WORKING PAPER 56

Food Security Strategies for Papua New Guinea

Passinghan Bukley K. Igua

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The CGPRT Centre

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"CGPRT Centre Works Towards Enhancing Sustainable Agriculture and Reducing Poverty in Asia and the Pacific"

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1. Introduction

1.1 Terms of reference

Under the general supervision of the Director of the CGPRT Centre and in cooperation with the project leader and the regional advisor, as the consultant, I was assigned the following tasks in the implementation of the research project "Food security strategies for selected South Pacific Island countries (SouthPIC)".

- To set up a work plan of the country study in Papua New Guinea in line with the objectives of the project stated at the in-country planning meeting with the participation of the project leader and the regional advisor, and relevant staff from Papua New Guinean Institutes.
- To conduct the country study in Papua New Guinea.
- To draft the country report of Papua New Guinea and to submit it in line with the work plan.
- To participate in a regional workshop, where results of the country study would be presented and discussed.
- To work with the project leader to publish the country report, an integrated report of the project and the proceedings of the regional workshop.

1.2 Objectives

Food security is a complex issue as it affects the whole fabric of human life and existence. It is intertwined with very wide and dynamic subjects, such as agricultural land resources, infrastructure, institutional development; social and demographic mobilities; and macro-economic development and policies. Understanding the food security problems, and the identification of strategies, and formulation of appropriate policy options require comprehensive research. This project is primarily intended to help the government of Papua New Guinea obtain clearer data, information, and understanding on the food security situation, problems, strategies and appropriate policy options in the country.

One of the aims of the study is to collate the fragmented food security data in a cohesive manner that the government can use for policy formulation. The objectives of this study are as follows:

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

1.3 Scope of the study

An initial project planning meeting was convened at Department of Agriculture and Livestock Provincial Industrial Support Services Conference room where resource people from various organisations and line agencies met to discuss the project.

Discussions and seminars were also held. This study was carried out basically through the synthesis of existing information on food security issues in Papua New Guinea. Information

was collected from the following sources: AusAid, Central Bank of Papua New Guinea, Cocoa Board of PNG, Coffee Research Institute, Department of Agriculture and Livestock, Department of Finance and Planning, Department of Health, Flame Flour Mills, Institute of National Affairs, Internal Revenue Commission, National Agriculture Research Institute, National Disaster and Emergency Services, National Statistics Office, National Mapping Bureau, National Weather Service, National Research Institute, Office of Environment, PNG Cocoa Coconut Research Institute, PNG Rice Industries and other major food importers.

2. Methods and Data Sources

2.1 Definitions, concepts and analytical methods

Food security is defined as a state of affairs where "all people at all times have access to safe and nutritious food in sufficient quality and quantity to maintain a healthy and active life". National food security includes adequate domestic production of food (self sufficiency) together with the capacity to import in order to meet the needs of the population. Household food security on the other hand refers to availability and stability of food supply together with the purchasing power of the household.

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

- Food security performances and determinants (national and household levels),
- Food security risk coping institutions, and
- Feasibility of regional food security cooperation.

Table 2.1 depicts the numerous components of a complex system influencing food security in Papua New Guinea. Food security is basically determined by food availability, access (entitlement) and utilization. There two modes of transactions that may be effective as the operating system for the three basic determinants: market transactions and institutional transfers. In general food security can be divided into elements:

- Market economy systems – characterized by institutional transactions.
- Social safety net systems – institutional setting designed at risk coping mechanism.

The study was based on the latest "sustainable food security" paradigm, which proposes six basic criteria for food security: food availability, food access, food utilization, stability, self-reliance (autonomy) and sustainability. Food availability, food access and food utilization determine food adequacy. Stability and self-reliance determine vulnerability, whereas sustainability determines long-term persistence of food security. Food security in PNG was evaluated using the "food security performance evaluation matrix" (Table 2.1). The performance is also affected both by social and political institutions, as well as economic and geo-bio-physical conditions.

Table 2.1 Food security performance evaluation matix.

Principal Determinants	Average Adequacy	Vulnerable Stability	Vulnerability Self-Reliance	Sustainability
1. Food availability				
2. Food access				
3. Food utilization and distribution				

2.2 Data sources

Most of the information contained in this report was derived from available information on the issue of food security in Papua New Guinea and sources are duly acknowledged.

3. National and Provincial Food Security

3.1 Country background

Papua New Guinea (PNG) occupies the eastern half of the island of New Guinea and 600 islands to the east and north, the major ones being New Britain, Duke of York, New Ireland, Bouganville, and Manus. It lies between the equator and 12 degrees south latitude. PNG shares borders with Australia to the south, Indonesia to the west, Solomon Islands to the east and the Philippines and Guam to the north and northeast, respectively. It has a total land area of 464,000 square kilometers and a sea area of 3.1 million square kilometers. The capital, Port Moresby, is situated on the main island and is an important sea port. It also has the country's main international airport.

Papua New Guinea is a very mountainous country, the mainland rising to 4,500m and a significant part is not available for agriculture. More than 50% of the land is at elevation of more than 600m. Papua New Guinea is situated within the highly mobile zone of the earth's crust surrounding the Pacific Ocean. Young folded and faulted mountain ranges, a profusion of islands and recent volcanic and seismic activity are characteristic of this circum-Pacific mobile zone.

The geology of Papua New Guinea is well documented in the 1:250,000 series of maps and accompanying reports produced by the Geological Survey Division of the Department of Mining and Petroleum and in the 1:1 million scale map by the Bureau of Mineral Resources (1972). More generalized descriptions of both geology and landform have been given by several authors, most notably, Bleeker (1983), Ollier and Bain (1972), Loffler (1974), Dow (1974) and Harding et al. (1986). More recently the Papua New Guinea Resource Information System (PNGRIS), a computer based inventory of information on natural resources, land use and population distribution which covers the whole nation was set up. It is designed to be a basic planning tool for both development and conservation

Papua New Guinea is characterized by a very wide range of ecological environments. This can be explained by the fact that the country, which forms part of a highly mobile section of the earth's crust, is composed of rugged and faulted mountains, reaching heights in excess of4,500m, with steeply sloping narrow ridges separated by deeply incised V-shaped valleys. Uplift and faulting, which occurred mainly during the late Oligocene to early Miocene period is still in progress. Volcanic activity has resulted in large areas covered by ash, while weathering and denudation of the mountain ranges has given rise to extensive alluvial plains. An account of the geological features of Papua New Guinea is given and modified after Ollier and Bain (1972).

The landform classification is discussed by Loffler (1974). Although genetic criteria in themselves are not relevant to land use assessment, a genetic classification of landform facilitates the extrapolation of data (particularly soils, slope, and vegetation) to unsurveyed parts of the country (Bellamy and McAlpine 1995).

Thirty-nine landform types are differentiated in the landform inventory (Bellamy and McAlpine 1995) and are divided into three broad categories according to the dominant geomorphic process by which they were formed:

- Depositional landforms
- Erosional landforms
- Volcanic landforms

The most comprehensive treatise on the soils of Papua New Guinea is that by Bleeker (1983), while most of the detailed country wide mapping of soil is that of Bleeker (1988) at a

scale of 1:1,000,000. Several previous works provided generalised mapping of soil resources of the country, notably, Haantjens et al. (1967), Haantjens (1970) and Bleeker (1974).

As a result of the complex geology and wide variability in landforms found in PNG, it is not surprising that the soil distribution pattern is also complicated. Eight the soil orders have been identified in Papua New Guinea and they include: (a) Entisols, (b) Histosols, (c) Inceptisols, (d) Vertisols, (e) Mollisols, (f) Alfisols, (g) Ultisols and (h) Oxisols.

Rainfall in Papua New Guinea has been described by numerous authors (Brookfield and Hart 1966; Hart 1970; Ford 1974; McAlpine et al. 1975; McAlpine et al. 1983). For much of Papua New Guinea, rainfall varies from 1,500 to 5,600mm per year. The central highland causes rain shadow areas and rainfall drops to 1,000mm per year. At these low rainfall areas, the pattern is also markedly seasonal, the dry season being from May to November. Elsewhere, rainfall is fairly uniform throughout the year. Papua New Guinea consists of many islands scattered over a fairly extensive area, but it shows much less climatic variation throughout the country than other South Pacific islands. PNG is tropical except for the high elevation areas where the temperature is reduced (for every 100m increase in altitude the temperature drop, or "lapse rate" is about 0.5^{o} C or 5. 5^{o} C drop for every 1,000m increase in altitude) and in the rain shadow areas (eg Port Moresby) with marked dry season. Temperature ranges from uniformly warm in the lowlands averaging between 26 to 27^{o} C. Average minimum temperature rarely falls below 27^{o} C and the maximum seldom exceeds 30^{o} C. The combination of relatively high temperature and rainfall is associated with high humidity and cloudiness. As a result evaporation estimates for the lowlands are moderately low, but with a range of 1,300mm to 2,400mm with the highest rates occurring in the dry coastal areas with the lowest in those areas of uniform rainfall.

In 1995, PNG's population was estimated at 4.03 million (excluding the population of North Solomon and PNG citizens abroad), with a sex ration of about 110.4 (Jorari and Lasia 1996). The majority (85%) of the population live in the rural areas deriving their employment and livelihood from agricultural activities. The urban population makes up the remaining 15%. Population statistics (1990) also indicated that 43% of the population is under 15 years of age, while the older generation of ages of 65 and over constitute only 1.5% of the population. The population change from 1980 to 1990 was calculated to be 22.5%. The average population density is 8 per sq. km; however, it varies greatly within the country with high population densities in provinces like Simbu and the Gazelle Peninsula of the East New Britain Province, and very low in others such as Western Province. Significant internal migration occurs between the provinces.

Population projections indicate that by 2020, the population will reach 7 million (Jorari and Laisa 1996). The average growth rate of PNG population between 1980-1990 was 2.3% annually (NSO 1994); at this rate the population will double in 30 years.

Papua New Guinea's social indicators are well behind those of other members of the group of lower income economies, close to those seen in the lower income group (Table 3.1). Although Papua New Guinea is classified as a lower middle-income country with an average annual capita income of about US$890, the living standard of the vast majority of its population is similar to that in low-income countries. This suggests that the benefits of economic growth may have been unevenly distributed and that poverty remains a development problem in PNG. Life expectancy is estimated at 53 years and the literacy rate is 63%. Women remain at a fundamental disadvantage due to cultural factors, heavy workload associated with subsistence production, relatively poor health conditions and historically poor access to educational opportunities and training.

Table 3.1 Comparative social indicators.

Indicator	PNG	Lower-Middle Income Countries	East-Asia and Pacific Region
Infant mortality (per 1,000 life births)	61	38	57
Life expectancy at birth	58	68	69
Primary school enrolment (gross)	80	103	117
Population with access to adequate sanitation (%)	22	58	29
GNP/Capita (1998 US$cap)	890	1,710	990

Source: World Bank (1998).

PNG is rich in natural resources, with gold, copper and agricultural products comprising the most important sources of export earnings. Despite the potential offered by its rich natural resource base, Papua New Guinea's economic development has fallen short of expectations. In the two decades since independence in 1975, the economic development of PNG has been driven by a small modern enclave sector, mainly based on mineral resource extraction, commercial logging and tree crop plantations. Government policies have almost exclusively focussed on fostering the development of these activities. Because it is heavily based on natural resource extraction and plantation agriculture, the performance of Papua New Guinea's economy is substantially driven by world market commodity prices. Overall, Papua New Guinea's enclave economy experienced significant but fluctuating growth in output and exports throughout the last two decades, with little impact on the rest of the economy, particularly the agriculture sector.

In Papua New Guinea two economies exist side by side, the traditional and the cash economy. The traditional sector, mainly subsistence farming, supports more than 80% of the population. The traditional activity of the country is subsistence gardening. Most villages are self-sufficient and only small surpluses of produce are available for trading. The growth of towns has, however, encouraged small-scale cash cropping in nearby villages and these crops are sold by village people in town markets.

A preliminary estimate of Papua New Guinea's Gross Domestic Product (GDP) in 1998 was 7.7 billion, equivalent to about K1700 (approximately US$ 825 or A$ 1,310) per head (Department of Trade and Industry 1999). The total real GDP grew by 2.5% in 1998 compared to 1997. This growth was mainly due to increased activity in the mining sectors. The increase in activity reflected a turn-around from the decline in 1997 when activity was adversely affected by severe "El Nino" related drought and frost and the Asian financial crisis (Department of Trade and Industry 1999).

Papua New Guinea is noted for its cultural diversity, with the isolation of villages and clans giving rise to 700-800 different languages. The isolation is in part a result of the rugged terrain, with much of the terrain mountainous and characterised by knife–edge ridges, steep gorges and swiftly flowing streams and rivers. "Pidgin" or "Tok pisin", a local version of English is widely spoken; Motu and English are the other official languages. The overwhelming majority of the population is Melanesian. In addition, there are a small number of Micronesians and Polynesians and a smaller number of Chinese descendents.

3.2 National goals

At attainment of Independence, the constitution of the land specified five national goals that addressed the following areas: integral human development, equality and participation, national sovereignty and self reliance, national resources and environment, and Papua New Guinea ways.

These five national goals are ideals, whose fulfillment lies remote, nonetheless should be pursued. Of the five goals, four refer to people and one relates to environment. All goals are linked in a sense that a contribution or setback in one of the goals will affect the others. In one way or an other these goals are invariably related to food production.

The first goal has the highest order and depends greatly on the degree to which the other goals are fulfilled. At the same time its strengths will support some of the other national goals, particularly the goals of equality and participation, and national sovereignty and self-reliance. Only when a person feels free, will it be possible to share in equal opportunities to benefit from development.

The goal of equality and participation encourages a subsistence food producer to participate in the cash economy by planting cash crops. The goal of sovereignty and self-reliance will be endangered if cash crop producers, together with others, buy imported foods to the extent that an unfavorable trade balance develops.

The conservation of natural resources and the environment is recognized in the fourth goal. Neglect of the fourth goal would have far-reaching adverse consequences not only for food and cash crop production but also indirectly for other national goals.

The fifth goal, PNG ways, may or may not support the other goals. It strengthens the national identity, its people and contributes to stability. But the same forces that stabilize also retard change and may hold back developments that could be beneficial to other goals. The fifth goal is a goal that requires adjustments as development takes place.

The five national goals are the cornerstone of the constitution. In 1973, the first elected government formulated eight development aims. These aims can be placed in three groups (Figure 3.1), those in group 1 are primarily political in context and those in group 2 deal primarily with welfare economics. Group 3 has only one aim, and appears more closely connected to the national goal of PNG ways than any other goal.

In 1978 the National Public Expenditure Plan (NPEP) was introduced, and it caused a major change in the execution of government policy and business. Through this plan, government set in motion a process by which new expenditure would take the form of projects for which funding could be provided for, at the most, four year “rolling” periods.

A main advantage of this new approach would be that line departments and agencies were given a disciplinary and analytical tool that would enable them to think through the activities for which funding was sought. It was also possible to monitor and evaluate progress, and funding could be terminated by NPO if results were unsatisfactory. With the introduction of NPEP, the government had two expenditure components: (i) recurrent expenditures–primarily expenditures that the government was committed to because of earlier policies and programs, and (ii) National Public Expenditure Plan – project expenditures.

NPEP projects were organized around nine so-called strategic objectives. Figure 3.2 illustrates the linkages between the nine strategic objectives and the national goals. None appears to be connected with the aim of PNG ways, but this aim is something that is meant to permeate through all strategic objectives.

One of the objectives deals with food production and nutrition. In Figure 3.1, these two elements have been separated because the improvement of nutrition is linked with the national goal of integral human development, while the improvement of food production is linked largely with self-reliance. The objectives can be divided into three groups as shown in Table 3.2.

The rural group contains five of the nine objectives, which also explains the larger proportion of projects spent in this group. The emphasis on the rural group is not surprising considering that 80% of the country’s population is rural based; and also because of the existing discrepancy in development between urban and rural areas.

Figure 3.1 Linkages between Papua New Guinea's eight aims and five national goals (numbers in brackets refer to the order in which the aims are officially listed).

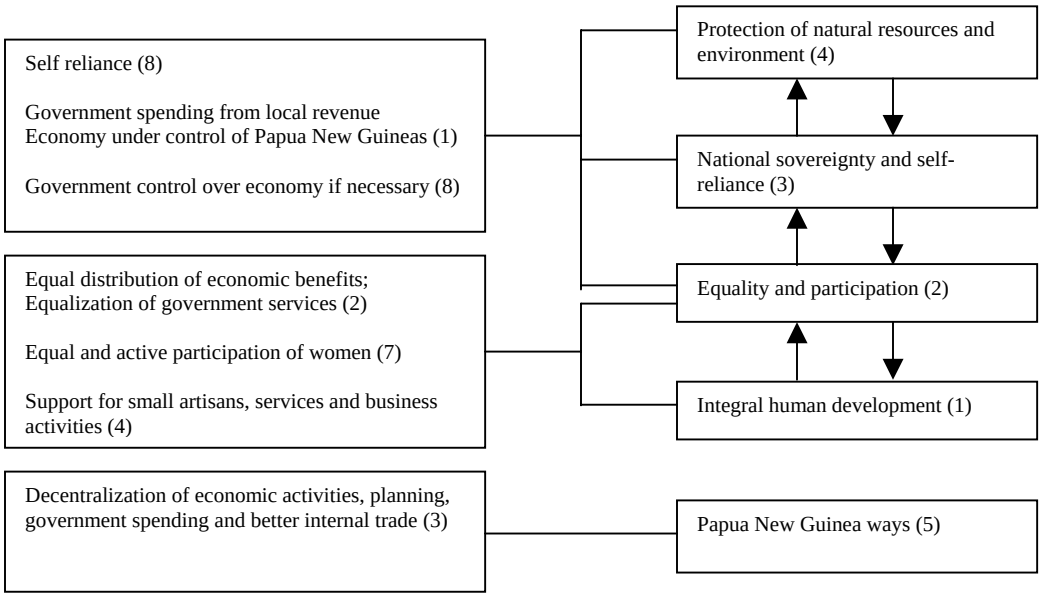


Figure 3.2 Linkages between the five national goals and the nine NPEP strategic objectives (1976).

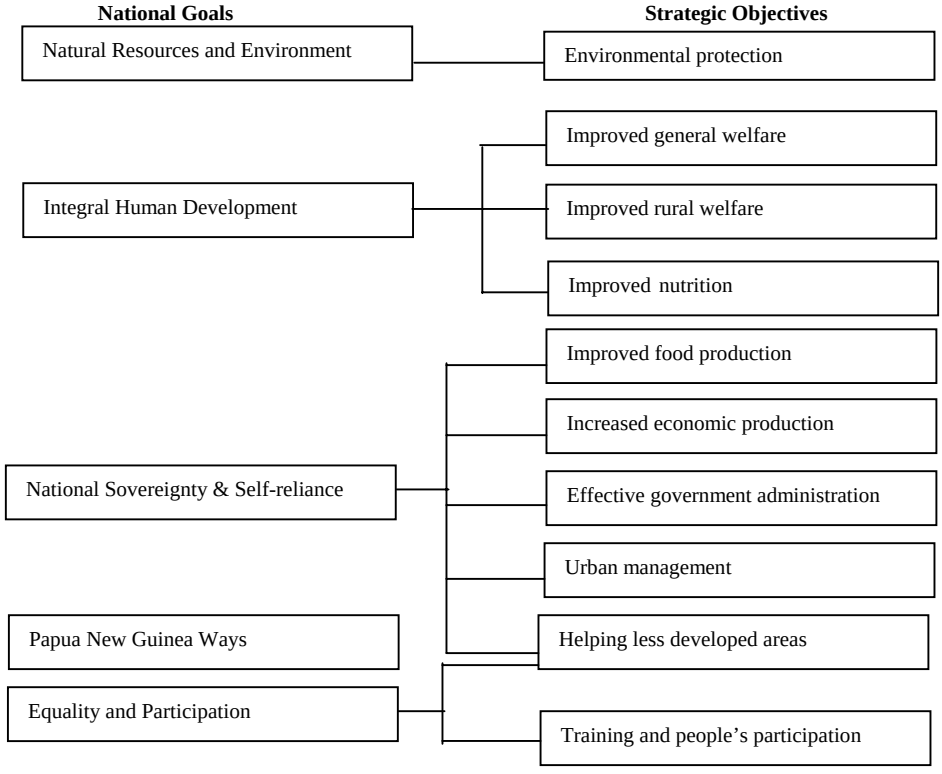


Table 3.2 Grouping of strategic objectives, NPEP.

