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**Integrated Report:
Food Security Strategies for
Selected South Pacific Island Countries**

**Pantjar Simatupang
Euan Fleming**

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.

Objectives

In co-operation with ESCAP member countries, the Centre will initiate and promote research, training and dissemination of information on socio-economic and related aspects of CGPRT crops in Asia and the Pacific. In its activities, the Centre aims to serve the needs of institutions concerned with planning, research, extension and development in relation to CGPRT crop production, marketing and use.

Programmes

In pursuit of its objectives, the Centre has two interlinked programmes to be carried out in the spirit of technical cooperation among developing countries:

1. Research and development which entails the preparation and implementation of projects and studies covering production, utilization and trade of CGPRT crops in the countries of Asia and the South Pacific.
2. Human resource development and collection, processing and dissemination of relevant information for use by researchers, policy makers and extension workers.

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**Integrated Report:
Food Security Strategies for
Selected South Pacific Island Countries**

**“CGPRT Centre Works Towards Enhancing Sustainable Agriculture and
Reducing Poverty in Asia and the Pacific”**

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**Pantjar Simatupang
Euan Fleming**

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Regional Co-ordination Centre for
Research and Development of Coarse Grains,
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Foreword

The research project “Food Security Strategies for Selected South Pacific Island Countries (SouthPIC)” started in July 1999 and was operationally completed in December 2000.

The original idea of the project was born in the discussions with many persons from different sectors during my travel to several island countries in the South Pacific in 1997. Although it was said that food security was not a chronic concern in these island countries, it was taken up as a common subject of the project because it was expected that the study for food security would cover a wide range of socio-economic subjects with a focus on food supply and consumption. Eventually, the expectation was fairly realized.

Four island countries, Fiji, Papua New Guinea, Tonga and Vanuatu, participated in the project. National experts appointed in each country carried out country study which was the main activity of the project. The reports of the country studies were published separately for individual countries in the Centre’s working paper series.

This integrated report summarizes the country reports of the four participating countries in the first place, and provides consolidated discussions on food security strategies in a broad concept in the second place. I sincerely hope that this integrated report, together with the country reports, will contribute to the further improvement of the food security not only in the participating countries but also in those countries that have similar conditions.

I am grateful for Dr. Euan Fleming, University of New England, Australia, for his devoted services as the regional advisor of the project and contribution to publication of this integrated report. I thank Dr. Pantjar Simatupang, Center for Agro-Socio Economic Research, Indonesia, who coordinated the project as the project leader and compiled this integrated report. My thanks should go to Dr. Douglas R. Stoltz for his editing services throughout the publication of the reports of the project.

Finally, I would like to express my sincere appreciation to the Government of Japan for its generous support in funding the project.

April 2001

Haruo Inagaki
Director
CGPRT Centre

Acknowledgements

First of all, we wish to express our deep gratitude to the national experts: Mr. Hiagi M.Foraete, Ministry of Agriculture, Fisheries and ALTA, Republic of Fiji; Mr. P.B.K. Igua, National Agricultural Research Institute, Papua New Guinea; Dr. Siosuia Halavatau, Ministry of Agricultural and Forestry, the Kingdom of Tonga; Mr. Shadrack R. Welegtabit, Reserve Bank of Vanuatu.

In the course of project implementation and preparing this integrated report, we relied upon the help of many people to whom we are indebted. First, we wish to express our sincere thanks to Dr. Haruo Inagaki, Director, CGPRT Centre, for playing a leading role in implementing the project, continuously backing up of our activities and giving detailed comments on drafts of this manuscript. We have benefited from the support and advices from Mr. S. Swatibau, Head of ECAP Pacific Operation Centre, Port Vila, Vanuatu. We express our thanks to Dr. Douglas Stoltz for editing all the reports published under the project. Ms. Agustina Merdyanti devoted many hours in front of the computer typing drafts of the publications. Finally we wish to express our profound thanks to Ms. Babay P. Putra, the assistant coordinator of the project, for her devoted services and painstaking performance.

Pantjar Simatupang, Project Leader
Euan Fleming, Regional Advisor

Executive Summary

This Working Paper is a summary of the results of the research project “Food Security Strategies for Selected South Pacific Island Countries (SouthPIC)” which are published separately in four country study reports and a workshop proceedings:

- (i) Food Security Strategies for the Republic of Fiji by Hiagi M. Foraete (Working Paper No. 55, 2001)
- (ii) Food Security Strategies for Papua New Guinea by Passingham Bukley K. Igua (Working Paper No. 56, 2001)
- (iii) Food Security Strategies for the Kingdom of Tonga by S.M. Halavatau and N.V. Halavatau (Working Paper No. 57, 2001)
- (iv) Food Security Strategies for Vanuatu by Shadrack R. Welegtabit (Working Paper No. 58, 2001).
- (v) Food Security in Southwest Pacific Island Countries, workshop proceedings, edited by Pantjar Simatupang and D.R. Stoltz (Monograph No. 40, 2001).

The “SouthPIC” project was formulated based on observations that although historically there is little evidence of chronic food shortage in the South Pacific island countries, some new emerging trends may have gradually eroded the adaptive strength of the national food security systems in the region. This is the main hypothesis to be assessed in the country studies of this project. However, the food security issue in South Pacific island countries is complex. The appropriate food security strategies and policy options can be formulated properly only through a comprehensive study. Accordingly, the outcome of this project is intended to help the governments in South Pacific island countries to assess the extent of food insecurity, and devise appropriate food security strategies and formulate policy options.

The general objectives of this project are to analyze food security conditions in selected South Pacific island countries and to formulate appropriate policy options for their food security strategies. Three specific objectives are:

1. To analyze food supply and demand balance and its dynamics at the national level in terms of:
 - (i) agricultural resource endowment and utilization, supporting infrastructure and related institutions, with an emphasis on food production capacity;
 - (ii) food production policy, realization and risks;
 - (iii) food import and export potentials, constraints, policy, realization and risks;
 - (iv) domestic food trade, distribution policy and market dynamics;
 - (v) domestic food demand for household consumption and other uses;
 - (vi) national food balance, and its dynamics; and
 - (vii) national food strategies and policies.
2. To assess food security at the household level in terms of:
 - (a) food availability and risks at local markets and in households;
 - (b) ability of household members to access the food they need, and its related risks;
 - (c) household food consumption patterns, food composition and allocation among household members, differentiated by age and sex;
 - (d) nutritional quality and sufficiency of household food consumption, differentiated by age and sex; and
 - (e) government strategies and policies related to household food security.
3. To identify a food security strategy and formulate policy options to improve food security in the respective countries.

The study was conducted using the latest “sustainable food security” paradigm, in which six criteria were analyzed for food security: food availability, access, utilization, stability, self-reliance (autonomy) and sustainability. Food availability, access and utilization determine adequacy. Stability and self-reliance determine vulnerability. Sustainability determines long-term persistence of food security. Using these criteria, food security in the participating countries was evaluated using a food security performance evaluation matrix (Table 1). In addition to economic and geo-bio-physical conditions, food security performance is also affected by social and political institutions.

Table 1 Food security performance evaluation matrix.

| Principal determinants | Average Adequacy | Vulnerability | | Sustainability |
|-----------------------------------|------------------|---------------|---------------|----------------|
| | | Stability | Self-reliance | |
| Food availability | ✓ | ✓ | ✓ | ✓ |
| Food access | ✓ | ✓ | ✓ | ✓ |
| Food utilization and distribution | ✓ | ✓ | ✓ | ✓ |

Sustainable food security can also be viewed within a hierarchical system of, in descending order, global, regional, national, sub-national/local (e.g. provincial), household and individual levels. Higher order food security is a necessary but not sufficient condition for lower order food security. The performance evaluation matrix (Table 1) was used to analyze food security at three levels of the food security hierarchical system: national, provincial and household. Detailed discussion on methodological issues is provided in the Appendix of this Working Paper.

The countries that participated in the project are Fiji, Papua New Guinea, Tonga and Vanuatu. They were selected on the basis of similarities in traditional food staples (roots and tubers), dominant cultures (Melanesian and Polynesian), physical conditions and resource endowments, size, stage of economic development and geographical region. There is also a degree of diversity among the four countries for the purpose of contrast. All countries are ESCAP members that are infrequently invited to participate in CGPRT Centre projects.

Based on the framework, the main study subjects of the project are:

- food security performance and its determinants at the national and household levels;
- food security risk-coping institutions; and
- feasibility of regional cooperation in food security.

The project was conducted by the CGPRT Centre with the assistance of one regional advisor, and partnership with one institute and one national researcher from each participating country. The regional advisor rendered advisory services to the Centre and the national researchers on various aspects needed for successful implementation of the project. The national researchers were assigned to conduct the country studies. The partner institutes played roles as supervisors of national researchers and as contact institutes in disseminating the project outputs to their appropriate end-users. The preliminary findings were discussed in a regional workshop in Sydney, Australia, on 12-13 December 2001. Publication and dissemination is to be conducted by the Centre, which was also responsible for overall coordination.

The organization of the project was as follows:

Overall Coordinator and Supervisor: Dr Haruo Inagaki, Director, CGPRT Centre
 Team Leader: Dr Pantjar Simatupang, Programme Leader, Research and Development, CGPRT Centre
 Regional Advisor: Dr Euan Fleming, Associate Professor, University of New England, Australia

National Experts:

| | |
|-------------------|--|
| Fiji: | Mr Hiagi Foraete, Acting Principal Agricultural Officer, Ministry of Agriculture, Fisheries and Forest |
| Papua New Guinea: | Mr P.B.K. Igua, Project Leader, National Agricultural Research Institute |
| Tonga: | Dr Siosuia Halavatau, Head of Extension Unit, Ministry of Agricultural and Forestry |
| Vanuatu: | Mr Shadrack R. Welegtabit, Research Department, Reserve bank of Vanuatu |

The fundings show that despite having limited arable land, a disadvantageous geographical location and space, and a small country size, and being prone to natural disasters, South Pacific island countries have managed to avoid acute food insecurity. All countries manage to procure sufficient food through domestic food production and importation. National food security is, however, in a potentially precarious condition in both the short run and long run. The major issue in the short run is temporary food insecurity due to vulnerability to various natural disasters, which are endemic in South Pacific island countries. Through generations of experience, the people of these island countries have adapted well to their harsh living environment. They have developed various indigenous mitigation mechanisms, such as diversified and sequential farming systems, egalitarian resource tenurial systems, risk pooling social institutions (mutual-help organizations), indigenous food preservation techniques, wild food reservation areas and out-migration, effective enough to prevent acute temporary food insecurity induced by the endemic natural disasters. Perhaps, the most serious concern now is long-term sustainability of the national food security systems. The indigenous wisdom has been eroding due to modernization processes and population pressure. Domestic food production capacity and productivity have shown declining trends and all countries have become increasingly dependent on food imports.

Provincial and household food security are of more serious concern than national food security. Although the degree of segmentation varies by country, national food security follows a dualistic structure. Rural food security systems and urban food security systems are either separated or weakly related, chiefly due to deficiencies in marketing infrastructure. Food availability in rural areas primarily comes from local production, whereby access to food by household is determined by access to natural resources (arable land and artisanal fishing grounds). As long as natural resources are abundant, rural food security systems remain strong and sustainable. The most vulnerable provinces are those with high population pressure. The most vulnerable households are poor, with inadequate command over resources to produce subsistence foods and cash income. With the exception of Tonga, all countries studied are facing increased rural poverty that has become a serious threat to household food security in rural areas. One of the main causes in Papua New Guinea and Vanuatu is a high population growth rate, but Tonga and Fiji have managed to avoid this problem through emigration.

Food availability in urban areas is heavily dependent on food importation. A household's access to food is determined by its purchasing power. The most vulnerable groups are the poor, who lack entitlements due to their low income-earning capacity. This is mainly a result of unemployment, underemployment or employment in low-paid and unstable jobs. A high urbanization rate and low capital investment for employment creation are the two most important determinants of urban food insecurity. Urban poverty, and hence food security, have been increasingly serious problems in Papua New Guinea, Vanuatu and Tonga.

The more serious problem in South Pacific island countries is nutritional insecurity. Both under-nutrition and over-nutrition are prevalent. Under-nutrition is caused by food insecurity or intra-household mal-distribution of foods among household members. Food insecurity is largely a poverty phenomenon, while intra-household mal-distribution of foods is a cultural phenomenon: husbands and older sons have first priority to access the foods available in the

home. Women and children are the groups most vulnerable to under-nutrition, which is prevalent in Papua New Guinea, Vanuatu and Fiji where food insecurity is also prevalent.

Over-nutrition is a syndrome of affluence that is prevalent among the middle- to high-income socio-economic groups due to over-eating of foods. Its basic cause is an inappropriate lifestyle due to what could be termed “unbalanced modernization”. This is the adoption of modern tools and transport, and the availability of off-farm jobs that reduce energy consumption. On the other hand, eating habits remain traditional, featuring big meals and a high frequency of eating. Over-nutrition is highly prevalent in all South Pacific island countries and is arguably the most important issue of food security in the region.

Strategy and policy recommendations for each case study country are elaborated in the respective country reports. In general, the core issues that should be placed as the top priority of the national policy makers are:

- (i) Chronic food security faced by the poor household in both urban and rural areas of Papua New Guinea, Vanuatu and Fiji;
- (ii) Over-eating syndrome in all countries;
- (iii) Natural disaster induced temporary food security problems in all countries;
- (iv) Changes in traditional farming systems and their impacts on food security and resource sustainability; and
- (v) Social and demographic changes and their impacts on food security, priority and resource sustainability.

South Pacific island countries have undertaken only limited trade of food commodities. The scope for regional cooperation includes:

- (i) Collaborative research and development on traditional crops that are common among the countries;
- (ii) Development of regional disaster preparedness and coping systems; and
- (iii) Development of regional agricultural research and development networks.

1. Introduction

1.1 General background

South Pacific island countries share some similarities in their national characteristics. All have small populations, ranging from a few thousand people in Niue to 4.3 million for Papua New Guinea in 1998. Land area is small and soils are of variable quality, with atoll soils particularly poor. There is no irrigation to speak of, and water supply is sometimes variable. Arable land and settlement areas are fragmented and dispersed over wide areas in most countries.¹ Mineral resources are limited, except in Papua New Guinea. All countries are remote from world input and output markets. Within each nation, the rural population is also often remote from markets, knowledge and technological centres, and prone to natural disasters, particularly tropical cyclones (and to a lesser extent, drought).² These characteristics are the major physical factors limiting economic development, in general, and agricultural development, in particular. The economies of South Pacific island countries are generally very small, dominated by the agricultural sector,³ and highly dependent on outside economies (Fleming and Hardaker 1995).

The main traditional food staples in South Pacific island countries are roots and tubers (primarily yam, taro, sweet potato and cassava), bananas and breadfruit. The food sector is constrained by small production capacity, limited and poor supporting infrastructure and an absence of technological innovations. The result is low and stagnant agricultural productivity and a relatively high cost of production, transportation and marketing (Fleming and Hardaker 1995; Hardaker and Fleming 1994). Competitive advantage in international markets is restricted to a limited number of products and economies become increasingly dependent on import supplies and government subsidies. These factors have the potential to make South Pacific island countries susceptible to serious food insecurity.

Yet, historically there is little evidence of chronic food shortages in South Pacific island countries, and certainly nothing comparable to the famines that have afflicted many emerging countries in Africa. This apparent anomaly can be explained by at least three factors. First, while agricultural land resources tend to be limited and variable in quality, man-land ratios have to date been favourable for securing adequate food supplies. Consequently, countries have historically been able to produce enough food to satisfy their basic needs, with little recourse to food imports. Second, traditional social mores, farming systems and institutions have maintained a strong presence, particularly in rural areas, with reasonably strong egalitarian principles. Third, large foreign remittances and aid have increased purchasing power in most South Pacific island countries. As explained below, the second factor is in the process of dissipating, while the third factor is unreliable. Hence, food security could become precarious if domestic agricultural production cannot be enhanced through technical improvements and other means to raise total factor productivity.

¹ There are exceptions. For example, all farming areas in compact countries such as Niue and Samoa are within a few hours drive of their respective capital cities.

² Because a high proportion of the land mass of South Pacific island countries lies within the humid tropics, drought tends not to be the major threat that it is in many other parts of the developing world. However, Papua New Guinea and Fiji have suffered from major droughts in recent years, and parts of Tonga have also been susceptible to short periods of drought.

³ Economic dependence on agriculture varies quite significantly between South Pacific island countries. As a general rule, though, agriculture now tends to be a relatively minor contributor to gross domestic product, but still provides a substantial proportion of exports. Its importance remains greatest as an employer of labour (Hardaker and Fleming, 1994).

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One important attribute of the Melanesian, Polynesian and Micronesian indigenous cultures in the South Pacific region has been the modest and harmonious ways of traditional life. Material consumption and asset accumulation have been limited determinants of welfare and should be kept modest. Sharing and caring among the family and community members have been important for living in harmony. Assisting family members and others has been a moral obligation. This lifestyle has had at least two important implications for food security in the past. First, modest monetary aspirations limited land allocation for cash crops, and hence adequate land was made available for food production. Second, sharing and reciprocity increased household access to land for subsistence farming as well as for food or income transfer.

Integrated semi-subsistence farming systems still predominate in South Pacific island countries. By their nature, they have as their primary objective the attainment of food security for the farming households (Yen 1979b; McGregor 1997). Because the integrated semi-subsistence farming system is always limited in size, more farming households can be supported in a given area of arable land than with commercial farming systems. This would enhance food security.

The land tenure system is the most persistent traditional institution in South Pacific island countries, dominated by customary land tenure arrangements (Schoeffel 1995). The key factor of this system is its reallocation mechanism to meet the changing needs of demographically fluctuating groups. For the most part, all members of a community have been assured access to sufficient land for subsistence purposes. Those with inadequate land for planting food gardens have usually been able to borrow land from others without payment of any significant rent. This egalitarian feature has made the traditional customary land tenure system an effective instrument for food security in most parts of South Pacific island countries.

Modest material aspirations, obligations to assist relatives and others, integrated semi-subsistence farming systems and customary land tenure systems are the key traditional features that enabled South Pacific island countries to achieve "subsistent affluent" living conditions in the pre-contact period (Fisk 1964). These conditions are also the major factors that have enabled South Pacific island countries to maintain food security until now. But all of these traditional features are being eroded by modernization and growing aspirations. Education and contact with foreigners have made the indigenous people more commercial-minded, with higher monetary aspirations. This increasing importance of a monetary objective has increased the commercial component of the integrated semi-subsistence farming system, even to the point where some smallholders now operate fully commercial farms. Commercialization has also gradually changed the customary land tenure system. The opportunity cost of lending land is rising, given that land is a potential source of cash from either commercial cropping or rentals. Informal transfers of land are becoming less common, as those with land tend to plant it in cash crops, and borrowing land for long-term cash crops is also becoming rare (Hau'ofa and Ward 1979). These tendencies have the potential to lead to food insecurity to the extent that South Pacific island countries might face serious food insecurity in the near future.

The emerging food insecurity is aggravated by at least three major factors. First, a large influx of Asian and European migrants has increased the demand for new food items such as rice, wheat, sugar, meat, eggs, milk, canned meat and fish, coffee, tea, alcohol and soft drinks (Ward and Hau'ofa 1979; Doumenge et al. 1988; Yen 1979a). Most of these food items must be imported. Moreover, these new food items are superior to roots and tubers in some aspects of cooking and serving practicality, shelf life, and also with respect to social prestige. The advantages of these foods tempt people to substitute them in their traditional diet. South Pacific island countries have become highly dependent on food imports. Many of these newer foods are, however, nutritionally inferior to foods commonly consumed in the more traditional diets (Ward and Hau'ofa 1979). This high degree of dependence on, and subsequent inelastic demand for, imported food could produce serious nutritional and social effects, especially in periods of rapid decline in export prices or output, or inflated import costs (ESCAP 1985).

Second, expansion of large plantations and smallholder commercial farms pulls a large area of land, and potentially much labour, out of traditional food crop production, reducing its output. Reductions in the supplies of locally produced foods that lead to an increase in their prices could further aggravate the food security problem by making them less accessible to poor households. Furthermore, as they become relatively more expensive, the roots and tubers would be replaced by imported foods.

