marketing chain for local foods is quite well established in Tonga as a whole. Tongatapu has two market centres and all other island groups have one market centre each except Ha'apai, which has none. The markets in Tongatapu and Vava'u operate every day, whereas the markets in the other islands operate only on the weekends. Apart from these markets, people put up their own stalls on the roadsides and sell agricultural produce.

The price of locally available agricultural produce is not regulated. This means that farmers can put up prices to whatever level the market will bear. Extremely high prices usually happen after a natural disaster or when produce is sold out of season. The prices are sometimes beyond the buying capacity of low- to medium-income earners.

The contribution of the supply of local food in the domestic market in Tongatapu to the economy of Tonga is shown in Table 4.8. Substantial amounts of cash revolve around the country through domestic marketing of produce from traditional farming systems. Much of the produce from traditional farming systems is sold in stalls out in the villages, which the figures in Table 4.8 do not account for. It is therefore an underestimation to say that traditional crops do not contribute much to the economy.

Table 4.8 Total supply and value of food sold in the local market in Tongatapu.

| Crop | Supply (tons) | | | Value (T\$) | | |
|---------------------|---------------|-------|-------|-------------|-----------|-----------|
| | 1996 | 1997 | 1998 | 1996 | 1997 | 1998 |
| Banana/ Plantain | 1,077 | 446 | 224 | 495,420 | 240,840 | 192,640 |
| Fruits | 1,660 | 1,774 | 1,023 | 1,311,400 | 1,667,560 | 961,620 |
| Vegetables | 585 | 707 | 321 | 549,900 | 664,580 | 301,740 |
| Kava | 0 | 2 | 1 | 482 | 18,417 | 12,413 |
| Yams | 369 | 519 | 187 | 560,880 | 820,020 | 387,090 |
| Giant taro | 97 | 259 | 93 | 51,410 | 142,450 | 87,420 |
| Xanthosoma | 294 | 554 | 151 | 152,880 | 321,320 | 113,250 |
| Colocasia | 67 | 76 | 43 | 48,910 | 63,460 | 47,085 |
| Sweet potato | 400 | 492 | 582 | 192,000 | 246,000 | 419,040 |
| Cassava | 721 | 792 | 561 | 173,040 | 221,760 | 241,230 |
| Potato | 14 | 30 | 16 | 17,220 | 37,200 | 23,200 |
| Total | 5,284 | 5,651 | 3,202 | 3,553,542 | 4,443,607 | 2,786,728 |

Source: Policy and Planning Division, MAF, 1998.

It is very important that the economic incentives from food production do not overshadow the need to produce on a sustainable basis. To achieve this, the approach must integrate the efforts of experts in sociological, economic, technical (agronomy, ecology, food technology, etc.), environmental, and political issues.

It is also interesting to compare the prices of local foods and their equivalent imported counterparts. Table 4.9 gives some of the local foods and their counterpart imported equivalents and their prices.

Table 4.9 Comparison of the prices of local and imported foods.

| Food Item | Energy | | Food Item | Protein | |
|----------------|--------|---------------|--------------|---------|----------------|
| | T\$/kg | T\$/1000 kcal | | T\$/kg | T\$/kg protein |
| Taro | 1.10 | 1.22 | Beef rump | 8.00 | 24.26 |
| Yam | 2.00 | 2.50 | Mutton flaps | 3.45 | 15.40 |
| Cassava | 0.41 | 0.30 | Corned beef | 8.20 | 56.55 |
| Rice | 1.50 | 1.22 | Fish | 4.00 | 17.24 |
| Cabin biscuits | 3.40 | 1.03 | Octopus | 3.00 | 17.34 |

The prices in Table 4.9 show that imported foods are as cheap as the local food and most times are more easily attainable. Even though mutton flaps may be inferior to fish, many will buy them because they are readily available. Cassava is the cheapest source of energy but it is also nutritionally the poorest.