Group	Strategic Objective	Components
Rural	Economic production	Major economic investment in natural resource developments and infrastructure building (e.g. national highway)
	Rural welfare	Sectoral programs in transport, primary industries, business development, rural health, community (primary) education, coastal fisheries
	Less developed areas	Area development, mostly IRD projects
	Food and nutrition	Rural food production for family use and to replace food imports
	Environment/conservation	Protection of environment and resource conservation other than those that are part of major resource development projects
Rural/Urban	General welfare	Hospital improvements, malaria control; population programme; also programs for women, unemployed and youth
	Training and participation	Secondary and post secondary training (technical education, university courses, plantation management training)
Urban	Urban management	Urban water supplies, sewage systems,
	National Government	Housing land development (user pay policy)
	Effective administration	Administrative and technical support of national government policy; administrative and research functions of other agencies

The implementation of policy, particularly that relating to rural development, was greatly affected by the process of decentralization, which started in early 1977 and continued till 1980, when all the provinces had their own governments. The main focus of the NPEP was rural development; thus many of its activities became provincial functions. Funding came with the transfer of these functions, but in addition the NPEP offered provinces the opportunity to expand them through grants tied for projects. Three approaches were possible:

- Participation in a national sectoral program through collaboration with an appropriate line department,
- Formulation of an integrated rural development project, and
- Submission of projects to NPO separately and directly.

Serious problems of coordination and communication are most likely to occur in the sectors that have been partially decentralized. For example in the agriculture sector, the responsibilities are divided (Table 3.3).

Table 3.3 Division of responsibility in the agriculture sector.

Responsibility	Mandated Institution
Policy and overall direction	Department of Agriculture and Livestock
Research	National Agriculture Research Institute, Coffee Research Institute, Cocoa and Coconut Research Institute, Oil Palm Research Association
Extension	Provincial DPI and other extension agencies such CCEA

The Department of Agriculture and Livestock (DAL) is responsible for policy and direction, while research comes under the National Agriculture Research Institute and other commodity institutions such as Cocoa and Coconut Research Institute, Coffee Research Institute and Oil Palm Research Association and the provinces are responsible for extension. This separation causes difficulties for interaction between policy-research-extension. Operational linkages are required to facilitate delivery of services.

For effective decentralization, a number of factors must be in operation. First, a good number of technically competent and experienced staff with managerial and organizational skills must be available. Most of the time these are not available and can not be made available at short notice through training courses. This is made worse by the simultaneous localization of staff that necessitated the rapid promotion of nationals. The problems caused by both decentralization and localization are still very much apparent in the provinces. On the whole strong leadership is absent, a sense of direction is lacking and staff moral is low. Agricultural services may have been particularly adversely affected because with its diversity in crops and livestock, and varying ecological conditions, agriculture is a difficult sector to serve. There is a need for improved agricultural planning to provide a framework for decision. Funding, of course, is another issue.

It is unfortunate that in provinces there is still separation between the political (elected) and administrative (appointed) parts of the provincial government. As long as this separation is not bridged there will be difficulties in communications and serious problems for unified leadership.

There is still a certain amount of control over provincial staffing by national government. Provincial appointments are subject to approval of Department of Personnel Management (DPM), and the provincials are paid from the national (conditional) grants to provinces. This grant can be cut off if the national government wishes to retrench provincial staff. Should provinces wish to maintain these officers, they would have to provide their own funds. With the transfer of functions dealing with subsistence food production, the provinces also acquired the prerogative of formulating their own food and nutrition policy.

3.2.1 Food and nutrition policy

A public outcry about the malnutrition levels in the rural areas of PNG was made by nutritionists from the Department of Health in 1973. This resulted in an increase in research and staffing programmes, and the first Nutrition Survey was attempted in 1975 to compile a national picture of malnutrition levels in PNG.

An inter-departmental working group was set up in 1977 to look into the issues of national food and nutrition policy in Papua New Guinea. This interdepartmental working group came up with the following recommendations:

- DPI (DAL) should be the coordinating agency for developing projects to process foods.
- Food Marketing Corporation and other organizations should be asked to begin development marketing.
- High priority should be given within five years (of 1981) to increase domestic food supplies to Port Moresby.
- Four instruments (Commerce, Transport, DPI and Labour and Industry) should give high priority to projects that develop marketing, processing, storage, transport, wholesaling and retailing of food.
- A nutrition education policy should be implemented.
- Regular nutrition education surveys are to be conducted and the National Planning Office (NPO) would co-ordinate the National Food and Nutrition Policy (NFNP) and report to the National Planning Committee.

These recommendations became national policy a year later on 8th February 1978. A major aim of the NFNP was to increase the proportion of total food supplies produced domestically. However, in general, not only are the signs of the hoped for internal increases very limited, but the volume of food imports have increased significantly and efforts to reduce imports have been found wanting. Detailed examination of the complete NFNP has indicated that little has been achieved since it became policy in 1978. Greater progress must be made to

implement the recommendations of the policy. The clear call of NFNP that "all future increases in food consumption must be met by domestic production" must be followed up.

When the first Food and Nutrition Conference was held in 1983, the national policy on food production and nutrition had two primary objectives:

- To reduce the country's dependence on imported foods, and
- To improve the nutritional status of the population.

The only vehicle or avenue to implement the policy was the National Public Expenditure Plan (NPEP), and less than half of the funding was utilised each year due to lack of suitable project proposals. A review of the NPEP indicated the following points:

- There was a general lack of viable import replacement NPEP projects coming from implementing agencies. For example, NPEP expenditure ceiling for the Food and Nutrition (F&N) Objective was only 4.4% in 1978-1979, 5% in 1980 and 4% in 1983.
- Commitments of NPEP project funds under the F&N strategic objective for the 1981-1986 NPEP period were only 1.6%. In 1983 this dropped to 0.4%.

There were a number of reasons for this under performance. First, the recommendations were too broad and government departments had difficulties in interpreting the principles of the policy in terms of the strategic objectives, and thus in submitting appropriate projects. Second, there was a shortage of available skilled manpower within the implementing agencies and provinces to identify and develop appropriate projects. Third, there was a general lack of structural links between the various agencies and thus they were unable to properly understand their roles and complimentarity or relationships to each other in meeting the objectives of the policy. Fourth, the Food Marketing Corporation tasked with the responsibility of developing marketing became defunct due to non-funding. It initially had a grant of K500,000; however there was no continued financial support. The corporation would have met some of its objectives, if it had been given the chance to operate independently as a commercial venture (Noel 1992).

The only achievements up to that time were the nutrition surveys, nutrition programs and nutrition education and food processing research (Noel 1992). The nutrition program in the Department of Health (DOH) is fairly well established. However to attain overall benefits of this program, linkages should be established to the development of domestic food production.

Nutrition education through schools has continued to be provided by the Department of Education (DOE). The government took specific action to limit the growth of imports by placing restrictions on eggs and most vegetables that can be produced locally.

There is a dilemma that the government faces. The government is understandably concerned about rising food imports and dependence on overseas suppliers of vital food items, the more so considering that PNG has extensive fertile land, and from a purely physical point of view can supply all its needs. But the marked price and institutional conditions do not facilitate food production. Yet what may be uneconomic under present circumstances may be advisable in the long run.

The government is pursuing a policy of price stability, because it believes in a stable economy to provide a conducive environment for the private sector to develop. So far it appears the government priorities lie in the side of containing inflationary pressures.

Food producers can broadly be grouped into four categories, but understandably there are four main gradations between the groups.

- Group 1: Subsistence food crop growers.
    - No market outlets, except perhaps small local market, with low demand potential.
    - Labour is migrating out to work as hired labour in plantations and other wage employment.
    - Labour is the major source of a small but important amount of cash for the group.

- Group 2: Market gardens with some export crops
  - Labour is primarily family labour.
- Group 3: Export crop smallholders with some food crops, using mostly family labour.
- Group 4: Commercial export crop producers, including plantations, using hired labour.

The Papua National Nutritional Policy Workshop of 1992 recommended policy goals to be achieved by year 2000. The broad goal is to improve the wellbeing of those suffering from nutritional problems and maintain or improve the nutrition of the general population to ensure healthier lifestyles and greater contributions to the overall social and economic development of the country. Sub-goals include:

- To reduce the incidence of PEM in the under 5 year population.
- To improve the health and nutritional status of women of childbearing age.
- To promote a healthy diet and lifestyle so as to prevent obesity, heart disease, diabetes and related disorders.
- To eliminate iodine deficiency.
- To monitor the nutritional impact of socioeconomic development projects.
- To monitor the socioeconomic effects of the Nutrition Policy.

3.2.2 Papua New Guinea Food Security Policy

Papua New Guinea (PNG) is blessed with mineral, agricultural, forestry, fisheries and marine resources, favourable climate and a small population of 4.5 million. Nevertheless, malnutrition rates are among the highest in the world. There is a widening gap between the growing demand for food particularly in the urban areas, and static domestic production, which is largely filled by food imports.

PNG is one of the seventy-seven countries classified as Low Income Food Deficit Country (LIFDC) by the Food and Agriculture Organization (FAO) of the United Nations (UN). This categorization is based on the increasing quantities of food imports, particularly cereals, as well as per capita dietary energy supply.

The long-term sustainability of national food security in PNG is precarious if the present trend of over-dependence on food imports continues. In order to reverse the trend, PNG should seriously look at developing and strengthening its own capacity to increase the domestic quota of its food supplies with proper supportive resources and structures.

The government through the Department of Agriculture and Livestock (DAL) formulated the PNG National Food Security Policy (PNGNFSP) with input from other line agencies, NGOs, statutory organizations and individuals. This involved a review of following to alleviate food insecurity problems and their associated effects on nutrition and poverty:

- Existing food related policies
- Developing strategies and programs
- Projects and activities in food crops and livestock production
- Fisheries and forestry derived foods
- Marketing
- Processing
- Preservation and utilization
- Proposing programs and projects for implementation.

The formulation of PNGFSP is consistent with the requirements of Commitments Three, Four and Seven, notably Commitment Seven, Objective 7.2, of the World Food Summit Plan of Action (WFSOA).

The PLNGNFSP recommends policy goals and sub-goals and sets out strategies and programs to realize the goals, and to address the main causes of food security. It also provides a guide for action by government departments, agencies, industries, non-governmental organizations, the private sector and individuals concerned with equity and national development.

The primary objective of PNGNFSP is to create awareness and seek support to increase and diversify food production, processing and preservation, marketing and distribution in order to achieve greater self-sufficiency in food and attain security at national, provincial, district and household levels by the year 2015. This can be realized through:

- Agricultural production and productivity.
- Income earning through domestic agricultural production and productivity.
- Income earning from through domestic marketing and exports.
- Rise in the standard of living.

Food security is an outcome of the interactions of many influences, including agricultural, health, education, and social factors. Improvement of the food security situation will require cooperation and coordination between the various government departments and agencies, NGOs, the private sector, donors and other stakeholders. Improving the food security situation will address some of the fundamental inequalities in PNG and could be seen as an important step towards meeting the National Goals contained in the preamble to the Constitution.

The National Food Security Policy Goal is to ensure that all people of PNG at all times have access to safe nutritious food in adequate quality and quantity to maintain a healthy and active life. Sub-Goals are:

- To increase food production and to improve access to food at the household level as a means to the eradication of food insecurity and rural poverty.
- To improve the nutrition status and standard of living of the people of PNG.
- To improve production, downstream processing, marketing and utilization of food.
- To strengthen institutional linkages to ensure that cross-sectoral policy compliments the PNG National Food Security Policy.
- To ensure the integrated management and sustainable use of land, water, fisheries and forests and genetic resources.
- To ensure maximum participation of women in all aspects of agricultural development, including research, extension and policy planning and implementation, education and training, and voluntary and formal organizations.

Agricultural, health and social issues influence food security, especially national food security. Therefore, the approach to solving food security issues should be multi-disciplinary, involving government departments, provincial and local level government, statutory institutions, commodity boards, industry corporations, private sector organizations, and non-government organizations (NGOs) and, of course, the farming community. Improvement in national food security requires full participation of all mentioned bodies. There is an urgent need to set up Food Security Committees at the national, provincial and district levels to address issues related to food security.

Papua New Guinea produces enough starchy tuber crops and bananas, but imports a lot of cereals (rice, wheat, maize, sorghum), vegetables and fruits. Domestic pork and chicken production is adequate to satisfy the current requirements, but the industries still depend on imported feeds. Half of the products are imported.

In the recent past imports of food items have continued to escalate such that import values increased from a little over K 200 million in 1991/92 to K 269 million in 1994, and K 325 million in 1995. Currently, it is almost K 600 million.

Food insecurity in Papua New Guinea is a result of many interacting factors. For convenience these could be classified into the following groups:

- Weak linkage and lack of collaboration between food programs and also between national departments that influence food security
- Insufficient domestic food production
- Inadequate support systems (infrastructure, credit and government support)
- Inadequate down-stream processing and preservation of agricultural produce

- Lack of export drive program for food crops for which Papua New Guinea has physical and economic advantages
- Inefficient research-extension and farmer training programs geared towards promoting food production
- High production costs of some of the introduced cereals, fruits and vegetables.

Some consequences of food insecurity are poverty, lawlessness and social disorder and poor health and nutrition and reduced life expectancy

Lack of food, due either to inability to produce or to purchase invariably leads to poverty. This in turn contributes to lawlessness and social disorder, as hungry people seek illegal ways to feed themselves.

The health and nutrition status of Papua New Guinea has been classified as very low. Foods that are prepared and sold by street vendors have been condemned by the World Health Organization (WHO) as unsafe for human consumption. Consumption of monotone diets has led to many nutritional related diseases and disorders. This pattern has not changed for years resulting in low life expectancy, which has been stagnant for a long time. High rates of infant mortality at birth and low birth weight are also associated with mothers not having access to nutritious foods.

In Papua New Guinea, body growth is slow and the adult size is small. This is often considered an adaptation to the low energy and nutrient densities of the diet, in which tubers and root crops predominate. The pattern of weight loss for rural adults is now familiar. There is substantial reduction of weight with age, (associated initially with a decline in fat reserves and eventually with a decline in lean body mass) and a minor reduction in height with age. This is especially true for rural women, and to a lesser degree for rural men. The National Nutrition Survey (1982/1983) estimated that provincial prevalence of children less than 80% of the reference weight-for-age ranged from 19.4 to 56.3%.

Adoption of a modern life-style by those with ready access to cash leads to increase in prevalence of over-nutrition and non-communicable diseases. This is not only the case in urban areas, but also in rural areas where people receive royalties from mining, logging and other projects or have high income from cash crops.

3.2.3 The National Agricultural Advisory Committee and the National Agricultural Council Meeting and Resolutions

The 16th Annual meeting of the National Agricultural Advisory Committee held in 1999 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 systems approach is recommended, within which the FAO concept of food security should be pursued namely:

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 pant nutrition systems, integrated pest management and appropriate post harvest handling, storage and processing methods. These should be combined with well designed marketing systems and credit schemes to generate greater income for the producers.

Sub-components of these 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.

Diversification of production systems

This involves 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.

Introduction of small irrigation and drainage schemes

This considers irrigation and drainage systems, using water sources such as rainfall, runoff, streams and rivers, and underground water together with agricultural land development, to insure against drought and water shortage for crop and animal production.

Analysis of constraints to food security

This gives special attention to socioeconomic constraints that impede farmers' adoption of technologies and approaches offered by research and development. It focus on the factors at the farm level that limit profitability and farmers' access to technology, land, inputs storage, marketing, processing and credit facilities. Rural labour shortage due to urban migration is also a limiting factor in food production in some areas in PNG. The results of the constraint analysis would serve as guide to reorient future operations for greater success.

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. 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 Department of Health and/or Education and World Health Organization (WHO) initiate and implement nutrition education strategies and provide materials and teaching aids targeting protein energy malnutrition, anemia, non-communicable diseases and iodine deficient disorders in the country.
- Continue the decentralization of DAL functions to regions, to be coordinated by regional directors with supporting technical teams.
- Change agricultural college curricula so students receive training which reflects the farming systems 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 schools.
- Emphasize more the provision of basic infrastructure such as roads, bridges, etc, 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, and also all 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.

In the final analysis, the PNG National Framework for Food Security 2001-2015 will be a product of a structured process of consultations amongst all concerned in order to accommodate cross-organizational issues and concerns. The document clearly defines the role of all players.

In order to attain a measurable degree of food security in the medium term, a coordinated national strategy action must be devised around a clear conspicuous National Food Security Policy. The policies will aim at eradicating the factors that contribute to food insecurity and set a framework for a national action plan to systematically attack food insecurity at all fronts – through a coordinated effort by all concerned peoples, organizations and institutions.

The Medium-Long Term Strategic Plan of Action (2000-2015), will cut across interdisciplinary programs and border on sectoral activities such as forestry, agroforestry and fisheries (aquaculture). The action plan will mobilize inter-institutional, across-organizational and multi-disciplinary input to attack food insecurity and poverty and achieve nutritionally better food for all.

3.2.4 The Food Security Work Program

The strategic framework for the National Food Security 2001-2015 will comprise fourteen sub-components, viz:

1. Traditional staple crops: This strategy will seek to promote, develop and where necessary conduct adaptive research to address the production, marketing and post-harvest related problems of traditional root and tuber crops and sago.
2. Rice and grain industry development and promotion program: This program will aim to improve the national self-sufficiency in rice, grains and other associated crops and livestock production in integrated farming systems. The strategy will seek 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 PNG.

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

   Alternatively, rice imports could be met by production from 45,000 ha of double cropped irrigated rice land or by harvesting from 200,000 ha of rainfed upland fields. PNG should aim at 20% import reduction by 2010, by shifting the production system from the predominantly upland rainfed towards rainfed lowland production with supplementary irrigation and fully irrigated double fields.
3. Irrigation and water control management: The drought of 1997 has shown how vulnerable and food insecure PNG was as nation where none of the traditional staples were 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 provided. There is hardly any irrigation system in Papua New Guinea. Papua New Guinea needs to develop irrigation 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 for increasing food security. On the other hand, seasonal floods have been a worry in some environments. This also puts agricultural land out of cultivation. There is also the need to look at and to develop drainage systems to control and manage excess water.

4. Horticultural fruit trees: The program will address the issues related to the production, development and promotion of fruit trees.
5. Integrated vegetable production: the special case of high altitude agriculture: This program will address the production, development, marketing and researchable problems connected with 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 meters above sea level.
6. Urban and peri-urban gardening: The justification for the establishment of this particular program is in response to the apparent spontaneous reaction to the increasing urban population, which has led to the intensification of peri-urban and urban gardening around major cities and towns in the country. The program will aim at the eradication of food insecurity and urban poverty. It will promote sustainable urban livelihoods focusing on utilization of the idle urban labour pool, promote equitable and morally acceptable access to resources. Indirectly, it aims at attacking the social law and order and other prevalent 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 improve incomes for urban families. This sub-program will initiate and develop small downstream processing projects for food preservation, storage and home utilization. These projects will target rural and urban families in the suburbs.
8. Agroforestry: The social and economic consequences of wholesale deforestation, especially devegtation around the country, for example the Bulolo valley, the Simbu Province and the outskirts of Port Moresby have become major concerns. The spontaneous upsurge of hillside gardening in the city has not only contributed to devegeation, but also to soil erosion and increased sediment deposits in the city drainage systems. This sub-program will seek to deliberately forge an alliance with city and town authorities (eg. NCDC) to address the problem of devegetation through agroforestry and other land management interventions.
9. Livestock production including aquaculture and honeybees: There is considerable potential for expansion of livestock production. Livestock products contribute in a big way to household incomes. New species and breeds of livestock such as rabbits, turkeys, geese, guinea pigs, village chickens, etc. need to be tested. This program will target livestock development, with special reference to small animals, inland fishing farming and honey bee production.
10. The Special Programme for Food Security: The Special Program for Food Security (SPFS), launched by FAO in 1994 in the Markham Valley of Morobe province will be accorded a special place. Phase I consisted of four inter-related and complimentary components of water control and management, which includes small scale irrigation, intensified crop production systems, diversification into aquaculture, etc. and socioeconomic constraints analysis.
11. Information, publication and agricultural statistics: One of the biggest constraints in Papua New Guinea is the access to information. It is hoped that an improvement in this area will result in a positive contribution to the better planning and overall improvement in rural development and in the country as a whole.
12. Improvement of extension methodologies and approaches: Another constraint in the delivery of services to the rural people has been the lack of extension. Even if there

was an extension service, it was often very poor. An improvement in the communication link particularly extension officers with access to information is very critical. For example, agricultural scientists have not published experimental results and/or made these available to extension officers. In the agricultural research sector, publications of experimental results have been scandalously low. This also has led to nil adoption of new technologies. An improvement of the extension methodologies and approaches is long overdue, and it is imperative that sufficient and continuous funding be made for this very important component.