Third, increasing land pressure has pushed food gardens to less fertile land further away from homes, or even wiped them out (e.g. Hardaker and Fleming 1994). A number of households, especially in urban areas, have insufficient access to land for food gardening. In Tonga, for example, there is now insufficient land for all commoner males to obtain their own plots and indeed some 30% of Tongans now do not own land (Schoeffel 1995). An increasing number of households, especially in urban areas, must rely on commercial markets for their food supplies. Food market and cash income risks, rather than merely production risks, become major determinants of household food security.

While historically there is little evidence of chronic food shortages in South Pacific island countries, this discussion shows that emerging trends may have gradually eroded the adaptability and strength of the national food security systems in the region. This is the main hypothesis to be assessed in the country studies of this project. However, as discussed previously, the food security issue in South Pacific island countries is complex. Appropriate food security strategies and policy options can be formulated properly only through a comprehensive study. Accordingly, the outcome of this project is intended to help the governments in South Pacific island countries to assess the extent of food insecurity, and to devise appropriate food security strategies and formulate policy options through a comprehensive study in each participating country.

1.2 End users and intended impacts

The general objectives of this project are to analyze food security conditions in selected South Pacific island countries and to formulate appropriate policy options for their food security strategies. Three specific objectives are:

1. To analyze food supply and demand balance, and its dynamics, at the national level in terms of:
 - (i) agricultural resource endowments and utilization, supporting infrastructure and related institutions, with an emphasis on food production capacity;
 - (ii) food production policy, realization and risks;
 - (iii) food import and export potentials, constraints, policy, realization and risks;
 - (iv) domestic food trade, distribution policy and market dynamics;
 - (v) domestic food demand for household consumption and other uses;
 - (vi) national food balance, and its dynamics; and
 - (vii) national food strategies and policies.
2. To assess food security at the household level in terms of:
 - (a) food availability and risks at local markets and in households;
 - (b) ability of household members to access the food they need, and its related risks;
 - (c) household food consumption patterns, food composition and allocation among household members, differentiated by age and sex;
 - (d) nutritional quality and sufficiency of household food consumption, differentiated by age and sex; and
 - (e) government strategies and policies related to household food security.
3. To identify a food security strategy and formulate policy options to improve food security in the respective countries.

The primary end-users of results of the project are the governments of the participating countries, especially ministries of agriculture and/or food, trade, health and nutrition, and

Chapter 1

national development planning. They should be able to make more informed decisions on food security by gaining a clearer understanding of its underlying determinants and present state, and of future trends in both food security and food security risks. This knowledge should enable policy makers to assess the consequences of growing food insecurity for household welfare, as well as the effects on macroeconomic performance in the participating countries. Information on the impacts of strategic and policy options, expected primary outputs of this project, could be valuable in planning food and economic policies. Implementation of the appropriate food security strategies and policies should improve the well being of the people and macroeconomic performance in the participating countries.

1.3 Participating countries, scope and general approach

The countries that participated in the project are Fiji, Papua New Guinea, Tonga and Vanuatu. They were selected on the basis of similarities in traditional food staples (roots and tubers), dominant cultures (Melanesian and Polynesian), physical conditions and resource endowments, size, stage of economic development and geographical region. There is also a degree of diversity among the four countries for the purpose of contrast. All countries are ESCAP members that are infrequently invited to participate in CGPRT Centre projects.

Based on the framework, the main study subjects of the project are:

- food security performance and its determinants at the national and household levels;
- food security risk-coping institutions; and
- feasibility of regional cooperation in food security.

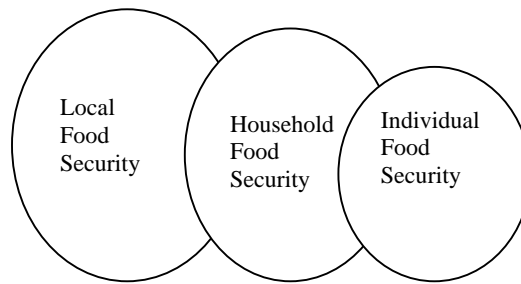
The study was conducted using the latest “sustainable food security” paradigm, in which six criteria were analyzed for food security: food availability, access, utilization, stability, self-reliance (autonomy) and sustainability. Food availability, access and utilization determine adequacy. Stability and self-reliance determine vulnerability. Sustainability determines long-term persistence of food security. Using these criteria, food security in the participating countries was evaluated using a food security performance evaluation matrix (Table 1.1). In addition to economic and geo-bio-physical conditions, food security performance is also affected by social and political institutions.

Table 1.1 Food security performance evaluation matrix.

| Principal determinants | Average Adequacy | Vulnerability | | Sustainability |
|-----------------------------------|------------------|---------------|---------------|----------------|
| | | Stability | Self-reliance | |
| Food availability | ✓ | ✓ | ✓ | ✓ |
| Food access | ✓ | ✓ | ✓ | ✓ |
| Food utilization and distribution | ✓ | ✓ | ✓ | ✓ |

Sustainable food security can also be viewed within a hierarchical system of, in descending order, global, regional, national, sub-national/local (e.g. provincial), household and individual levels. Higher order food security is a necessary but not sufficient condition for lower order food security (Figure 1.1). The performance evaluation matrix (Table 1.1) was used to analyze food security at three levels of the food security hierarchical system: national, provincial and household. Detailed discussion on methodological issues is provided in the Appendix.

Figure 1.1 Food security within a hierarchical system.



1.4 Organization and implementation

The project was conducted by the CGPRT Centre with the assistance of one regional advisor, and partnership with one institute and one national researcher from each participating country. The regional advisor rendered advisory services to the Centre and national researchers on various aspects needed for successful implementation of the project. The national researchers were assigned to conduct the country studies. The partner institutes played roles as supervisors of national researchers and as contact institutes in disseminating the project outputs to their appropriate end-users. The preliminary findings were discussed in a regional workshop. Publication and dissemination is to be conducted by the Centre, which was also responsible for overall coordination.

The organization of the project was as follows:

| | |
|-------------------------------------|--|
| Overall Coordinator and Supervisor: | Dr Haruo Inagaki, Director, CGPRT Centre |
| Team Leader: | Dr Pantjar Simatupang, Programme Leader, Research and Development, CGPRT Centre |
| Regional Advisor: | Dr Euan Fleming, Associate Professor, University of New England, Australia |
| National Experts: | |
| Fiji: | Mr Hiagi Foraete, Acting Principal Agricultural Officer, Ministry of Agriculture, Fisheries and Forest |
| Papua New Guinea: | Mr P.B.K. Igua, Project Leader, National Agricultural Research Institute |
| Tonga: | Dr Siosuia Halavatau, Head of Extension Unit, Ministry of Agricultural and Forestry |
| Vanuatu: | Mr Shadrack R. Welegtabit, Research Department, Reserve bank of Vanuatu |

A coordination planning meeting was held at the Centre on 20-21 September 1999. The regional advisor participated in the meeting along with the Centre's director. The agenda items discussed at the meeting were:

- (a) brief review of the project background and objectives;
- (b) formulation of methodological guidelines for country studies;
- (c) framework of the project reports;
- (d) schedule of in-country planning meetings; and
- (e) other related matters.

Based on the discussion, the project leader, in consultation with the regional advisor, prepared the following materials for the in-country planning meetings:

- (a) report of the coordination planning meeting;
- (b) general reference of the project plan; and
- (c) basic concepts and analytical framework.

The handout on basic concepts and analytical framework is included in the Appendix.

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The in-country planning meetings were held in each participating country during 6-17 December 1999. The project leader and the regional advisor participated in these meetings. The concept of the project, methodologies of the country study, work plan, framework of reports and other related issues were thoroughly discussed in the meetings. The national experts were requested to finalize the work plan of the country study and start the country study from January 2000. Due to the withdrawal of Mr Wycliff Bakeo and assignment of Mr Shadrack Welegtabit as his substitute as the national expert of Vanuatu, the project leader revisited Port Vila on 16-17 March 2000 for a planning meeting with the new national expert of Vanuatu.

The regional workshop was initially scheduled to be held at the CGPRT Centre, Indonesia, in October 2000. In order to increase direct participation of the stakeholders, the place of the workshop was changed to Port Vila, Vanuatu for 26-27 October 2000. In the initial plan, in addition to national experts and commentators of the four participating countries, we also intended to invite representatives of ESCAP/POC in Port Vila, Kiribati, Samoa and Solomon Islands to participate in the workshop. However, due to some technical constraints, the place and time of the workshop were revised again and the workshop was finally held in Sydney, Australia, on 12-13 December 2000.

1.5 Reports resulting from the project

There are three types of reports as the outputs of the project: (i) country reports, (ii) an integrated report, and (iii) the proceedings of the workshop.

1. Food Security Strategies for the Republic of Fiji by Hiagi M. Foraete (Working Paper No. 55)
2. Food Security Strategies for Papua New Guinea by Passingham Bukley K. Igua (Working Paper No. 56)
3. Food Security Strategies for the Kingdom of Tonga by S.M. Halavatau and N.V. Halavatau (Working Paper No. 57)
4. Food Security Strategies for Vanuatu by Shadrack R. Welegtabit (Working Paper No. 58).

The title of the workshop proceedings is “Food Security in Southwest Pacific Island Countries”, which is edited by Pantjar Simatupang and D.R. Stoltz (Monograph No. 40).

2. The Macro-environment: Resilience and Fragility

2.1 Location and size of the countries

South Pacific island countries are located in the southern part of the Pacific Ocean, far distant from the world's main economic markets. Their nearest common neighbouring countries are Australia and New Zealand. They are all small in terms of land area, population and economic size (Table 2.1). The combination of remoteness and smallness is disadvantageous for food security systems for at least two reasons. First, it inhibits international trade in food products, which is an essential instrument for an efficient and resilient national food security system. Remoteness causes delivery costs to be very high and makes trade time-consuming. Smallness prevents the exploitation of economies of scale in food marketing. High transportation costs make the parity prices of imported foods very high, whereas the prices of exportable foods in domestic markets tend to be low. The number of major trading partners is limited. Presently, the major trading partners of South Pacific island countries are Australia and New Zealand. Consequently, South Pacific island countries fail to take full advantage of international trade as an effective element in an efficient and resilient national food security system.

Second, small country size makes the national food security systems susceptible to both internal and external disturbances. A small country has a low capacity to absorb disturbances. Natural calamities, such as cyclones, drought and pest attacks, may easily destroy most food gardens and stocks, and hence directly cause severe national food insecurity. Such calamities can also have devastating impacts on economic infrastructure as well as on economic activities in general, which further worsens the food security condition.

Third, remoteness and smallness inhibit technological innovation in food production. Remoteness may be an effective constraint to the international transfer of agricultural technologies. Agricultural research and development must be used on a sufficiently large scale. If the country size is too small, research and development may not be feasible for the innovation of a broad range of agricultural technologies. This may be one of the main reasons why investment in agricultural research and development is generally lacking in South Pacific island countries (Fleming 2001). Consequently, technological innovations in food production are generally limited. South Pacific island countries have also failed to take significant advantage of international technological innovations to enhance their national food security systems.

Fourth, small market size generally leads to oligopolistic market structure (Williams 2001), which is less efficient than the competitive market structure. The oligopolistic market structure causes food prices to be higher and more volatile than they would be in a competitive market, and is not conducive to a high degree of food security.

2.2 Spatial configuration of populated areas

Another stylized geographical feature of South Pacific island countries is "insularity". Each country is fragmented into widely scattered islands or small "social islands" (Ward and Hauofa 1979). This, too, has significant negative impacts on national and provincial food

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security systems.¹ First, fragmentation of the already small size of the economy aggravates diseconomies of small scale in the domestic food economy. Infrastructure development is very expensive and is not feasible in some areas. Under-investment in transportation is a major constraint to domestic food market development (Fleming 2001). Consequently, integrated systems of urban-rural and producer-consumer market linkages, essential for a strong food security system, are underdeveloped. Inter-provincial trade within countries is limited to areas with good access to the main urban centres.

Second, the small size of many islands or “social islands” exposes them to the risk that a high proportion of their total area and population can be severely affected by natural hazards. A cyclone can easily damage the whole of a small island, destroy food crops and emergency food sources, and thereby cause acute food insecurity. The low elevation of atolls, a feature of a number of South Pacific island countries, offers inhabitants little refuge in the event of a tsunami, and severe damage can be inflicted to the unstable surface (Ward and Hauofa 1979).

Third, the widely scattered small population units and underdeveloped transport systems make a formal food security early-warning system and contingency plan difficult to implement and costly to sustain. A centralized emergency food stock system, which is generally the most cost-effective approach in most countries, is neither technically feasible nor economic in South Pacific island countries.

In sum, the extreme remoteness, isolation, insularity, small size and scattered populations of South Pacific island countries provide a difficult environment for national food security systems. This unfavourable geographical context makes South Pacific island countries vulnerable to various food security risks, which will be discussed in the next section.

Table 2.1 General indicators of selected South Pacific island countries.

| Indicators | Unit | Year | Country | | | |
|---------------------------------|-------------------------|---------|--------------|------------------|-------|---------|
| | | | Fiji | Papua New Guinea | Tonga | Vanuatu |
| 1. Total area | 1,000 Km ² | 1997 | 18.3 | 462.8 | 0.8 | 12.2 |
| 2. Population | | | | | | |
| a. Total | 1,000 person | 1998 | 786.0 | 4,300.0 | 98.4 | 182.0 |
| b. Annual growth | % per year | 1993-97 | 0.9 | 1.9 | 0.3 | 2.6 |
| c. Crude density | Persons/Km ² | 1980 | 35.0 | 7.0 | 122.0 | 9.0 |
| | | 1998 | 43.0 | 9.0 | 131.0 | 15.0 |
| d. Urban population | % of total | 1980 | 37.8 | 13.0 | 23.7 | 17.9 |
| e. Urban population growth rate | % year | 1998 | 41.6 | 16.8 | 44.2 | 19.6 |
| 3. Agricultural land | | | | | | |
| a. Share in total | % | 1980 | 9.3 | 1.1 | 63.9 | 8.9 |
| b. Land area | Ha | 1997 | 15.3 | 1.3 | 66.7 | 9.9 |
| c. Area per capita | Ha/person | 1980 | 0.27 | 0.17 | 0.50 | 0.92 |
| | | 1997 | 0.35 | 0.15 | 0.48 | 0.67 |
| 4. Gross national product (GNP) | | | | | | |
| a. Total | US\$ million | 1997 | 2,007 | 4,185 | 177 | 238 |
| b. Per capita | US\$/person | 1995 | 2,340 | 1,210 | 1,740 | 1,220 |
| | | 1997 | 2,460 | 930 | 1,810 | 1,340 |
| 5. Proportion in poverty | % | | 13-25 (1997) | 21.7 (1996) | nda | nda |
| 6. Unemployment rate | % | 1994 | 5.7 | nda | 1.3 | nda |
| | | 1996 | 5.8 | nda | 13.3 | nda |

Source: Key Indicators of Developing Asian and Pacific Countries, 1999. Asian Development Bank.

¹ The term, provincial, is used in this paper to denote spatial groupings of areas within a country, according to either geographical or administrative delineations. The term, regional, is used to denote supranational groupings of countries, notably the South Pacific region comprising all South Pacific island countries.

2.3 Geology

South Pacific island countries can be classified into main four main groups, according to their size and morpho-geological structure (Doumenge et al. 1988):

1. The “mainlands”, with an area of several thousand square kilometres, are situated in the southwest Pacific precontinental zone, and present an ancient volcanic sedimentary substratum with heavy relief, and large areas suitable for extensive agricultural development.
2. The “mountainous islands”, with an area of from several dozen to several hundred square kilometres, are volcanic masses that are not easily penetrable. They have steep slopes and localized agro-pedological potential.
3. The “low-lying islands” cover several hundred square kilometres and are coral masses that have emerged several dozen metres above sea level at the end of the Tertiary period. Their volcanic base occasionally breaks through into the fossil lagoon. Farming conditions here are extremely variable, rather limited on the periphery but extensive in the centre, except where there is a heavy concentration of guano, which is mined.
4. The “atolls” (several square kilometres up to a few dozen square kilometres of arable land) are embryonic coral masses situated at sea level. Their agro-pedological potential is often limited and soils are hydromorphic or rendzina.

Category 1, “mainland”, is the most suitable one for extensive food production. This is also where populations are mostly concentrated. This category is not the largest part of the individual countries, however. Arable land for extensive food production is limited and increasingly scarce in South Pacific island countries with the exception of Papua New Guinea.

The broad region of the South Pacific island countries spans the contemporary junction and zone of interaction between the Indian and Pacific tectonic plates. This is an active zone of geological movements where earthquakes, volcanic eruption and tsunamis occur frequently. Combined with the small size and insular characteristics of the countries, these natural disasters could easily devastate whole standing food crops, housing and productive natural resources. They are the major risks to food security systems in the region.

2.4 Climate

South Pacific island countries span a latitudinal range from 5°N to 23°S within which mean monthly temperatures at sea level are relatively uniform. Seasonal and diurnal variations are generally small in coastal areas and at lower elevations temperature is not a significant constraint for the majority of tropical food crops. The main variations from a generally uniform temperature regime occur at higher elevations, but only in Papua New Guinea are elevations sufficient for latitudinal zonation of temperature to become significant for agriculture. Areas above 2,500 metres are generally too cool for root crop cultivation while frost occasionally causes damage to food and tree crops at elevations above 2,000 metres (Ward and Hauofa 1979).

Annual rainfall intensity is generally high. Few areas in South Pacific island countries have annual rainfall of less than 2,000 mm. Normal total precipitation is usually sufficient to support rainfed agriculture throughout the year. However, the orographic and shadow effects of terrain cause considerable spatial variations within the larger and higher islands. In some mountainous areas, extremely high rainfall occurs throughout the year with annual totals of over 4,500 mm where risks of flooding, erosion and mass movement are very high. Flooding is also a risk factor to food security in hilly and mountainous areas.

South Pacific island countries are prone to abnormal weather. One major climatic disaster is drought. The drought phenomenon should be differentiated into two types: (i) dry-season drought, and (ii) occasional extended periods of severe drought (McGregor 1997). Dry-

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season drought, which occurs in the period from May to June in most parts of the South Pacific, is largely an anticipated risk to which farming systems and household food security systems have adjusted. This does not generally create a severe food security problem in the region.

The occasional severe drought is highly correlated with the El Niño Southern Oscillation (ENSO). It can be very severe and prolonged (Ward and Hauofa 1979) and occurs over an extensive area. It could interrupt farming activities and significantly depress food production and hence create serious food insecurity in some years. Examples are 1978 and 1983 in Vanuatu, 1987 and 1997 in Fiji, and 1941, 1972, 1987 and 1997 in Papua New Guinea. A particular compounding and increasing problem for food production resulting from drought is uncontrolled fires. In addition, in the highlands of Papua New Guinea, severe drought is often associated with damaging frost (McGregor 1998).

Another weather-related risk to food security is cyclones. The principal area for cyclone generation in South Pacific island countries extends in a belt between 10°S and 15°S and between 150°E and 180°E (Ward and Hauofa 1979). Papua New Guinea rarely experiences the full force of cyclone winds. But in Fiji, Tonga and Vanuatu cyclones can be very severe and occur frequently. During the 1960-1989 period, cyclone frequency was 34 times in Fiji, 15 times in Tonga and 32 times in Vanuatu (McGregor 1998). There is a perception of increasing and unprecedented cyclone activity in recent times. The impact of a cyclone is generally localized, affecting only one or two islands. But it can be sufficiently strong to cause severe damage to food crops and human settlements. Vulnerability to major cyclones has also been increasing. Human settlement has moved from inland areas to be predominantly located in the coastal areas where cyclones have their greatest impacts. The traditional cropping patterns that have lessened the impact of cyclones in the past are now not as common. Also, deforestation means that forests no longer provide the degree of protection to food gardens that they did in the past, and the use of traditional food preservation methods is no longer common (McGregor 1997). In general, cyclones are a significant risk factor for local food security in South Pacific island countries.

2.5 Population

The total population of each country studied is small. Only Papua New Guinea has a population more than one million (4.3 million persons in 1998). The population of Tonga was only 98,400 persons in 1998. In the same year, the populations of Fiji and Vanuatu were 786,000 and 182,000 persons, respectively (Table 2.1). During the 1993-1997 period, the annual population growth rates were 0.9% in Fiji, 1.9% for Papua New Guinea, 0.3% in Tonga and 2.6% in Vanuatu.