4.5 Food availability and utilization

Food availability and consumption in Tonga have increased over the past 17 years (see also Tables 4.1 and 4.2). The average per capita food availability has grown from 3,200 kcal per day in 1983 to 4,053 kcal per day in 1999 (Table 4.10). Increased domestic production is not solely responsible for the increased food availability; regrettably, it is also because of high levels of food importation.

Table 4.10 Nutrient availability.

| Year | Nutrient | | | Crop production | | | Animal production | | |
|------|---------------|-------------|---------|-----------------|-------------|---------|-------------------|-------------|---------|
| | Energy (kcal) | Protein (g) | Fat (g) | Energy (%) | Protein (%) | Fat (%) | Energy (%) | Protein (%) | Fat (%) |
| 1983 | 3,200 | 67.3 | 105.8 | 83.0 | 55.6 | 58.0 | 17.0 | 44.4 | 42.0 |
| 1986 | 3,394 | 93.0 | 46.0 | 83.9 | 37.0 | 12.7 | 16.1 | 63.0 | 87.3 |
| 1999 | 4,053 | 108.0 | 73.2 | 79.6 | 43.6 | 9.2 | 20.4 | 56.4 | 90.8 |

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It is interesting to note that, in 1983, the protein availability was more from crop/plant origin than from animal origin. At the national level, nutrient availability is more than adequate. If food adequacy indices for energy and protein were worked out, they would both come to over 100%. That is, the recommended daily intakes of energy and protein are both below the national average for Tonga.

It is also interesting to note that the per capita root crop output per day for the various island groups of Tonga (Tables 4.1 and 4.2) ranged from 1.58 kg to 5.01 kg. These crops account for a large percentage of the daily energy requirements along with other sources eaten every day like bread.

4.6 Risk coping systems

Improving food security has three dimensions: to ensure a sufficient food supply both at the national level/regional level and at the household level; to have a reasonable degree of stability in supply of food both from one year to the next and throughout the year; and to ensure that each household has the ability to produce or procure food that it needs. The following are areas where some efforts have been taken to achieve food security in Tonga.

- *Overall development strategy and macro-economic policies.* It has been the objective of the Government in its past development programs to promote economic growth with equity (Central Planning Department 1981, 1987, 1991). Economic policies have contributed to the sustainability of food security programs in the long run.
- *Increasing food and agricultural production.* Policies and strategies have been in place to increase and stabilize food and agricultural production of the population. They include programs that enhance productivity such as improving access to inputs, credit and other agricultural services and to markets through improved infrastructure. Strengthening community participation in food and agricultural production, especially by women, has been a major effort to date.
- *Improving access to land.* It is a fact of life that a large proportion of Tongan males are landless. However, a large portion of arable, agricultural land is lying idle due to owners not cultivating it or having left the country. The government has introduced lease legislation allowing more flexibility for farmers to lease land on mutual agreements with landholders. This has opened up more land for more farmers for increasing food and agricultural production.
- *Improving emergency preparedness planning.* Natural disasters such as droughts and cyclones lead to food insecurity in the short run. Establishing an effective early-warning system and a pre-determined contingency plan of action will strengthen the capacity to cope with emergencies. The Ministry of Works is mandated with this role and is now coordinating all government bodies and private sector participation in disaster preparedness.
- *Food aid.* Food aid can play a very important role in improving household food security during emergencies. This has been done in times of crisis only as a backstop while farmers recover and replant their plantations.
- *Strengthening the coping mechanisms of households to meet with emergencies.* Government has responded in time of crisis by providing households with seeds for growing short-term crops, livestock feed, water, and food aid.
- *Proper use of soil.* The soil is the main medium of food and agricultural production. Its proper, sustainable use is paramount to sustaining food security. To this end some categorization has been made to ensure proper utilization, namely (i) areas which can sustain intensive cropping and high levels of population and consumption; (ii) areas where agricultural intensification should be avoided; and (iii) restoration areas, where land has lost its productivity and must be left undisturbed to allow natural recovery

processes to occur. A start has been made in Tonga declaring certain areas as national and forest reserves. Policies are needed to put this land categorization into practice.