13. Rehabilitation and redevelopment of farmer training centres: Due to lack of funding this important vocational training scheme was left to deteriorate. A lot of school dropouts from the rural communities are joining the urban drift into the urban centres in the hope of finding menial work. There is no incentive to keep these disillusioned youth in rural areas. It is very important to revive the farmer training schemes. Skills and techniques obtained from such institutions will go a long way in preparing students for a productive life in the rural communities. The rehabilitation and redevelopment of farmer training centres will require a major injection of funds and manpower.
14. Farm machinery and equipment: Farming in Papua New Guinea is a very physical exercise, with a relatively high labour input compared to the developed countries with mechanized agriculture and little labour input. Investment in appropriate simple farm machinery and equipment will certainly improve productivity. There is a need to carry out research and development (agricultural engineering research) into the manufacturing of simple farming implements to assist farmers in their routine operations. Assistance could be sought from the South East Asian experience. Such developments will definitely help women in particular. Women remain at fundamental disadvantage due to cultural factors, heavy workload associated with subsistence production, relatively poor health conditions and historically poor access to education and training. It is envisaged that investment in farm machinery and equipment will improve general health and increase the life expectancy, which is currently 53 years.

The long-term sustainability of national food security in Papua New Guinea is precarious, based on the present trend of over-dependence on imported foods. To reverse this trend, PNG should seriously look at developing and strengthening its own capacity to improve domestic food supplies with proper supportive structures and measures.

It should also be recognized that the tragedy of widespread of food shortages can not be eliminated through government action alone. Thus a broad mobilization of public and private sector commitment, as well as collective and individual investment, will be necessary to deflect the course of food insecurity in PNG.

People in Papua New Guinea are blessed with a wide range of food. Papua New Guinea is as diverse in its food as it is in landform, languages, and culture. The type and degree of diversity changes with altitude, climate, soils, and other socioeconomic factors.

The coastal people live on starchy staples of banana, sago, taro and marine food such as fish and seashells, while in the highlands sweet potato is the dominant starch staple with pigs providing the main protein source.

3.2.5 Food production research and extension programs

In 1928, the scene for agriculture research was set when the first Agricultural Experiment Station was established at Kerevat, East New Britain Province. From 1928 up until 1950, the focus was on export tree crops. The turning point came when the New Guinea Nutrition Survey identified nutritional problems in some areas of the country (Hipsley and Clements 1950). This caused the Department of Agriculture, Stock and Fisheries to initiate work on rice and peanuts. The important role of the subsistence producer in feeding the nation was highlighted by Walters (1963) and Macewan (1978).

Chapter 3

Agricultural research into food production was initially the responsibility of the Department of Agriculture, Stock and Fisheries (DASF) followed by the Department of Primary Industry (DPI), then the Department Agriculture and Livestock (DAL) until very recently NARI was established and given the mandate to carry on the task. Other Institutions such as the universities, Wau Ecological Institute and Christian missions also contribute to research but their role is minor. Agriculture in the past was focused on export crops, with notable success in coconuts, cocoa and coffee. Food crops have largely been neglected. In 1976, the Horticulture Section was established as part of the Agronomy Branch. This section was charged with the research and extension on food crops, vegetables, fruits and nuts. An increasing number of agronomic studies on traditional food crops were carried out, in particular, on sweet potato.

The National Agricultural Research Institute (NARI) is a publicly-funded, statutory research organisation, developed under the Ministry of Agriculture and Livestock by the Government to conduct applied, adaptive and development-oriented research on food crops, alternative food and cash crops, livestock, and resource management issues.

NARI is responsible for providing authoritative technical, analytical and diagnostic services and up-to-date information to the entire agricultural sector in the country. The major clients are the smallholders and semi-subsistence farmers in the rural areas of the country.

Bourke (1982) and Kesavan (1992) have reviewed food crop research for the last thirty to fifty year period. A summary of trials conducted from 1928-1978 is given in Table 3.4. Since 1978, there has been numerous other trials which are not included in table below.

Table 3.4 Number of field trials on food crops in Papua New Guinea (1928-1978).

Major group of crops	No. of trials	% of total	No. of cv* trials	% of major group	Major crops	No. of trials	% of total trials	% of major group	No of cv* trials	% of major group
Energy and staple crops	286	23.3	94	32.9	Sweet potato	136	11.1	47.5	39	28.7
Cereals	349	28.4	214	61.3	Rice	234	19.0	67.1	142	60.7
Grain legumes	245	19.9	155	63.3	Peanuts	91	7.4	37.1	26	28.5
Fruits and nuts	66	5.4	33	50.0	% of major group	14	1.1	21.2	0	0.0
Vegetables traditional	16	1.3	14	87.5	Setaria Pitpit	5	0.4	31.3	4	80.0
Vegetables introduced	238	19.3	183	76.9	Cabbage	47	3.8	19.7	23	48.9
Farming systems	30	2.4	-	-	-	-	42.8	-	-	-
Total	1,230	100	693	56.3	-	527		-	234	44.4

*Cultivar.

Note: coconut an important source of food, is not included. Source: Bourke (1982).

The following points are noted from Table 3.4.

- A total of 1,230 trials on 77 crop species were carried out in this period.
- Of the 1,230 trials, 693 (56%) were variety trials identifying superior planting materials. Other agronomic aspects such as fertiliser use, plant density, propagation techniques and pest control were also investigated.
- Major groups investigated, in terms of numbers of trials, were grains with a large body of work on rice, traditional staples, grain legumes with emphasis on peanuts, and introduced vegetables.
- The work on traditional staples has logically concentrated on sweet potato which accounts for 11% of the research trials.
- Farming or cropping systems research mak eup 2.4% of the research trials. One of the notable experiments was a long-term rotation trail at Kerevat from 1954 to 1973. It was concluded that none of the rotations tested has provided a satisfactory alternative to bush fallow rotations of subsistence farming (Bourke 1977).

- The publication record of research work is considered " scandalously low" by Bourke (1977). Of 1,200 or so trials, results from only 230 (19%) have been published. The situation, it appears, has improved in the recent past but a bigger effort is still required. A project funded by AusAid through the Australian Contribution to National Agricultural Research System project (ACNARS) is addressing this particular issue.

Sweet potato is the most important staple in Papua New Guinea. It is generally accepted that sweet potato was introduced some 400 years ago. Since its introduction it has gained prominence in the highlands, supplying 60-90% of the energy needs of highlanders (Kesavan 1992). Sweet potato is also replacing traditional staples such as *Colocasia* taro in the lowlands due to its superior adaptability. Diseases (taro leaf blight) and insect pests (taro beetle) are the cause of the decline in taro production in the lowlands.

There has been a major investment into the evaluation of sweet potato through financial assistance from the EU PRAP Project. A total of 72 first varieties were selected and currently are being multiplied for distribution.

3.3 Food and health

The replacement of traditional food staples with processed food, combined with a reduction in physical activity, increased mechanization and the introduction of the cash economy, have all contributed to the present epidemic of unhealthy behaviour and lifestyle. It was not very long ago that people would derive 95% of their food energy from complex carbohydrates and 2% from fat. Modern diet increases dietary fat and reduces complex carbohydrates and fibre. Rice, flour and tinned fish/meat have replaced the root tubers and green vegetables.

The energy intake of Wanigela people of Koki Settlement greatly exceeds estimated requirements. Women consume 50% more than the recommended level. Total fat intake is also too high, although the fat content of the diet was 33%, as recommended for a western diet. A survey in 1991 of the Wanigela people at Koki and Marshall Lagoon estimated the prevalence of non-insulin dependant diabetes mellitus (NIDDM) at 35% in urban Wanigela. This is one of the highest figures in the world.

Communities situated within the vicinity of major mine development sites have undergone a change in diet. For example, when work on Ok Tedi gold mine started, the nearby tribes were still nomads living in the stone age. Nowadays they have a modern life with all its advantages and disadvantages (Taufa 1996).

These changes are similar to those experienced in urban PNG and other mine sites. Non-communicable diseases like diabetes and heart diseases, are now prevalent, whereas they were hardly known before mine development (Taufa 1996).

3.3.1 Main nutrition problems of Papua New Guinea and their root causes

Despite the advances made in providing services and income opportunities to the population over the last decades, malnutrition remains a significant problem in many areas and appears to be increasing in others (Marks 1992). This is indicative of the government's failure to move towards the National Goals contained in the Preamble to the Constitution. These stress the primacy of "integral human development" and "equality and participation" in national development.

The issue of malnutrition in Papua New Guinea is not as dramatic and severe as in many other countries. Nonetheless, it affects a large proportion of the population, in some areas the majority. Malnutrition is having a significant impact on the wellbeing of the population leading to an unnecessary burden of sickness and early death (Marks 1992). In Papua New Guinea, the causes of malnutrition are complex and subtle, thus no single program will overcome the problems, and action is needed in several sectors to provide a range of services. Indeed,

nutrition can be used as an indicator of the standard of living in an area and as a measure of development.

Protein-energy malnutrition (PEM)

Protein energy malnutrition (PEM) is regarded as the most important form of malnutrition in Papua New Guinea affecting both children and adults (Marks 1992). The 1982-83 National Nutrition Survey (NNS) found that PEM, as reflected by growth retardation of children under 5 years of age, was widespread. However, there was great variation in the extent of the problem between different areas. Provincial prevalence of children less than 80% of the reference weight-for-age (W/A) ranged from 19.4 to 56%, and within provinces there was also considerable variation between estimated prevalence for different districts. For example in Morobe Province PEM varies from 30.8% to 64.7% for different districts.

The most significant proximal causes of PEM in Papua New Guinean children are low birth weight, inadequate nutrient intake, and illnesses due to infectious diseases. These are caused by circumstances related to food availability, access to cash, household and role of women, custom, knowledge, and education. The relative importance of these is different for different areas.

Acute PEM is not common among adults. However, weight loss with age is common in some rural areas, particularly in women during pregnancy and breast-feeding. As well as placing the women's health at risk, this is an important contributing factor to postnatal growth retardation and high infant morbidity and mortality rates.

Table 3.5 Percent of children underweight amongst children attending maternal and child health clinics, 1980-1990.

Year	Percent less than 80% weight for age: under 1 year	Percent less than 80% weight for age: 1-4 years	Clinic coverage Under 1 year	Clinic coverage 1-4 years
1980	14.0	18.0	-	-
1981	13.4	20.0	-	-
1982	12.3	20.0	-	-
1983	13.1	21.0	-	-
1984	13.8	23.2	-	-
1985	17.5	25.6	-	-
1986	15.8	24.4	89.3	9.7
1987	19.6	27.2	94.2	13.5
1988	15.6	27.0	93.2	9.2
1989	16.1	25.8	87.4	9.2
1990	16.0	27.6	91.1	10.1

Note: The data are extracted from Department of Health Annual Reports for these years.
Source: Marks (1991).

Diabetes

Diabetes is caused when there is too much sugar in the blood. When food is eaten, particularly sugar-containing foods (sweets, chocolate, etc) and starchy foods (bread, rice and root crops), the body changes these to sugars. A hormone produced by the body, insulin, helps use up sugar for energy, growth and repair. A person becomes diabetic when there is not enough insulin, or insulin is not working well enough to help the body use sugar properly. This leads to increased sugar in the blood.

The decrease in insulin may be caused by damage to the pancreas, which is responsible for producing the insulin. Damage to the pancreas can be caused by over working the pancreas, infection, injury, and alcohol. Once the damage is done to the pancreas, diabetes is a lifelong issue. Thus prevention is very important.

Non-insulin dependant diabetes mellitus (NIDDM) is a major health problem in the Asia-Pacific region. It is the price to be paid for social change. The prevalence of NIDDM shows a wide range across the adult population in Asia-Pacific region. Studies have reported that the prevalence in China is 4%, while in certain communities in Papua New Guinea prevalence is as high as 30%. In Papua New Guinea the urbanized Wanigela and Tolais are known to be most vulnerable (Sinha 1996). Obesity is known as a risk factor and treatment

consists of a healthy eating plan and exercise when possible. People suffering from this type of diabetes can produce insulin in their bodies, however the amount produced is not enough. Sometimes there is sufficient insulin present but it can not do the job properly.

This type of diabetes is most common among adults who are overweight or have a history of diabetes in the family. It is common in the urban areas and occurs mostly in people older than 35 years. Sometimes tablets are taken by patients to help the pancreas make insulin.

Insulin dependant diabetes mellitus (IDDM) is the type of diabetes in which people can not produce insulin in their own body. The body is unable to use glucose that is supplied with the food they eat. Weight loss is a symptom of IDDM. Patients need insulin injections for the rest of their lives. IDDM occurs mostly in young children and sometimes in elderly people.

The changes in lifestyles have also seen high incidences of other non-communicable diseases in the country (Table 3.6). There is a definite need to establish an information network on diabetes mellitus, coronary heart diseases and hypertension and other non-communicable diseases in the country (Hiawalyer 1996).

Table 3.6 Morbidity of diabetes mellitus and cardivascular diseases per 100,000 population.

Year	Diabetes Mellitus	Congenital Heart Diseases	Rheumatic Diseases	Coronary Plumonale	Hypertension	Coronary Artery Diseases
1979	2.8	0.9	0.5	26.3	5.2	0.2
1984	3.5	3.6	1.0	22.4	6.4	0.4
1989	5.0	1.9	1.1	19.8	11.4	0.5
1993	7.1	1.6	2.1	20.1	9.6	1.2

Source: Hiawalyer (1996). Note: The numerator is the morbidity data from discharges from hospital, while the denomination is the population estimated from 1970, 1980 and 1990 census.

Nutritional anaemia

Anaemia is known to be widespread in both adults and children. Precise estimates of its prevalence are not available, but studies of particular population groups have reported a prevalence as high as 90%. Amongst adults, the most affected appear to be women (over 14 years of age) in the mainland and lowland areas. Women of childbearing age are considered vulnerable. The main contributing factors to anaemias include low dietary iron intake, malaria and intestinal parasites.

Obesity, high blood pressure heart diseases, diabetes and some cancers

There are no data to indicate the exact extent of these disorders in Papua New Guinea. However, the number of cases of heart disease and diabetes is increasing. By far the most cases are reported in the National Capital District and East New Britain Province, although case reports from other centres are increasing. NCDs appear to be a problem mainly of urban areas due to the change of diet and lifestyle that often accompanies urbanization.

Iodine deficiency disorders (IDDs)

Goitre and endemic cretinism are known to occur in many provinces of Papua New Guinea. Anecdotal evidence suggests that the occurrence of IDDs is decreasing. However, surveys carried out in villages in Madang and Morobe provinces in 1985 showed visible goitre rates amongst adult females ranging from 0.5 to 54.2% and cretinism ranging from 1.1 to 6.5%. There is little systematic documentation of the extent and distribution of these disorders. Research has shown that IDDs in Papua New Guinea are primarily a problem of iodine-deficient soils in the affected areas resulting in low iodine levels in locally produced foodstuffs.

3.3.2 General issues and strategies

Diversity in extent of malnutrition, problems and constraints

The extent of malnutrition varies enormously across different locations. It cannot be assumed that the problems causing malnutrition in one community are the same as those causing

it in nearby areas. Farming systems differ, access to cash differs, customs relating to food and health differ. Consequently effective programs and projects will need to be location specific, that is they will need to be designed to meet the specific needs of particular regions, areas or districts.

Need for better surveillance systems

There is a lack information to allow effective programme management, planning, and programme evaluation. A greater emphasis needs to be put on the systematic collection of data related to food and nutrition so that decision making can be more informed, relevant and effective.

Difficulty in delivery services

Most government departments were having difficulty in providing their rural services. Contributing problems include lack of funds and resources, lack of support, little incentive and little motivation.

Use of social marketing and the media

Some social marketing (advertising) programs have been very successful here and in other countries (e.g. use of condoms). A greater use should be made of advertising and the media. Specific products could be developed to address specific needs such as food supplements for women during pregnancy, weaning foods for children and nutritious snacks. In order to develop these products the government could work more with the food industry. In addition, the media should be used more to promote sports and a better diet and to highlight lifestyle problems in the urban areas.

Food availability

Six areas have been identified as main causal factors of malnutrition in Papua New Guinea. Their relative importance will vary with location. The main causal areas are food availability, infectious diseases, urban lifestyle and urban diet, access to money, women's issue, and education (formal and informal).

The problems of urban food supply are listed below:

1. The main problem of domestically grown food is the high price relative to imported foods, mainly because of the high transport costs and value added tax (VAT) of 10%. It is not uncommon for growers to accompany the produce to market themselves rather than sell to traders. The higher prices may also stem from excess demand.
2. Food availability is also affected by the irregular supply of foodstuffs. Growers produce a surplus either to sell at the market or as a form of insurance against unexpected setbacks.
3. Post-harvest losses are considerable, especially during transportation to market. There is a need for improving knowledge and awareness on handling, packing, and quality control amongst growers.
4. There is also a lack of communication throughout the marketing chain. Growers are slow in responding to consumer demands and requirements.
5. Traditional food crops have low status, because there is a change in taste away from traditional staples towards introduced foods and soft drinks.
6. Land shortages due to increased cash cropping and population pressures result in the lack of space for household gardens, especially in squatter settlements around towns and cities.

In one of its goals, the Department of Agriculture and Livestock (DAL) is to: "Expand and improve the production of food crops and livestock in order to assist in meeting local

nutritional requirements as well as ensuring household food supply". However, DAL was not able to fully realize its goals because it was preoccupied with setting up of industry-run corporations for the export crops: coffee, palm oil, cocoa, and coconut. Since DAL corporatised these activities, efforts were concentrated on food crops. Programs aimed at the food sector included: smallholder market access and food supply programme, marketed fruit and vegetables access programme, village livestock development programme, and tree fruit development. Some of these have since been terminated.

In July of 1996, the National Agriculture Research Act was passed by parliament allowing the formation of the National Agriculture Research Institute (NARI). The formation of NARI was one of the major initiatives identified by the PNG government under the Medium Term Development Strategy to contribute to and bring about sustainable development in the agricultural sector. NARI has been tasked with responsibility for conducting research that is focused and oriented towards smallholders to help work towards commercialization, downstream processing, market orientation, resource management, investment, stability and overall sustainability.

There are a lot of improvements to be made and one key area is in communication linkages. In 1992, a proposal was made for the formation of a committee to examine all aspects of the food chain from smallholder production to retail outlets. Representatives on the committee should be from DAL, DPI (provincial), and health inspectors, private business, transport companies, producers and consumer representatives. Specific areas should include:

- Co-ordination and dissemination of market information.
- Identification of new markets and products (e.g. nutritional snacks, citrus fruits and native nuts). The establishment of these new products would initially require research from NARI and policy directives from DAL.
- Training in handling of produce by transport companies, etc.
- Greater monitoring and analysis of existing data on food imports and urban prices. There is a need for regular market surveys, especially on prices.

The traditional products should be promoted more. There is a lot of potential to improve the status of traditional staples, thorough nationwide advertising campaigns. Government institutions such as military barracks, hospitals and universities, should be encouraged to use more domestic produce.

Smallholders need advice on how to increase production and improve handling of produce. This is a role for extension staff. The potential for large-scale commercial production of traditional food crops needs to be explored.

Variations in food supply over time

A variation in food supply over time is another factor that affects food availability. These variations are due to climatic changes, natural disasters, war and many other reasons. The effects of these variations could be reduced through monitoring of (i) economic indicators such as food prices, import volumes, real wages, etc. (ii) migration, particularly urban drift, (iii) climatic patterns – e.g. rainfall. Regular monitoring of these indicators would provide early warning of shortfalls in food supply. As part of a contingency plan, it would be necessary to stockpile planting materials.

Infectious diseases

The ten following diseases were considered relevant to the problems of PEM and anaemia in mothers and children: dairrhoea, malaria, pneumonia, tuberculosis, measles, whooping cough, typhoid, parasite infestation, sexually transmitted diseases (STDs) and AIDS.