The low population growth rates in Tonga and Fiji were due to emigration. In the early 1990s there were 21,175 Tongans living in New Zealand and 11,000 living in California and Hawaii (Schoeffel 1995). The high emigration rate has at least two important implications for national and household food security. First, a low domestic population growth rate results in only small increases in domestic food demand and eases population pressure on agricultural land. Low population pressure on agricultural land is beneficial for maintaining a high level of reliance on locally produced food. Second, high and continuous emigration and strong family relationships induce significant and continuous inflows of income remitted home by the migrants. The remittances, both in cash and in kind, have been an important source of income for the families that stay at home as well as a source of foreign exchange for the national balance of payments. At the family level, remittance income increases the ability to command sufficient food, and hence it has been an important factor in maintaining household food security. At the national level, remittances increase the national ability to import foods and hence enhance national food security. But we should also note that emigration is a brain drain that may have negative effects on national economic development, thereby adversely affecting national food security in an indirect way.

The high population growth rates in Vanuatu and Papua New Guinea may cause serious challenges to their national food security in the future. First, high population growth increases the population pressure on agricultural land and hence reduces the capability for reliance on locally produced food. As shown in Table 2.1, agricultural land per capita in Vanuatu declined substantially from 0.92 ha in 1980 to 0.67 ha in 1997. For Papua New Guinea, the decline was quite small, from 0.17 ha in 1980 to 0.15 ha in 1997, because the available land area is still very large. The population density in Papua New Guinea is lowest among the countries under study, with only 9 persons per km² in 1998. But it should be noted that the proportion of agricultural land to total land is very low in Papua New Guinea. This indicates that the “agriculturalization rate” in Papua New Guinea is still very low and most of the land is unexploited for agricultural practices.

Another direct consequence of high population growth rate is high growth rate of the labour force. If employment opportunities do not increase at the same pace as job-seekers, then unemployment and poverty incidence will increase. As shown in Table 2.1, the unemployment rate has been almost stable in Fiji in recent years, but in Tonga it increased significantly. Poverty incidence in South Pacific island countries seems quite high. The available data indicate a poverty rate of more than 20% in Fiji and Papua New Guinea. Unemployment and poverty have become especially significant in urban areas.

Rapid urbanization is a common phenomenon in South Pacific island countries. Fiji and Tonga have become highly urbanized with the proportions of urban population reaching 42% for Fiji and 44% for Tonga by 1998. For Papua New Guinea and Vanuatu, the proportions of urban population in 1998 were still below 20% but they are expected to increase rapidly. The population growth rates of their capital cities, Port Moresby and Port Vila, respectively, are 3.2% and 10.0% per annum (Schoeffel 1996).

The rapid urbanization rate is a serious threat to food security in urban areas. First, it is associated with high rates of unemployment and poverty, and hence food entitlement is a problem to many urban households. As explained by Welegtabit (2001), most of the unemployed in the urban labour force in Vanuatu are poorly educated. Many of those who have employment are unskilled casual workers. Their jobs are not permanent and are highly sensitive to economic fluctuations. It is this job insecurity that causes food insecurity for many urban households.

Second, urbanization heightens population pressure on urban land, which has become increasingly scarce and expensive, limiting access by many households recently arrived from rural areas to sufficient food garden areas, the traditional source of food subsistence in South Pacific island countries. Most urban households must now rely on market exchanges to meet their food needs. Household income and food prices become the main determinants of household food security. Household food security is hence increasingly sensitive to labour and food market conditions.

Third, rapid urbanization increases dependency on food imports for convenience, price and availability reasons. Imported foods have become the main diet for urban households in South Pacific island countries, increasing national reliance on international food markets. As a consequence, urban food security is becoming increasingly susceptible to fluctuations in international food market prices, the exchange rate and international freight costs. Since the freight cost component in imported food prices is high, imported food prices are sensitive to world oil prices, which have fluctuated substantially in recent years.

2.6 Agricultural land

With the exception of Papua New Guinea, the total area of agricultural land in each South Pacific island country is generally small since the country size is generally small. As noted above, however, although Papua New Guinea has a very large land area its agricultural land is not so large since the share of agricultural land in total land area is only around 1%. In

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fact, agricultural land per capita in Papua New Guinea is the smallest among the four countries under study, and it is declining. The highest rate of agricultural land use is in Tonga, which was already around 67% in 1997 (Table 2.1). Fiji has had the most success in expanding agricultural land in recent years, from 9% of total land area in 1980 to 15% in 1997. Papua New Guinea and Vanuatu may have some difficulties in expanding their agricultural land areas. The main constraints are lack of entrepreneurship (human capital), transport and communications infrastructure, and investment capital.

As a result of its success in expanding agricultural land area and achieving a low rate of population growth, Fiji has managed to ease the population pressure on agricultural land. Contrary to the trends in the other three countries under study, agricultural land per capita in Fiji increased from 0.27 ha in 1980 to 0.35 ha in 1997. The worst trend has been in Vanuatu, where agricultural land per capita dropped sharply from 0.92 ha in 1980 to 0.67 ha in 1997, mainly due to its high population growth rate. Declining agricultural land per capita is a crude indicator of declining capacity to meet food demand through domestic production. An immediate consequence of this tendency is increases in the prices of domestically produced food items (foods that formed the main part of traditional diets) relative to imported foods. Through substitution effects, the increases in prices of domestically produced foods relative to imported food prices have induced increased food imports. Fleming and Lim (1998) provide evidence of relative increases in the prices of domestically produced staple foods (root crops) to imported staple foods (rice and flour), but only for Fiji. Yet it is reasonable to expect that this trend in relative prices is a salient feature of all South Pacific island countries, and it is threatening the food security of the poor in urban areas who lack food entitlements.

Besides these price effects, the most serious impact of increasing scarcity of agricultural land on household food security is through subsistence food production effects. First, increasing land scarcity has caused increasing numbers of households, especially in urban and peri-urban areas, to have an insufficient area of food gardens for their food needs. Second, limited land area forces the smallholder households to increase cropping intensity in order to meet short-run food needs. But, in the long run, increasing cropping intensity has begun to cause declining soil fertility and hence undermine the sustainability of present household food security. Third, increasing land scarcity induces the privatization and commoditization of land. The customary land tenure system, which historically has been effective in guaranteeing access of all households to sufficient food garden areas, is now being eroded. This tendency has the potential to become a serious threat to household food security in rural areas.

2.7 Fishery

South Pacific island countries generally have long coastlines that have a high potential for fishery development. With the exception of Papua New Guinea, their populations predominantly live in coastal areas with limited land area for agriculture. Consequently, they are highly dependent on the sea for food and cash income. Fish has been traditionally the major source of animal protein for the coastal population. Fishery products may also be sold locally for cash income or exchanged for other food items. Fishery exports are very important, and provide significant amounts of foreign exchange to import food products (May 1979). The abundant fishery resources, therefore, play important roles in enhancing household and national food security.

Fishing enterprises may be divided into two broad categories: industrial fishing and artisanal fishing. Industrial fishing is characterized by large vessels, modern fishery gear and supporting devices, high skill levels and specialized labour, operating highly commercial enterprises in offshore fishing zones. Its main products are high-value fishery products, such as tuna, for export. This type of fishing is important for the national economy, especially for obtaining foreign exchange and promoting economic growth. It has only a limited role in enhancing the food security of households in coastal communities, however. Being maritime

countries, most South Pacific island countries have a great opportunity to expand industrial fishing. But its requirements of large amounts of investment capital and a highly specialized labour force are the main challenges facing the development of this type of fishing.

The artisanal fishery sector is more relevant for household food security in coastal areas. It is characterized by the application of traditional fishery techniques, operates in coastal areas near the shore, and is either pure subsistence or semi-subsistence. Its main fishing grounds are lagoons, coral reefs and shallow waters along the coastline near the settlement areas. Fishing grounds are owned by family clans or communities through traditional property rights systems that are egalitarian and have been largely sustainable until now. As long as the fishery resources are sufficiently abundant, the clan or community chiefs will arrange property right rules such that all family will have assured access to fishery resources sufficient to meet the needs of the family members without harming their sustainability. In such a case, household food security is assured.

This is the well known “affluent but traditional” feature of South Pacific island country societies. But it is no longer a general phenomenon as population pressure has rendered many local fishery resources insufficient to meet the needs of all families. Increasing fishery resource scarcity and commercialization of fishing have gradually eroded the egalitarian and sustainable indigenous property rights systems. As a result, many households do not have access to sufficient fishery resources and some fishing grounds are in danger of over-exploitation. This tendency may pose a serious threat to household food security in some coastal areas of South Pacific island countries.

2.8 Forestry

With the exception of Papua New Guinea, all South Pacific island countries have limited forestry resources. Nevertheless, forest and bush are important elements of food security systems in South Pacific island countries. Rather than producing high commercial value forestry commodities, the major role of forests in strengthening food security systems is as food reservation. The forest and bush produce various wild foods such as wild yams, fruits and nuts, which are highly resistant to many natural calamities. The wild foods can withstand severe natural calamities not only because by their nature they are intrinsically strong but also because their ecosystems provide support and protection against various forms of natural stress. Although a strong tropical cyclone could destroy the whole food crop system, the wild foods are not affected. In such a case, the forest and bush would function as emergency food sources for the nearby communities so that acute temporary food insecurity may be avoided. Using the forest and bush as a “national food reservation” is another application of traditional indigenous knowledge by the people of South Pacific island countries that has been instrumental in constructing strong and resilient food security systems.

It should be noted, however, that the capacity of available forest and bush as a natural food reservation has been gradually eroded over time. The main reasons are deforestation and conversion of the bush and forest to agricultural land, settlements, and infrastructure. This tendency is directly related to population pressure and the rate of economic growth, which are both quite high in most South Pacific island countries. If not managed properly, deforestation may mount a serious threat to the sustainability of food security systems in some South Pacific island countries.

Besides reducing the food reservation capacity, deforestation also reduces environmental protection capability. It reduces water catchment capacity and increases vulnerability to soil erosion, landslide and flood. In the long run, this tendency may reduce soil fertility and land suitability for food production. Landslides and floods may become a serious threat to food crop production. In other words, through environmental protection, the bush and forest also play important roles in strengthening the production systems that contribute to food security.

Deforestation or the conversion of bush and forest to other uses undermines the long-term sustainability of food security systems in South Pacific island countries.

2.9 Crop farming

Farming systems in South Pacific island countries may be divided into three types according to their market orientation: pure subsistence, semi-subsistence (or semi-commercial) and pure commercial. The pure subsistence farm household does not sell any products as all output is used to meet food subsistence needs. Pure subsistence farming is now an indication of marginal conditions, and exists because land is limited or where effective market demand for consumer products does not exist, such as in very remote areas. Such households are now rare in South Pacific island countries. At the other extreme, the purely commercial farm sells all of its products. Such farms are generally plantations in South Pacific island countries, owned by corporate enterprises. They produce high-value cash crops or animal products, mostly for export, and rarely become involved in the production of staple foods. Some plantations grow food for their workers or allow their workers to maintain subsistence food gardens (McGregor 1997). In between, the output of the semi-subsistence or semi-commercial farm is used partly for subsistence needs and partly for commercial sale for cash. Presently, most farming systems in South Pacific island countries are of the semi-subsistence type. In general, the subsistence food garden is an essential element in any type of farming system in these island countries and is a salient feature of food security systems in the region.

The major food crops common to all South Pacific island countries are yam, taro, sweet potato, cassava, banana and breadfruit, the traditional staples in the region. Rice is also grown in Fiji, introduced by the Indo-Fijian households over a century ago. The major cash crops are coconut, cocoa, oil palm, kava, squash, coffee and vegetables. In general, crop varieties are very broad, which is important to facilitate highly diversified cropping systems as a risk mitigation response.

With the exception of commercial plantations, farming systems in South Pacific island countries remain traditional, characterized by multi-tiered crop configurations, limited external inputs and long cycles of planted-fallow rotation. Crop varieties and planting timetables are carefully selected such that the food garden can assure availability of food consistent with the quantity, variety and time of the household demands both for daily consumption and customary obligations. Managing seasonal and unpredictable risks is a most important consideration in choosing farming systems. An example of crop mix and planting timetable to maximize household food security is shown in Table 2.2.

Table 2.2 Crop mix and planting timetable of a typical cropping system in Vanuatu.

| Crop | Planting Time | Harvest Time |
|---------------------|------------------|---------------------|
| 1. Cassava | Any time | 6 months |
| 2. Sweet potato | March | June-July |
| 3. Yam | June-July | March-May |
| 4. Banana | Fuel moon | 1 year |
| 5. Taro | End dry season | November |
| 6. Peanut | Any time | 3 months |
| 7. Watermelon | June-July | November - December |
| 8. Pumpkin | Any time | 1 year |
| 9. Pineapple | December | 1 year |
| 10. Corn | Anytime | 3 month |
| 11. Island cabbage | October-November | 3-4 months |
| 12. Chinese cabbage | October-March | 3 months |
| 13. Breadfruit | March-October | 3-4 months |
| 14. Kava | Wet season | 3-5 years |

Source: McGregor (1997).

Semi-subsistence farm households also adopt sequential harvesting techniques to enhance food security (McGregor 1997). Yams and sweet potato may be partially harvested by picking the mature tubers first, leaving the immature ones to be harvested later. Some crops, which can be stored for extended periods in the ground, are kept in sufficient amount as a food reserve against unexpected risks. As an example, Fiji taro can be harvested in 12 months, but can be left standing in the ground for up to 5 years.

In general, achieving sustainable food security is the primary objective in the semi-subsistence farming systems in South Pacific island countries. Through experience over generations living in fragile environments, producers have adapted farming systems to manage the most frequent food security risks. The traditional food farming systems are one of the most important forms of application of indigenous knowledge, and have proven to be an effective disaster-mitigation response in such risky farming environments.

There is growing concern that the strength of the traditional cropping systems to support household food security may have been eroding gradually (Welegtabit 2001; Halavatau and Halavatau 2001) due to agricultural commercialization and increased population pressure on farmland. The first reasoning is that the rapid expansion of large plantation and smallholder commercial farming pulls a large area of land and much labour out of food crop production, thereby reducing food output, particularly of roots and tubers, the traditional foods. Reduction of food supplies would further aggravate the food security problem. Furthermore, reduction of root and tuber supplies would increase their prices and hence make access to them by poor households more difficult. As they become increasingly expensive, the roots and tubers would be replaced by imported foods. But it should be noted that this reasoning is not always true, since agricultural commercialization would increase household incomes and foreign exchange, possibly more than sufficient to buy the additional imported foods. Even so, increasing external dependency could potentially reduce the qualitative strength of the food security systems.

The second reasoning is that increasing population pressure has pushed food gardens to less fertile land, farther away from home, or even completely wiped them out. Increasing land scarcity may also force some households to increase cropping intensity excessively that may reduce productivity by compromising the sustainability of the cropping systems. Consequently, subsistence food production could fall and its implicit cost increase. This tendency, of course, will reduce food availability and access for households, and increase food insecurity, especially for rural and poor urban households. This concern may be valid in some South Pacific island countries such as Vanuatu, Tonga and Fiji.

2.10 Livestock farming

Livestock production makes a substantial contribution to the welfare and total productivity of the people of South Pacific island countries although national statistics do not always show the full extent of this contribution (Quartermain 1979). Most traditional forms of subsistence and semi-commercial livestock farming are based on domesticated pigs and chickens. Other major introduced animals are goats, sheep, cattle and horses. Animal production, of pigs in particular, is totally integrated into the social and agricultural systems of people in the region. Pig production is the most important because of its role in customary feasts. Horses are commonly kept in Tonga as a means of transporting crops. Animals produce manure for crop farming, while crop farming provides feed for animal production. Livestock farming is a source of cash income and meat for subsistence as well as for customary festive occasions for many households. It should also be noted that livestock are generally resistant to many natural calamities, such as cyclones and moderate drought, and hence livestock farming is also important as a risk mitigation element of the household food security systems.

Large commercial livestock farming ventures are few in South Pacific island countries. The most well established cattle ranching activities are in Vanuatu where there has been some success in smallholder cattle production. But successful ventures are mainly large-scale schemes

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operated by expatriates. Smallholder village cattle scheme have largely been unsuccessful (Schoeffel 1996). The marketable surplus of livestock products is generally small in most South Pacific island countries, which are net importers of livestock products. The imported livestock products are largely to meet the demand of the urban population. Most of the imported livestock products are of low quality, such as mutton flaps, canned meat and other fatty meat products. These products are cheap but nutritionally poor. High fat consumption is one of the main reasons for the high incidence of obesity in the region.

2.11 Indigenous values and institutions

The core institutional attributes providing a strong foundation for various food security-related social institutions in South Pacific island countries have historically been the modest and harmonious ways of life. With this ethos, two important institutions emerged, namely customary land tenure and customary sea tenure systems. These two tenurial systems govern land and fishery resource exploitation in an egalitarian and sustainable manner. As long as the stocks are sufficient, the clan or community chiefs will arrange land and fishing ground distribution such that all households will have access to sufficient sources for their subsistence needs. In other words, the customary tenurial systems have been important building blocks of food security systems.

Another important institution derived from the core values in South Pacific island countries is the reciprocal social obligation for exchanging gifts and help. This is an important risk-coping device of food security systems. Households that face temporary food shortage, due to harvest failure for example, would get food gifts from their neighbours so that they would not suffer from acute hunger. Reciprocity and helping each other also occur between provinces and countries. Should a community face a food disaster, then neighbouring communities would organize emergency food aid and other forms of assistance.

The extended family system and social solidarity values are also important determinants of the emigration-remittance flows in some South Pacific island countries. Relatives cooperate to support a family member to emigrate; in return, upon success in obtaining a good job, the emigrant would send remittances to those who previously helped him (her). He (she) may also invite and help other relatives or friends to emigrate. As discussed elsewhere, the emigration-remittance nexus is an important mechanism that enables some South Pacific island countries to sustain strong national food security even with a high population growth rate and limited resources.

It can be concluded that the indigenous institutions have historically been the most important factor making food security systems in South Pacific island countries resilient in the face of fragile macro-environmental settings. Acute hunger is exceptional, if indeed it ever happens. But the big question is whether these indigenous institutions are sustainable in the long run. There have been some signs that they are gradually eroding due to modernization and commercialization. Low material aspirations are being replaced by a more hedonic lifestyle. The market economy has introduced individualization of social relationships and dehumanization of transactions in goods and services. This tendency is strongest in urban areas where marketization is more rapid than in rural areas. Consequently, food insecurity problems are likely to become more prevalent in urban areas than in rural areas.

2.12 Indigenous food preservation and storage techniques

Food preservation and storage methods have historically played a central role in the mitigation of natural disasters in disaster-prone areas in South Pacific island countries. Through generations of experience, the people in the region have established some indigenous knowledge and techniques on how to preserve and store some food items for emergency

purposes. One of the most important one is breadfruit preservation. This crop is abundant during the harvest season, well in excess of current fresh consumption. Breadfruit is most perishable in its fresh form but in dried form can be stored in a stable condition for years (McGregor 1997). Dried breadfruit has been a traditional “survival food” in the event of a food disaster.

The other indigenous food preservation techniques are fermentation and smoking. These techniques can prolong the useful life of some food items for some months. The people of South Pacific island countries have also some indigenous knowledge on extending the storage life of some planting materials by constructing an optimal storage environment. With these techniques, some yam cultivars can be stored for up to six months. All of these indigenous techniques have proven very important as mitigation instruments against food disasters.

3. Food Security Conditions and Problems

3.1 Dietary patterns

Dietary pattern is a result of the interaction between food availability (supply) and food access and preference (demand). Naturally, the traditional diet in South Pacific island countries was based on domestically produced food items. The traditional food staples as the main sources of energy are taro, yam, sweet potato, cassava, banana and breadfruit. The main sources of animal protein are seafoods, chicken and pig. The main sources of vitamins are various leafy vegetables. If consumed in an appropriate quantity, the traditional diet should be sufficient to meet nutritional requirements for a healthy and active life. In fact, nutritionally, the traditional staples contain more essential micro-nutrients than the introduced staples (Table 3.1). Moreover, the traditional dietary pattern has been an optimal adaptation to local resource endowments, environmental characteristics and social setting for sustainable food security. Accordingly, in a largely autarkic economic regime, the traditional dietary pattern was the most appropriate one to guarantee sustainable food security.