- *Water management.* Wise use of water is now being looked at. Where and when water is scarce, supplementary irrigation should be employed to sustain production. Irrigation policies are now being developed.
- *Chemical awareness programs.* The present agricultural export crops and some of the food crops demand use of pesticides and fertilizers. Their potential drawbacks have raised concerns from the public, including (i) the runoff of N and P from excess use of fertilizers that damages water resources; (ii) pesticides contaminating groundwater and surface water; (iii) health risks of chemical use to people; (iv) chemicals travelling through the food chain; (v) off-site effects of chemicals on fish in the ocean; and (vi) chemical contamination of fresh produce and pesticide residues in food.
- *Technology transfer.* Sound crop protection techniques are traditionally generated in research stations and then transferred to farmers through extension systems. On-farm trials are also practised where farmers are involved in the problem diagnosis, and project planning and implementation. This will ensure sustainable production and a high degree of adoption since farmers feel that they own the project.
- *Promoting healthy diets and lifestyles.* Promoting better eating habits and positive health behaviour is one of the most challenging tasks in overall efforts to improve nutrition. In addition to access to a variety of safe and affordable foods, people need accurate information on what constitutes a healthy diet and how they may best meet nutritional needs. Besides education, strategies to promote healthy diets must include providing motivation and creating opportunities for people to change behaviour recognizing individual preferences, lifestyles and often time constraints. The King of Tonga has played an important part as a role model in these respects.

5. Household and Individual Food Security

Ensuring household food security is a necessary condition for improving nutritional status, but by itself it is not sufficient. The nutritional status of each member of the household depends on three conditions being met: the food available to the household must be shared according to individual needs; the food must be of sufficient variety, quality and safety; and each family member must have good health status in order to benefit nutritionally from the food consumed. Figure 5.1 shows the different mechanisms involved in household food security in Tonga.

5.1 Food availability

Food availability in the households can be from either own food production or purchases from the market. Most Tongan households are involved in agricultural activities for export and/or domestic consumption. More than 50% of Tongans aged 15 years and above were stated as economically active in the 1996 Population Census (Statistics Department 1999a). All Tongans have access to food whether it be from own farm production or from markets. The question is, if they do not produce their own food, do they have enough cash to purchase their food needs. Many of those in the work force (government or private sector) are paid about T\$50 to T\$70 per week. Unless these families grow at least some of their own food or receive remittances from overseas, they will be struggling to meet their household needs.

There are four main factors that influence food production for home consumption that are now briefly outlined.

5.1.1 Access to land

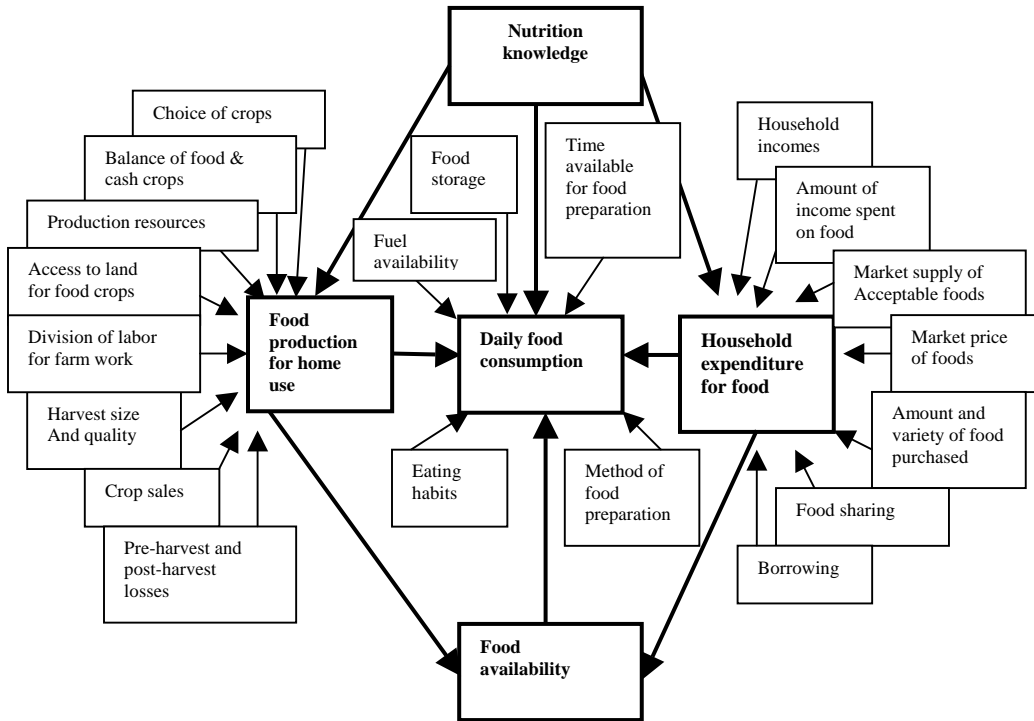
First, there has to be land available for farming. Many people do not have access to farmlands and hence they grow part of their food needs at their town allotments. Others, who can afford to, rent or lease land. On average, the farm size is about 8.25 acres.