The general strategies to reduce the incidence of these diseases are to improve the diagnosis and treatment of these diseases, and to improve the prevention of the diseases (Table 3.7). The urban lifestyle and diet often lead to a number of nutrition related diseases such as

PEM, anemia, obesity, diabetes and coronary heart diseases. A number of constraints have been identified:

- The non-communicable disease section of DOH has been established, but it is still not adequately equipped in terms of resources and manpower.
- Public awareness of the importance of chronic diet-related diseases is limited or lacking.
- Owing to work commitments, many workers do very little exercise or none at all.
- Sporting facilities are limited owing to high migration into urban areas.
- Consumer protection is lacking.
- Promotion of traditional foods is insufficient in major institutions, including schools.
- Prices of local foods discourage their usage.
- Baseline information on obesity is non-existent.

Table 3.7 Broad and specific strategies.

Broad Strategies	Specific Strategies	Who	How
Design & develop information on education curriculum (IEC)	• More use of existing materials on NCDs	• DOH & DOE • NGO	Develop working group
Promote healthy lifestyle	• Improve sporting facilities and encourage sporting authorities	• DOHY • Urban	Construct and upgrade sports facilities
More emphasis on consumption of traditional food & healthy diet	• Increase use of local foods in hotels, restaurants & airlines. • Design and promote use of dietary guidelines • Develop a policy favouring locally produced healthy foods	• Town Auth. • DOE • NGO • DOH & DOE • DOFP & DTI • DAL & DOH	Include traditional foods in the catering school. Develop a working group. Cabinet decision.
Need for system of monitoring	• NCD unit of DOH • Obtain baseline information on the extent of obesity in urban areas • Need for urban dietary surveys to determine nutrition factors related to NCDs	• DOH • DOH • University (Comm. Med.) • NSO • DOH	• Survey • Research
Improve detection and management of obesity, hypertension and diabetes	• Include management guidelines in standard treatment manuals	• DOH	
Increase consumer protection	• Discourage use of tobacco and excessive use of alcohol • Revise and update existing food laws	• DFP • DOH • DOH & JUSTICE	• Impose export tax and use this for health and education
Reduce urban drift and migration	• Increase use of existing IFC materials	• DOE & DOHY • POPULATION UNIT	• Social research • Encourage job opportunities

3.3.3 Access to money

There are three nutritional problems that are relatively independent of access to income: iodine deficiency, anaemia and non-communicable diseases. These are not likely to be substantially changed if access to income is increased rapidly. Protein-energy malnutrition (PEM) is the major nutritional problem for which lack of access to income is a primary cause.

There is probably an indirect relationship between iodine deficiency diseases (IDDs) and access to money because IDDs are usually found in relatively isolated areas. However the group felt the most appropriate intervention is through legislation.

Non-communicable diseases (NCDs) are not primarily a consequence of lack of access to money, but of lack of knowledge about nutrition. Limited choices are undoubtedly important at the lower end of the income scale. The risks for the different NCDs are unevenly distributed by income and by education. The major NCDs are unevenly distributed by income and by education. The major sectors responsible are the Departments of Health and Education. There is a role for the Department of Agriculture and Livestock to improve the urban supply of locally produced foods.

Anaemia, iron, foliate and malaria prophylaxis distribution at antenatal clinics were considered an important precautionary measure. The group considered malaria as the overriding factor contributing to anaemia. Thus the major strategy should be directed to the control of malaria. Because of relationships between anaemia, maternal nutritional status, birth weight and child nutritional status, it would be expected that any improvement in women's anaemia status should lead to an improvement in children's health and nutrition.

Protein-energy malnutrition (PEM) is a significant problem affecting 38% of children under 5 years old in 1982/83. This has serious implications. Improvement requires major inputs from the Health Department (increasing awareness, service delivery, disease prevention, etc.), Education (information), Home and Youth Affairs (information). There is much evidence to show that PEM is closely related to lack of access to income. Therefore, a major component of any national programme to improve PEM should focus on increasing people's access to monetary income.

PEM in children generally reflects the relative nutritional status of their households or families, rather than unequal distribution of food resources within households. Thus strategies for alleviating childhood PEM are probably best aimed at households as economic units. There is some evidence that the incidence of PEM of women is greater than that of men, but it is not known whether this is a consequence of unequal distribution of food within families.

We consider that information and training about financial management at individual, household and group levels should be given priority in all programs primarily aimed at increasing income. At present this a major deficiency that relates not only to the sustainability of the programs but also at times to direct nutritional effects.

Existing programs to raise or generate income

In the late 1980s there were a large number of programs, which were either of the integrated or single sector DPI types. Most of the programs share some common features, although they vary tremendously in their scope. The large integrated projects (SHRDP – Southern Highlands Rural Development Project, ESRDP – East Sepik RDP, and those in Enga and West Sepik) which often targeted whole provinces, explicitly sought to raise rural incomes. PEM alleviation was not usually an explicit aim. SSRDP (South Simbu Rural Development Project) had very mixed aims, with its targeted population including one district which had the seventh highest nutritional status in the country, and one which was numbered in the 20 poorest.

Performance and constraints of existing programs

In general the group considered that most existing and previous programs had not been successful in raising income substantially. Some effects may be long-term and only appear following completion of the project. But for most programs, evaluation has been minimal. It is important to find out if the changes that have occurred are the result of the intervention, or would have happened regardless.

Rural income generation at present is particularly constrained by low world commodity prices; in Papua New Guinea average rural incomes from cash crops have undoubtedly fallen by

an overall average of about 30% in the last few years. Thus, the starting point is worse today that it has been in the recent past.

Thus the major problems facing existing programs can be summarized as lack of organization, management skills, and accountability. This is clearly documented in the 1989 SMAFSP Evaluation Report. The potential of obvious mismanagement appears greater in projects than in normal line department activities for several reasons.

- Most projects are designed from the top down, and thus regarded as the government's responsibility rather than something to which local communities or populations pay more than lip service. Present procedures for obtaining community participation are inadequate.
- Post-project integration of project activities and personnel into normal government structure is poor. Recurring costs are difficult to budget for.
- Integration is claimed but rarely achieved. Lack of cooperation and coordination between departments, non-governmental organizations and all participants is common.
- There is a lack of information, in particular baseline material, and continuous monitoring and evaluation of performance.
- Logistical problems of working in isolated areas with coordinators based at central headquarters are severe.
- Projects commonly swamp local initiative with excessive free handouts.
- One problem with projects is that they tend to proceed from the assumption that past service delivery has deteriorated to the point of failure, and then seek solutions, which allocate funds to more of the same. There has generally been little redefinition of government service delivery structures, although the commodity of specific services under formation now may represent a significant break with the past.

Possible improvements to existing programs

Most existing programs could be improved considerably if the above problems were fully addressed. Some of the problems, for example, marginal disadvantaged location, are clearly not so amenable to change.

In many cases, the group felt that much of the activity associated with projects was poorly planned and executed and could be dropped without major loss. The principal benefit provided was seen to rest with the provision of basic infrastructure such as roads, bridges, etc.

Small-scale enterprises ranging from primary production (poultry, etc.) through processing (cocoa fermentries, etc.) represent an important way in which a minority of the population can increase their incomes. Of course, in any village only a very few such economic niches exist. The identification and support of such small-scale entrepreneurs is very important.

Strategies

- Isolated areas, special policy: transport subsidies: For a long time to come, Papua New Guinea will contain many small and scattered isolated settlements in remote, disadvantaged areas serviced only by air or long distance sea transport. PEM is and will be high in these areas. It is impossible in the near future to boost relative incomes and purchasing power in such areas to near national average levels. Even if no specific policy were adopted, market forces are not likely to empty such areas of their population as people move to more economic opportunities as the latter do not exist and land is not available.
- PEM in areas where the average nutritional status is good: It is not known whether PEM in nutritionally good areas occurs in particular groups or locations, or is scattered throughout the population. Policy should vary in response to distribution. It is important that monitoring should seek to identify locational or economically restricted occurrence of PEM. The emergence of new groupings of people defined by their

relations to the market (timber workers, oil palm laborers, urban unemployed, etc) whose livelihoods may be vulnerable in new ways should be kept in mind.

- Populations affected by major resource developments: PEM is unlikely to be a major nutritional problem faced by communities near mine locations and other major resource projects, although it may be in the initial stages. Other nutritional and lifestyle diseases are a more likely risk. Policy should regard such populations as a special category. In many cases the amounts of money returned by such industries to landowners and other participants are much larger than people previously have experienced. The major need in these situations is for assistance and training in cash management and longer-term investments.

3.3.4 Women's issues, health and disease

According to the 1980 census 'moderately high fertility rates and declining child mortality rates' have resulted in a fairly youthful population. 43% of the population was under 15 years of age (DOH 1986b:ll cited in Gillett, 1990). The densest areas of population were in the highlands regions, NCD, North Solomons and the Gazelle Peninsula of East New Britain. Of the total female citizen population of 1,420,980, 85% lived in rural villages, 11% in urban areas and 4% in the rural non-village sector (National Statistical Office 1988:22-24, DOH 1986b:Table A.2). The highest percentage of women living in rural areas was recorded in the provinces of Enga and Southern Highlands (97%). The lowest percentage was recorded in West New Britain Province at 72% (National Statistical Office 1988:22-24, DOH 1986b:Table A.2).

The total fertility rate (TFR) in PNG recorded for the period of 1976 – 1980 was high at 5.4. The TFR varied from province to province, the highest TFR being recorded in West New Britain Province (6.9) and in the North Solomons Province (6.5). The lowest TFR was recorded in the provinces of Simbu (4.1) and the Western Highlands (4.1). The provinces which have better access to health services tend to have the lowest infant and child mortality rates, proportionately greater levels of fertility, and the highest percentage of children under five. These are East and West New Britain, North Solomons and Central provinces.

Improvements in nutrition, health services and living conditions are all factors in the declining rate of mortality (DOH). From 1971 to 1980 the infant mortality rate (less than one year old) in PNG dropped from 134 to 72 per 1,000 live births. Child and adult mortality rates have also declined in the same period. However people living in rural areas are more disadvantaged.

Migration between provinces usually occurs from a desire to seek better economic opportunities in mines, plantations and urban centres. Between 1971 and 1980 the number of women living in urban centres increased by 50% (Gillett 1990) due to more men bringing their dependents to town rather than women seeking urban employment independently.

Life expectancy

Life expectancy for women rose from 41 to 51 years between 1971 and 1980. There is however wide variation at provincial levels. In all provinces the life expectancy rose for males and females between 1971 and 1980. The highest life expectancy for women was recorded in the North Solomons at 59 which in 1971 was 48. The lowest level was recorded in West Sepik which rose only 6 years in the period of 1971-1980 from 37 to 43. In 1980 the life expectancy of West Sepik women was less that of their North Solomon sisters in 1971.

Due to women's responsibilities for family and in agriculture, they are less likely to or avail themselves of adequate care. Difficulty of access to clinics is also a problem for women seeking medical help. Women also may not have access to travel. In 1985 the major cause of adult female deaths in hospitals was due to obstetric causes (14%) followed by malaria and pneumonia both at 9%.

The three major threats to women entering pregnancy are malnutrition, infectious diseases, and the availability and quality of maternal health services. The number of women reported being pregnant or breastfeeding varied greatly from province to province. The highest percentages were found in island regions and the lowest in the highlands.

In 1988 the figure for new antenatal attendance was 68% of all pregnant women, although it was considerably lower in remote areas

Situation of women in customary marriages

The majority of marriages in PNG are arranged by custom. The paying of a bride price is a custom in which it is believed the husband's clan has rights over the woman's reproductive capacity and labour (Chao 1984). It is important to know this if one is to understand the PNG male psyche.

A study conducted in Milne Bay showed that parents were taking their sons for treatment twice as often as often as their daughters. Thus it appears that men were favouring their sons (Young 1986). In Milne bay living arrangements are patrilocal. Thus daughters are people who will grow up and move to their husband's village. Aggression, rivalry, warfare and domination of women colour the male character (Gillett 1990).

Domestic violence is on the increase in PNG. Domestic violence is defined as violence between married couples or couples who live as a married couple. Wide variation exists between the provinces however the highlands regions recorded the highest rate of domestic violence. In some highland provinces all women reported that they were beaten.

Domestic violence in PNG has always existed but seems to have worsened with modernization. Some of the things that have amplified the problem are alcohol abuse, breakdown in traditional values and cultures, influence of western films, the breakdown of traditional outlets of male aggression and the influx of cash. Three main causes for domestic violence in urban areas are alcohol abuse, money problems, followed by sexual jealousy. However, the Law Reform Commission found in 1982 that the underlying cause for domestic violence was the culture of male dominance exacerbated by rapid social change.

The division of labour between the sexes is quite distinct. Women's work consists of raising children, cultivating gardens, preparing food and tending pigs. Men's work involves community protection, building and warfare (Holloway 1976).

As the desire for a western lifestyle increases, the status of the rural women decreases. More emphasis is placed on cash cropping and wage employment. This situation has led to the loss of confidence and self esteem among rural women.

However, the traditional husband/wife relationship is changing. Churches have introduced the model of marriage – mutual respect, love and partnership. These programs need to be supported

In the majority of families men make the decisions thus programs such as family planning could also be targeted at men.

Women's workload and activity level

Life in the rural areas is very demanding due to the physical nature of the work involved in subsistence agriculture and most women spend the majority of their childbearing years pregnant or breastfeeding. In the 1982/83 National Nutrition Survey over 62% of women were breastfeeding. The highest percentage was recorded in Simbu with 85% and the lowest was found to be in Central province at 62%.

Women generally do more work than men. For example, Heywood et al. (1986) reported that women from Wosera sub-district maintain gardens, process sago, harvest and collect food, collect water and firewood, prepare family food, care for the children, help pick, hull and dry coffee, and market surplus food and cash crops. These Wosera women reported that they often

go to bed without eating because they are too tired to cook. This is probably due to a combination of factors such as overwork, under nutrition and anaemia.

Women's workload may be increasing. Reasons given are the intensification of the gardening system, cash cropping, male out migration, and an increased number of children (Heywood et al. 1986). Although women contribute very significantly to the family's income, they often have very little control on how the money is spent. Money squandered on alcohol or gambling reduces the money available for food or school fees (Gillet 1990).

Problems can also be found when women find paid work. More time is spent at work compared to time spent in the gardens to grow food in the subsistence economy (MacDonald 1984).

Education

An educated woman is more likely to understand and take measures to maintain health. For example will she have a tetanus shot during pregnancy? Will she have a trained attendent at the birth? Will she practice family planning?

In PNG girls are behind boys in education with 31% of girls selected to go on to grade 7 compared to 40% of boys (1985/1986), although there have been improvements over the years. The proportion of female grade 1 students increased from 37% to 45% from 1971 to 1988 and Grade 6 enrolments have increased from 34% to 44% from 1971 to 1988.

A study in 1988 showed that in all provinces gross enrolments for grades 1-6, boys had a higher percentage than girls (Table 3.8), the only exception being North Solomons. The highest percentage for girls was in Manus Province with 86% enrolled compared to boy's enrollment of 93%. The lowest percentage was found in West Sepik at 54% of girls being enrolled compared to 77% of boys enrolled (Webster 1989).

Table 3.8 Gross enrolment rates for grades 1 to 6 by province and sex, 1982-1988.

Province	1982		1985		1985	
	Male	Female	Male	Female	Male	Female
Western	74	62				
South Fly			83	78	88	81
North Fly			92	64	96	79
Gulf	75	39	79	59	81	61
Central	75	64	86	77	92	81
NCD	80	77	77	76	83	81
Milne Bay	71	55	74	72	75	74
Oro	68	57	75	64	76	68
S. Highlands	55	30	59	50	57	47
Enga	65	39	64	45	69	47
W. Highlands	51	42	56	48	68	58
Simbu	60	43	69	54	101	80
E. Highlands	58	47	70	60	82	68
Morobe	67	52	70	54	73	58
Madang	64	45	69	52	71	56
East Sepik	71	53	82	67	75	69
West Sepik	71	45	73	40	77	54
Manus	90	83	94	83	93	86
New Ireland	80	73	89	89	88	85
East New Britain	82	81	82	79	84	82
West New Britain	80	72	82	74	80	70
North Solomons	72	67	74	74	74	74
Papua New Guinea	67	51	72	61	77	65

Note: Gross enrolment rate is the percentage of children enrolled in Grade 1 to 6 out of the total population of children aged 7 to 12. For 1982 South Fly and North Fly are included in Western.

Sources: Webster 1989: Table 3.6 Asia and Pacific Program of Educational innovation for Development (APEID) 1989: Table 2.1

Reasons for the low representation of women in education are cultural. It is commonly considered by all including girls (an important note) that a women's role is working in subsistence agriculture and childbearing. Thus aspirations for girls are low.

Townsend (1985) estimated that about one quarter of young mothers are literate and about 52% of urban women have completed primary school.

Mental health

Concerns have been raised by primary healthcare workers that a number of out-patients have a variety of complaints that have no physical basis or symptoms and are out of proportion to the amount of physical disability experienced. Large proportions of these patients are women. There are few resources available to deal with mental health issues coupled with lack of qualified staff.

Malnutrition

With the increase in population and lower food production, the problem of malnutrition is increasing in more and more areas of Papua New Guinea. There is a steady increase in food imports into the country. The consumption of imported food is higher in the urban and peri-urban communities than the rural areas of Papua New Guinea. The most critical and vulnerable areas for malnutrition are the remote areas with very poor or no access to basic government services. As a general rule it can be said that with every additional hour of surface travel (land or sea) to the nearest point of public service there is usually a reduction of 10% in the availability of protein rich foods. The national daily consumption of protein is 55 grams per person per day, while the average daily consumption in the National Capital District is as high as 82 grams, which is approximately 50% higher.

Access to safe water is another example of the factors that contribute to the malnutrition problem. Approximately 25% of the population have access to safe water. This is water from wells and rainwater stored in tanks or other enclosures. The majority of people still depend on creeks, ponds and streams that may be potentially contaminated with bacteria causing diseases such as typhoid and cholera. In towns and urban areas a higher proportion of the population has access to safe water. For example in the National Capital District 92.3% of the population have access to safe water. The classification of districts with the highest levels of malnutrition is given in Table 3.9.

Table 3.9 Classification of districts with the highest levels of malnutrition.

Region/Province	Incidence of Malnutrition		
	Very High	High	Moderate
Milne Bay	Eas'ala	Misima	Samarai
	Losuia	Rabaraba	Alotau
Central		Goilala	Kokoda
Western		Kiunga	
West Sepik	Lumi	Amanab	Telefomin
	Nuku		
Madang	Ramu	Madang	Rai Coast
Morobe	Menyamya		Kabwum
East Sepik	Maprik		
S. Highlands		Nipa	
		Tari	
		Koroba	
E. Highlands		Okapa	Kainantu
		Wonenara	Lenganofi
Enga			Lagaip
			Wabag
W. Highlands			Jimi
Simbu			Karimui
			Gembogl
			Sinasina
East New Britain	Pomio	Lamet	
New Ireland		Namatanai	
West New Britain			Talasea
			Kandrian
			Ewasse

Source: Heywood et al. 1988.

Women who breastfeed should continue to eat more as well as take in extra liquids. This will maintain a good level of breast milk as well maintain the mother's weight.

Anaemia

Anaemia is a problem in PNG especially among pregnant, breastfeeding and menstruating women. It has been estimated that up to 90% of women in lowland areas are anaemic. One way to combat anaemia is to eat a well balanced diet rich in iron.

Women with malaria are also susceptible to anaemia as malaria damages the red blood cells in the body. Major problems with anaemia are that there is a greater risk of miscarriage, excessive bleeding during childbirth and delivering of a baby with a low birth weight.

Iodine deficiency can lead to endemic goiter, an irreversible condition. Women who have an iodine deficiency may give birth to children who are cretins. This can be prevented are by using iodised salt and eating seafood.

Diabetes

Women who have diabetes are at a high risk and even more so if they become pregnant. It is important that diabetic pregnant women are identified early so that proper care can be taken. Babies born to women with uncontrolled diabetes are at a high risk for congenital malformations.

Over nutrition leading to obesity is becoming a new health problem for women in urban areas. As women do not have to work in subsistence agriculture, the energy that would otherwise be expended in this activity is not used up. The problems are exacerbated by the major changes in diet e.g. increase in purchased foods that have a high sugar content.

Malaria

The third leading cause of death in health centres in PNG is malaria. The two leading causes of death in health institutions are pneumonia and conditions originating in the perinatal period. Malaria is increasing as people originally from non-malarial areas (highlands) move to the lowland malarial areas. This movement occurs due to economic activity and development.