Contacts with foreign cultures and economies have induced significant changes in dietary pattern in many areas of South Pacific island countries. Immigrants and travellers bring their particular food preferences and dietary patterns. Europeans introduced wheat-based staples such as bread and the Irish potato. Asians introduced rice and wheat-based staples, and some varieties of vegetables. These introduced dietary patterns were therefore mostly based on imported food items. The opening up of the economies provided strong forces for the rapid adoption of the introduced dietary patterns, not only by migrants and their descendants but also by the indigenous people in the region. Consequently, the dominant role of the traditional diet has been eroding gradually.

The rapid substitution of the traditional dietary pattern by introduced dietary patterns is irreversible and will continue in the future for the following reasons. First, the traditional foods have been and will remain more expensive than their imported substitutes. On one hand, the price of domestically produced foods will continue to increase (Welegtabit 2001) because of increasing costs of production, due to declining productivity (Halavatau and Halavatau 2001), and increasing demand due to population growth. On the other hand, the prices of imported foods, rice and wheat in particular, have declined due to the fact that global supply shifts have outweighed demand shifts in the world market in recent times. This has occurred in large part because of rapid technological change, which has not been matched in the root crop industries that predominate in South Pacific island countries.

Second, the introduced dietary patterns are more suitable for an “instant and convenient lifestyle”, the basic characteristic of a modern society where the value placed on time is high. Such a pattern of life has already begun to emerge in the urban areas of South Pacific island countries. The traditional food items, such as taro, yam, sweet potato, cassava, banana and breadfruit, are bulky and sold in large bundles (15-30 kg). They are mostly available in local markets and in fresh (and hence perishable) form. These factors make their procurement inconvenient and storability is quite limited. In contrast, imported food items such as rice and wheat flour are available in a variety of stores, can be bought in small quantities, and can be stored for a few months. Processing, preparation and cooking methods for traditional foods are labour-intensive and time-consuming whereas the imported foods may be cooked with automatic appliances. The imported foods are also easily sold in “ready to eat” or “fast food” forms (Table 3.1).

Third, the increasing need for cash induces agricultural commercialization whereby farmers sell the more expensive traditional foods for cash and buy cheaper imported foods to

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satisfy their own food needs. Foraete (2001) reported that this practice has been occurring in many areas of Fiji, especially in peri-urban areas where marketing is not a limiting factor. Commercialization of farming is inevitable as the village economy becomes increasingly monetized and material aspirations of the rural people increase.

Fourth, the urbanization rate will remain high due to population pressure and a desire for better education and an urban lifestyle. As explained previously, the introduced dietary patterns are more suitable to such a lifestyle than are the traditional diets. Moreover, urbanization will increase the number of poor people who prefer the cheaper imported foods to the more expensive locally produced foods, or can only afford the former.

Table 3.1 Comparative characteristics of traditional foods and imported foods in South Pacific island countries.

| Characteristic | Traditional Diet (Indigenous Foods) | Introduced Diet (Imported Foods) |
|-------------------------------------|--|-------------------------------------|
| 1. Origin | Domestic produce | Imported produce |
| 2. Price | More expensive | Cheaper |
| 3. Procurement convenience | | |
| a. Buying place | Traditional markets | Shops or stores |
| b. Size of purchasing unit | Large | Variable |
| c. Bulkiness | High | Low |
| d. Cleanness | Low | High |
| 4. Cooking process (manual) | | |
| a. Time requirement | High | Low |
| b. Labour requirement | High | Low |
| c. Cleanness | Low | High |
| 5. Automatic cooking alternative | Non-existent | Existent |
| 6. Ready to eat/fast food forms | Not available | Available |
| 7. Nutritional quality (non-energy) | | |
| a. Minerals | High | Low |
| b. Vitamins | High | Low |

There are two opposing views of the impacts of changing dietary patterns towards the consumption of more imported foods in South Pacific island countries, outlined above. The pessimistic view of the dietary changes towards more imported foods is that it has negative impacts on national food security. First, it causes a greater dependency on imported foods and decreasing food self-sufficiency. Increasing dependency on foreign suppliers increases uncertainty of national food availability and exposes national food markets to international market fluctuations. Second, food importation requires foreign exchange and hence can cause balance of payments problems. Being small countries, South Pacific island countries have a limited capacity to control and absorb external risks. Third, dietary change causes nutritional insecurity. It is argued by some that the imported foods are inferior to the traditional food in terms of nutritional quality (e.g. Foraete 2001; Halavatau and Halavatau 2001; Welegtabit 2001). In particular, the traditional staples contain more essential minerals and vitamins than the imported ones (Table 3.2). As mentioned above, an influx of high fat-content meat, mutton flaps in particular, is considered to be one of the main causes of obesity problems in South Pacific island countries. Fourth, food imports depress domestic food production. Imported foods are cheaper and more consistent with consumer preferences, and hence can easily out-compete locally produced foods. Increasing dependency on food import, therefore, worsens the already bad nutritional security problem.

Optimists, however, argue that there is nothing to worry about higher consumption of imported foods. First, food importation diversifies the sources of food procurement and consumption patterns, and hence reduces vulnerability of national food security to domestic food production risks. This is especially important for those South Pacific island countries prone to natural disasters. Food importation is thus most important in mitigating food availability risk

by providing an effective risk-coping mechanism against domestic food production shortages. Second, food importation is an efficient market adjustment mechanism in an open economy that facilitates optimal resource allocation, which is welfare-enhancing rather than welfare-worsening. Open-market operations hasten economic growth, increasing household income, improving the balance of payments and enhancing food security. As a simple proof, South Pacific island countries import cheap foods and export high-value products (Williams 2001), and so food importation facilitates higher rates of economic growth by utilizing their comparative advantage. A country with a high income per capita and healthy balance of payments should not experience national food insecurity even though its population is highly dependent on food imports. Third, there is no evidence that food imports have had negative impacts on the domestic production of food products (Williams 2001). Fourth, some imported foods are cheaper than domestically produced traditional foods and hence more for affordable. Availability of cheap imported foods enhances the food security of poor households in urban areas of South Pacific island countries by increasing the food entitlements of poor households. Fifth, it is illogical to say that the inferior nutritional quality of some imported foods must inevitably cause nutritional problems. Unbalanced nutritional intake is a reflection of unbalanced diets, which in turn are a reflection of individual food choice. Food importation should not be blamed as the culprit of a problem of unbalanced diets. The problem of unbalanced diets is educational, demanding improved dietary knowledge, and cultural, requiring lifestyle changes.

These conflicting views have strong arguments, but we lean towards the optimistic view that food imports need not be bad, although they can be if they form part of unbalanced diets. In the long run, food importation, or market liberalization in general, should enhance national food security. In the short term, however, it could undermine national food security by leading to worsening nutritional security. Governments in South Pacific island countries should institute, as a precondition, education programs on nutrition, health and lifestyle matters if they are concerned about the low nutritional value of food imports. They can also help make locally produced foods more competitive with imports by developing marketing infrastructure, abolishing market distortions and conducting good governance, in order to minimize the negative impacts of market liberalization on national food security.

Table 3.2 Composition of some common foods in Vanuatu.

| Item | Energy (kj) | Protein (g) | Fat (g) | CHO (g) | Fibre (g) | K (mg) | Ca (mg) | Thia (mg) | Vit. E (mg) |
|----------|----------------|----------------|------------|------------|--------------|-----------|------------|--------------|----------------|
| Taro | 339 | 0.8 | 0.4 | 19 | 0.7 | 264 | 28 | 0.07 | 2 |
| Yam | 338 | 2.0 | 0.1 | 18 | 1.5 | 271 | 7 | 0.04 | 4 |
| Rice | 509 | 2.3 | 0.2 | 28 | 0.8 | 10 | 4 | 0.03 | T |
| Bele | 229 | 3.4 | 2.0 | 6 | 1.5 | 376 | 431 | 0.14 | |
| Carrot | 111 | 0.9 | 0.1 | 6 | 4.4 | 235 | 29 | 0.07 | 4 |
| Mango | 268 | 0.7 | 0.2 | 15 | 2.1 | 225 | 10 | 0.06 | 1 |
| Raw fish | 458 | 21.4 | 2.4 | T | 0.0 | 353 | 29 | 0.07 | |
| Crab | 456 | 19.2 | 2.3 | 1 | 0.0 | 166 | 226 | 0.03 | 4 |
| Veal | 674 | 29.2 | 4.8 | 0 | 0.0 | 355 | 8 | 0.18 | T |

Source: Weleghabit (2001).

3.2 Dual structure of food security systems

One salient feature of national food security systems in South Pacific island countries is their dualistic structure. They comprise two distinct and weakly related rural and urban components. Rural food markets are either very thin or do not exist. Urban food markets are either weakly integrated with or completely separated from rural food markets. The main reason for this dualistic structure is underdeveloped food marketing infrastructure (Fleming 2001), transport and telecommunication deficiencies, in particular.

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The core elements of rural food security systems are family farming and artisanal fisheries, which are the economic base of most rural areas in South Pacific island countries (Figure 3.1). Their strength is determined to a large extent by the availability of arable land and artisanal fishing grounds, both of which have limited sustainable production capacity. As long as national resources are sufficiently abundant, the egalitarian traditional institutions will remain intact and the rural food security systems will remain strong and sustainable. Accordingly, the most important dynamic forces that determine the sustainability of the rural food security systems are population growth and the ratio of population to arable land and artisanal fishing grounds. Population pressure increases resource scarcity, thus limiting access to sufficient resources and inducing institutional changes that increase the intensity of resource exploitation. Scarcity-induced institutional changes cause a breakdown of egalitarian tenurial systems and hence reinforce the barriers to access to sufficient resources to some members of the population. Increased resource exploitation can increase short-term productivity but at the expense of declining long-term total factor productivity. Consequently, the rural food security systems will gradually weaken.

Another dynamic force that determines the sustainability of the rural food security systems is modernization, as rural societies become more exposed to external markets and cultures. Modernization increases material aspirations, for cash income in particular, and induces marketization of the rural economy that in turn induces agricultural commercialization and reinforces institutional changes. Increasing allocation of resources for cash income reduces the amount of resources allocated to subsistence food production. Agricultural commercialization induces transformation of the rural food security systems from mainly subsistence-based farming toward semi-commercial or pure commercial farming. Given that marketization is efficiency-enhancing, this transformation process should have a net positive impact on the food security systems. But, if the markets are not efficient, the net impact may well be negative.

The urban food security system is summarized in Figure 3.2. Urban food security systems are characterized by market exchange. Self-produced foods from food gardens are appropriately considered as the product of survival or risk-coping mechanisms for the poor segment of urban households. Because most urban households rely on market exchange for their food procurement, the key factors of urban food security are food availability in the markets, either through domestic or import procurements, and a household's ability to command or purchase food (entitlement). The availability of sufficient foreign exchange to import foods is a necessary condition to guarantee urban food availability. Household purchasing power is a sufficient condition to guarantee household food security. Foreign exchange availability is determined by macroeconomic performance, in particular GDP, employment, balance of payments and inflation, whereas household purchasing power is determined by household real income.

It should be clear from the above discussion that rural and urban food security systems are different (Table 3.3) and only weakly related. Market connections are weak because inter-provincial trade is still limited due to infrastructure constraints. Perhaps the most important integrating factor is the migration-remittance connection. As discussed earlier, the urbanization rate is very high and family ties remain strong in most South Pacific island countries. The strong family ties induce exchanges of goods and money among relatives between rural and urban areas.

Figure 3.1 Rural food security system.

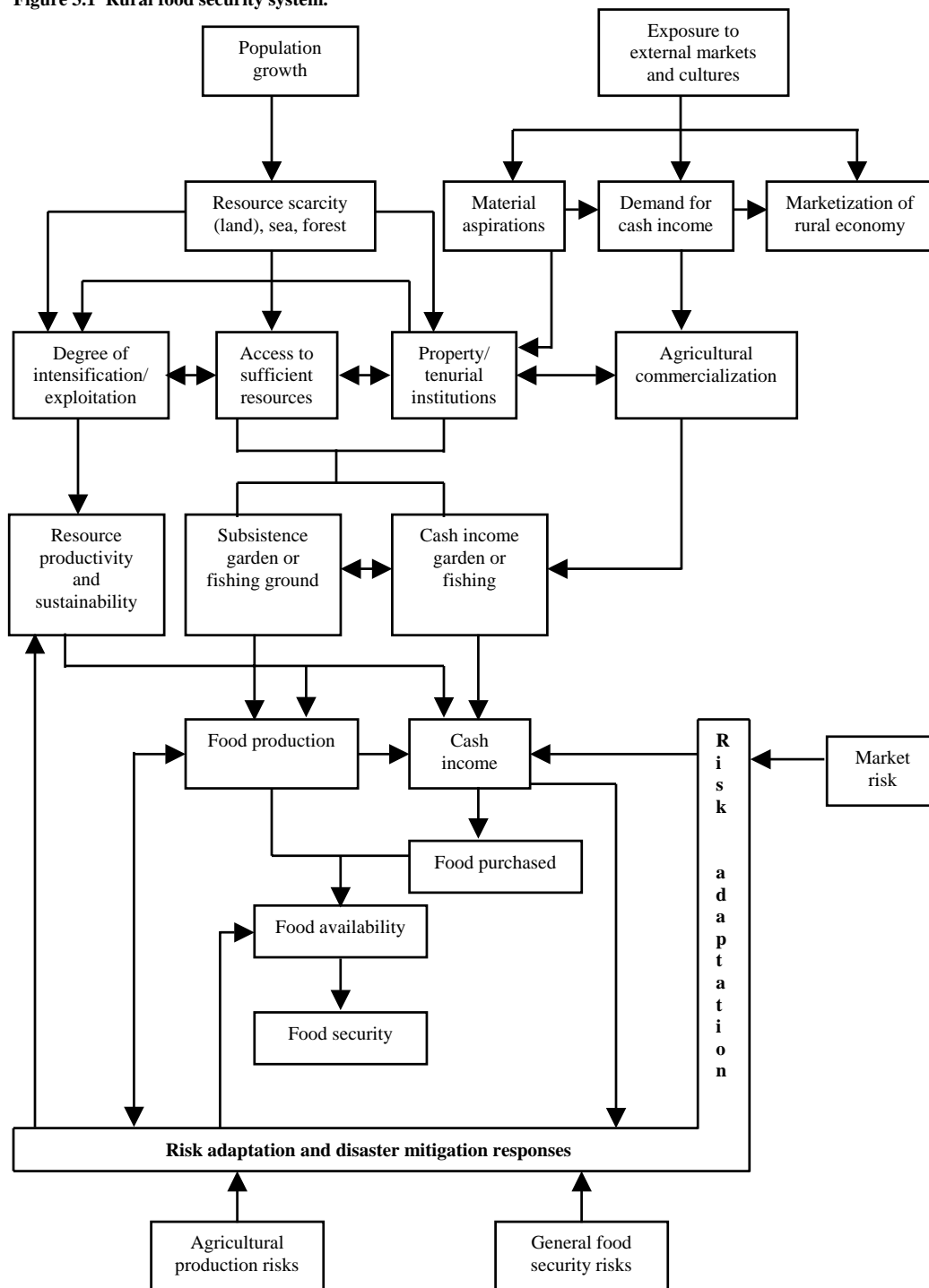


Figure 3.2 Urban food security system.

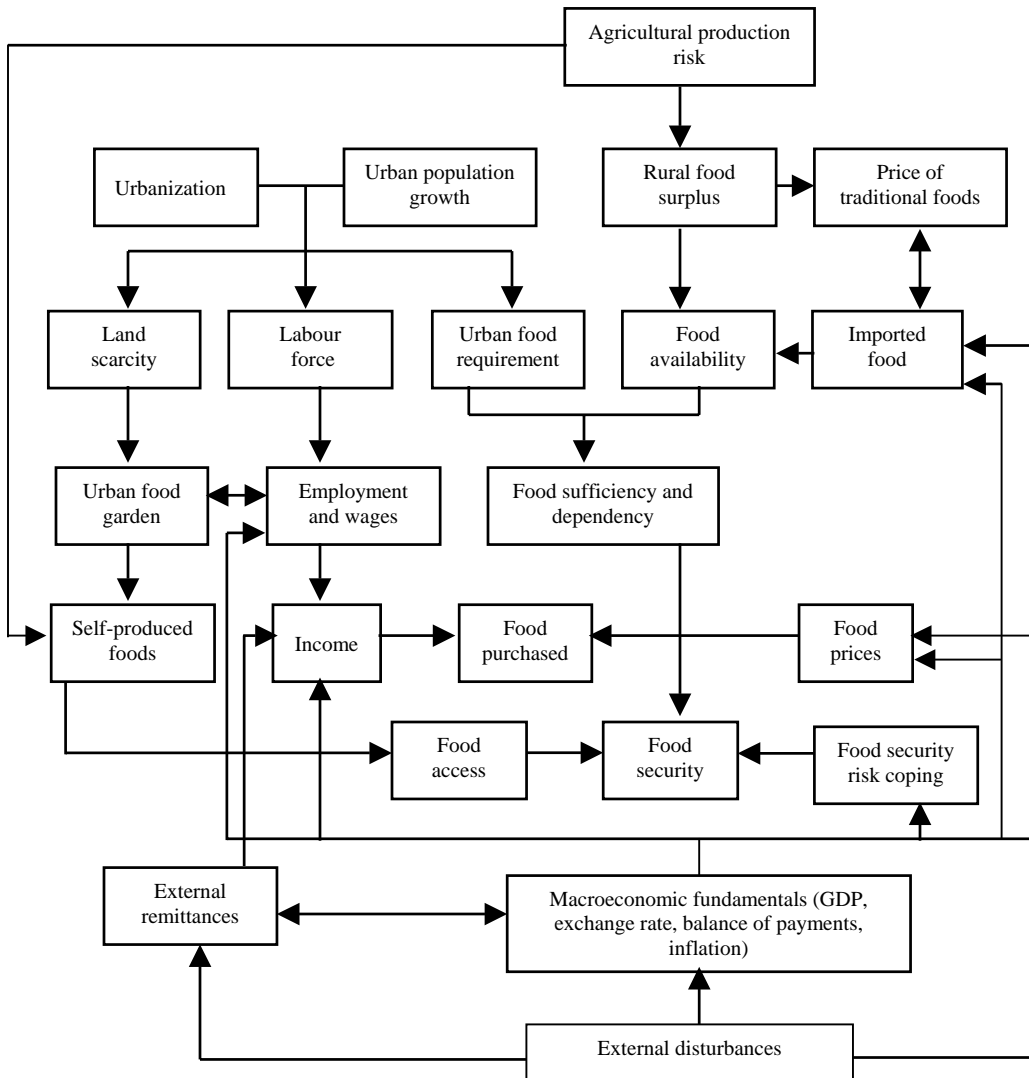


Table 3.3 Basic characteristics of rural and urban food security systems.

| Characteristic | Rural food security systems | Urban food security systems |
|-----------------------------|--|--|
| 1. Main foods | Traditional foods | Imported foods |
| 2. Main procurement systems | Self produced | Purchased |
| 3. Main limiting factor | Access to land and fishing ground | Permanent and well paid jobs |
| 4. Main risk factors | Natural disaster (food production related risks) | Macroeconomic and food market disturbances |

Accordingly, food security conditions and problems in South Pacific island countries can best be analyzed by using the dualistic systems paradigm. Indeed, the degree of dualism may differ between provinces within a country as well as between countries, depending on trade patterns and economic integration.

The most important determinant of long-term food security in urban areas of South Pacific island countries is urbanization. The very high urbanization rate has caused a high urban unemployment rate. Unemployed persons are generally rural migrants who are poorly educated

and unskilled. Unskilled labourers mostly work in the construction sector on a temporary basis. Their employment is therefore low-paid and unstable (Welegtabit 2001). They are the poorest segment of the urban population. It can be concluded that the most important underlying causes of food insecurity in urban areas of South Pacific island countries are the high unemployment rate, low-paid jobs and unstable employment.