5.1.2 Choice of crops and production resources

Once a piece of land is accessed, the next thing is to prepare the land and choose which crops to grow. The farmer has to command certain resources in order to be able to farm. He has to have capital to pay for inputs such as tractor time for land preparation, planting materials, fertilizers, pesticides, and sometimes water if there is a drought. The choice of crops may be determined by an income-generating opportunity, and in that case, the grower has to balance the production of cash crops with the production of food crops for household food security. Some of the export crops such as squash, vanilla, and kava do not provide food for the households although they provide cash for purchasing food. Of course, squash is edible but it still has to find its way into the diets of Tongans.

Coupled with the choice of crops, farmers need to employ the best package of practices in order to produce the best crops. This requires their improved knowledge in the areas of crop management. The farmer has to know when to plant a crop, the optimum rates of fertilizers, the right rates and time to apply pesticides, the right protective gear, when to harvest, and proper post-harvest handling and storage of the produce.

Figure 5.1 Food security mechanisms in Tongan households.



5.1.3 Division of labour

Household labour is very important in crop production, especially since the cost of labour in Tonga is probably the most expensive in the South Pacific region. Labour cost ranges from T\$2.50 to T\$5.00 per hour. Commercial farming in Tonga has seen greater involvement of women, who were hardly ever seen working on farmlands a few decades ago. Women help in planting crops, pollinating vanilla, harvesting crops such as squash and vanilla, post-harvest handling of squash, and selling produce at the markets. These tasks are performed in addition to doing the cooking and other household tasks. This division of labour has seen the cost of production minimized and incomes and harvested food from farms maximized.

5.1.4 Harvest and losses

The crop harvest obtained depends on the level of management farmers give to the crops. If good management is carried out, then a good harvest will be realized. Pre-harvest loss is minimized by employing good weed-, pest- and disease-control methods and avoiding animal damage, especially by free-ranging pigs. Post-harvest losses are minimized if good seed establishment is achieved and by proper harvest and post-harvest handling. This is because poorly established crops tend not to keep well after harvest.

5.2 Food entitlement

Food entitlement is the capability of the household to command sufficient food at all times, either through home production or market purchases. Most farming households, especially from rural areas, produce their own food for consumption. The other dimension of food entitlement is household incomes. Most households not farming earn cash wages or salaries.

5.2.1 Household incomes

A comparison of household incomes in urban Nuku'alofa, rural Tongatapu and the outer islands reveals the following:

- Most households in the outer islands—such as the outlying islands of Ha'apai, Niuatoputapu, and Niuafu'ou—do not have much cash in hand.
- Most households in rural Tongatapu earn from their farm but also have other incomes like labour wages from working groups in the villages (toungeae), selling handicrafts, or wages from jobs in Nuku'alofa. Other sources of incomes for coastal rural areas and the outlying islands of Ha'apai are fishing and handicrafts.
- A large percentage of households, whether in urban Nuku'alofa, rural Tongatapu or the outer islands, still receive money through foreign remittances. There was a notion that there has been a decline in foreign remittances, but it appears to be still very much alive.