There are three high-risk groups in PNG. The first are young children between the ages of six months and five years. This is the period in which they build up immunity to malaria. The second group is non-immune people of all ages for obvious reasons. These people are highlanders and expatriates that have moved to malarial areas. The third group is pregnant women.

Research has shown that immunity to malaria is reduced during pregnancy. The placenta acts as an amplifying organ for malarial infection**.** Having a healthy immune system prior to pregnancy may help prevent malaria during pregnancy. Chloroquine can help prevent the disease from occurring. Some of the serious problems with maternal malaria that have not already been outlined are increased numbers of preterm deliveries, abortions (miscarriage) and stillbirths. One other problem is congenital malaria. This occurs when the malaria parasites cross the placenta and infect the fetus.

The number of children a woman has can effect her susceptibility to malaria. Studies in Yagaum in Madang have shown that women having their first or second child (parity 0-1) show the highest rate of malaria. Women with a parity of 6 show the lowest. Bray and Anderson (1979) suggest that with age, the vulnerability to malaria in pregnant women is decreased.

The national policy for malaria control 1986 to 1990 has the following objectives: (i) to reduce and eliminate death from malaria; (ii) to reduce the number of severe cases of malaria; (iii) to shorten the period of suffering from malaria; and (iv) where possible, to reduce the influence of malaria.

The current approach to prevention and control has an emphasis on educating communities and individuals. Research is being done to develop a vaccine. Gillett (1990)

suggests that prevention and control should include drug treatment and prophylaxis, mosquito control, and reduction of person - mosquito contact.

Impact of sexually transmitted diseases on the health of women and infants

Often STDs can lead to pelvic inflammatory disease (PID) which can cause infertility. In pregnant women this condition often brings about miscarriages and stillbirths. The two most frequently reported STDs are gonorrhoea and syphilis. Gonorrhoea is the most common STD reported in PNG. The symptoms of initial infection may be mild but if untreated it can lead to PID. For pregnant women there are high chances that an ectopic pregnancy may occur if there has been tubal scarring and inflammation. Syphilis is a common disease amongst young adults in PNG.

The first case of the human immuno-deficiency virus (HIV) in Papua New Guinea was reported in 1987. It is estimated that there are currently 16 new infections per 100,000 people. The official estimate for the people affected by the epidemic is now 10,000-15,000 people. The virus is being spread predominantly through unprotected sexual intercourse, although increasing numbers of infants are being infected during pregnancy. The very high rates of other sexually transmitted diseases are a major factor for HIV transmission in the country. The AIDS epidemic has wide-ranging implications for development and food security. The concern in PNG is that AIDS has reached epidemic proportions similar to those in Africa. Factors showing the increased concern for STDs include:

- The rapid growth of the population.
- Breakdown of traditional values controlling sexual behaviour.
- The steady migration of the 15 to 29 years age group into urban centres.
- The spread of penicillin resistant strains of gonorrhoea.
- The burden on the already stretched health system

Family planning

There are still strong perceptions that children provide security and strength. Population growth is equated with political strength. This poses a problem to family planning. With the increase in population comes the question of land. While some believe that there are large areas of land that could support a greater population (Muirden 1973), many areas are unsuitable for agriculture. In the Gazelle Peninsula, Maprik District and certain areas of the highlands there is awareness of potential land shortage. This situation can lead to internal social conflict

PNG was included in an early 1980s survey of world access to birth control. The survey found that 80 out of the 95 developing countries had inadequate family planning. A score of 41 to 64 was fair, 13 to 39 poor, and 0 to12 very poor. With a score of 26, PNG ranked in the ‘poor’ category. This means that there is minimal family planning information or services and the concentration is in the urban areas.

An increase in population necessarily means that there will be an increase in government expenditures. Therefore definite planning is important. At present, it is increasingly difficult to expand coverage of health services and education because increased expenditures are needed to merely maintain current levels. One pertinent question to ask is whether or not the money is going where it ought to.

As mentioned earlier, in the Gazelle Peninsula there is trouble with land shortage. This has led to out-migration, ecological degradation, and tension over land tenure. Formerly migration was circular from rural to urban however there is a strengthening of the urban drift. In the towns this leads to problems in housing, urban services, employment and law and order.

Health services for rural women in PNG

Whilst there is growing demand for more obstetric health care, the majority of this demand has come from the urban areas. In some rural areas 20% of births occur in a health centre or sub centre. The majority of rural women are delivering by themselves.

The greater the distance from a health centre, the less supervision is given. Due to the in-accessibility of the terrain, the only way for many rural women to receive antenatal care and supervision of deliveries is if the service comes to her. There are mobile MCH, however these need to be made more efficient.

Studies have shown that government-run clinics fare less well than church-run clinics in providing services adequately. Church-run clinics devote more of their time to maternal health. Islands and Papuan Regions have higher quality services, with Momase Region the poorest.

Priorities for today - challenges for tomorrow

Politically there is support to improve the standard of living for women in statements in the Constitution, the Eight Aims, the National Health Plan 1986-1990 and the National Women's Policy. Gillett (1990) suggests the following:

- to improve the social and economic status of all women;
- to raise awareness of women's health issues at national, provincial and local levels;
- to reduce the high rates of illness and premature death among women in rural areas by maintaining and improving access to and quality of essential health services (to deal with antenatal problems, medically supervised deliveries, family planning and sexually transmitted diseases, nutrition, malaria, etc).

The community as a whole needs to acknowledge the dynamic role of women in PNG and thus realise that good health for women in PNG necessarily means that the general level of health of the family can be raised. In Papua New Guinea, women generally have the main responsibility for rearing the child. They also play a very important role in household management and agricultural production. As a consequence they are very significant in the maintenance and improvement of food systems.

Studies have reported that in some parts of the country the workloads of women are high, arduous and increasing (Heywood et al. 1986). This is related to the intensification of food production, the contribution of women to cash cropping, absence of males, an increased number of children at school and unable to help, and larger family size due to higher survival rates (Gillet 1990). As a cause of infant deaths perinatal conditions have shown a steady increase between 1985 and 1989. It is however, unclear the extent to which changes in the workload of women and food intake during pregnancy affect perinatal deaths.

In PNG, women should be the focus of many education programs and interventions that are used to address the problem of PEM. Interventions should be evaluated according to the likely effect on women's workloads and activity levels. A number of strategies are suggested as follows:

- Enforce allocation of training and job opportunities for women through quota systems within specific departmental components. An example is the New Zealand Government's scholarship specifically to train women in agriculture at colleges and universities.
- Utilize community based education programs as a means of distributing already existing health and agricultural information.
- DAL, NARI and DOH should supply the Department of Education (DOE) with posters, booklets and other educational materials that can be sent directly to community schools for use in their community based education programs.
- Enforce the conditions of working mothers. For example government legislation has allowed working mothers childcare areas for their children and "breast feeding breaks"

throughout the day. Poor enforcement makes working mothers become reliant on bottle-feeding which can lead to undernourishment.

- DAL/NARI must be provided with training, equipment and facilities to test for iodine in salt. Salt not providing adequate iodine should be banned.
- DAL/NARI should develop a model program involving "didimeris" (women in agriculture, particularly agricultural extension officers) in post harvest work. This would involve training in all aspects of post harvesting including storage, preparation and usage of waste, the relationship between nutrition and fisheries, and the importance of extension services.
- Income generation through food processing: The Department of Agriculture and Livestock, University of Technology and the National Agriculture Research Institute could develop a program on food processing to educate women on producing healthy snacks for sale. This could include sago pops, banana chips and dried fish jerky. This would be an ideal way to utilise "didimeris" (female agricultural officers) but some training is needed.
- NARI/DAL could target specific areas where food production is declining and develop site-specific programs. An extension program about alternative agricultural techniques (use of organic manure, composting, pest and disease control, etc) could be implemented. Programs should also address the issue of women's workload. Women are currently working longer and harder to provide for their families.
- More emphasis on nutrition education in urban areas through organised women's groups. DOH can coordinate and support a program of informal nutrition education for women. Implementation can be made through Young Women's Christian Associations, church association such as Women's Fellowship and other voluntary organisations.
- Increase awareness of women's issues: Women's status is low and this permeates all aspects of life to the point that children suffer as a result. A nationwide campaign could be launched through funding assistance from UNICEF, NGOs, etc.
- The existing theatre groups (e.g. Raun Raun theatre) can be used to educate the public about health and nutrition problems.
- Celebrities could be used to promote health messages: sports heroes could promote nutrition and Miss PNG could promote family planning.

3.3.5 Education and nutrition

The Department of Education (DOE) provides nutrition education at all levels in both formal and informal education. Nutrition education is often incorporated into different subjects offered in primary and secondary schools. In community schools, for example, concepts and skills in nutrition education are taught in agriculture, health, community life and science. In provincial high schools nutrition education is one of the main components of home economics. Other subjects such as agriculture, guidance and science have also integrated knowledge and skills on nutrition. Nutrition education is vital because it enables students to:

- Understand the relationships between food, good growth and all aspects of human development.
- To develop the skills of hygiene, food preparation and storage.
- To develop the skills in making wise decisions about food selection, preparation and consumption

Since 1988, there has been increased emphasis on vernacular language in both formal and non-formal education. It has also changed the focus on English as the medium of instruction in all levels of formal schooling. The National Literacy and Awareness council was established in 1989 with the following roles:

- Advisory role on literacy and awareness activities.

- Administrative role to guide and direct the literacy and awareness secretariat for effective implementation of its activities and functions.

The following year, the literacy and awareness secretariat was established to coordinate and support literacy and awareness programmes of government and NGOs throughout the country. A notable achievement of the literacy and awareness program is the "tokples" pre-schools which have been developed and are being tried in many provinces. An adult curriculum is being developed which includes awareness issues such as health and nutrition, environment and agriculture, legal and civil rights.

Constraints

Primary schooling is not compulsory. Approximately 73% of school-aged children attend primary school, however about half of that number fail to complete the grade for one reason or another. In the rural areas, access to schools can be a problem due to the long distances children have to travel to attend classes. Although the minimum age of entry is seven years, there are still many children enrolling in grade 1, aged 8-15 years. In some areas, the enrolment of girls is lower than that of boys, contributing to the increasing problem of illiterate women in the country.

Access to community schools in urban areas can also be a problem. This is due to lack of space to accommodate increasing numbers of school-aged children.

There are limited opportunities for grade 6 school leavers who fail to continue on to secondary schools. Most of these children are expected to stay in the village and contribute to the development of their communities or find employment in the urban areas. Unrealistic expectations of parents can cause feelings of resentment and a sense of failure among those who do not have have the opportunity to go to high schools or vocational centres.

In provincial high schools and vocational centres the timetable does not allow for the effective participation of relevant agencies outside the school system. There are also the perennial problems of staff turnover and a shortage of qualified teachers. Sex stereotyping of subjects also means that only girls do home economics and boys do practical skills.

Curriculum content

The curricula in both community and provincial high schools are academically based and are not relevant to the majority of students who are likely to stay in the village. These subjects are also too foreign for students to apply in the village. The present examination system at both levels only measures skills in English, mathematics, science and social science. This has largely contributed the low status accorded to vocational-oriented subjects such as agriculture, home economics, health and practical skills.

The food and nutrition curricula need urgent revision to address the current issues and concerns. Many of the nutrition curricula were developed 20 years ago and need to be revised.

Language

The use of English as the medium of instruction in classroom is alien to the mother tongue. It is believed that this is one of the factors that cause parents to not participate in the education of their children. The knowledge and skills the children learn in schools are not applied at home because they think it is only meant for the classroom. In a lot of households, the decision on what food to buy and consume lies with the parents, who may lack the knowledge and skills on food values.

Non-governmental organisations (NGOs) include a diverse group of organisations ranging from international agencies through religious groups to community groups. NGOs play an important role in promoting some of the developmental issues that line departments and agencies are not able to carry out for one reason or another.

NGOs have been very useful in providing those important services to people when needed. Funding to nationally-run NGOs for specific projects has increased because of good accountability, transparency and quality of work.

The government institutions involved in bringing development still have existing roles in their respective disciplines.

3.4 Domestic food production

3.4.1 Agricultural production

Papua New Guinea's agricultural system can be defined as a shifting agricultural system with bush and grass fallow. Table 3.10 shows that the majority of people in rural areas have forest fallow agricultural systems. An interesting note is that the agricultural systems are intensifying. The population has grown, but agriculture is not expanding in area.

When the ratio of the time (years) that the land is cultivated in crops to the time it is fallow is reduced 1:25 to 3:15 (1:5) the intensity of the land use is increasing (Allen and Bourke 1997). This does not mean that the whole of the land is used for agricultural purposes. Apart from hunting game the land is also used to gain cash. The intensification of land use is also related to a wide range of non-food needs of the population such as school fees, housing, travel, etc (Allen and Bourke 1997).

Land use intensity in PNG is low, however. In 1980, 27% of the rural population was living in just over 5% of the total area. Allen and Bourke (1997) noted that as the population increases, the land is being subjected to increasing pressure.

Table 3.10 Fallow vegetation, area and population on land used for agriculture in Papua New Guinea.

Fallow vegetation	Area (km^2)	Area (%)	Population	Population (%)
Tall secondary forest	12,243	72.5	887,364	38.3
Low secondary forest	15,852	9.4	363,265	15.7
Scrub and cane grass	11,475	6.8	410,604	17.7
Short grass	11,438	6.8	243,646	10.5
Tall cane grass	5,548	3.3	397,815	17.2
Previously unused forest	543	0.3	306	0.0
Savanna	1,526	0.9	12,332	0.5
Total area	168,814	100.0	2,315,332	100.0

Source: Mapping Agricultural Systems in PNG Project. Population from National Census.

Table 3.11 Population density classes by area and population on agriculturally used land in Papua New Guinea.

Population density	Area (ha)	Total (%)	Population	%
0-10	101,473	60.1	317,325	13.7
11-20	36,111	21.4	507,725	21.9
21-50	20,000	11.8	605,313	26.1
51-75	6,608	3.9	400,622	17.3
76-100	2,491	1.5	222,360	9.6
101-150	1,739	1.0	190,345	8.2
151-200	387	0.2	58,809	2.5
201-300	5	0.0	12,833	0.6
	168,814	100.0	2,315,332	100

Source: Mapping Agricultural Systems in PNG Project. Population from 1980 Census.

Agriculture is the most important source of income and employment for the large majority of the population. The sector has contributed 25 to 30% of GDP over the past 10 years and provides the main source of support for the normal sector of the economy. Although agriculture is an important source of exports, the growth in oil exports has seen its relative importance decline. The agriculture sector provided 35% of exports in 1985 but only 15% in

1995. The main cash crops are coffee, cocoa and palm oil, which in total provide 11% of total export revenue. Other important cash crops are copra, copra oil, rubber and tea.

One of the key constraints to the sector's performance over the past decade has been low world prices. The steady fall in prices placed considerable strain on the budget because of price support schemes applied to each of the major tree crops. The schemes are intended to reduce export price volatility and maintain price incentives to producers. The sustained low prices and the absence of adequate downward adjustment in prices paid to producers led to the exhaustion of scheme reserves in the early 1990s. Since 1989, the schemes have received government injections of more that K250 million.

The constraints facing the agriculture sector have been the subject of much analysis, and many of these constraints have remained unchanged for over a decade (see, for example, Jarrett 1985). These constraints include:

- Negative effective rates of protection;
- The poor quality of extension services;
- A shortage of credit for smallholders;
- High debt levels in the plantation sector;
- Poor infrastructure, particularly transport (the infrastructure problem is discussed further below); and
- Difficulty of obtaining secure access to land.

The negative rates of protection arise from moderate to high tariffs on transportation equipment, fuel and other industrial products. Prior to the recent round of tariff cuts, effective rates of protection were in the order of negative 30 to 50%. The government's current commitment of tariff reductions as part of structural adjustment is anticipated to lessen this problem. Significant progress was made in this regard in the 1996 budget, which included tariff reductions on inputs.

Under the old Organic Law, agricultural extension was largely a devolved function, but it was frequently accorded little priority by provincial governments. The Coffee Industry Corporation is the only industry association with a comprehensive extension process. Palm oil is also relatively well catered for within the industry through the services provided by large holder estates. Some extension services are also made available through various donor-funded projects.

The poor quality of extension services arises from a low level of funding and a fragmentation of support services across a growing number of institutions that makes coordination difficult. Extension services are provided by the central Department of Agriculture and Livestock, provincial departments, autonomous corporations, statutory bodies and a research institute with centralization in the Department of Agriculture and Livestock (around 80% of staff work in Port Moresby). The poor quality of extension services is particularly a problem for smallholders who tend to have low productivity levels.

In line with the general direction of fiscal reform, a range of measures has already been adopted to bring agricultural support closer to the farmers. The Department of Agriculture and Livestock decentralization of some of its functions to regional offices, community and NGO participation in the provision of support services is to be encouraged, and local communities are to receive support for small-scale communal developments (for example, irrigation, crop and input storage, and agro-processing). Under the provincial government reforms, the effectiveness of extension services will depend heavily on the development of capabilities at the local level. Given existing weaknesses and the fragmentation in lines of authority inherent in the new provincial government system, the development of these services will be a significant challenge.

There has been pressure for sometime for a restructuring of the Rural Development Bank (previously the Agricultural Bank of Papua New Guinea) to address the large accumulated debt in agriculture. The bank has a cumulative loss of K68 million with arrears on payments equivalent to almost 30% of total assets. Despite the provision of government-subsidized finance from both the Rural Development Bank and the commercial bank sector, the needs of smallholders are widely believed to be unattractive to the banks, constraining their growth.

The difficulty of obtaining secure access to land in Papua New Guinea is particularly important to the agriculture sector. The problem is largely attributable to the customary ownership of land, which does not provide individual title. The government has attempted to address the issue through the development of a legislative strategy for customary land registration, including national framework legislation, land dispute resolution and the alienation of land for industrial use. Improvements to the existing cumbersome land administration system are also being pursued with the assistance of donors. Little progress has been made and the Work Bank financed land mobilization project was recently cancelled. The prospect for a resolution of these problems is small, given the importance of land to the country's culture.

The central role of land ownership in Melanesian culture suggests that the challenge is to develop options that are compatible with both commercial development and local tradition. To some extent this has been achieved in neighboring Fiji, and it may be possible to draw some useful lessons from this experience.

The government is currently developing a new strategy for the agriculture sector. It is unclear how this strategy will be implemented in the context of other provincial government reforms.

In 1996 the government established the National Agricultural Research Institute and a National Quarantine and Inspection Authority. Given the devolution of a significant number of projects and programs to the provinces under the provincial government reforms, this will leave the department with responsibility for planning, the implementation of national projects and for setting and monitoring service standards. In carrying out these functions, the department will face a range of constraints common across central departments.

Agricultural production by region

In 1996 the national agricultural production was 16.24% of real GDP (World Bank 1998).

In the Southern region agricultural production is 0.58% of real GDP (all 1996 figures), however the figure is not completely accurate as the figures for Oro Province were not available. It should be noted that NCD is counted and as it is the major urban centre in PNG there is barely any agricultural production of any kind. In 1990 subsistence agriculture was 4% of the labour force in NCD. Nevertheless at 0.58% the Southern region contributes the least of all the regions towards agricultural production as a percentage of real GDP. In the Gulf province agricultural production is 0.02% of real GDP which is the lowest of all the provinces; it is a position shared only with Manus province. The highest figure for the region is Central province at 0.29% of real GDP.

The Highlands region is the region that contributes the most to agricultural production as a percentage of real GDP. In 1996 its total contribution was 8.53%. This figure is over half the national figure (16.24%). Agricultural production in the Western Highlands province as a percentage of real GDP was 4.06, being the highest of all the provinces. The second highest contributor towards agricultural production is also in the highlands region and that is the Eastern Highlands with 3.15%.

The Momase region contributes 1.92% in agriculture as a percentage of real GDP. Of the four regions it is the second least productive region. The highest percentage for this region is Madang province at 0.84. The lowest amount for agricultural production for the region is recorded in Sandaun province at 0.03% of real GDP.

The Islands region is the second highest contributor towards agricultural production as a percentage of real GDP at 3.99. This figure is just less than a quarter of the national figure (16.24%). The province that is the highest contributor is East New Britain province at 2.50% of real GDP. Of all the provinces it is the third highest contributor towards agricultural production as a percentage of real GDP. The lowest in the region is Manus province at 0.02%; this is the lowest of all provinces along with Gulf provinces.

Food availability varies between community to community and household to household for many reasons. However the utilization is very much dependent on the types of food that are available.

There is a need for the development of community-based food processing industries in Papua New Guinea. Attempts have been made by the government and institutions to promote self-reliance in various aspects of food processing technology. However, most of the efforts have been on a large scale and have not involved people at the community level.