The food procurement side of the urban food security systems is highly dependent on imported foods. As explained in the previous section, imported foods are cheaper and their characteristics are more suitable than traditional foods to meet the preferences of urban people. Through imports, food availability can always be assured as long as foreign exchange is available, suggesting that food importation is good for urban food security. But a high dependency on imported foods makes urban food security vulnerable to both external disturbances, such as food embargoes, international food prices and transportation costs, and internal disturbances.¹

3.3 Food security risks and vulnerability

Food security risk refers to the probability that some people in some place for some of the time fail to have access to adequate food due to some unpredictable events. In other words, food security risks are the probability of some group of people falling into food insecurity due to unpredictable events or risk factors. Depending upon its severity, the food insecurity problem can be reflected in either hunger or famine. Its duration may be temporary, prolonged or permanent. A short-term disaster causes temporary food insecurity, whereas a disaster with a prolonged impact can cause chronic food insecurity.

The main foods eaten in the rural areas of South Pacific island countries are still locally produced traditional foods.² Most rural households produce a substantial part of their subsistence food needs. Rural food markets are thin and segmented. Accordingly, food security risk is primarily determined by local food production risk. Macroeconomic and external market disturbances do not have significant effects on rural food security. The most significant threats to rural food security are natural disasters, which could devastate traditional food production.

As stated above, the main foods of urban people in South Pacific island countries are now imported foods and the role of traditional foods is minor and declining over time. There is the potential for traditional foods to be wholly substituted by imported foods in urban diets. Hence, because disturbances in domestic food production can be neutralized by adjusting imported food supply, the level of domestic food production need not have a significant impact on urban food security. Accordingly, natural disasters, a rural phenomenon in South Pacific island countries, have only minor impacts on urban food security. The major risk factors of urban food security are macroeconomic and external market disturbances, and occasionally internally generated civil disturbances.

The food production environment in South Pacific island countries is fragile and prone to natural disasters, which can be divided into three categories (McGregor 1998):

- (i) physical natural disasters: cyclones, floods, drought, frost, volcanic eruptions, earthquakes, tsunami and sea-level rises;
- (ii) biological disasters: incursions of agricultural pests and diseases; and
- (iii) environmental disasters: soil erosion, coastline erosion, degradation of land production capacity and over-fishing.

¹ Due to recent civil unrest, the macroeconomic performance of Solomon Islands (a South Pacific island country not specifically covered in the project) has been disastrous and its ability to import food and other essential items is close to zero at present (March 2001).

² The definition of a traditional food is relative. For example, sweet potato is commonly regarded as a traditional food in the diets of people in most South Pacific island countries yet it was introduced in the region quite recently.

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The occurrence and severity of impacts of physical natural disasters that pose a serious threat to food security in rural areas vary by province and country (Table 3.4). Cyclones are the most prominent and widespread disasters. With exception of the highlands of Papua New Guinea, all South Pacific island countries, and Fiji and Vanuatu in particular, have been subject to cyclones from time to time. Frosts, on the other hand, only occur in the highlands of Papua New Guinea.

Table 3.4 The vulnerability of South Pacific island countries to natural disasters.

| Natural disaster | Fiji | Papua New Guinea | Tonga | Vanuatu |
|----------------------|--------|------------------|--------|---------|
| 1. Cyclone | High | Low | High | High |
| 2. River flooding | High | High | Medium | High |
| 3. Tsunami | High | High | High | High |
| 4. Earthquake | Medium | High | Medium | High |
| 5. Land slide | High | High | Low | High |
| 6. Drought | High | Medium | High | Medium |
| 7. Frost | - | High | - | - |
| 8. Volcanic eruption | - | High | Medium | High |
| 9. Coastal flooding | High | High | Medium | High |

Source: Excerpted from McGregor (1998)

The impact area and effective time of each natural disaster is generally limited. As an event, a cyclone can last anywhere from several hours to some days. A drought can last for several months. Each natural disaster has a discrete end, but its impact could be devastating to food crop production and cause severe food shortages and temporary food insecurity in some areas of South Pacific island countries. The most vulnerable people live in isolated rural areas that depend solely on local food production. They could suffer from famine if their food gardens were destroyed by a natural disaster and if emergency food aid were not available in time. Catastrophic disasters occasionally occur in the remote mountainous areas of Papua New Guinea.

Biological disasters inflicted by pests or diseases can cause greater long-term food shortages than physical natural disasters. Unlike natural physical disasters that have a discrete end, a major pest or disease outbreak is open-ended and may never cease. Over time, the distributed impacts of biological disasters can be devastating. Moreover, biological and physical disasters can have reinforcing impacts. Physical disasters can seriously disrupt a delicate ecological balance and lead to a rapid proliferation of pests or diseases. Pests and diseases can weaken crop resistance or tolerance against physical disasters. McGregor (1997) concluded that the impacts of biological disasters on the agricultural and general economy in South Pacific island countries have been, on balance, far worse than any physical disaster such as a cyclone. Biological disasters pose a serious threat to both rural and urban food security.

Some recent examples of devastating biological disasters in South Pacific island countries are (McGregor 1998):

- The incursion of coffee leaf rust in Papua New Guinea in the mid-1980s necessitated a large investment of industry, government and aid funds to control the disease.
- The incursion of yellow zucchini mosaic virus and watermelon one virus into Samoa and Western Viti Levu in Fiji has made it difficult to grow cucurbits such as watermelon commercially.
- The establishment of papuana beetle in Viti Levu has excluded many growers from lucrative export markets.
- The incidence of taro leaf blight in Samoa meant the loss of the country's most important staple and major export earner.
- The entry of melon fly into Solomon Islands has made it difficult to grow any member of the cucurbit family.

Commercial crops, fruits and leafy vegetables, in particular, are more vulnerable to pest and disease outbreaks than staple food crops. Most of the newly introduced commercial crops, such as watermelon, squash pumpkins, zucchini and Chinese cabbages, are less tolerant of pests and diseases than traditionally grown crops. They are generally planted in large areas as a monocrop. Because they make significant contributions to export earnings and GDP in some South Pacific island countries, pest outbreaks on these crops can cause serious macroeconomic problems and lead to food insecurity in both rural and urban areas.

Fruit flies (family Tephritidae) are the world's major pests affecting fresh fruits and fleshy vegetables, and are of major concern in every South Pacific island country. There is at least one, and usually more, endemic species of fruit fly present that can damage up to 90% of cucurbit plants. Production of cucurbits becomes very difficult in areas where these flies have become established (McGregor 1997). Ominously, these pests can move very fast from one region to another and from one country to another.

Environmental disasters are manifested in degradation of the food production capacity of land and fishery resources arising from human activities. They include indiscriminate burning, deforestation, unsustainable cropping practices and overexploitation of fishery resources. Indiscriminate burning and deforestation induce soil erosion and can lead to degradation of land suitability and capacity for agriculture. Deforestation also undermines the food security systems by destroying trees, which used to act as shields to protect food gardens against cyclones, and wild foods, which used to be the reservation foods used as part of risk-coping mechanisms. Substitution of the sustainable traditional cropping systems by unsustainable cropping systems reduces long-term soil fertility and leads to unsustainable food security systems. Overexploitation of fishery resources leads to continuous depletion and eventually extinction of fish resources. Environmental disasters underline the long-term sustainability of national food security systems. The process goes very slowly and is hardly noticed.

3.4 Food security conditions and problems

3.4.1 Food availability

In general there is no chronic food availability problem in South Pacific island countries. Despite limitations in marketing infrastructure, domestic food systems and international markets work quite effectively in supporting national and provincial food availability in all countries. Although most countries in the region are small (microstates) and have limited arable land, all of them can rely on their domestic food production for the major source of their national food procurement. Yet all are food-deficit countries and food imports have been increasing. However, they have so far had sufficient foreign exchange to finance food imports to meet the food deficit gap.

Rather than adequacy, an important common issue of food availability in South Pacific island countries is vulnerability. Population settlements are widely scattered in these island countries and, except in urban areas, food markets are generally underdeveloped and segmented as transportation infrastructure linking areas of settlement is still underdeveloped. Because South Pacific island countries are prone to natural disasters that can have devastating impacts on domestic food production, temporary food shortages can lead to acute provincial food insecurity, although foods are abundant nationally where the quick flow of foods from surplus provinces to deficit provinces is impossible due to transport constraints. Improving provincial food distribution is one of the most important challenges faced by governments in all South Pacific island countries in order to strengthen their national food security systems.

3.4.2 Provincial distribution and household access to food

Even where market forces bring about an efficient and prompt distribution of foods from surplus areas to deficit areas in South Pacific island countries, they do not guarantee consistent

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food entitlements across provinces. This is because of the often vast inter-provincial and rural-urban differences in incomes and wealth.

In South Pacific island countries, the food accessibility issue should be evaluated using the dualistic view of national food security systems. The backbone of rural food security systems is subsistence farming (including fisheries). Most food consumed within the household is self-produced. In such a system, food production (availability) is sufficient to ensure household access to adequate food and hence household food security regardless of the ability to transfer food between areas. The most critical element is resource availability. So far, with the exception of Fiji, most households in rural areas of South Pacific island countries have had access to agricultural land and fishing grounds adequate to produce food to meet their subsistence needs. This is the main reason why there has been no chronic food insecurity in rural areas.

The situation in Fiji is significantly different. The rural population consists of indigenous Fijians and Indo-Fijians. All land is owned by indigenous Fijians, and so Indo-Fijians may only use agricultural land within the existing leasehold system. Agricultural commercialization is more widespread in Fiji than in other South Pacific island countries, and the rural economy is highly monetized as rural economic development has been largely devoted to cash crops for export (Foraete 2001). Accordingly, food access in rural Fiji is a matter of labour employment as well as access to resources. Poverty is a continuing problem in rural Fiji. Traditional institutions, such as family networks, now often fail to provide a safety net for the poor and disadvantaged people (Foraete 2001).

Average income per capita in urban areas of South Pacific island countries is quite high, and no South Pacific island country should be classified as a low-income country. But income distribution is highly unequal. The country studies indicate that the incidence of poverty is quite high in the urban areas of Fiji, Papua New Guinea and Vanuatu. Furthermore, the numbers of urban unemployed workers in South Pacific island countries are growing rapidly, due to migration and natural population growth. On the other hand, job creation is proceeding slowly, due to low investment growth. As an example, the urban economy of Vanuatu generates only 500 new formal sector jobs for the additional 3000 urban migrants each year (Williams 2001).

3.4.3 Risk mitigation

The fact that historically there has been no acute food insecurity in South Pacific island countries may lead some to wonder why this could happen in such a harsh and disadvantageous environment. It is explained by the presence of effective food security risk-mitigation mechanisms. Risk mitigation is a measure or action taken to minimize the negative impacts of food security risks. It may be divided into three types. The first type, *risk management*, includes all anticipative actions to minimize the negative impacts on food production and income before the disasters occur. Second, *risk coping* includes all actions taken during the event of a food crisis to prevent acute hunger and to facilitate early recovery. Third, *risk avoidance* is an action to leave the disaster impact area permanently.

Perhaps the most important risk management strategy to minimize household vulnerability to food security risks is the maintenance of the indigenous values of modest and harmonious ways of life, strong family relationships and high social solidarity already referred to above. It should be noted, however, that in Fiji this customary tenurial system discriminates against Indo-Fijians who do not have rights to land. This is becoming an acute problem for many Indo-Fijian families. Many land leases currently coming to the end of the original lease period have not been renewed, forcing Indo-Fijian families off the land and into a state of extreme poverty.

Another important risk-pooling institution is the informal mutual support systems among family, clan and community members. This is a set of informal relationships of obligations, reciprocity and rights to expect certain things. In Papua New Guinea, this is called the “wantok” system (Igua 2001). This system has adapted well to the changing physical, economic and social

environments, and tends to be more important in rural areas than urban areas. For Tongans, this system has even been extended to foreign countries. Intra-family and inter-family transfers have been a very important means of assisting households in need. In fact, for Tonga, international transfers form an integral part of the national economy and national food security system.

There are also contingency plans set up by the government and non-government organizations (notably, churches) to provide a safety net for poor and disenfranchised people, and rescue programs against natural disasters.

The extent and strength of indigenous relationships and institutions vary by country. The most intensive and strongest ones appear to be in Tonga and Papua New Guinea. They still exist in Vanuatu, but have been eroding significantly, and are probably now least significant in Fiji. As Foraete (2001) put it: "Fiji is not an egalitarian society but one with deep inequalities. Despite the much vaunted strengths of tradition and community, family networks now fail to support some of the poorest and disadvantaged sufficiently if, indeed, they ever did."

Another important risk management measure is the adoption of a farming systems approach. As discussed in previous sections, traditional farming systems in South Pacific island countries are the result of adaptation to the local environment over generations. Achieving sustainable food security is the primary objective of the traditional farming system, which is a hidden strength of the food security systems. The introduction of commercial monocropping systems may increase farmers' incomes but it also increases their vulnerability to natural disasters.

Preserving food with indigenous techniques and conserving wild foods in forests are also risk-coping strategies to reduce vulnerability to food production risks.

The last choice, if food security risk is permanent and unbearable, is risk avoidance, whereby people migrate from rural areas. This phenomenon is indicated by the high urbanization rate in all South Pacific island countries and a high rate of inter-island migration in Vanuatu (Welegtabit 2001), which is mainly caused by the pressures of food insecurity. Emigration to other countries may also be interpreted as a mechanism to avoid food security risks or to ease population pressure on the land.

Despite growing food insecurity in urban areas, some coping strategies have developed to avoid the problem, such as the purchase of cheap imported foods, borrowing and asking for transfers from relatives.

The people of the South Pacific island countries are survivors of quite dangerous living environments, having adapted well to their natural environment over generations. They have developed effective risk mitigation measures to prevent acute food insecurity. Although precarious, food security systems in South Pacific island countries have proven to be quite resilient, although they are now under greater pressure than they ever have been in the past.

3.5 Nutritional security problems

The more serious problem faced by all South Pacific island countries is nutritional insecurity. "Food security is achieved, if adequate food (quality, safety, socio-cultural acceptability) is available and accessible for and satisfactorily utilized by all individuals at all times to achieve good nutrition for healthy and happy life" (Gross et al. 2000). Nutritional security is more than the conventionally defined food security. Food security is a necessary but not sufficient condition for nutritional security. Food insecurity implies nutritional insecurity, but food security does not imply nutritional security. Satisfactory utilization of food is the additional requirement for food security to imply nutritional security.

A nutritional problem (malnutrition) is reflected in either under-nutrition or over-nutrition. Under-nutrition is caused by a deficiency of nutrient intake or under-eating. Failure to access adequate food (food insecurity) must imply under-eating and hence under-nutrition. On the other hand, even if access to food is unlimited, under-nutrition as well as over-nutrition may still occur if food utilization is not satisfactory. Food utilization refers to intra-family food

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preparation and food allocation that determines individual food intake. Under-nutrition can be caused by either failure to access adequate food (food insecurity) or misutilization of food, whereas over-nutrition is caused by misutilization of food.

Under-nutrition caused by failure to access adequate food is a predominantly a poverty phenomenon. Some household members may suffer from under-nutrition because they do not have sufficient income to buy the food they need. Foraete (2001) reported on a survey conducted in 1990/91 in which it was found that 10% of Fijian households had incomes too low to afford a minimum standard of living. Poverty is an undercurrent in all communities in Fiji. It is not concentrated in rural or urban areas or in any ethnic group. Iguia (2001) also reported that poverty causes food insecurity and malnutrition in Papua New Guinea. Welegtabit (2001) reported that poverty is especially serious in urban areas in Vanuatu, due to the high urbanization rate. Poverty is not a serious problem in Tonga, however.

Another cause of under-nutrition is improper intra-family food distribution. There is a tradition that the father and the older sons should have priority in the consumption of food available in the home. This may explain why under-nutrition is prevalent among children and women. In Fiji, Foraete (2001) reported that malnutrition severely affected 6% of children and moderately affected a further 21% of children in 1980. The situation has been improving and, by 1993, only 1% of children were severely malnourished. However, anemia remains a major public health problem affecting 40% of young children and 30% of women.

Iguia (2001) also reported that children and women are the groups most vulnerable to malnutrition in Papua New Guinea. Protein and energy malnutrition is the most important form of malnutrition with prevalence among children by province ranging from 19.4% to 56% in 1982-83. Medical records from maternity and child clinics show that the prevalence of protein and energy malnutrition among children under five years old increased from 10% in 1980 to 27.6% in 1990. Although precise estimates of their prevalence are not available, Iguia (2001) also reported that nutritional anemia and iodine deficiency are widespread in Papua New Guinea, especially among children and women. Under-nutrition is not a significant problem in Tonga since most households have access to sufficient food (food-secure) (Halavatau and Halavatau 2001). In Vanuatu, Welegtabit (2001) reported that 23% of children 0-5 years of age were underweight due to under-nutrition in 1983.

The problem of malnutrition can also be attributed to a lack of knowledge by indigenous people of how to prepare nutritious meals (Welegtabit 2001). The introduction of exotic tropical fruits, nuts and vegetables has tended to attract more attention than traditional varieties. Research is lacking on traditional food crops and their potential as substitutes for imported foods. Governments pay little attention to the scope for improvement of traditional food crops and for making people aware of the usefulness of these crops. People prefer imported food to domestic foods, ignoring the fact that most imported foods might be nutritionally inferior to some domestically produced foods.

Over-eating, which induces over-nutrition, is a more serious problem in South Pacific island countries. Rather than a poverty phenomenon, over-nutrition is more a phenomenon of affluence. It is prevalent among people in the middle and upper classes who have incomes high enough to afford excessive amount of foods, participating in many feasts. The prevalence of over-nutrition is highest in Tonga and lowest in Papua New Guinea among the four South Pacific island countries under study.

Halavatau and Halavatau (2001) reported that, while almost all Tonga households are food-secure, a large number of them are not nutritionally secure. The 1986 National Nutrition Survey found 10% of men and 39% women were obese. Over-nutrition seems to be increasing. A more recent survey indicated that 32% of adults were overweight and 42% were obese. Changes in dietary patterns to include more low-quality imported foodstuffs exacerbate the problem of over-nutrition, as does the change to a more sedentary lifestyle. Many people command more off-farm cash income and hence do not need to work as hard on their farms,

becoming less active and burning off fewer calories. Over-nutrition has been linked to various non-communicable diseases (NCDs) such as overweight, obesity, diabetes and heart disease.

Foraete (2001) reported that only 40% of the population in Fiji had healthy weights in 1993. Obesity was found to be a serious health problem amongst women over 35 years of age. Overweightness was also apparent in children under five years of age. About 12% of people in Fiji suffer from diabetes. Ischaemic heart disease and high blood pressure caused the deaths of 41% of Indo-Fijian and 28% of indigenous Fijians in 1990. Between 1982 and 1990, death rates in people over 20 years increased by 30% among indigenous Fijians and 40% among Indo-Fijians. High blood pressure is more common in the urban population. Foraete (2001) also argued that one of the main causes of malnutrition has been the change to a poorer quality diet and more sedentary lifestyle, exacerbating the adverse effects of over-nutrition.

Although Welegtabit (2001) did not provide specific figures, he also reported that over-nutrition has been increasing in Vanuatu. The incidence of diabetes and hypertension was two to three times higher in urban areas than in rural remote areas. As in Tonga and Fiji, over-eating interacts with the high consumption of poor-quality imported foods to cause malnutrition. In general, people in rural areas are living on healthier diets than their urban counterparts.

Igua (2001) reported that over-eating is not as dramatic or severe in Papua New Guinea as in other South Pacific island countries. This problem primarily occurs in urban and booming rural areas (mine sites, logging areas and big project sites) where people have high cash incomes and a less active lifestyle. Over-nutrition has become increasingly serious, however. The morbidity of diabetes mellitus increased from 2.8% in 1979 to 7.1% in 1993, and hypertension increased from 5.2% in 1979 to 9.6% in 1993.

Besides deteriorating dietary patterns and more sedentary lifestyles, some indigenous values and cultural beliefs also contribute to the high prevalence of over-nutrition in South Pacific island countries. There is a traditional belief that a big and fat body is beautiful, masculine, healthy and socially desirable. This belief had a degree of validity in the past when physical strength was necessary for survival. The traditional habit of eating big meals is in line with the need for a big body. Modernization in the transport, agricultural and health sectors, and lifestyle changes have reduced the need for a big body. Yet, the old beliefs, social values and eating habits persist. The inconsistency between the change in lifestyle, on one hand, and the beliefs, social values and eating habits, on the other hand, is one of the main reasons why over-nutrition is endemic in South Pacific island countries.