5.2.2 Expenditure patterns

The main expenditures by households irrespective of whether from urban, rural, or outer island communities are on food items. In urban Nuku'alofa, most households purchase most of their food needs. In rural areas, a large percentage of the food for the households is from their own production, whereas households in the outer islands provide their own staples but purchase some of their protein requirements as tinned fish and corned beef. Second to purchasing food in expenditures for households in urban Nuku'alofa and rural areas is paying bills for utilities (electricity, water, and telecommunications). Many rural households and some from urban Nuku'alofa buy a substantial amount of productive inputs.

Expenditures are usually more than incomes for average households. But households can balance their budgets thanks to remittances from relatives overseas.

There are three other mechanisms that many households resort to in order to acquire food: (i) borrowing money from relatives or friends in time of need; (ii) food sharing with relatives and close friends; and (iii) a large proportion of households in Tonga have credit in retail shops in the villages. Having credit ensures that the household commands foods (mostly imported) all the time.

5.3 Food utilization

The true traditional diets of local foods are only found in the outer islands, basically because people in these locations do not have easy access to imported foods and bread/butter/sugar and soft drink types of meals. Results of a study on the availability and consumption of food/drinks/snacks by primary school children in Tonga by Halavatau (1999) give a good indication of how Tongans' dietary patterns have deviated from the traditional diets.

The study found that about 60% of children in Tongatapu had bread, butter, and sugar drinks for breakfast, with children from Central District (urban area) consuming more of these foods. Only 8% of the students had Tongan staples for breakfast. The study also found that most students go home for lunch and more than half of them (52%) had mostly bread, butter, and soft drinks with high sugar content for lunch. There were 15% of the students who had local staples for lunch, almost double the number who had staples for breakfast. About 23% of students carry cash to school and spend it on lollies, sugar snacks, and bread-type foods. For dinner, about 80% of students had Tongan staples but still some (about 14%) had bread for dinner. About 60% of the students had imported protein for dinner and only 27% had local protein.

The students covered in the study were from all walks of life. What is important in diets of Tongans is that your economic status does not much influence what you eat. On the whole, most people eat the same kind of foods for breakfast and lunch. The fact that most low-income households have credit in retail shops means they can also access foods that high-income

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households access. However, this mechanism of taking goods on credit renders many families in debt, even for life. The dietary patterns shown by this study are true for the other bigger islands like 'Eua, Vava'u, and the bigger and more accessible islands of Ha'apai.

It is also important to note that there are households that do not have adequate foods at times to meet the dietary needs of individuals. But this happens sometimes only and not consistently.

Halavatau (1999) found 14% of the children were overweight and 12% were already obese. These results are supported by those of a study by Adachi et al. (1991) comparing diets and health of the people of Kolofou (urban Tongatapu) and Uiha island in Ha'apai. The study was conducted for over 15 years and will resume in the near future. Adachi et al. (1991) found that after more than a decade, those in Uiha who were overweight but healthy at the beginning of the study were starting to be obese and having heart problems. This is related to change in their dietary habits. People of Uiha can now easily access poor-quality imported food. The 1986 National Nutrition Survey found 10% of men and 39% of women were severely obese. The unpublished 1992 Non-Communicable Diseases and Nutrition Risk Factor Survey found 32% of adults were overweight and 42% were obese.

Overall, the households of Tonga are food-secure but they may not be nutritionally secure. The fact that there is an increasing incidence of non-communicable diseases (NCDs) in Tonga is a manifestation of the insecure nutrition of some of the people. The current state of health of the people of Tonga has resulted from the change in the dietary habits to include more imported low-quality foodstuffs and also the change in the lifestyles into a less active mode of life. There is improved public transportation and most Tongans have vehicles to commute everywhere, resulting in most people doing much less exercise than before. People also command more cash to purchase food to satisfy their needs and hence do not need to produce crops. These changes have resulted in many Tongans becoming less active and, with the kind of food eaten, they can only put on weight and burn off fewer calories. Consequently they become overweight, obese, and ultimately have high blood pressure, heart diseases, and diabetes.