Results show that it is possible to carry out community-based food processing using simple production systems and technologies, and secondly it is necessary to evolve a style of production and management which will satisfy both requirements of commercial viability and realities of the village conditions (Rashimah 1992).

One would argue that Papua New Guinea should be able to produce enough food to supply the requirements of the population, because it has a population density of less than 11 per square kilometre. However, there are number of factors that constantly constrain food crop production.

Firstly, although the country has a total of 463,000 square kilometres of land area, a major portion is not suitable for agriculture. It was reported that, even if limited potential land is included, only 123,000 square kilometers of the country is suitable for agriculture. It is also important to note that the distribution of the population is very uneven. Of the national land area mapped, only one-third is inhabited, while the other two-thirds is uninhabited (Hanson et al. 1999). Information from the computer database Mapping of Agricultural Systems in Papua New Guinea (MASP) indicates that there are a number of agricultural systems that support a human population density of more than 100 persons per square kilometre. For example in Manus Province, Farming System 1603 which is located on the small fringe reef island off the north and south coast has a population density of 331 person/sq. km. There is a general increase in the demands and pressures on land and other renewable resources over time.

Traditionally, shifting cultivation was the driving force behind food production in the country. This was based on the long natural fallow that was possible because of the low population densities. This however, has changed due to increasing land area coming under cash crops and settlement leaving very little land for shifting cultivation. This consequently has led to short fallow periods and a decline in soil fertility and an encroachment onto marginal land such as sloping land. These changes have threatened the sustainability of the traditional farming system and hence food security and livelihood of the people.

Farming systems

Farming systems in rural Papua New Guinea have been based on low intensity subsistence farming (Bourke 1992) practiced by shifting cultivation. However since the 1930s, the rural communities have seen many changes in land use and subsistence agriculture. With the introduction of cash crops such as coconuts, cocoa and coffee a lot of arable land was taken away from subsistence gardening. In the last five decades the increase in population in the rural communities has also resulted in people concentrating near urban centres. Even in the remote areas, some people have left their villages, which traditionally shifted with their gardening activities and have settled alongside new roads (Leng 1992). All these factors have led to a shortage of land for the traditional system of farming, which requires a long fallow period for soil fertility regeneration. In recent years, the increase in population pressure and the extensive use of arable land for cash crops have resulted in the intensification of agriculture. A number of studies have been carried out in various parts of the country looking at changes in the rural village. One example is the study by Bourke (1992) which focused on fifty years of change in Asirinka Village in the Aiyura basin of the Eastern Highlands Province. Six examples of farming systems are given below.

East and West Sepik Provinces: In the East and West Sepik provinces sago is the most important food. High in carbohydrates though low in protein, sago is supplemented with coconuts, fish and greens. When it comes to food the emphasis is placed on hunting and fishing and gathering of wild vegetables. Gardens are made on lands cleared from tall secondary forests. It is also stated that one planting is made before the land is left fallow. People are becoming stable and settlements are becoming more compact, according to Allen and Bourke (1997), because people want to be closer to health and education services. They further state that game and fish are becoming less plentiful.

Iwa Island, Milne Bay Province: In the Iwa Island of Milne Bay Province land shortage and high population are such that land is cleared every year and is left fallow for one to two years. This has occured gradually over time. This intensive use of land has negatively effected the soil fertility. Some efforts are made to increase soil fertility by planting two types of trees (Scheinitzia novoguineensis, Rhus taitensis), a technique which could be used in other parts of PNG. The main crops are sweet potato, yam and cassava. The villagers claim that the most important foods are cassava and coconut. The local yam production does not meet demand, thus the people often go to other islands to trade produce for yam. The drive to make new gardens in order to meet demand has seen a decline in fruit and nut trees as the area is now being used for making gardens).

Sialum Coast, Huon Peninsula, Morobe Province: On the Sialum coast, gardens are made on land cleared annually. Land is left fallow for two to three years. Yam is the most important crop followed by sweet potato and cassava. Banana and coconuts are also planted. Land use is high. The seasonal rainfall affects agricultural production in a way that food supply is short every year from July to December. People get through this time of the year by trading with the people in the surrounding mountainous area. They trade their fish for sweet potato and taro. When the price of copra is good, rice is bought.

Maril Valley, Simbu Province: In the Maril Valley of Simbu Province, the system is a shifting agricultural system, with long fallow periods of 10 to 15 years. The cropping periods are three to five years. The most important crop is sweet potato and other crops include banana, taro and yam. Pigs are also very important to the people and they are kept in large areas fenced off from the gardens.

A long fallow period is one way that the farmers are trying to improve soil fertility. Another way is to put in nitrogen fixing peanuts in between the planting of sweet potato. Another nitrogen fixing plant used is casuarina trees before the gardens are put back into fallow. The trees also double as firewood. Allen and Bourke (1997) state that the people battle with erosion and loss of topsoil by constructing wooden soil retention barriers in the most steeply sloped gardens. There is intensification of land use, which unfortunately result in soil erosion, which means declining sweet potato yields.

Tauri and Hauabanga Valleys – situated between Gulf and Morobe Provinces: The agricultural system is low intense, however it is intensifying with the shortening of the fallow period (shifting agriculture). One crop is planted before a fallow period of 8 years, (which apparently is short). In a survey in 1980 some villages were being cleared from grass fallow. The soil degradation comes from clearing forest from land on very steep slopes in an extremely high rainfall environment.

The most important crop is sweet potato, which is a recent phenomena replacing *Colocasia* taro. Other important crops along with taro are Chinese taro, banana, cassava, Irish potato and corn. Although it is planted only once, Chinese taro can produce for up to 10 years.

Kandep and Marient Basins, Enga Province: Agriculture extends up the valley sides, which are 2,800 metres above sea level, making it one of the highest permanent settlements. Efforts to maintain soil fertility are made by adding organic matter. Sweet potato is cultivated on top of mounds of dirt piled on top of old vines, weeds and grasses. It can be continuously cultivated in this manner for up to 40 years with a short fallow period of 8 months. Wohlt (1986) estimated that there are 1,360 mounds per hectare. The gardens are made on the higher steeper slopes above swamps. The swamps are where the pigs forage. There is also a chance for fishing in the lakes. The introduction of Irish potato was important, as it is less frost sensitive. Irish potato along with corn and pumpkin have become important to the diet.

Maintenance of soil fertility in Papua New Guinea farming systems

The decline in soil fertility resulting in lower yield can be attributed to the intensification of agricultural farming systems. With the increase in population in certain areas, land is becoming more of a constraint. For example, between 1980 and 1990 the Gazelle Peninsula had an annual population growth rate of 3.4% compared to the national growth rate of 2.2%. (NSO 1990). There are several solutions to this problem already available: (i) fertilizer application: the promotion of fertilizer especially animal manure, (ii) crop rotation: rotation of leguminous plants such as peanuts and winged beans, (iii) composting and mulching, and (iv) agroforestry and the use of alley cropping practices.

Increasing land pressure is becoming an important issue. For example, Cundall et al. (1988), Cook et al. (1989) and Tyler (1994) have also reported increasing land pressure, shortening fallow periods and declining yields on the Gazelle Peninsula. The trends support the need for developing cropping systems that will increase yield sustainably under continuous cropping on sloping lands. Prevention of soil loss by erosion barriers and conservation of soil fertility through agroforestry practices are two means of achieving that objective.

Very little information is available on the effect of cultivation on sloping land. Carmen (1989) carried out initial soil erosion studies on volcanic ash soil of the Gazelle Peninsula. Soil loss of 38.2 t/ha/yr on clean weeded gardens with disturbed soil surface on slopes of 29^{o} was reported. In contrast, soil loss from conserved gardens was less, recording only 0.2 t/ha/yr. The use of logs across the slope and plant debris left on the soil surface in the conserved garden was more effective in reducing soil loss and runoff from the garden.

Earlier studies at Kerevat reported vetiver grass (*Vetiver zizanioides*) as a very effective soil erosion barrier and a good promoter of terrace development (Humphrey 1996). The study recorded soil loss figures of 28.3 t/ha/yr from the control plots, while vetiver grass hedgerows reduced runoff by 66% and 71% at wide (3.9 m) and narrow (2.6 m) spacing, respectively, and reduced soil loss by 99% at both spacings. Reductions in runoff and soil loss were both significant.

Seven selected hedgerow species (including a control treatment) were evaluated for their effectiveness as erosion barriers. Apart from their service as erosion barriers, the hedgerows were selected on the basis of (i) maintenance of soil fertility, (ii) food crop hedge and (iii) cash crop hedge. Total or cumulative soil loss (Table 3.12) over the two cropping cycles ranged from 24.4 to 41.8 t/ha (Igua and Binifa 1999). Soil loss by treatment followed the order: control > trashline > Valangur > pineapple > Gliricidia-Flemingia > banana-gaga > pitpit.

This study (Igua and Binifa 1999) confirmed that without the hedgerow barrier, soil loss would be higher than with hedgerow barriers. However, the study also showed that the effect of hedgerows did not sustain crop yields. Sweet potato tuber and peanut kernel yield were relatively low and exhibited declining trends with successive crops, indicative of loss of nutrients through soil erosion. A cumulative total of sweet potato tuber production by treatment followed the order: pineapple (23.7 t/ha) > Gliricidia/Flemingia (22.2 t/ha) > control (19.8 t/ha) > trashline/vetiver (19.7 t/ha) > valangur (18.9 t/ha) > banana/gaga (17.5 t/ha) > pitpit (16.4 t/ha). Differences in yield between treatments were not significant.

Peanut kernel yield obtained were relatively low compared to an expected average of 5 t/ha ranging from 0.18 to 0.25 t/ha and 0.02 to 0.20 t/ha in the first and the second crop, respectively. Total peanut kernel yield followed the order: Gliricidia/Flemingia (0.43 t/ha) > valangur (0.41 t/ha) > banana/gaga (0.37 t/ha) > trashline/vetiver (0.36 t/ha) > pineapple (0.30 t/ha) > pitpit (0.25 t/ha) = control (0.25 t/ha). Differences in yield between treatment were not significant.

Future work should address the issue of soil fertility through the incorporation of organic matter. Simultaneously, efforts should be focused on the selection of appropriate leguminous cover crops to improve the quality of fallow and the identification of less disruptive cultivation practices. The choice of crop types suitable for sloping land is another possible area of study.

Publication and dissemination of information on soil erosion control should be promoted more vigorously, particularly in areas such as the Gazelle Peninsula and the Gumine area in the Simbu province and other areas experiencing high land pressure due to population growth.

Table 3.12 Soil loss (t/ha) from February 1996 to March 1999.

Treatment	GP1	GP2	GP3	FP	GP4	GP5	GP6	Total
Gs	3.3	3.6	10.5	0.7	4.1	1.6	2.1	29.2
Bg	2.7	3.8	10.4	1.1	4.3	2.7	3.3	28.3
Va	2.8	2.8	18.5	1.1	3.8	2.4	3.5	34.9
Ti/Ve	3.0	2.5	19.9	1.2	3.3	2.1	3.7	35.7
Pp	3.7	2.5	8.2	0.7	2.9	2.0	4.4	24.4
Pl	3.2	2.3	14.5	0.9	3.1	1.9	5.4	31.3
Co	4.1	4.4	18.5	1.0	5.5	4.9	6.7	41.8
Statistical	NS	NS	NS	NS	NS	**	**	*
Significance						LSD:0.82	LSD:1.41	LSD:11.3
						CV%:22.8	CV%:23.5	CV%:24.4

NS = Not statistically significant, ** = Highly significant (1% level), * = Significant at 5% level.
Treatment: Gs = Gliricidia/Flemingia, Bg = banana/gaga, Va = valangur, Tl/Ve = trashline/vetiver, Pp = pitpit, Pl = pineapple, Co = control GP1 = Growing period 1, GP2 = Growing period 2, GP3 = Growing period 3, GP4 = Growing period 4, GP5 = Growing period 5, GP6 = Growing period 6, FP = Fallow period.

Without an appropriate length of fallow, soil fertility will continue to decline. Ruthenberg (1980) considered that under intensive cultivation this decline could continue until yields are between nil and one-third of the yield of the newly cleared land. However, yields could remain higher on rich alluvial and volcanic soils. Estimation of yield decline made from long-running trials started in 1954 (Newton and Jamieson 1963; Bourke 1977) on young volcanic soils suggests that this is correct. In a soil exhaustion trial with continuous cropping of sweet potato, yield dropped to about half of the initial yield. Igua and Binifa (1999) reported that a recent soil erosion experiment showed that this yield decline is higher when sweet potato is grown on slopes. Over two cropping cycles, where each cycle consisted of two crops of sweet potato, followed by a crop of peanut then a 6 month fallow, yield reductions ranged from 68 to 45% for sweet potato and 91 to 5% for peanuts (Igua and Binifa 1999). Apart from soil fertility, numerous factors may be casual factors for the decline in yield, such as pests and diseases, type of cultivar/variety, soil type, climatic factors and so on.

The traditional system of fertility maintenance involves little labour and the use of a large area of land and time to allow soil fertility to build up. Increase in the population has resulted in significant changes in the cropping systems. As the cropping systems change, these inputs have to be substituted for in some way, either as cash to buy fertilizer or by utilizing available organic materials.

Some efforts can be made to reduce the rate of fertility decline such as the adoption of certain crops and cropping systems. Any form of cropping that leads to constant cultivation and exposure of the soil will increase deterioration and must be kept to a minimum. Crops such as bananas can be encouraged in association with other perennials, preferably in combination with mixed relay cropping of short-term arable crops grown in an agro forestry system. This would

appear to be the best low input approach to a semi-intensive system aimed at reducing the decline in soil fertility or increasing the basic stable yield.

It is obvious that the farmers will decide for themselves the level to which soil fertility will have to fall before they take action.

3.4.2 Food crops

Farming patterns in food gardens

Results from a survey carried out on nine provinces, indicated a diversity in cropping patterns in food gardens (Koley and Waliji 1992). Significant differences were also reported between the highland zones and the coastal and island zones. Comparisons between the coastal and island zones were statistically non-significant. Koley and Waliji (1992) also reported that there were indications of some shift in cultivation practices in food gardens, especially in the lowlands. Crops such as banana and sugarcane have replaced traditional staples of taro and yam. In more recent times, sweet potato has become more dominant in the lowlands than ever before. Taro the traditional staple in the lowlands was under heavy attack from taro leaf blight causing the sweet potato to be the preferred the staple due to fewer pest and disease attacks. In the highlands, however, sweet potato retains its stronghold.

In Papua New Guinea, root crops are extremely important. Major crops, other significant crops, introduced crops and other minor crops are given in Table 3.13. Traditionally, sweet potato, taro, yams, sago (*Metroxylon spp*) and bananas were the staple foods, either singly, or in combination. Imported cereal products derived from rice, wheat and barley are also significant food items.

These root crops grow specifically in certain altitudes in the country. The four major altitudinal zones of the country are divided into lowland (0-600m), intermediate (600-1,200m), highlands (1,200-1,800m) and the high altitude (1,800-2,700m) and this terminology is used here.

Sweet potato

It is generally accepted that sweet potato was introduced into Papua New Guinea some 400 years ago following European exploration into the New World. It has been proposed by Yen (1974) that sweet potato reached Papua New Guinea via Indonesia, India and Africa from the West Indies. Sweet potato is the major food crop in the highlands of Papua New Guinea and is replacing other staples in the lowlands. Papua New Guinea is considered the second largest centre of genetic diversity in the world. Yen (1974) estimated that 5,000 varieties are grown in Papua New Guinea, of which 1,600 are actually maintained in ex-situ.

Taro

Taro was one of the most important staple crops in the Gazelle Peninsula before the establishment of large plantations. Since 1940 there was a change in the farming system, which has caused a decline in taro growing on the lowlands. In areas still covered with large areas of virgin forest, taro is still the major staple crop grown under shifting cultivation.

There are two main cropping patterns on the Gazelle. One system is shifting cultivation following a long forest fallow (Bourke 1976). The other is a short grass/shrub fallow. The short fallow normally lasts for six months to two years. The land pressure and population increase has forced people to use this shorter pattern of cropping.

The role and importance of taro today in the New Guinea Highlands can only be fully understood with reference to the history of agriculture in this region, in which taro has a prominent position.

Table 3.13 Root crops in Papua New Guinea.

Major Root Crops	Other Significant Root Crops	Minor Root Crops (traditional)	Minor Root Crops (recently introduced)
Sweet Potato (*Ipomoea batatas)*	Cassava *(Manihot esculenta)*	Potato Yam *(Dioscorea bulbifera) (Dioscorea nummularia) (Dioscorea pentaphylla) (Dioscorea hispida)*	Chayote or Choko *(Sechium edule)*
Taro *(Colocasia esculenta)*	Winged Bean *(Phosphocarpus tetragonolobus)*	Pueraria *(Pueraria lobata)*	Queensland Arrowroot *(Canna edulis)*
Lesser and Greater Yams *(Dioscorea esculenta* and *D. alata)*	Swamp Taro *(Cyrtosperma chamissions)*	*Amorphophallus campanulatus*	Onions and Shallots *(Allium cepa)*
Xanthosoma Taro *(Xanthosoma sagittifolium)*	Giant Taro *(Alocasia macrorrhiza)*	Polynesian Arrowroot *(Tacca leontopelatoides)*	Beetroot *(Beta vulgaris)*
	Potato *(Solanum tuberosum)*	Cordyline or tanget *(Cordyline terminalis)*	Turnip *(Brassica rapa)*
		Nephrolepis biserrata	Leeks *(Allium ampeloprasum)*
		Pteris moluccana	Parsnip *(Pastinaca sativa)*
		Habenaria spp	Garlic *(Allium sativum)*
		Banana (*Musa spp*)	Carrot *(Daucus carota)*
		Boerhavia erecta	Yam Bean *(Pachyrrhizus erosus)*
		Amaranthus spp	

Potato

Potato is one of the introduced tuber food crops to PNG. It was introduced into PNG around the turn of the last century. Introduction was mainly by missionaries and government workers from the Germany, Australia and the USA.

Considering the nutritional value under PNG conditions, it yields up to 5,000kg/ha of carbohydrate and 800kg/ha of usable protein in 100 days. It also offers superior sources of ascorbic acid (vitamin c) with a useful amount of thiamine, niacin, iron and phosphorus. About 5,000 tons are consumed per year, while the local production is about 10%. When considered on the basis of production per unit area of time, it has potential to perform better than other crops for carbohydrate and protein production. The varieties that are suitable to PNG grow best at 1,500-2,500 m altitude. Acceptable yields have been obtained as high as 2,800 masl.

There are number of problems experienced with the production of potato including diseases of potato such as bacterial wilt, viral infection, lack of a suitable variety to be used as seeds genetically inferior planting materials, and mixed varieties used in planting.

Food crops situation in PNG

Traditionally, sweet potato, taro, yam, sago, and the banana were the staple diets either singly or in combination. However, cereal products derived from rice, wheat and barley are now significant food items.

The food crops in PNG are very diverse at both the species and cultivar levels. For example, some 300 species are used for food. On the basis of the variation within the species, PNG has been claimed to be the possible centre of origin for a number of crops. The diversity of the species must be considered against a background of diversity of most species and if the number of cultivators were the sole criterion, New Guinea would be considered as the centre of origin for sweet potato and certainly the same applies to taro.

PNG is experiencing a period of accelerated cultural, economic and social change that is having a profound effect on the agriculture. The production of root crops of South American

origin (sweet potato, xanthosoma taro, cassava and potato) is increasing at the expense of the Asian-pacific taro and yams. These crops themselves must have replaced earlier crops such as *pueraria, D. nummularia*, *cordyline* and *Alocasia* taro (Barrau 1965).

Traditional vegetables: retrospect and prospect

The vegetables grown throughout the country today are a mixture of introduced species (some very early introductions, as evidenced by the traditions and rituals associated with them), and indigenous species (Table 3.14). New Guinea is the centre of diversity of many of them and hence there is a unique opportunity within this country to study and develop them further. Many green vegetables used traditionally do not constitute staple crops, but they are very important supplementary foods, providing additional protein, vitamins and minerals in the diet. Their importance has almost certainly been overlooked in the past, especially for highland areas. Studies of dietary intake there suggests that green vegetables contribute at least 20-30% of the daily protein intake and sometimes much more as well as 4 to 6% of the daily energy intake.