Another explanation is the high frequency of cultural festivities and family parties in all South Pacific island country communities. Most cultural festivities and family parties entail the consumption of large quantities of food and drink. Attending social festivals is a social obligation and the family party is part of an intricate pattern of reciprocity. Accordingly, most people in South Pacific island countries, the middle and upper classes in particular, attend many parties. This social phenomenon frequently results in over-eating and leads to over-nutrition and needs to be tackled through a social education campaign. People should be educated to beware of the danger of over-eating and the specious validity of the belief that a fat and big body is good.

It can be concluded that both under-nutrition and over-nutrition are of serious concern in South Pacific island countries. Under-nutrition is chiefly caused by poverty-induced food insecurity. The most vulnerable groups are the poor households in both urban and rural areas. In rural areas, the basic cause of poverty is limited access to productive resources and economic infrastructure. In urban areas, the basic cause is unemployment and underemployment due to the fact that increases in urban population are not being matched by commensurate increases in job opportunities in urban areas. As such, it can be said that the root of the problem is population pressure and under-investment.

On the other hand, over-eating causes over-nutrition. It is not a food security problem in the sense of food inadequacy. The most vulnerable groups are the rich who have the ability to command plenty of food. This problem is a social phenomenon that arises from an

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inconsistency between beliefs, lifestyle and eating habits. Lifestyle changes rapidly in line with modernization, whereas eating habit remain based on the old values and cultural beliefs. This problem can only be solved through social education.

4. Policy Options

The national experts proposed the following policy options to deal with food security problems in their respective countries. These policy options are taken from the respective country reports: Foraete (2001) for Fiji, Igua (2001) for Papua New Guinea, Halavatau (2001) for Tonga and Welegtabit (2001) for Vanuatu. The national experts also made some suggestions for regional cooperation, reproduced below, to deal with the food security issues. In summarizing the policy options suggested by the national experts, we have not attempted to impose our priorities or views. It is therefore inevitable that some differences in priorities and inconsistencies in views are present between the sets of policy proposals.

4.1 Fiji

There is no overall insufficiency of food in Fiji but, judging by the high numbers of people suffering food-related diseases, it appears that numerous households are not able to secure enough food of the right quality and quantity to ensure good nutrition. The current situation is typified by:

- (i) an over-dependence on imports to meet at least national nutritional needs;
- (ii) high cost of local root crops compared with imported processed cereals;
- (iii) reduced production of local root crops; and
- (iv) increasing preference for cheap and convenient processed foods.

Food security is no longer solely a simple matter of food production. To ensure an adequate supply of nutritious food at the household level, many factors need to be addressed in a co-ordinated manner. Promoting household food security should be undertaken through the following strategies:

- (i) develop national objectives to encourage increased production and improved marketing of local food;
- (ii) encourage the growing of sufficient food at the household level for family needs;
- (iii) promote the selection of nutritious food to satisfy every household member's nutritional requirements;
- (iv) assist families to secure sufficient income to ensure access to available food; and
- (v) promote the proper distribution of available food within the household unit.

Some agricultural programs are currently being implemented with positive implications for the improvement of national and household food security. They need to be encouraged and maintained. There needs to be an effective program of agricultural extension to support local producers of traditional crops and the growing of these crops in household gardens, especially at the village level. The post-harvest quality of local food crops should be improved by introducing simple food processing techniques at the village level and more effective marketing systems. There is a need for the Extension Department in the Ministry of Agriculture, Fisheries and Forests (MAFF) to develop standardized practices for the promotion of sustainable food security.

The resolution of some 20,000 leases that are beginning to expire on native land in the sugar cane areas has major implications for poverty and household food security. The government is mindful that if this issue is not satisfactorily resolved, Fiji faces the daunting prospect of large and increasing numbers of rural households without access to land. Furthermore deteriorating prospects in the sugar industry will mean that rural employment opportunities for these displaced households will diminish.

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The most challenging food security issues for Fiji in this millennium are sustaining domestic food production levels in line with food demands and market potential, and continuing the transition from subsistence to commercial agriculture. Fiji's ability to meet this challenge is greatly enhanced by its long-term comparative advantage in the production of traditional food crops. This comparative advantage in traditional crop production is based on farmers' ability to grow crops cheaply, consumer preferences and the unavailability of low-cost imported substitutes. If crops are grown in the traditional manner, without chemicals and in rotation, these are highly sustainable activities.

Government can support traditional food crop development in the following areas:

- Research support can be critical if there is an outbreak of a pest or disease that can devastate a traditional food crop, as shown by the dalo (taro) beetle on Viti Levu and taro leaf blight in Samoa. If appropriate control measures are developed, then there is an extension role to disseminate this information to farmers.
- Quarantine has a crucial role to play in minimizing the risk of these introductions.
- Strategically located roads can open up significant markets for traditional food crops and provide an incentive for increased plantings of food crops as past road developments have shown.
- The high nutritional value of traditional food compared with imported and processed food needs to be continually brought to the attention of the community. Low cost activities such as the nutritional posters produced in the past by the National Food and Nutrition Committee (NFNC) can be very beneficial.
- Farmers need to be made fully aware of the devastating consequences of indiscriminate burning on the productivity of food gardens. The rapid expansion in commercial taro production has brought with it unsustainable production practices which need to be addressed through education and in some cases through regulatory enforcement.
- The status of traditional foods and farming systems needs to be enhanced through school curricula, youth training programs, and via the media.
- The employment-generating youth training programs currently being promoted by government should give priority to traditional food crop production as a high return/low risk activity.
- The traditional food production sector has as much to gain as any other from the demand generated from outward-looking economic policies that lead to sustained economic growth. As incomes rise, so will the demand for high value traditional food.

With the government now committed to developing and adopting a National Plan of Action for Nutrition for Fiji, the NFNC Secretariat is the appropriate body to undertake its development and co-ordinate and monitor its implementation. Therefore, the role and functions of the NFNC secretariat should be strengthened to effectively undertake this task. The Secretariat would focus on the priorities of the Fiji Plan of Action for Nutrition (FPAN), service a high-level committee of representatives of ministries to co-ordinate the implementation of the FPAN, provide expert food and nutrition advice to the government and its ministries, conduct research including pilot surveys, and monitor and report on the food and nutrition situation and the implementation of the FPAN. The scientific expertise in the proposed secretariat needs to be strengthened and its activities reviewed in light of its changing role and functions. Some of the current activities of NFNC would be more appropriately undertaken by other agencies, e.g. nutrition education by the National Centre for Health Promotion.

Fiji has been fortunate to have received assistance for nutrition and health-related projects and programs from several donor countries, such as Australia (AusAID), Britain, Canada (Canada Fund), United States of America and the European Union, as well as from international organizations such as the United Nations Development Programme (UNDP), United Nations Children's Fund (UNICEF), Food and Agriculture Organization of the United Nations (FAO), World Health Organization (WHO) and overseas volunteer groups. Assistance in the form of human, special technical and monetary resources has been invaluable. Many of

the programs and activities could not have been implemented without it and it is important that it continues.

Future support may need to be rationalized. The development of local professional expertise in the field of nutrition should be assisted and encouraged so that the country is able to draw on this expertise when needed. The involvement of the private sector and non-government organizations (NGOs) has been welcome and badly needed. These NGOs include the Red Cross, HART, religious groups (Dorcas, Roman Catholic Women's League, etc.) Their involvement in nutrition-related activities has been out of interest and concern for the welfare of families.

Commercial enterprises such as Morris Hedstrom, R.B. Patel and Bajpai Supermarkets have also been involved in the past with specific programs such as the Good Food Campaign. These types of participation and co-operation need to be encouraged. The future roles of NGOs as implementing agencies for nutrition programs could be explored further.

Regional organizations, such as the South Pacific Commission (SPC), have been instrumental in the development of nutrition education materials, and supportive in providing technical expertise and funding of certain nutrition related projects (e.g. the food composition tables). SPC has, through its Community Training Program, trained many women community leaders now working in communities throughout Fiji. The nutrition component has been one of the areas of training that has been strengthened in the past few years. This was done to address the felt needs of the communities. The University of the South Pacific (USP) continues to contribute through their nutrition training programs. The use and assistance of USP's academics in future research could be explored further.

The following policies are, therefore, recommended:

- Promote equitable distribution of wealth among all sectors of the population.
- Promote food security.
- Promote healthy diet, environment and lifestyle.
- Promote multi- and inter-sectoral co-operation.

In support of the above policy goals, some of the strategies that could be undertaken include:

- (i) Continue to direct macroeconomic policies towards price control, and generating income and employment opportunities.
- (ii) Encourage and promote more local food production.
- (iii) Expand research efforts towards reducing post-harvest losses (to include all foods) to increase the availability of food for consumption at the household level.
- (iv) Strengthen and improve the targeting of food distribution systems to alleviate chronic and seasonal household food insecurity.
- (v) Strengthen the national system to control food quality and safety through multi-sectoral co-operation.
- (vi) Reduce the incidence of micronutrient deficiencies.
- (vii) Reduce the incidence of NCDs by promoting a healthy lifestyle and the consumption of a nutritionally adequate and balanced diet.
- (viii) Develop/strengthen nutrition and health education programs for target groups with specific problems (e.g. anemia in women, CVD in adult males and obesity in women).
- (ix) Provide technical assistance through international agencies for the alleviation of household food insecurity
- (x) Strengthen food quality and safety standards and their enforcement.
- (xi) Review and strengthen the co-ordinating role of NFNC among government departments, international agencies, NGOs, academia and industries for developing, planning, implementing, monitoring and evaluating nutrition-related programs.
- (xii) Develop and implement a national nutrition monitoring system.
- (xiii) Encourage and support environmentally friendly practices that promote good health.

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- (xiv) Strengthen nutrition and healthy lifestyle education in the formal education system, the curricula in tertiary institutions and at the workplace.
- (xv) Develop a food assistance program for the vulnerable groups.
- (xvi) Strengthen the delivery of the MCH program by mobilizing NGOs.
- (xvii) Encourage the active involvement of food industries in the support of nutrition education programs.
- (xviii) Develop entrepreneurial capacity within NFNC through the provision of services at cost.

It is also recommended that every effort be made to integrate the above into multi- and inter-sectoral activities so that they become a component of the respective ministry's larger collective concerns, objectives, priorities and programs.

The main challenge is how to handle the agenda of food security in the prevailing environment of deregulation. There is also an urgent need to develop a fully-fledged aggregate food database system within the agricultural statistics information system of MAFF. Examples of the sorts of information needed are per capita food availability and the status of food security as measured by levels of food inadequacy in an aggregate household food security index. Finally, it is essential to strengthen the community-based approach for sustainability and ensure continuation of policy commitment and refinement of program implementation.

4.2 Papua New Guinea

The 16th annual meeting of the National Agricultural Advisory Committee held in 2000 made some significant resolutions and recommendations with regard to national food security. These recommendations must be implemented and used as guides in formulating all national food programs. To promote food security, a farming system approach is recommended within which the FAO concept of food security should be pursued, namely:

1. Intensification of sustainable plant production systems

This should be done through the transfer of well-adapted and accessible technologies and farming practices. These include the effective use of high-yielding varieties, integrated plant nutrition systems, integrated pest management and appropriate post harvest handling, storage and processing methods. These should be combined with a well-designed marketing system and credit schemes to generate greater income to producers.

Sub-components are (i) Rice and Grain Development Program, (ii) Traditional Staples Improvement and Development Program, (iii) Fruits and Vegetable Development Program, and (iv) Spices and Essential Oils Development Program.

2. Diversification of production systems

This involves the integration of livestock and the planting of multi-purpose tree species as components of the farming systems. The sub-components to be developed are (i) Sheep and Goat Development Program, (ii) Cattle Development Program, (iii) Poultry Development Program, (iv) Pig Development Program, (v) Rabbit Development Program, (vi) Aquaculture (Inland Fish Farming) Development Program, and (vii) Apiculture (Honey-bee) Development Program.

3. Introduction of small irrigation and drainage schemes

This scheme entails the development of irrigation and drainage systems, using water sources such as rainfall, runoff, streams and rivers, and underground water together with agricultural land development, to prevent drought and water shortages in crop and animal production.

4. Analysis of constraints to food security

This analysis gives special attention to socio-economic constraints that impede farmers' adoption of technologies and approaches offered by research and development. It focuses on those factors at the farm level that limit profitability and farmers' access to technology, land, input storage, marketing, processing and credit facilities. Rural labour shortages due to rural-urban migration are also a limiting factor in food production in some areas in Papua New Guinea. The results of the constraint analysis would serve as guide to reorient future operations for greater success.

4.2.1 Major strategies for action

- Adopt an integrated rural development strategy contributing to food and nutrition security focusing on a limited number of high food insecurity areas each year. And use community assessment to decide on the activities to be implemented.
- Develop mechanisms for providing funds to support well-designed community projects in consonance with local needs initiated by community groups and provincial staff. Strengthen the rural credit schemes. Train individuals, households and groups on financial management.
- In conjunction with the Departments of Health and Education, and WHO, initiate and implement nutrition education strategies and provide materials and teaching aids targeting protein energy malnutrition, anemia, NCDs and iodine-deficiency disorders.
- Continue the decentralization of the functions of the Department of Agriculture and Livestock to the provinces, to be coordinated by provincial directors with supporting technical teams.
- Change agricultural college curricula so that students receive training that reflects the farming system approach to research and extension. The nutrition component of the curricula should also be revised to stress the links between agriculture and nutrition. Promote and strengthen agriculture education in schools.
- Emphasize more the provision of basic infrastructure such as roads, bridges and telecommunications to improve market access.
- Examine all aspects of the food chain from smallholder production to retail outlets. And develop mechanisms to improve communication links between the groups involved; coordinate and disseminate market information; identify new markets and products; train producers, transport companies etc. in the handling of produce; and monitor food imports and urban prices.
- Encourage major institutions and companies such as schools, prisons, airlines and hotels to use local produce.
- Investigate the potential of large-scale production of traditional staples and introduced food crops and livestock.
- Develop programs promoting all aspects of post harvest work, including storage, preparation, usage of waste and training in nutrition.
- Develop a food processing program to educate women to produce for sale healthy snacks such as sago, fish and legume pops, sweet potato, taro and banana chips, and dried beef and fish jerky. Other snacks based on cereals, fruits and legumes should also be developed and included in the program.
- Assess small-scale food processing machines and equipment for their suitability under local conditions. Also, assess the possibilities of fabricating appropriate equipment for food processing.
- Encourage, promote and assist private sector participation in food production, processing, distribution and marketing.
- Promote and assist urban and peri-urban agricultural programs.

4.2.2 The strategic plan of action

In order to attain a measurable degree of food security in the medium term, a coordinated national strategy must be devised around a clear set of national food security policies, designated as the Papua New Guinea National Framework for Food Security 2001-2015. The policies should aim to eradicate the factors that contribute to food insecurity, and set a framework for a national action plan to systematically attack food insecurity on all fronts through a coordinated effort by all concerned peoples and institutions. The Papua New Guinea National Framework for Food Security 2001-2015 will be a product of a structured process of consultations among all concerned in order to accommodate cross-organizational issues and concerns. The document will clearly define the roles of all players.

The Medium- to Long-Term Strategic Plan of Action (2000-2015) transcends interdisciplinary programs and broader sectoral activities such as forestry, agroforestry and fisheries (aquaculture). The intention with the Strategic Plan of Action is to mobilize inter-institutional, trans-organizational and multi-disciplinary inputs to attack food insecurity and poverty and achieve nutritionally better food for all.

The strategic framework for the Papua New Guinea National Framework for Food Security 2001-2015 comprises 14 sub-components, namely:

1. *Traditional staple crops.* This strategy is to promote, develop, and where necessary conduct adaptive research to address, the production, marketing and post-harvest treatments of traditional root and tuber crops and sago.
2. *Rice and grain industry development and promotion program.* This program aims to improve the national self-sufficiency in rice, grains and other associated crops and livestock production in Papua New Guinea, following an integrated farming systems approach. The strategy is to develop and apply suitable research, extension, processing and development methods for increased productivity and production of rice, grain crops and other associated crops and livestock in favourable areas of Papua New Guinea.

It is proposed that Papua New Guinea puts about 100,000 ha of rainfed lowland rice into production to be able to produce 150,000 to 170,000 tons of milled rice (the equivalent of 240,000 tons of paddy rice). This should be done over the next 10 to 15 years, or longer if necessary, in a systematic and orderly manner by harnessing the local resources and population in gradually developing a viable rice industry.


Alternatively, rice imports could be substituted by the production from 45,000 ha of double-cropped irrigated rice land or by harvesting from 200,000 ha of rainfed upland fields. Papua New Guinea should aim at a 20% reduction in rice imports by 2010, by shifting the production system from the predominantly upland rainfed towards rainfed lowland production with supplementary irrigation and fully irrigated double-cropped fields.

3. *Irrigation and water control management.* The drought of 1997 showed how vulnerable and food-insecure Papua New Guinea is as a nation; when none of the traditional staples could be used to feed those who were hungry, we had to rely on imported rice and flour to feed our people.

Where rainfall is inadequate, supplementary or full irrigation has to be resorted to; yet, there is hardly any irrigation in Papua New Guinea. It is time the Government of Papua New Guinea starts to develop irrigation systems to support food production. The development of irrigation will ensure the growing of two or more crops in any growing

season rather than only one crop or none. Thus, access to water is essential to increase food security.

On the other hand, seasonal floods have been a worry in some environments and also put agricultural land out of cultivation. There is a need to formulate and implement drainage systems to control and manage excess water.

4. *Horticultural fruit trees.* This program addresses issues related to the production, development and promotion of fruit trees.
5. *Integrated vegetable production.* This program is concerned with the special case of high-altitude agriculture, specifically the production, development, marketing and researchable problems relating to the cultivation of both traditional and introduced vegetables above the cut-off point for coffee in the high-altitude highlands between 1,800 and 2,400 metres above sea level.
6. *Urban and peri-urban gardening.* The justification for the establishment of this program is as a response to the apparent and spontaneous reaction to the increasing urban population, which has led to the intensification of peri-urban and urban gardening around the major cities and towns. The program aims to eradicate food insecurity and urban poverty by promoting sustainable urban livelihoods focusing on the utilization of an idle urban labour pool, and equitable and morally acceptable access to resources. Indirectly, it aims to attack the breakdown in law and order and other prevalent social problems associated with urbanization.
7. *Downstream processing, preservation, storage and utilization.* Efficient home-based processing, distribution and marketing systems can make a vital contribution to food security, employment and incomes of urban families. This sub-program initiates and develops small downstream processing projects for food preservation, storage and home utilization. Its projects target rural and urban families in the suburbs.
8. *Agroforestry.* The social and economic consequences of wholesale deforestation, especially devegetation, have become major concerns. Examples exist in the Bulolo valley, Simbu Province and the outskirts of Port Moresby. The spontaneous upsurge of hillside gardening in Port Moresby has contributed to devegetation and soil erosion, and has increased the sediment deposits in the city drainage systems. This sub-program seeks to forge an alliance with city town authorities (e.g.  C) to address the problem of devegetation through agroforestry and other land management interventions.
9. *Livestock production including aquaculture and apiculture.* There is considerable potential for the expansion of livestock production. Livestock products contribute in a big way to household incomes. New species and breeds of livestock such as rabbits, turkey, geese guinea pigs, village chickens, etc. need to be tested. This program will target livestock development, with special reference to small animals, inland fish farming and honey-bee production.
10. *The Special Program for Food Security.* The Special Program for Food Security, launched by FAO in 1994 in the Markham Valley of Morobe province, is accorded a special place. Phase I consisted of four inter-related and complementary components of water control and management: small-scale irrigation, intensified crop production systems, diversification into aquaculture and analysis of socio-economic constraints.

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The expansion phase of this program will be enhanced when the government finally implements programs in (i) information, publication and agricultural statistics; (ii) improvement of extension methodologies and approaches; (iii) rehabilitation and redevelopment of farmer training centers; and (iv) farm machinery and equipment.