5.4 Risk coping systems in the households

Households adopt a variety of coping mechanisms and strategies to offset the impacts of production shortfalls, market uncertainties, and nutrition insecurity. Some of the mechanisms like borrowing, food sharing, and taking food on credit have been discussed earlier. The other coping mechanisms are now discussed under the headings of private responses and community-based systems.

5.4.1 Private responses

Most households have bank savings, accumulated assets (later sold if required), diversified incomes, and at times take loans to bolster any shortfalls in household food security. At the household level, there is also a need to protect crops from the vagaries of nature such as drought and cyclones. When there is a cyclone warning, farmers prune tall crops, prop any crops such as banana and harvest their food needs in case the cyclone arrives.

The nutritional knowledge of most households in general is not enough to equip them to make wise choices of good-quality foods. It is also difficult to make a choice when one knows that to purchase good-quality foods means food will not be adequate in volume for the household. That leaves many nutrition-literate housewives with the dilemma of buying insufficient good-quality food or buying enough poor-quality food.

Another factor determining diet is taste, which can undermine nutritional status in many households. For example, we know that mutton flaps are of poor quality but, because of their taste, people will still buy them. That leaves a big need to educate everybody in the household on nutritious foods and balanced diets.

5.4.2 Community-based systems

Households do not usually act in isolation but in the context of a community. Considerable diversity exists in terms of community-based actions to cope with food security risks.

Common fields (toutu'u) are a common community-based food production system in which youths or elders of the community grow crops for all households. This is a good system because it tends to pull along the lazy households through peer pressure. Communities have a labour pool with the objective of making money from weeding people's gardens. Households grow their own food crops in their own allotments but the crops are managed by their labour pool. Some communities also have group farm enterprises in which the proceeds are divided amongst the members.

Women have working groups for producing handicrafts such as tapas and mats. These groups are primarily for social obligations, but some handicrafts are also sold to cover some of the household needs. Many communities in the outer islands and also in the bigger islands trade with Tongans from overseas. The locals make tapas, mats, etc. and the overseas Tongans bring money to buy the crafts. In this way, the local communities get the income to pay for household expenses.

The women's community approach also spills over to the food production and nutrition aspects of the households. Many women groups grow home gardens and also conduct nutrition training workshops on food needs and proper nutrition, food storage, and food preservation.

Whenever there is a natural disaster, the community approach seems to be more effective than (often outside-funded) government actions. Households get together and help each other protect properties against potential dangers from cyclones. They may prepare a house or a church hall to house the community in case the cyclone reaches an emergency situation. After the cyclone, the community will work together in tidying up the damage and helping the households worst hit. They will also help each other with food needs after the cyclone, during the rehabilitation period. In times of drought, communities usually plan group activities to counter the effects of the droughts.

6. Policy, Information, and Research Implications

It has been established in this study that most Tongans have adequate quantities of food to eat. Most imported foods consumed by Tongans, however, are poor in nutritional quality. Therefore, in order to design effective policies, it is necessary to gain a clear understanding of the links between food, agriculture and nutrition as well as all the determinants of nutritional well-being. There are three key propositions:

- Food security is a precondition for nutritional well-being. It has been shown in Tonga's case that in addition to enough food, there is also the dimension of good nutritional quality.
- The significance of agriculture in improving nutrition is because of its role in production of food of the desired quality and quantity, and its role in directly or indirectly providing employment and income to many of the households in Tonga.
- Health, sanitation and care to vulnerable members of the society, especially those with heart diseases, diabetes, cancer and other NCDs, have a strong influence on nutrition. Being sick means substantial losses in productivity, decreased work performance, diminished cognitive ability and school performance.

It is necessary, however, to fulfill a number of preconditions before it is possible to conduct sustained actions to ensure food security in terms of food availability, access to food (entitlement), and nutritional adequacy (utilization). The partly fulfilled preconditions include macroeconomic policies and development strategies aiming at accelerated, employment-intensive economic growth, and policies and programs for increasing agricultural production and raising productivity in the economy.