The green leafy vegetables are primarily used as the complementary food, but are also consumed by themselves in some cases. The nutritive value of most of these food plants is known but generally greens are good sources of plant protein, vitamins and essential minerals such as iron and calcium. The number of species of green vegetables varies from one province to another.

Table 3.14 Traditional vegetables in PNG.

Legumes	Edible Pitpits	Other Green Vegetables	Other Useful Food Plants
Psophocarpus tetragonolobus-Wing bean	*Setaria palmifolia* Highland pitpit	*Rungia klossii*	Palm hearts or 'cabbage'
Lablab purpureus	*Saccharum edule* Lowland pitpit	*Abelmoscus manihot*-Aibika	Bamboo Shoots
Lablab niger		*Gnetum gnemon*-tulip	Ferns
Dolichos lablab hyacinth bean		*Oenanthe javanica*	Gingers
Phaseolus lunatus- lima bean		*Amarantus spp*. Spinaches	Woody Species
		Rorippa sp. (*Nasturtium schlecteri*)- Highland Cress	

Table 3.15 Nut-bearing plants in Papua New Guinea.

Pandas jiulianettii Martelli	Fam. Pandanaceae
Inocarpus fagifer (Parkison) Fosberg	Fam. Leguminosae (Aila -Pidgin)
Castanopsis acuminatissima (Bl.) A.DC.	Fam. Fagaceae
Pangium edule Reinw.	Fam. Flacourticeae
Finschia chloroxantha Diels	Fam. Proteaceae
Macadamia intergrifilia Maiden & Betche	Fam. Proteaceae (Queensland nut)
Aleurites moluccana (L.) Willd	Fam. Euphorbiceae (Candle Nut)
Omphalea gageana Pax & Hoffm.	Fam. Euphorbiceae
Terminalia catappa L.	Fam. Combretaceae
Terminalia impediens Coode	Fam. Combretaceae
Terminalia kaernbachii Warb.	Fam. Combretaceae (Okari)
Canarium indicum L.	Fam. Burseraceae (Galip)
Canarium kaniense Lautb.	Fam. Burseraceae
Anacardium occidentale L.	Fam. Anacardiaceae (Cashew nut)

Some nut-bearing plants and fruit trees in Papua New Guinea

In PNG there are various tree species with edible nuts mostly used as traditional foods. The trees require little care so nut-bearing trees are an asset to village people. Some have potential as exports, but no trade has been developed. Table 3.27 lists some nut-bearing plants in Papua New Guinea.

The nut-like fruits of several other wild trees are used in Papua New Guinea including *Heritiera littoralis, Elaeocarpus womersleyi, and Sterculia schumanniana* (Laut.)

The production of most tropical fruits is still carried out by traditional techniques, which has led to poor production and quality. Despite their importance, production has been low. Among the tropical fruits that are commercially produced are bananas, citrus, pawpaw and mango, but the full potential of these species remains unexploited. Several other less known fruit trees such as guava, sapodilla, sour sop, custard apple, carambola, jack fruit, bread fruit, durian, rambutan and mangosteen are still grown on research stations and as backyard trees. Long-term research is therefore is needed to develop and evaluate crop production techniques.

In 1979 fresh fruits valued at almost K80,000 were imported; in 1999 that figure easily doubled. Increasing production of some of the imported fruits like citrus and apple could save the country a large amount of foreign exchange as well as provide increased income for many villagers. The increased production and consumption of the fruits can enhance the people's diet. The rural diet is very rarely deficient in vitamins and minerals, other than iron and iodine. The dark green vegetables are better able to supply iron and protein than most fruits. In the diet of urban and non-rural village dwellers the fruits are useful. The urban dwellers are also increasingly changing from traditional diets to diets based on imported cereals.

Problems with growing fruits

Four species of the short-hole weevil damage a number of fruit species by chewing holes in the leaves and in the bark. The bark chewing may cause terminal bud damage and secondary shoot proliferation. The species involved are *Oribius destructor*, *O. inimicus*, *Aulacophrys fascialis* and *A. cornutus*. Damage may be severe locally. It is likely that pests that are presently of minor importance or which have yet to be recorded will become more significant as intensity of production is increased.

Research needed

Further research is needed for the following crops: avocado, banana, apple, pandanus, pineapple, strawberries and plums. Identification of superior varieties is the main aspect that needs investigation but methods to induce out of season production and other cultural practices need attention for some species. There are a number of fruits that have the potential for the highlands and that deserve to be grown widely. These are guava, strawberries, pawpaw (up to 1,00m altitude), purple and yellow banana, passion fruit, naranjilla, black raspberry and the tree tomato.

The nutritional role of fruit is in the provision of vitamins and energy and to a lesser extent minerals. Most children in PNG obtain their vitamins and minerals from fruit juice, because they prefer the flavour of fruits in comparison to green vegetables.

The genetic base of the species of fruit trees introduced from the South East Asia and tropical America is very narrow and the amount of variation from which worthwhile selection can be made is very small so there is needed for further introduction from overseas.

The time taken for evaluation of seedlings from introduced fruit trees is very long in most cases. Therefore, there is a need for literature review of the latest developments in fruit breeding so selection done overseas can be introduced as the vegetative materials for multiplication and testing in a wide range of environments.

Distribution of planting material

One of the functions of the LAES is to supply planting materials to the people of PNG so that many people can grow and enjoy some of the exotic fruits that have been introduced to this country. Over a three year period since January 1980, LAES distributed 15,400 seeds of tten fruit and nut species within PNG. Avocado and sour sop constituted 80% of the seeds and the seedlings distributed.

Rice and grain research

Rice and wheat are important as part of national food security. Papua New Guinea must investigate its capability to produce rice and wheat production and other grains to see if it can place rice and wheat on the plate at a competitive price.

On average, rice and grain and associated products account for 20% of the annual calorie intake for Papua New Guinea families.

The climate and soil conditions are suitable for rice growing and the recent wheat production figures in Enga Province have shown promising signs. The main issue for the country is the competitiveness of the two crop production systems. Research strategy will be aimed towards addressing issues of productivity and viability so that production for subsistence can be determined and on the other hand the economics and gross margins of production can be determined so commercial production issues can be answered.

NARI assumed full responsibility of rice and grain research as of 2001. It is currently under DAL. NARI has excellent collaborative research with Trukai farms. A recent success was in the biological control of the corn stemborer in which Trukai invested a lot of money into research, bringing benefits to small grain growers in the Markham Valley.

A rice packaging plant has recently (12 November 2000) been opened in Lae. The plant owned by Trukai Industries has the capacity to package one kilo rice bags of the Roots Rice brand. The Roots Rice brand is a blend of locally grown rice and rice from overseas. Trukai Rice is an Australian company. It is injecting K390,000 into the Lae economy through wages.

Trukai is encouraging farmers to grow rice which they will buy from local growers. This could be the impetus to increase rice consumption in PNG. Trukai also supports infrastructural development.

To keep the staples market competitive, there must be sincere efforts in infrastructural development. Poor access to markets as well as high transport costs hinder the growth of the traditional staples market. This is important because it is the most disadvantaged people in PNG (rural dwellers) that are the main producers of traditional staples.

Intervention is therefore necessary to ensure sustainability of farming systems and food security for the people. Most farmers are resource poor and investing in a highly intensive farming system that requires high inputs of agro-chemicals and mechanization is not a possibility at the present time. It is evident that fallow periods are getting shorter, soil fertility is declining and problems of pest, and diseases are increasing.

3.4.3 Fisheries

Papua New Guinea enjoys a large marine area that as yet is relatively unexploited. There is considerable potential for commercial deep-sea (pelagic) and near-shore fisheries. The potential is calculated to be 800,000 tons compared to a reported catch of 200,000 tons (King et al. 1996). Important species are tuna, barramundi, lobster, shark, crabs and prawns.

Fisheries make very little contribution to the economy, as most of the catch is processed and sold in other countries by foreign-based vessels. The low direct contribution to the economy and high imports of processed fish (approx-55,000 metric tons of mackerel or K50 million per annum) has generated interest in the creation of a domestic processing industry. The most important development in recent years has been the establishment of fish canneries in Lae (Besta) and Madang (Diana Tuna).

The government's medium-term objective is to replace distant water fishing with an expanded domestic processing and fishing industry. However, important constraints to the industry's development are the lack of investment funds, inadequate equipment, the high costs of transportation, the difficulty in product storage, the fragmented nature of the domestic market and the poor distribution system. Some of the problems faced by the coastal fishing interests can be overcome by the government's direct intervention, such as the provision of financing.

Tuna fishing is a key area. In November 1994, the government first announced a tuna industry domestication policy, aimed at encouraging the development of domestic fishing

operations. Papua New Guinea has tuna stock in its water all year round and has an estimated 20% of the stocks of the Pacific fishery. The South Pacific Commission has estimated that the sustainable tuna harvest is between 240,000 and 260,00 metric tons per year. This figure is substantially higher than the reported catch of 150,000 tons per year. There is concern that the actual catch is higher due to poaching and under-reporting. While the sustainability of the resource is an important issue, the general view is that the catch could be increased, and certainly the local role in the industry could be enhanced.

The National Fisheries Authority in pursuing the domestication of the tuna industry has been progressively reserving long-line licenses for local operators. More recently the policy has been extended to purse seine operators. The authority has reported considerable interest, and the number of domestically licensed boats is expected to rise significantly in the near future. The current number of licensed boats is 12. Although local involvement in the tuna industry must be encouraged, it is imperative that this is achieved through a comprehensive policy framework. The classification criteria for the registration of a domestic vessel has not been rigorously established and there is a danger that foreign operators will use the policy as a low cost means of access to PNG's tuna resource.

The biggest policy question for the fishing sector is whether the benefits of action to encourage the domestic industry, such as direct intervention in the coastal fishing and the recently adopted transhipment requirement, will outweigh the potential cost.

It is imperative that the overall incentive structure facing investment in the industry be examined. In this respect a sector specific study of the tax, tariff and regulatory regime facing domestic operators is merited. In establishing an appropriate incentive structure, it is also important to ensure full coordination with the government's overall tariff reform program and to avoid the granting of ad hoc concessions.

It is of considerable importance to recognise that a policy that seeks to encourage domestic involvement is not in conflict with the development of a more effective multi-lateral management of the tuna resource. Given the world importance of the tuna resource in the Pacific, there is little doubt that multi-lateral action could considerably increase the returns to the exploitation of the resource. To date this issue has not been sufficiently well researched. Higher costs of foreign access would also act as an increased incentive for local involvement. However, it is very important that low cost access for domestically registered vessels is managed in a way that is consistent and coordinated with multi-lateral action.

Papua New Guinea is a signatory to the Palau agreement that requires a reduction in the number of foreign fishing vessels by 10% per annum from 1997. They are also a party to the Federated States of Micronesia (FSM) agreement, which gives domestically registered vessels access to all signatories' waters.

The PNG government collects approximately K15 million per annum from the sales of fishing licenses to foreign vessels (from Japan, Taiwan, United States and Korea), with about K1 million received from a regional agreement with the United States. The amount of resource rent obtained from the sector has been small relative to the value of fish caught. This is partly explained by the significant number of unauthorized fishing activities. Consequently there is a need to strengthen the management and monitoring capability of the fisheries sector. As is the case with forestry, fishing represents a substantial renewable resource that requires careful and well-informed management.

Under reporting of catch levels remains a serious problem. Over the years, under-reporting may have been as high as the recorded catch. In an attempt to address this issue, a pilot exercise in contracting surveillance of offshore fisheries out to the private sector is being considered. There is great potential to reduce illegal and unreported fishing activity, however, the funding structure of such activities will need careful consideration.

It is now a general requirement for foreign fishing vessels to transship in PNG harbors rather than at sea, thus simplifying the monitoring tasks and providing additional direct benefits through the use of domestic facilities.

3.4.4 Livestock

Consumption of red meat (beef, sheep, and goat meat) in Papua New Guinea has trebled over the past two decades to its current level of about 52,000 tons (cwe) per year. However, recorded production over this period from commercial enterprises has remained around 2,000-2,500 tons of beef per year. By far the major source red meat produced in Papua New Guinea is beef. Production of sheep meat and goat meat is considered insignificant. Red meat demand is being increasingly met by imports. In 1998, imports of beef and sheep meat reached 41,800 tons (shipped weight), involving an outlay of around K130 million.

Expansion of red meat production would lessen import requirements and save foreign exchange. However, expanding production will only improve Papua New Guinea living standards if it can be done efficiently. To be efficient, the value to Papua New Guinea of the additional meat produced must at least match the value of the resources (land, pastures, labour, etc.) devoted to achieving this additional production that could be earned for the country in alternative activities. Whether it is in Papua New Guinea's national interest to expand its red meat production is not clear. From a national viewpoint it would make good economic sense to place increasing reliance on imports of red meat to satisfy the growing gap between demand and production, if such imports can be obtained cheaper than the resource costs needed to expand production. Making this assessment requires an analysis of red meat production prospects relative to those for competing meats, particularly poultry, consumer preferences toward different sources of meat protein and the influence of government policy and regulatory arrangements on both production and demand for red meat and competing meats.

Consumption patterns of meat are definitely changing. Red meat is consumed in a range of market segments, each catering to different income groups. Segments differ markedly according to the type and cut of meat consumed and their reliance on domestic production and imports. Retailers influence meat availability to consumers by always switching to the cheapest source and cut of meat. This reflects the need to market cheap meat protein sources to the bulk population of low purchasing power households.

Per capita consumption of meat in total has been constant over the last decade. But the composition of this consumption has changed with more sheep and poultry meat consumed at the expense of beef. Sheep accounts for 38% of meat consumption, poultry meat 39% and beef 17%.

Slaughtering and processing of most cattle are carried out at government owned abattoirs. Most of these facilities are old and rundown and are struggling to keep basic equipment in working order. Byproduct recovery is poor and none of the abattoirs is accredited for exports. An industry wide approach to abattoir construction and utilization is needed to ensure the maintenance of facilities of sufficient standard.

Papua New Guinea has substantial areas of grassland suitable for cattle production, but there is no tradition of ruminant livestock grazing in village agriculture. Encouraged by the Australian administration in 1950s and 1960s and with funding support from the World Bank (for smallholders) and the Papua New Guinea Development Bank, the industry expanded rapidly. Cattle numbers peaked in 1976 at about 153,000 head, with one-third on over 1,000 smallholder projects. Cattle numbers have since declined sharply to between 75,000 and 90,000 now. About 80% of these are on large ranches, occupying 113,000 hectares of grazing land. The remainder is on 550 smallholder farms on 78,000 hectares of land. A further 300,000 hectares of customary land is judged suitable for cattle grazing. Much of this land is unsuitable for other forms of agriculture.

The decline in cattle numbers is generally attributed to poor management, the withdrawal of government support (particularly extension), ownership disputes, poor financing arrangements, law and order problems and better returns from alternative enterprises. For the industry as a whole, both pasture productivity and the productive performance of the herd (fertility, calving percentage, growth rate) appear to be low, although numerical evidence on performance was not collected in this survey.

Commercial production of poultry meat has grown rapidly with protection from imports to reach around 17,500 tons in 1998. When estimates of village fresh and subsistence poultry production are included, annual production is around 41,000 tons. Commercial pig meat production is around 1,000 tons per year, with perhaps a further 5,000 tons of village production. These figures compare with an estimate of total beef production of around 2,900 tons in 1998.

Commercial poultry and pig meat production is heavily dependent on imported feeds. Value added (the net income accruing to Papua New Guinea) per million kina of production value is low. By contrast, value added per value of production for beef is high.

Despite heavy support from foreign aid for more than 20 years, a commercial sheep meat industry has failed to develop. Goat numbers in the highlands have increased steadily, though there has been no real attempt to view goats as an industry. Goats have proven suitable for village agriculture and a study of their potential in Papua New Guinea and how to achieve it is warranted.

The beef industry has no priority within government. Until recently, the industry was hindered by high tariffs on imported inputs. The current tariff regime still provides substantial encouragement to poultry production relative to beef. NARI, the government's agency for agricultural research, has recently reached agreement with DAL to take over responsibility for R&D into large livestock. This will provide an institutional base for beef industry R&D and there is currently no R&D agenda in government to support it. The government no longer provides extension services to smallholders and no effective alternative provision has developed.

Although the industry has struggled over the last decade, during which general economic conditions were generally adverse for it, the industry has proven to be a long-term survivor in Papua New Guinea. It has a well-established production base of large holders and a persistent core of smallholders. The industry's strengths include its positive base, the absence of major diseases, the ready availability of feed supplements and labour, strong local demand for beef with considerable scope for import substitution and great potential for productivity improvement.

Offsetting these strengths are a number of inherent weaknesses, which retard the industry's ability to grow. These include the following: (i) customary land system (which makes it difficult to parcel land into efficient grazing areas), (ii) low productivity of native pastures, (iii) the poor road infrastructure, (iv) the lack of extension support to smallholders and institutional support within government, (v) the lack of an R&D support base, and (vi) the poor information flow. Whether or not their land is used for income earning activities is not important to many landholders. Possession rather than income earning ability is still of major importance in many areas.

Both producer and consumer choices are influenced by government policies and customs. Trade policies in particular exert considerable influence over the incentives to produce different types of meat, the availability of imported meat and relative retail prices of beef and competing meats. Policies concerning research and development and extension services can also favour one type of meat relative to others. The difficulties of assembling broad area farming enterprises under Papua New Guinea's customary land ownership system, together with the lack of a tradition in open range grazing, have long been recognized as inhibitors of the development of livestock industries, especially beef.

Despite considerable past investment in research for pasture development, disease control and beef cattle management, beef production has failed to increase and cattle numbers have progressively declined. The concern relates to the reasons for this decline, what needs to be done to assist the industry to reverse the decline and whether it is in the best interests of Papua New Guinea for renewed efforts to be made to encourage beef industry growth.

3.5 Food exports, imports and inter-provincial transfers

3.5.1 Economic overview and trade statistics

After growing rapidly prior to independence, growth in real gross domestic product (GDP) per capital leveled off during the late 1970s and the 1980s. At the start of the 1990s, real GDP per capita had changed little from the level seen in the late 1970s

In 1989 the economy suffered a major setback with the closure of the Bougainville copper mine. In its last full year of operation the mine contributed 8% of GDP, 35% of export receipts and 12% of government revenue. The closure of the mine was accompanied by a 15% decline in Papua New Guinea's terms of trade in 1989.

The government responded quickly with a package of stabilization measures. These measures were successful in preventing the emergence of serious macroeconomic imbalances in the immediate aftermath of the Bougainville crisis, but they were unsuccessful in tackling the fundamental structural issues. The shortcomings of this adjustment effort and the lessons that can be learned for the current reform measures are important themes to be noted.

A rapid expansion in mining and petroleum output quickly restored economic growth and, in combination with an increasingly expansionary fiscal policy, produced a rapid increase in real GDP per capita of around 30% between 1990 and 1993. However, the surge in economic growth was both short-lived and unsustainable and a serious fiscal imbalance emerged.

GDP per capita provides a somewhat misleading picture of the position of Papua New Guinea. GDP measures all income generated within a country, not all of which is retained by residents. The income retained by residents is measured by gross national product (GNP). Much of the recent increase in GDP has arisen from largely foreign owned mining and petroleum projects, and about 7% of GDP is lost to GNP as a result of remitted profits and salaries to foreigners (in the form of net factor payments abroad). Because of these remittances, the increase in GNP has been less than the increase in GDP.

Despite the potential offered by its rich natural resource base, Papua New Guinea's economic development has fallen short of expectations. Real GNP per capita is in the middle of the range seen in major South Pacific countries and the rate of growth is substantially less than in other middle income countries in neighboring South East Asia. For example, from 1980 to 1993 Indonesia, Thailand and Malaysia achieved an average annual growth in GNP per capita in US$ terms of more than 3.0% compared to Papua New Guinea's 0.6%.

The recent devaluation of the kina has important implications for the calculation of per capita incomes. Calculated on a US$ basis, per capita GDP probably fell by about 27% between 1993 and 1995, significantly changing the cross-country ranking of Papua New Guinea's per capita income.

Another important perspective on the state of development in Papua New Guinea is provided by international comparisons of the main social indicators. Life expectancy and adult literacy rates in Papua New Guinea are substantially below those seen in major neighboring countries in the South Pacific and south east Asia. The infant mortality rate, crude birth and death rates and the fertility rate are all above the average of major neighboring countries. In general, Papua New Guinea's social indicators are well behind those of other members of the group of lower middle-income economies and close to those seen in the lower income group of economies.