4.3 Tonga

The country study of food security in Tonga by Halavatau and Halavatau (2001) revealed adequate food availability at the national and provincial levels, but not nutritional security. At the household level, there are certainly sections of the population that are threatened by food insecurity. These groups include the landless low-income earners and some people who live on 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. Many urban Tongans are employed as low-wage earners whose expenditures are greater than their earnings. The deficit is met from remittances received from overseas relatives. Households spend most money on food and paying bills for utility services.

The main food security problems in Tonga are related to the consumption of too much low-quality foods (fatty mutton flaps, tinned foodstuff and sugary foodstuff) and the associated nutrition-related problems of overweightness, obesity and NCDs. The high incidences of nutrition-related diseases are related to changes in dietary habits and lifestyles.

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

The main determinants of the vulnerability of food security at 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 a national disaster management plan and also a disaster management plan for the agricultural sector.

The households also have various food security 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 pool, women's working groups, and groups mobilized to act in times of cyclones and droughts.

The main recommendations of the study by Halavatau and Halavatau (2001) are for the government to:

- recognize and prioritize the core issue of food security in Tonga as too much food consumption, especially of low-quality imported food and associated NCDs;
- develop appropriate integrated mechanisms for the implementation of food security, nutrition, and health-related activities;
- identify key players for each identified policy, and charge them with the responsibility of developing the policy; and
- identify the key players for each identified information and research activity, and give them the responsibilities of collecting the information and conducting the required research.

4.4 Vanuatu

In a small open, remote and high-cost economy like Vanuatu, rapid population growth compounded by high population to land density will present Vanuatu with many unforeseen

problems in years to come. Most government emphasis and attention has focused on providing adequate social infrastructure such as housing, health, sanitation, water and education. Over the past decades, very little attention has been given to the food needs of the general population in rural and urban Vanuatu. Policy makers have yet to appreciate the existence of food insecurity in a country so richly blessed with agricultural potential.

Policy makers must realize that the food security needs of people vary as they move from rural to urban areas, in particular the vulnerable low-income earners. Urbanization has changed the determinants of food security for the ever-increasing number of ni-Vanuatu who reside in the urban areas. Rural food security, assured by good access to abundant agricultural resources has been replaced by a dependency upon the ability to earn income to buy adequate food.

The vulnerability of food security in urban areas varies with respect to economic status. Low-income earners, and in some instances the unemployed in urban areas, are clearly the people who are most at risk. Their vulnerability is due to low and insecure incomes, and a dependency on a very narrow range of imported foods (rice and flour). Diversity in food options is almost absent in urban Vanuatu. If food security is to be adequately addressed, food diversification must be re-established into people's daily diets.

In developing countries, food systems are not simply about food production. Food systems are a complex network of production, distribution, marketing and consumption. In the case of Vanuatu, food insecurity arises from deficiencies in marketing and distribution rather than production. Technical food production has over the years determined the relative food prices in favour of imported food items. The capability to achieve national food self-sufficiency provides no guarantee of food security, either at the household level or nationally. A comprehensive understanding and appreciation of the multi-factorial and interrelated nature of food systems is central to the successful formulation of initiatives for national food security at all levels.

In formulating and implementing national food policy options, policy makers need to consider carefully the possible impact at the household level. A single policy measure, such as taxes, is unlikely to have a common influence on all households. Its implications for food security will also vary spatially and according to socio-economic status. Not all households in either rural or urban settings are the same. Policies implemented in support of national objectives can conflict with the needs of individual households.

There are no easy approaches to improving food security in Vanuatu. The present problems, and the future development of food security, will require policy makers to start paying more attention to this issue now. It is at present required that a more analytical approach be undertaken using data from national surveys on income, expenditures, consumption, nutrition and other demographic variables. There has been little food policy analysis undertaken to assess the food security status of the general population. This lack of food policy analysis has led to the adoption of reactive policy measures, which carry an inequitable burden for the vulnerable low-income earners in urban areas and those on limited cultivable land and exhausted soils in rural areas. Present food policy measures have also failed to address the fundamental causes of the problems that they seek to remedy. If food security is to be appropriately and effectively addressed, policy makers must understand and appreciate the food system, from production to household consumption. It is envisaged that further studies are required to address the issue of food security in Vanuatu, such as the present food security situation and future trends, food dependency causes and consequences, and malnutrition.

4.5 Regional cooperation

South Pacific island countries have undertaken only limited trade on food commodities. The scope for regional cooperation in food trade may be very limited. Possible areas for regional cooperation are:

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- (i) collaborative research and development on traditional food crops that are common among the countries;
- (ii) development of regional disaster preparedness and coping systems; and
- (iii) development of regional agricultural research and development networks.

5. Conclusions

Despite having limited arable land, a disadvantageous geographical location and space, and a small country size, and being prone to natural disasters, South Pacific island countries have managed to avoid acute food insecurity. All countries manage to procure sufficient food through domestic food production and importation. National food security is, however, in a potentially precarious condition in both the short run and long run. The major issue in the short run is temporary food insecurity due to vulnerability to various natural disasters, which are endemic in South Pacific island countries. Through generations of experience, the people of these island countries have adapted well to their harsh living environment. They have developed various indigenous mitigation mechanisms, such as diversified and sequential farming systems, egalitarian resource tenurial systems, risk pooling social institutions (mutual-help organizations), indigenous food preservation techniques, wild food reservation areas and out-migration, effective enough to prevent acute temporary food insecurity induced by the endemic natural disasters. Perhaps, the most serious concern now is long-term sustainability of the national food security systems. The indigenous wisdom has been eroding due to modernization process and population pressure. Domestic food production capacity and productivity have shown declining trends and all countries have become increasingly dependent on food imports.

Provincial and household food security are of more serious concern than national food security. Although the degree of segmentation varies by country, national food security follows a dualistic structure. Rural food security systems and urban food security systems are either separated or weakly related, chiefly due to deficiencies in marketing infrastructure. Food availability in rural areas primarily comes from local production, whereby access to food by household is determined by access to natural resources (arable land and artisanal fishing grounds). As long as natural resources are abundant, rural food security systems remain strong and sustainable. The most vulnerable provinces are those with high population pressure. The most vulnerable households are poor, with inadequate command over resources to produce subsistence foods and cash income. With the exception of Tonga, all countries studied are facing increased rural poverty that has become a serious threat to household food security in rural areas. One of the main causes in Papua New Guinea and Vanuatu is a high population growth rate, but Tonga and Fiji have managed to avoid this problem through emigration.

Food availability in urban areas is heavily dependent on food importation. A household's access to food is determined by its purchasing power. The most vulnerable groups are the poor, who lack entitlements due to their low income-earning capacity. This is mainly a result of unemployment, underemployment or employment in low-paid and unstable jobs. A high urbanization rate and low capital investment for employment creation are the two most important determinants of urban food insecurity. Urban poverty, and hence food security, have been increasingly serious problems in Papua New Guinea, Vanuatu and Tonga.

The more serious problem in South Pacific island countries is nutritional insecurity. Both under-nutrition and over-nutrition are prevalent. Under-nutrition is caused by food insecurity or intra-household mal-distribution of foods among household members. Food insecurity is largely a poverty phenomenon while intra-household mal-distribution of foods is a cultural phenomenon: husbands and older sons have first priority to access the foods available in the home. Women and children are the groups most vulnerable to under-nutrition, which is prevalent in Papua New Guinea, Vanuatu and Fiji where food insecurity is also prevalent.

Over-nutrition is a syndrome of affluence that is prevalent among the middle- to high-income socio-economic groups due to over-eating of foods. Its basic cause is an inappropriate lifestyle due to what could be termed "unbalanced modernization". This is the adoption of modern tools and transport, and the availability of off-farm jobs that reduce energy

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consumption. On the other hand, eating habits remain traditional, featuring big meals and a high frequency of eating. Over-nutrition is highly prevalent in all South Pacific island countries and is arguably the most important issue of food security in the region.

South Pacific island countries have undertaken only limited trade on food commodities. The scope for regional cooperation in food trade may be very limited. Possible areas for regional cooperation are:

- (i) collaborative research and development on traditional food crops that are common among the countries;
- (ii) development of regional disaster preparedness and coping systems; and
- (iii) development of regional agricultural research and development networks.

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Appendix

Basic Concepts and Analytical Framework

1. Food security definition

A widely accepted definition of food security is “secure access by all people at all times to adequate, safe and nutritious food which meets dietary and food preferences for an active and healthy life” (FAO 1998; Maxwell 1996; von Braun et al. 1992).

Food security is defined by a triad of concepts: *food availability*, *food entitlement* and *food utilization* (Chung et al. 1997). These concepts are the fundamental determinants of food security. Food availability refers to the physical availability of food that is readily accessible by all people to meet their dietary needs and preferences. Food entitlement refers to the ability of individuals to command adequate food for consumption. Food utilization refers to the proper processing and allocation of food intake by individuals. These three concepts are hierarchical in that:

- Adequate food availability is necessary but not sufficient to guarantee adequate food entitlement for all people.
- Adequate food entitlement is necessary but not sufficient to guarantee adequate food intake by all people (food utilization).

For household food security, as an example, adequate physical availability of food in a neighbourhood is necessary to facilitate entitlement to adequate food for all households in the area. If there were no food available, then food entitlement would not exist. On the other hand, even if there were plenty of food available, some households would be food-insecure if they lacked entitlement to food. Furthermore, even if a household has secure access to adequate food, some of the household members could be food-insecure if the food utilization (processing and allocation) within the household is not appropriate. Adequacy of food intake at the individual level is the final necessary and sufficient condition for household food security.

The triad of concepts is the main reason to reject the *food availability approach* (FAA) to food security. The FAA is the theoretical foundation of the well-known food self-sufficiency strategy for national food security policy, which has been widely adopted by developing countries. Sen (1981) proposed an alternative paradigm, the *food entitlement approach* (FEA). The essence of FEA is that entitlement or ability to command adequate food, rather than food availability, is the key to food security. FEA is a useful paradigm to analyze food security issues within a perfect market economy.

The term “secure access” indicates that the food security concept addresses people’s risks of not having access to enough food. Food security is the ability to secure enough food to ensure adequate dietary intake for all people at all times. The food security concept addresses people’s risks of not having access to needed food. The aim of an effective food security policy is to ensure that all households have an adequate dietary intake and can acquire it without being subjected to excessive risks (von Braun et al. 1992). It is clear, therefore, that the food security concept also includes a vulnerability element (Watts and Bohle 1993; Radimer et al. 1990; Kendall et al. 1995). Risks determine vulnerability and hence the level of food insecurity (Maxwell and Frankenberger 1992). Operationally, risk or vulnerability should be treated as an indicator of performance of the triad of concepts of food security. In other words, food security is determined not only by adequacy but also by vulnerability to inadequate food availability, food entitlement and food utilization. Identification and measurement of the risk factors for these three fundamental determinants of food security are important for understanding food security problems, and hence for strategy identification and policy formulation to deal with the problems.

The term “at all times” means that food security should be achieved on a sustainable basis in a long-term perspective. In other words, sustainability is another indicator of food security performance. It is now widely adopted as a necessary element of food security induced by a growing awareness of environmental issues. The new concept is commonly known as sustainable food security (Swaminathan 1995; Simatupang 1999). Sustainability is treated as another indicator of performance of the triad of concepts. Empirically, sustainability is indicated by the trend in performance. Sustainable food security is indicated by a non-negative trend of food availability, entitlement and utilization. *Sustainable food security is thus determined by the adequacy, vulnerability and sustainability of food availability, entitlement and utilization.*

The term “by all people” indicates that food security concerns the food needs of all individual members of a society. As mentioned above, food security can be measured at various hierarchical levels: individual, household, provincial, national, regional and global. Since an individual is usually a member of a household, household food security is a necessary but not sufficient condition for individual food security. This can be explained as follows. If a household does not have access to enough food to meet the needs of all its members, some individual(s) in the household would face food insecurity. But, if all members of the household have secure access to adequate food (individual food security for all household members), then by definition the household is food-secure.

Conceptually, absolute food security must be measured at the individual level. But this is very burdensome and expensive, and hence impractical. Empirically, the household is the lowest level at which it is practical to evaluate food security by collecting survey data. The broader levels of food security can usually be evaluated using secondary data.

The term “adequate food” means that both the quantity and quality of food must meet nutritional requirements and food safety standards for an active and healthy life. Also, the food should accord with eating preferences. Socio-economic research on food security in developing countries usually does not consider food safety standards, which vary with the object of measurement. Although increased attention is now being given to other nutritional requirements, nutritional standard is generally based on energy requirement for practical research. In other words, food adequacy may be measured by the energy content of the actual food consumption.

Food preference is assumed to be revealed by the actual food consumption bundle. The requirement for food adequacy that a food consumption bundle must meet the preferences of the people may be considered as the social dimension of the food security concept. Some researchers have broadened the notion of food security to include an element of social acceptability (Radimer et al. 1990; Kendall et al. 1995). But, according to the revealed preference argument, social acceptability criteria have been implicitly met if food adequacy is evaluated based on actual food consumption.

Although it need not be included as an additional indicator of food security performance, food preference or social acceptability might be an important risk factor for food security. In the long run, people’s preferences change, usually away from locally produced foods to imported foods. This trend has the potential to increase or decrease vulnerability of both food availability and food entitlement. On one hand, imported food dependency exposes the national food systems to external shock and uncertainties, and hence creates vulnerability to the national food security systems. On the other hand, food importation is a means to diversify sources of national food availability and hence strengthen the national food security systems. Indeed, food preference is also an important determinant of food expenditure (and hence entitlement) as well as food utilization.

We can directly infer a definition of food insecurity from the definition of food security. Food insecurity exists when people are already at risk or are suffering from under-nourishment due to food unavailability, lack of entitlement and/or improper food utilization. Food-insecure people have food intake levels below their minimum energy requirements, as well as exhibit physical symptoms caused by energy and nutrient deficiencies resulting from an inadequate or unbalanced diet, or from an inability of the body to use food effectively because of infection or disease.

Food insecurity (and hence food security) can be measured by the level of risk of food intake falling below minimum energy requirements, and the degree of malnutrition deficiency syndromes.

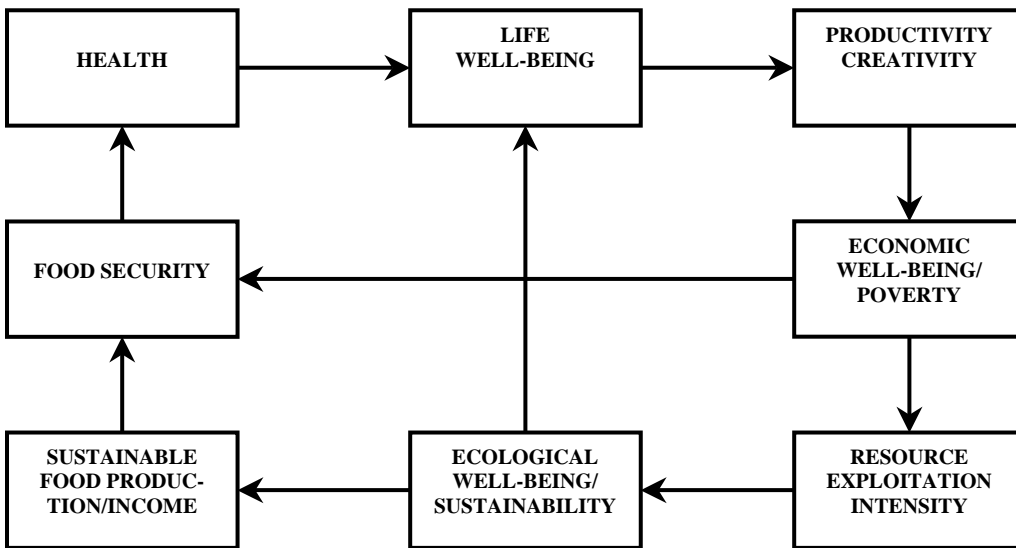
Socio-economic researchers generally use the first approach, whereas nutritionists use the second one. In this project, we used the first approach.

There are two kinds of food insecurity: chronic and transitory (World Bank 1986). Chronic food insecurity is the persistent incidence of food insecurity over a long period. The severity is generally low to medium, and could be continuous or seasonal. It is manifested by hunger and malnutrition syndromes. The root cause is usually poverty. Transitory food insecurity is the temporary incidence of food insecurity. It could be very severe, leading to famine or starvation. It results from instability in food prices, food production or household income due to factors such as economic crises, natural disasters and wars. In reality, however, the two types of food insecurity are closely intertwined. Typically, the poorest people who are chronically food insecure are hit hardest by transitory food insecurity problems (von Braun et al. 1992).

2. Root causes of food insecurity

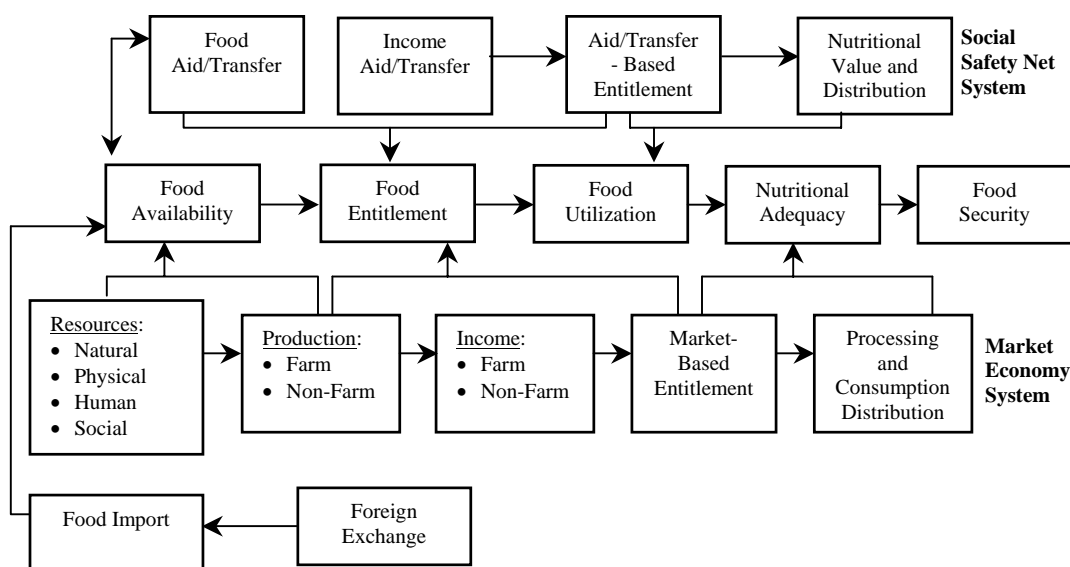
While the root cause of food insecurity is poverty, food insecurity is also an important determinant of poverty. In fact, the main constraints to economic development—poverty, unsustainability and food insecurity—are interrelated in a vicious cycle that causes chronic food insecurity. Chronic food insecurity may be seen as a *food insecurity poverty trap*, to be solved through long-term poverty alleviation programs that turn the vicious cycle into its converse, a virtuous cycle, illustrated in Figure A1.

Figure A1 A virtuous cycle of food security and life well-being.



There are two modes of transactions that may be effective as operating systems for ensuring food availability, entitlement and utilization: market transactions and institutional transfers. In general, food security systems can be divided into two elements: market economy systems and social safety net systems. Determinants of food security within these two systems are conceptualized in Figure A2. Market economy systems are characterized by price-based market transactions. Social safety-net systems are risk-coping mechanisms designed within an institutional setting. They can comprise both formal, governmental-based institutions and informal, non-government institutions.

Figure A2 Determinants of food security.



3. Food security policy framework

Food security is a basic human right on the grounds that a lack of it causes human suffering, indignity and in its worst form even death (Byron 1988; Sen 1989). It is also a necessary condition for sustainable economic development (Timmer 1997). This is because food insecurity can lead to substantial productivity losses and a misallocation of scarce resources due to diminished work performance, lowered cognitive ability and school performance, and inefficient or ineffective income-earning decisions (von Braun et al. 1992).

Yet food security is a complex policy issue. Government plays a key role in its achievement through strategy formulation, policy design and implementation, monitoring and evaluation of progress. *An effective food security policy aims to ensure an adequate dietary intake for all households without exposing them to excessive risks in attaining that intake* (von Braun et al. 1992). The risk of food insecurity is dealt with by public and private actions, and the optimal combination of these actions—considering costs and benefits—characterizes successful food security policies. A policy is effective when it achieves its goal at the least cost and is sustainable in the long run.