It is quite clear from the prior discussions that in order to develop appropriate food security policies, information on the risks for food security is of paramount importance.

6.1 Information

It is very important to collect information related to food security, nutrition and health issues. Currently, there is plenty of information scattered around in different departments and in experts' computers. It is essential that information is collected and put in a form accessible by all users. The ultimate goal is of course to set up a database located where everybody can access it. The present study revealed that there is plenty of information around on food availability, crop production, household food consumption characteristics, nutrition and health-related issues.

There is, however, a need to collect precise information in the following areas:

- Household food consumption by island group, by age group, and by urban and rural locations.
- Household expenditures by island group and urban versus rural area¹.
- National nutrition survey—the last national nutrition survey was in 1996.
- Food availability by island group, especially availability of imported foods in the outer islands.
- Agricultural census—the last census was in 1985 (Statistics Department 1988).
- Fish landings for the whole country and by island group.

6.2 Research implications

The present study showed that there are areas of food insecurity that need investigation. The real food insecurity issue in Tonga is too much food consumption and the associated NCDs. The information needs mentioned above can be acquired through research projects. The potential research areas on food security are:

- Establish food security risk groups and study their lifestyles and dietary habits.
- Identify areas and groups vulnerable to food insecurity.
- Investigate the status of micronutrient deficiencies, especially Fe, in Tongan communities.
- Analyse pesticide residues in food and the environment.
- Evaluate the food processing requirements of some of the local crops.
- Implement institutional-strengthening activities.
- Undertake crop production research in the areas of agronomy, plant nutrition, and pest control.
- Undertake fish production research as well as the collection of fish statistics.

6.3 Policy

Table 6.1 gives the risks to food security and the sector of the population that is at risk. The policies developed should be designed to address these risks. The national and sectoral objectives relating to food security and nutrition have been discussed elsewhere in this paper. This section will only discuss the policies derived from this study that should be instituted in order to facilitate easier achievement of food security.

Table 6.1 Food security risks and populations affected.

| Risks | People at risk |
|--|--|
| Links between agriculture, food, nutrition and health are not well spelt out at the macroeconomic level in the Development Plan. | Every Tongan living in Tonga. |
| Employment risks—there are more people unemployed than actually suggested in the 1996 Population Census. The definition of employed in agriculture does not suggest real employment. | Youths and anyone who farms for only a few hours a week. |
| Agricultural trade risks—disruption of exports because of disease outbreaks, etc. or disruption of imports. | Smallholders who specialize in export. Households highly dependent on imported foods. |
| Food price risks | Low-income earners and net food-purchasing households. |
| Crop production risks (cyclones, droughts, pests). | All households involved in crop production. |
| Health risks (those suffering from NCDs resulting in declining labour productivity). | Entire Tongan community, especially women. |
| Pesticide use and residues. | Farmers who use pesticides and all households. |
| Nutritional risks (eating too much fatty food like mutton flaps and sugary foods). | All households. |

The key areas for policy intervention are as follows:

- Employment and income risks can be tackled in the long run through agricultural production policies, and in the short run through entitlement strengthening. Labour-intensive public works would have short- and long-run risk reduction effects, the latter through the creation of assets that generate future income streams.
- Government and NGOs can work together but the success rate is usually not very encouraging. The National Plan of Action for Nutrition is an inter-departmental plan that seems to work well (Tonga National Food and Nutrition Committee 1995b). There is therefore a need for a program to establish an integrated mechanism for successful inter-organizational implementation of food security activities.
- MAF should develop policies to strengthen food production. The policies should cover the areas of research, extension and marketing of produce both overseas and locally.
- The government can address food price risks through macro-level policies to ensure price stability. This is the current practice except for primary produce, which is sold in an open market system. Food consumption and household expenditures show that households spend most of their budgets on food. It is therefore essential that government should also intervene to limit the variability of prices of locally produced agricultural produce/products.
- There is also a need to develop policies in the area of food quality and quality assurance for produce sold in the domestic markets. There is an effort to enforce quality standards for export products under Codex Alimentarius. Similar standards should be developed for locally produced crops sold in the domestic markets.
- Policies covering the area of food choices should also be developed. An effort at the national level is required to protect consumers from the likelihood of developing NCDs by eating too much low-quality imported foods such as mutton flaps and sugary confectioneries over a long period of time.
- Government should strengthen the area of trade to ensure that incomes of people relying on exports are not disrupted as it will also impact on their household food security. The same applies to disruptions in imports.
- The National Food and Nutrition Committee should strengthen the area of nutrition by developing policies addressing specific areas important to the attainment of nutritional well-being for all Tongans. The issue of mutton flaps could also be tackled under such policies.
- There should also be policies developed to address nutrition in general and these should include awareness, education and training programs.
- The education sector should also develop a policy for incorporating nutrition programs into school curricula at the primary, secondary, and tertiary levels.
- National disaster management plans to deal with the impacts of cyclones, droughts, and disease outbreaks should also be developed. Work is currently underway to develop a national disaster management plan and the Ministry of Agriculture and Forestry is also developing a disaster management plan for agricultural production.
- The health sector should develop policies for the prevention of NCDs. This should include an awareness program and education at all levels of the community.

It is the authors' contention that policies directed at food security and issues relating to food security are essential for the achievement of both short-term and long-term food security objectives at the macro and micro levels.

7. Conclusions and Recommendations

7.1 Conclusions

The study has shown that Tonga at the national and provincial levels is food-secure in terms of food availability, but may not be when the dimension of nutritional security is added to the equation. At the household level, there are certainly sectors of the population who are threatened by food insecurity. These groups include the landless, low-income earners and some people on the remote outer islands.

A majority of rural Tongans and those on outer islands still produce their own food, whereas a substantial number of urban dwellers are net food purchasers. This is related to household incomes: most Tongans who are employed earn low wages and the trend for their expenditures shows that they spend more than they earn. Households also spend most money on food and paying bills. The expenditures of many households are moderated by remittances received from overseas relatives.

The main food security problems in Tonga are related to consumption of too much low-quality food (fatty mutton flaps, tinned foodstuff and sugary foodstuff) and the associated nutrition-related problems of overweight, obesity and NCDs.

The high incidences of nutrition-related diseases are related to changing dietary habits and changing lifestyles. Most Tongan diets now have a substantial amount of imported low-quality foods. Tongans now have access to improved public and private transport, rendering them less active so that they burn fewer calories. Consequently, they are more prone to NCDs.

The priorities at the national level do not spell out the attainment of food security, but rather state objectives such as accelerated economic growth that merely imply food security. Food security is strongly emphasized at the sectoral levels in the agricultural, fisheries, nutrition, and health sectors.

The main determinants of short-term vulnerability of food security at both the national/provincial and household levels are natural disasters (cyclones, droughts, and pest outbreaks). The government has established a disaster management committee and work is now underway to develop the national disaster management plan and also a disaster management plan for the agricultural sector.

Households also have various risk-coping mechanisms to counter threats of food insecurity. The mechanisms include private responses such as bank savings, diversified incomes, loans, borrowing, and food sharing. The community-based responses include common fields (toutu'u), labour pools, women working groups, and groups mobilized to act in times of cyclones and droughts.

7.2 Recommendations

The main recommendations of the study are:

7.2.1 National

- The government needs to recognize and prioritize the core issue of food insecurity in Tonga as too much food consumption, especially of low-quality imported food, and the associated NCDs.
- The government needs to develop appropriate integrated mechanisms for the implementation of food security, nutrition, and health-related programs.

Chapter 7

- Key players for each identified policy need to be identified and charged with the responsibility of developing the policy.
- Key players for each identified information and research need are to be identified and given the responsibilities of collecting the information and conducting the required research.

7.2.1 Regional

- The government should explore the possibility of regional cooperation in food security activities. It could be a regional project on strategies for food security or regional projects on aspects of food security. Projects could be initiated in the areas of disaster preparedness and coping systems, or in the involvement of youths in agricultural activities.

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