The search for food security may have important implications for a region's environment and natural resource utilization as well as its demographic situation. Households may achieve temporary food security, for example, by disposing of assets or “mining” their resources, at the cost of becoming highly vulnerable to future insecurity.

The dimensions, causes and consequences of food insecurity differ widely from country to country, and even within the same country. Hence, a general blueprint for setting priorities should not be considered and the search for the optimal combination of policies has to be country-specific (von Braun et al. 1992).

The differing causes and characteristics of food insecurity among households may require different policy responses. In particular, there are differences in household food security issues in rural and urban contexts (von Braun et al. 1992; 1993). In rural areas, household food security is primarily a function of agricultural production, particularly food production. Technological changes in agriculture and expansion of the rural infrastructure go a long way towards mitigating rural food insecurity. In urban areas, the focus may have to be on generation of employment, social safety,

health policies (von Braun et al. 1993) and the real wage rate (relative to food prices). Typically, energy consumption is lower in urban areas, partly because of differences in activity levels. Further, low levels of health and hygiene in poor urban areas sometimes make urban food security qualitatively different from that in rural areas.

Food security policy (FSP) and programs address the risks of becoming food-insecure. There are seven important sources of risks to food security:

1. food production risks from market, institutional and national disaster-induced failure
2. uncertainties associated with food trade and availability
3. variability in food prices
4. variability in incomes and employment
5. health and other environmental risks
6. political and policy failures such as wars, and other political and social crises
7. socio-demographic risks, encompassing the disintegration of social norms and abnormal demographic structure.

Some policy actions to deal with these risks are listed in Table A1.

Table A1 Hypothetical policy option matrix.

| Policy Option | Risks | | | | | | |
|---|-----------------------------|------------------------|------------|------------------------------|------------------------|------------------------------|-------------------|
| | Food Production | Trade and Availability | Food Price | Income and Employment | Health and Environment | Political and Policy Failure | Socio-demographic |
| 1. Agricultural production | | | | | | | |
| a. Technological change | PHL | PHL | PHL | PHL | P/N | PLL | PLL |
| b. Input subsidies | PHS | PHS | PHS | PHS | NMS | NLS | - |
| c. Output price support | PHS | PHS | NHS | P/N | NLL | NLS | - |
| d. Diversification | PLL | PHL | PML | PML | PHL | PHL | PLL |
| e. Extensification | PHL | PHL | PHL | PHL | NLL | PHL | PLL |
| 2. Conservation | | | | | | | |
| a. Food trade and distribution intervention | PHS | PHS | PHS | PLS | PLS | PHS | PLS |
| 3. Food subsidies and transfer | | | | | | | |
| a. Food price | NHS | PHS | PHS | PML | PLL | PHS | PLS |
| b. Feeding program | NLL | PHS | PLS | PLL | PHS | PHS | PHL |
| c. Food stamp | NLL | PHS | PLS | PLL | PHL | PMS | PLS |
| 4. Income and employment | | | | | | | |
| a. Public works | PLL | PLL | PLL | PHS | PHS | PLS | PLS |
| b. Credit | PLS | PLS | PLS | PHS | PLS | P/N | PLS |
| 5. Health and education | | | | | | | |
| a. Education | PHL | PLL | PLL | PHL | PHL | PHL | PML |
| b. Health | PHL | - | - | PHL | PHL | PML | - |
| 6. Food institutions | | | | | | | |
| a. Food security safety net | PHL | PHL | PHL | PHL | PHL | PHL | PLL |
| b. Social security system | - | - | PLL | PHL | - | PHL | PHL |
| c. Laws and regulations | - | PHL | - | - | PHL | PHL | PHL |
| 7. Non-agricultural sector development | PML | - | PML | PHL | P/N | P/N | PLL |
| 8. Macro policies | | | | | | | |
| a. Exchange rate overvaluation | MMS | PHS | PHS | MMS | - | NHS | - |
| b. Infrastructure investment | PHL | PHL | PHL | PHL | PHL | PHL | PHL |
| PHL | = Positive High Long-term | | PMS | = Positive Medium Short-term | | | |
| PML | = Positive Medium Long-term | | PLS | = Positive Low Short-term | | | |
| PLL | = Positive Low Long-term | | NHS | = Negative High-Short-term | | | |
| NHL | = Negative High Long-term | | NMS | = Negative Medium Short-term | | | |
| NML | = Negative Medium Long-term | | NLS | = Negative Low Short-term | | | |
| NLL | = Negative Low Long-term | | P/N | = Positive/Negative | | | |
| PHS | = Positive High Short-term | | | | | | |

The two main types of food security strategies are growth-mediated food security and support-led food security. The growth-mediated food security strategy entails no specific programs. Food security is pursued by promoting economic growth and transformation. A support-led food security strategy, on the other hand, includes special programs through which food security is pursued (Table A2). The government provides assistance to remove or mitigate destitution without waiting for a transformation of the economy and a subsequent rise in the level of general affluence. The two strategies are connected, especially in the long run.

Table A2 Typology of food security interventions.

| Type | Country Example | Cost per Intended Beneficiary | Benefit-Cost Ratio | Infrastructure Required | Leakage to Non-needies | Improvement in Nutrition Habits of the Malnourished |
|--|--|-------------------------------|--------------------|-------------------------|------------------------|---|
| Untargeted food subsidies | Egypt, Morocco | High | Low | Minimal | High (60-70%) | Low |
| Untargeted food rations (that is, ration shops) | India, Pakistan | Moderate | Low-Moderate | Minimal | High (50-60%) | Low Moderate |
| Ration shops targeted geographically | India, Brazil | Moderate-Low | Moderate-High | Minimal | Low (5-10%) | Moderate |
| Self-targeting food rations | Pakistan, Bangladesh | Moderate-Low | Moderate-High | Minimal-Moderate | Low-Moderate (10-30%) | Low-Moderate |
| Food stamps - targeted by income | Sri Lanka (post 1979), United States, Colombia | Moderate | Low-Moderate | Minimal-Moderate | Low-Moderate (10-30%) | Low-Moderate |
| Food stamps - targeted by health status | Colombia, Indonesia | Low | Moderate | Moderate | Moderate (30-60%) | Moderate |
| Supplementation schemes - on-site or take-home preschooler plus mother | India, Indonesia, etc. | Moderate-Low | Moderate | Moderate | Moderate (30-60%) | Low-Moderate |
| Supplementation schemes - on-site, most vulnerable group targeting | Tamil Nadu, India | Moderate-Low | High | Moderate | Low (3-10%) | Moderate-High |
| Supplementation schemes - take-home, nutritionally vulnerable | India | Low | High | Moderate | Low | High |
| Food-for-work programs | India, Bangladesh, Indonesia | Moderate | High | Moderate-High | Low (3-10%) | Low-Moderate |

Source: Adapted from Mateus (1983). It should be noted that this typology might now not be indeed encompassing.

4. Measurement and analysis

A food bundle for households in South Pacific island countries includes all food commodities that are commonly used for daily consumption, with a special emphasis on roots and tubers. The commodity coverage includes domestically produced native crops (e.g. roots, tubers, leafy green vegetables, bananas, breadfruit) and introduced crops (e.g. rice, vegetables) as well as imported commodities in unprocessed, semi-processed and processed form (e.g. rice, wheat flour and flour-based products, canned meats, fresh fruits and vegetables).

The nutritional values of foods eaten in diets are computed by summing the nutritional contents of the respective food items. The necessary information for this computation is the amount

and nutritional content of the food items. National experts consulted nutritionists or references to obtain the nutritional contents of the food items. Where available, national food balance sheet statistics were used to obtain information on energy and protein availability in the country. Nutrient contents of food availability or food intake were computed as follows:

$$N_i = f_{i1}F_1 + f_{i2}F_2 + \dots + f_{in}F_n = \sum_j^{\eta} f_{ij}F_j \dots \dots \quad (\text{Equation 1})$$

- N_i = total amount of nutrient i, i = calorie, protein, micronutrient
 F_j = amount of food item j, j = (1 for taro), (2 for rice), 3, ---, n
 f_{ij} = nutrient i contents of food item j (e.g. amount of calories per unit of taro).

Standards of food nutrition adequacy for energy, protein and micronutrients vary by country and region within a country as well as by sex, age, job and ethnic group. The national experts consulted nutritionists and references to obtain these standards.

A more meaningful measure than total nutritional content of food availability or food intake is nutritional intake per capita. Nutritional intake per capita was computed as total nutrients divided by the total population:

$$\begin{aligned}
 NC_i &= N_i/POP && (\text{Equation 2}) \\
 NC_i &= \text{Per capita availability or intake of nutrient i} \\
 POP &= \text{Total population}
 \end{aligned}$$

A food adequacy indicator was computed as the ratio of nutritional contents of food availability or actual consumption to their respective standard requirements:

$$\begin{aligned}
 FAI_i &= 100 * NC_i/NR_i \quad \% && (\text{Equation 3}) \\
 FAI_i &= \text{Food adequacy index for nutrient i} \\
 NR_i &= \text{Nutrient requirement standard for nutrient i}
 \end{aligned}$$

Food availability or intake is insufficient to meet nutrient i if $FAI_i < 100\%$, and it is surplus or over-consumed if $FAI_i > 100\%$. Graphical analysis of food security was conducted by plotting food adequacy index over time where time series data were available. If the food adequacy index is always above 100%, there has been no food security problem (Figure A3a). If the food adequacy index is always below 100%, there has been a persistent food security problem (Figure A3b). If the food adequacy index periodically or irregularly falls below 100, the food security problem is temporary (Figures A3c and A3d).

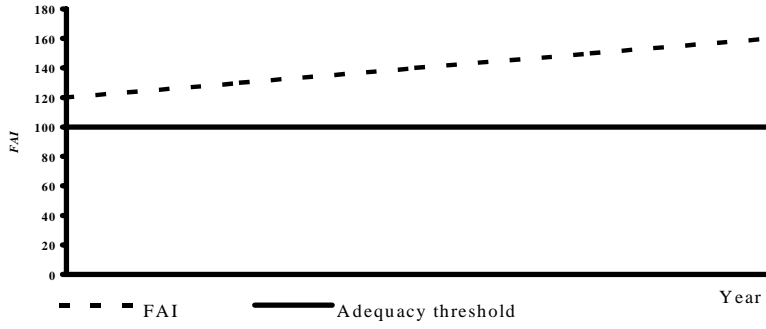


Figure A3b Persistent food security.

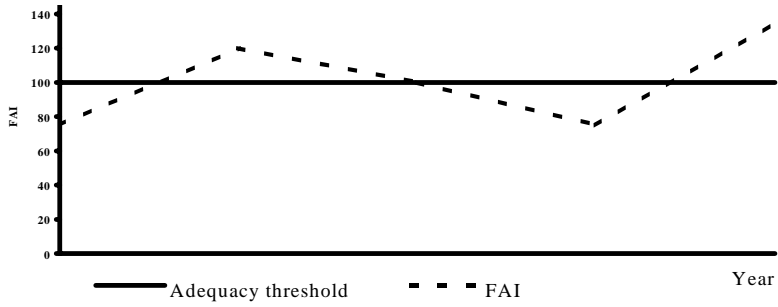
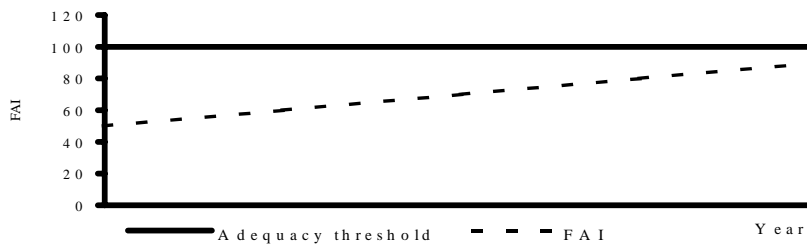
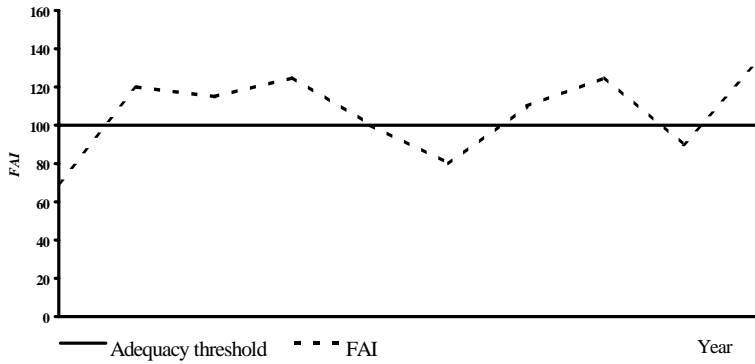


Figure A3d Irregular food insecurity.



National food availability by individual food item is computed as consumable domestic production plus commercial imports and transfers (notably, aid and remittances):

$$\begin{aligned} \text{NFA}_i &= \text{CDPF}_i + \text{CIF}_i + \text{TRF}_i + \text{SO}_i && \text{(Equation 4)} \\ \text{NFA}_i &= \text{national availability of food item } i \\ \text{CDPF}_i &= \text{consumable domestic production of food item } i \\ \text{CIF}_i &= \text{commercially imported food item } i \\ \text{TRF}_i &= \text{food item } i \text{ transferred from abroad} \\ \text{SO}_i &= \text{opening stock of food item } i. \end{aligned}$$

Consumable domestic production (CDP) is the amount of a domestic food item in production readily available for non-farm utilization. It was computed as:

$$\begin{aligned} \text{CDPF}_i &= \text{GDPF}_i - \text{SEED}_i - \text{LOSS}_i && \text{(Equation 5)} \\ \text{GDPF}_i &= \text{gross domestic production of food item } i \\ \text{SEED}_i &= \text{seed and planting material utilization of food item } i \\ \text{LOSS}_i &= \text{post-harvest losses of food item } i. \end{aligned}$$

Food availability per capita for each major staple was computed by dividing CDPF by the total population. Nutritional adequacy of food availability was computed by using the procedure outlined in (E1-E3). The vulnerability of food availability was evaluated by analyzing its variability within a year by seasons and by years over time. The analysis was conducted by using a standard deviation indicator and/or graphical analysis. Sustainability was evaluated by analyzing the long-term trend in food availability. It should be noted that vulnerability and sustainability analysis would be more meaningful if conducted not only on total availability (NFA) but also by its sources (CDPF, CIF and TRF). In this regard, the degree of reliance or dependence on a particular source affects vulnerability. The reliance indicators were computed as follows:

(i) Domestic Production Reliance (DPR)

Domestic production reliance is measured by the ratio of consumable domestic production (CDPF) to national food availability (NFA):

$$\text{DPR}_i = 100 * \text{CDPF}_i / \text{NFA}_i \quad \% \quad \text{(Equation 6)}$$

DPR is generally considered positively related to security of national food availability.

(ii) Import Food Reliance (IFR)

Import food reliance is measured by the ratio of commercial food imports (CIF) to national food availability (NFA):

$$\text{IFR}_i = 100 * \text{CIF}_i / \text{NFA}_i \quad \% \quad \text{(Equation 7)}$$

IFR is generally considered negatively related to security of national food availability.

(iii) Transfer Food Reliance (TFR)

Transfer food reliance is measured by the ratio of food transfer to national food availability (NFA):

$$\text{TFR}_i = 100 * \text{TRF}_i / \text{NFA}_i \quad \% \quad \text{(Equation 8)}$$

TFR is positively related to insecurity of national food availability.

The right-hand side of equation Equation 4 identifies the sources of food access. Food access at the national level, therefore, was evaluated based on national capability to obtain adequate food. Adequacy of food access (entitlement) was evaluated on the basis of:

- (i) national capability to produce foods: planted area, productivity and competitiveness;
- (ii) national capacity to import foods: foreign exchange availability and import price; and
- (iii) a country's opportunity to obtain food aid and other transfers.

Vulnerability and sustainability of food access were evaluated according to these three means of gaining entitlement to food in the following manner:

- (i) Domestic food production
 - Vulnerability was evaluated by analyzing seasonal (within-year) and cyclical (over years) variability of domestic production, using standard deviations, frequencies of production shocks and graphical analysis. The causes (risk factors) of vulnerability and government coping policies were identified and analyzed.
 - Sustainability was evaluated by analyzing long-term trends in domestic production, planted area, land productivity and labour productivity.
 - Survivability of domestic farming systems was evaluated by analyzing their competitiveness against alternative farming systems as well as competitiveness of their output against imported products. Competitiveness with alternative farming systems was evaluated by comparing their profitability with that of alternative farming systems. Competitiveness against imported products was evaluated by comparing domestic unit cost with the product's import parity price.

- (ii) Capacity to import
 - Vulnerability was evaluated by analyzing the burden of food importation. Two relevant indicators for the burden are:

$$\begin{aligned} \text{Import-GDP ratio} &= \text{IYR} = \text{Value of food import/GDP} \\ \text{Import-export ratio} &= \text{IER} = \text{Value of food import/value of total export} \end{aligned}$$

- International price variability and trend, availability of food supply in international markets and constraints on the importation process may critically affect import vulnerability.
 - Sustainability may be indicated by long-term trends in both IYR and IER. Increases in IYR and IER indicate unsustainability.
- (iii) Food aid or transfers
 - Vulnerability was evaluated by analyzing the reliability of food aid and transfers, especially remittances. Is there an institutionalized system or merely incidental giving? Are they personal transfers, transfers by private agencies or state gifts?

Total (gross) utilization (NFU) of food item i is composed of domestic use (DUF), exports (EXF) and change in stocks (CSF). Total utilization is always equal to total availability:

$$\text{NFU} = \text{DUF}_i + \text{EXF}_i + \text{CSF}_i \equiv \text{NFA}_i \quad (\text{Equation 9})$$

Where information on DUF and CSF was not available, the two were combined to get apparent domestic utilization (ADC):

$$ADC_i = NFA_i - EXF_i = CDPF_i + (CIF_i - EXF_i) + TRF_i \quad (\text{Equation 10})$$

Domestic use (DUF) or, alternatively, apparent domestic consumption (ADC) was used as a proxy for gross national food consumption, the ultimate measurement unit of food security at the national level. Consumption per capita (in items of food items or nutrient content) was computed by dividing DUF (or ADC) by the total population. Nutrient adequacy was evaluated by constructing and analyzing a food consumption adequacy index. The computation procedure is similar to that explained earlier in equations E1 to E3.

Vulnerability of domestic food consumption is reflected by its variability, which was evaluated by using standard deviations, frequency of abrupt shocks and graphical analysis. It was decomposed into its sources. In this regard, degree of reliance on the respective sources and utilization structure affect the vulnerability of domestic food consumption. Some important reliance and utilization ratios are:

(i) Self-Sufficiency Ratio (SSR)

The self-sufficiency ratio was computed as the ratio of consumable domestic production to apparent domestic consumption:

$$SSR_i = 100 * CDF_i / ADC_i \quad \% \quad (\text{Equation 11})$$

SSR_i is commonly considered positively related to national food security, although many commentators have questioned the validity of this supposition.

(ii) Trade Dependency Ratio (TDR)

The trade dependency ratio was computed as the ratio of net imports to apparent domestic consumption:

$$TDR_i = 100 * (CIF_i - EXF_i) / ADC_i \quad \% \quad (\text{Equation 12})$$

TDR_i is negatively related to personal food security.

(iii) Aid Dependency Ratio (ADR)

The aid dependency ratio was computed as the ratio of food transfer to apparent domestic consumption:

$$ADR_i = 100 * TRF_i / ADC_i \quad \% \quad (\text{Equation 13})$$

A positive ADR_i indicates the absence of self-sufficiency.

Provincial food security was evaluated using a similar procedure to that for national food security where data on provincial food balance sheets were available. Otherwise, the national expert had to resort to secondary information from previous studies or expert opinions. Time series data on food production and prices, regional domestic production and population were used with data on common dietary patterns in the province. The dietary pattern may vary by ethnic group. Demographic information is therefore also important for this estimation.

Another important piece of information is the food crisis incidence by province. Frequency over time and geographical distribution of the food crises may indicate vulnerability of provincial

food security. The underlying cause, surveillance and forecast, contingency plan and coping mechanisms are relevant for discussion.

Where household survey data were available from previous studies, households were classified into socio-economic class by region (rural versus urban), ethnic group, job (farm versus non-farm), etc. The basic principles for analyzing household food security are similar to those for national food security.