Papua New Guinea has a medium human development ranking according to the United Nations Development Program (UNDP). The 1995 Human Development Report ranked Papua New Guinea 126th out of 174 countries based on the human development index, a composite measure of income per capita, life expectancy and literacy rates. The country's index of 0.51 (the index ranges from zero to one, with one the highest ranking), compared with a ranking of 0.86 for Fiji, 0.65 for Western Samoa, 0.54 for Vanuatu and 0.51 for the Solomon Islands.

Papua New Guinea's relatively poor position is in part a reflection of difficult starting conditions. Between 1970 and the early 1990s, Papua New Guinea achieved comparable rates of improvement in key social indicators relative to other members of the group of lower middle-income economies and the group of middle-income economies as a whole. These indicators include female and male life expectancies, the infant mortality rate, and crude birth and death rates.

However, in recent years there has been a deterioration of social conditions associated with a perceived decline in the quality of social services. There has been a significant rise in the incidence of common diseases and many health facilities are reported to be in a state of disrepair. The 1990 population census revealed an apparent increase in infant mortality rates from 72 per thousand live births in 1980 to 82 per thousand live births. In education, attrition rates are high and rising and overall standards of achievement appear to be falling (World Bank 1995b). This deterioration of service delivery has occurred despite the allocation of relatively high levels of funding.

The recent reforms to the system of provincial government and the renewed emphasis on the delivery of basic services to rural communities are largely in response to these trends. Improving the efficiency and effectiveness of service delivery is a major challenge for the Papua New Guinea authorities and one which will have a lasting impact on medium-term development prospects. Although the main social indicators paint a bleak picture of Papua New Guinea, the country is relatively free of the widespread poverty seen in some countries at a similar stage of development. This is a result of the ability of the majority of the population to engage in relatively productive subsistence agriculture that can meet a person's survival needs with around 20 hours work per week, and a social-political system that provides for the distribution of income and wealth. The Wantok system of communal values and reciprocal obligations is a distinguishing feature of the Melanesian culture. It provides a valuable safety net that, in times of sickness and distress, has helped Papua New Guineans avoid the extremes of poverty. However, it also acts as a significant disincentive to accumulate wealth.

The mining and petroleum sectors have a major impact on the economy of Papua New Guinea. These sectors have contributed 26% of GDP and 66% of total exports in 1998 compared to 20% and 60% in 1997, respectively. The growth reflected an increase in the production of gold and copper at the Lihir gold mine and resumption of full production at the Ok Tedi mine, following the drought induced temporary closure, combined with the commencement of the production at the main and southeast Gobe Oil projects. These more than offset the decline in the production at the Kutubu oil project.

Agriculture, forestry and fisheries sectors together contributed 24% of GDP and 23% of total exports in 1998, excluding manufactured agriculture goods.

In 1998, the manufacturing sector accounted for 9% of GDP and 11% of total exports. In 1998, GDP for the manufacturing sector was K693.4 million and manufactures exports were K395.6 million compared to K647.5 million and K305 million in 1997.

Manufactures exports rose 29.7% mainly due to an increase in the export volume of copra oil associated with an increase in export prices of copra oil, palm oil and black tea and depreciation of the kina. The volume of palm oil exported declined by 22.5% due to the adverse impact of the drought on production but this was offset by the increase in the export price resulting in an increase of the export value.

According to the Central Bank's employment index, the employment trends over the year from 1997 to 1998 showed a decrease of 5.2% in the formal private sector excluding mining and petroleum. The mining and petroleum sector employment increased by 16.5% in 1998 compared to 1997.

By industry, the decline was in all sectors except retail and financial and business services sector. The level of manufacturing sector employment also decreased by 1.3% in 1998 compared to 1997. The decline was generally due to lower casual employment, laying-off of

some staff, rationalization of operations, completion of some projects and road maintenance and lack of new projects.

At the end of December 1998, the level of foreign exchange reserves was K404.1 million, sufficient for 2.3 months of total imports and 2.9 months of non-mineral import cover. Compared to the 1997 level of foreign reserves of K666.9 million, there was a decline of 39.4%.

Foreign equity investment in Papua New Guinea increased by 18% to K2,625 million in 1998 from K2,225 million in 1995. The increase mainly reflected the flow of foreign equity into the mineral sector. The increase in 1996 was a result of the float of Orogen Minerals Ltd and the privatization of the government's interests in the New Britain Palm Oil Development to non-residents. The increase in 1997 was due to equity financing for the construction of the Gobe Oil project. The 0.8% decline in 1998 was due to the absence of new major projects and the withdrawal of equity investment by the manufacturing sector.

The mineral and manufacturing sector contributed 80.2% and 1.7% of the total equity investment in Papua New Guinea in 1998, compared to 79.6% and 2.5% in 1997, respectively. There was a decline in the manufacturing sector due to redemption of preference shares by a manufacturing company.

Australia is the biggest investor in PNG holding 64% of the foreign equity, followed by the Bahamas (7.2%) and the United Kingdom (6.4%) in 1998. From 1995 to 1998, Australia, United States, United Kingdom, Canada and Malaysia increased investment while Singapore declined.

The ratio of foreign equity holdings to GDP decreased from 3.8% in 1997 to 3.4% in 1998. This was largely due to completion of major mineral projects, the absence of new major projects and the withdrawal of equity investment by the manufacturing sector combined with a strong growth in nominal GDP.

Until September 1994 the kina was pegged to a trade weighted basket of currencies. It was devalued by 10% in January 1990, 12% in September 1994 and allowed to float in October 1994 in order to strengthen the position of international reserves. By the end of 1998, the nominal exchange rate against the US $ had fallen by 53% from what it was at the end of 1993 (Table 3.16). The kina depreciation initially caused a significant increase in the domestic prices of exports and imports.

Table 3.16 Exchange rates, 1994-1998.

Foreign Currency Units per Kina	1994	1995	1996	1997	1998
Australian Dollar	1.0927	1.0716	0.9653	0.9365	0.7708
U.S. Dollar	0.8485	0.7545	0.7553	0.6971	0.4856
Japanese Yen	84.71	76.79	82.17	84.23	63.43
Deutches Mark	1.3178	1.0866	1.1369	1.2073	0.8564
Pounds Sterling	0.5442	0.4899	0.4845	0.4264	0.2933
New Zealand Dollar	1.3220	1.1948	1.1032	1.0520	0.9043
Singapore Dollar	1.2392	1.1105	1.0691	1.0324	0.8132
Hong Kong Dollar	6.5663	6.0602	5.8647	5.4004	3.7673
SDR	0.5828	0.5079	0.5203	0.5065	0.3583

Source: Bank of Papua New Guinea.
Note: (1) 1994 rates are as of 31 December. As from 1995, rates are average of the year.

The inflation rate increased from 3.9% in 1997 to 13.6% in 1998. The higher inflation rate in 1998 was mainly due to the depreciation of the kina, which resulted in a higher landed cost of imported goods. The value of the kina depreciated against all the major currencies. Over the 1998 fiscal year, the kina was depressed against the US dollar, Australian dollar and Japanese yen by 30, 18 and 25% respectively.

The depreciation of the kina was mainly due to the lower level of mineral prices including crude oil, and the collapse in log prices and decrease in the export volumes of cocoa, copra and palm oil, which affected export earnings (Tables 3.17 and 3.18).

Table 3.17 PNG major export commodity prices, 1995-1996 (Kina per ton, f.o.b.).

	1995	1996	1997	1998	1999 up to March
Cocoa	1,559	1,615	1,899	3,130	3,256
Coffee (all grades)	3,893	3,055	5,505	5,705	4,448
Copra	427	494	523	668	764
Copra Oil	897	1,036	1,051	1,310	1,629
Palm Oil	762	683	753	1,277	1,449
Rubber	1,481	1,464	1,477	1,490	1,271
Tea	1,286	1,366	1,600	2,864	2,764
Timber Logs (Kina/m^3)	174	178	172	145	161
Crude Oil (Kina/barrel)	22.37	27.32	30.46	29.00	24.83

Source: Bank of Papua New Guinea.
Note: Figures are annual average unit values.

Table 3.18 International commodity prices, 1995-1999 (Kina per ton, c.i.f.).

	1995	1996	1997	1998	1999 up to Mar.
Cocoa (London, Ghana)	1,971	2,068	2,447	3,658	3,497
Coffee (New York, Mild Arabica)	4,222	3,493	5,889	5,922	5,218
Copra (Philipines, Rotterdam)	556	650	632	856	1,021
Copra Oil (Malaysia, Rotterdam)	873	1,012	960	1,366	1,636
Palm Oil (Malaysia, Rotterdam)	825	709	787	1,368	1,286
Rubber (London, No.1 RSS)	2,166	1,952	1,556	1,660	1,702
Gold (London) US$/fine oz	384	388	332	295	287
Copper (London, wire bars) US cents/lb	132	103	104	76	64
Crude Oil (f.o.b., U.K, Brent) US$/barrel	16.91	20.42	17.99	12.74	11.28

Source: Bank of Papua New Guinea and Department of Petroleum & Energy.
Note: Figures are annual averages prices.

The weakening of the kina against the major currencies caused an increase in the prices of imported goods, the majority of which originated from Australia, the United States and Japan. To solve these problems, various measures were launched to improve monetary and fiscal policies, reform the banking system, implement structural reforms and ensure private debt payments.

Since 1985 there has been a steady growth in exports as well as an increase in import. The Papua New Guinea value of imports and exports and balance of trade is shown in (Table 3.19). In 1998, PNG exported K3.7 billion and imported K2.2 billion. There was an increase of 20.4% exports in 1998 compared to 1997. The PNG trade surplus surged 55% in 1998 to a record K1.5 billion as exports swelled (Tables 3.20 and 3.21).

Table 3.19 Papua New Guinea value of imports, exports and balance of trade 1985-1998.

Year	Exports	Imports	Balance of Trade
1985	917.4	866.9	50.5
1986	1,017.1	904.1	113.0
1987	1,096.5	993.0	103.5
1988	1,248.3	1,133.4	114.9
1989	1,231.1	1,254.0	-22.3
1990	1,197.9	1,141.2	56.7
1991	1,456.6	1,336.0	120.6
1992	1,938.8	1,275.0	663.8
1993	2,525.1	1,110.0	1,415.1
1994	2,682.0	1,336.0	1,346.0
1995	3,420.0	1,620.0	1,800.0
1996	3,334.0	1,996.0	1,338.0
1997	3,079.0	2,129.0	950.0
1998	3,707.0	2,231.0	1,476.0

Source: National Statistical Office for historical data, exports up to 1993 and imports up to 1990; Bank of Papua New Guinea, Balance of Payment System, for export, 1994 to 1998 and imports 1991 to 1998.

Table 3.20 PNG exports, imports and direction of trade 1994-1998.

Exports	Unit	1994	1995	1996	1997	1998
Total exports	K. million	2,682.0	3,420.0	3,334.0	3,079.0	3,707.0
Annual growth rate	%	6.2	27.5	-2.5	-7.6	20.4
Agricultural exports (1) (excluding manufactured agricultural goods)	K. million	267.7	314.2	321.7	496.5	643.6
Annual growth rate	%	86.7	17.4	2.4	54.3	29.6
Market share	% of total	10.0	9.2	9.6	16.1	17.4
Agricultural exports (including manufactured agricultural goods)	K. million	374.6	498.0	578.6	777.2	1,020.2
Annual growth rate	%	54.1	32.9	16.2	34.3	31.3
Market share	% of total	14.0	14.6	17.4	25.2	27.5
Mineral exports	K. million	1,782.7	2,435.4	2,244.6	1,838.9	2,452.1
Annual growth rate	%	-0.4	36.6	-7.8	-18.1	33.3
Market share	% of total	66.5	71.2	67.3	59.7	66.1
Forestry exports (logs)	K .million	483.1	436.7	464.8	409.3	154.2
Annual growth rate	%	16.6	-9.6	6.4	-11.9	-62.3
Market share	% of total	18.0	12.8	13.9	13.3	4.2
Manufactures exports	K. million	118.2	196.8	272.4	305.0	395.6
Annual growth rate	%	0.0	66.5	38.4	12.0	29.7
Market share	% of total	4.4	5.8	8.2	9.9	10.7
Marine exports	K. million	10.3	16.7	10.4	9.6	42.2
Annual growth rate	%	35.5	62.1	-37.7	-7.7	339.6
Market share	% of total	0.4	0.5	0.3	0.3	1.1
Direction of Export	**Unit**	**1994**	**1995**	**1996**	**1997**	**1998**
APEC (2)	K. million	2,082.6	2,578.2	2,604.1	2,376.4	2,872.4
	% of total	77.7	75.4	78.1	77.2	77.5
ASEAN (2)	K. million	83.5	185.9	144.6	182.8	282.8
	% of total	3.1	5.4	4.3	5.9	7.6
Australia	K. million	118.2	196.8	272.4	305.0	395.6
	Growth Rate	16.3	36.8	24.9	-2.7	24.6
	% of total	28.0	30.0	38.5	40.5	42.0
Japan	K. million	648.7	829.4	533.4	400.9	443.6
	Growth Rate	17.8	27.9	-35.7	-24.8	10.7
	% of total	24.2	24.3	16.0	13.0	12.0
Export price index (3) (1980 =100)	K. million	147.6	207.1	204.2	226.2	259.4
Imports	Unit	1994	1995	1996	1997	1998
Total imports	K. million	1,336.0	1,620.0	1,996.0	2,129.0	2,231.0
Annual growth rate	%	20.4	21.3	23.5	6.7	4.8
Source of Imports						
APEC (4)	K. million	1,252.1	1,486.8	1,832.8	1,965.5	2,003.6
	% of total	93.7	91.8	91.8	92.3	89.8
ASEAN (4)	K. million	182.8	165.3	204.8	244.3	195.6
	% of total	13.7	10.2	10.3	11.5	8.8
Australia	K. million	630.3	845.6	1,110.6	1,089.5	1,176.0
	Growth Rate	16.6	34.2	31.3	-1.9	7.9
	% of total	47.2	52.2	55.6	51.2	52.7
United States	K. million	199.2	240.1	264.1	287.7	313.4
	Growth Rate	78.3	20.5	10.0	8.9	8.9
	% of total	14.9	14.8	13.2	13.5	14.0

Source: National Statistics Office, Bank of Papua New Guinea and Internal Revenue Commission.
Note: (1) Excludes palm oil, copra oil and black tea
(2) Exports to Thailand 1994, 1995 and 1998 not available
(3) Exludes crude oil exports
(4) Imports from Philipines 1994, 1995 and Thailand 1994, 1995 &1998 are not available
APEC – Asia Pacific Economic Co-operation
ASEAN – Association of South East Asian Nations
MSG – Melanesian Spearhead Group

Table 3.21 Balance of payments (million Kina), 1995-1999.

	1995	1996	1997	1998	1999 (up to March)
Balance on Current Account	**859**	**411**	**-161**	**124**	**-141**
(a) Trade (Net)	1,800	1,338	950	1,476	309
Merchandise exports	3,420	3,334	3,079	3,707	860
Merchandise imports	-1,620	-1,996	-2,129	-2,231	-551
(b) Services (net)	-1,034	-1,022	-1,204	-1,539	-436
Invisible credits	443	611	619	699	128
Invisible debits	-1,477	-1,633	-1,823	-2,238	-564
(c) Transfer (net)	93	95	87	187	-14
Private (net)	-138	-69	-46	26	-14
Official (net)	231	164	133	161	0
Balance on capital account	-556	58	30	-364	50
(a) Official capital flows	-25	14	-89	-92	-31
(b) Private capital flows	-193	-147	134	-189	-91
(c) Non-official monetary Sector transactions	35	-46	-61	31	33
(d) Change in offshore Account Balances	-373	237	46	-114	139
Revaluation	0	0	0	0	0
Errors and omissions	-59	-37	14	-23	16
Overall balance	244	432	-123	-263	-75
International Reserves	**357.4**	**789.1**	**666.9**	**404.1**	**328.9**
Months of import cover:	R	R	R	R	R
Total import cover	2.6	4.8	3.8	2.3	1.8
Non-mineral cover	3.4	6.3	4.8	2.9	2.4
GDP (nominal)	6,308.6	6,914.0	6,824.2	7,713.5	8,505.1
Share of GDP (%)	**r**	**r**	**r**	**r**	**r**
Balance on current account	13.6	5.9	-2.4	1.6	-1.7
Balance on capital account	- 8.8	0.8	0.4	-4.7	0.6

Source: Bank of Papua New Guinea, Department of Treasury and Planning.

Minerals and agricultural primary products such as crude oil, gold, copper, coffee, cocoa, copra, tea, rubber, palm oil, copra oil, logs and marine products are mainly exported and finished products such as food, electrical goods, machinery, vehicles and mineral fuels and manufactured goods are mainly imported (Tables 3.22 and 3.23).

Table 3.22 Principal exports (quantity), 1996-1999.

	Unit	1996	1997	1998	1999
Minerals					
Copper	Ton ('000)	127.7	77.8	109.5	30.7
Gold	Ton	46.9	44.3	58.2	12.7
Crude oil	Ton ('000)	39,307.7	27,972.2	28,033.6	7,347.5
Agricultural					
Coffee	Ton ('000)	62.3	59.2	83.5	10.7
Cocoa	Ton ('000)	41.0	386	26.1	7.3
Palm oil	Ton ('000)	267.0	274.9	213.0	68.9
Copra oil	Ton ('000)	49.6	48.6	53.2	18.1
Copra	Ton ('000)	90.3	90.3	58.1	12.4
Tea	Ton ('000)	6.5	6.5	6.6	1.8
Rubber	Ton ('000)	4.4	4.4	4.9	1.3
Forest products					
Timber logs	Cu.m ('000)	2,607.4	2,375.9	1,066.9	323.7
Marine products	Ton ('000)				
Marine products		2.8	2.2	10.0	0.3

Source: Bank of Papua New Guinea.

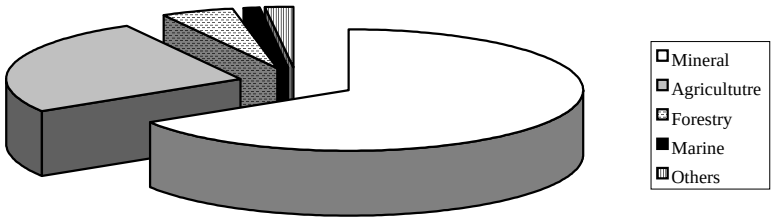
Table 3.23 Principal exports (value), 1996-1999 (million Kina, f.o.b.).

	1996	1997	1998	1999 up to March
Minerals	**2,244.6**	**1,838.9**	**2,452.1**	**562.9**
Copper	387.0	259.8	395.7	98.2
Gold	773.6	718.7	1,227.8	278.9
Silver	10.1	8.2	15.5	3.3
Crude oil	1,073.9	852.2	813.1	182.5
Agricultural	**556.1**	**721.5**	**964.7**	**215.1**
Coffee	190.3	325.9	476.4	47.6
Cocoa	66.2	73.3	81.7	25.4
Palm oil	182.4	207.1	271.9	97.9
Copra oil	51.4	51.1	69.7	28.3
Copra	49.0	47.2	38.8	9.4
Tea	12.7	10.4	18.9	4.9
Rubber	4.1	6.5	7.3	1.6
Forest products	**480.3**	**433.6**	**173.2**	**52.9**
Timber logs	464.8	409.3	154.2	50.7
Others[1]	15.5	24.3	19.0	2.2
Marine products[2]	**10.4**	**9.6**	**42.2**	**3.9**
Others[3]	**42.6**	**75.4**	**74.8**	**25.2**
Total PNG exports	**3,334.0**	**3,079.0**	**3,707.0**	**860.0**

Source: Bank of Papua New Guinea.
Notes: [1] Others including timber, plywood, wood chips.
[2] Marine products including prawns and fish.
[3] Other agriculture products, manufactured goods, immigrant effects.

The total value of exports increased by 20.4% in 1998 compared to 1997. This was due to significant increases in the value of cooper, gold, agricultural and marine products. Mineral exports accounted for 66% of total exports in 1998 (Figure 3.3).

Figure 3.3 Composition of total export value in 1998.



PNG experienced a surplus in the balance of trade with significant increase after the rapid expansion of oil exports. Mineral exports excluding crude oil accounted for 66% of the value of the commodity exports in 1998 compared with 60% in 1997. This was due to the increase of mineral export volumes and the depreciation of the kina. The first full year production of gold at Lihir mine, combined with the resumption of normal full production at Ok

Tedi and Pogera mines following the drought induced temporary closure in September 1997, increased the production volumes. These production increases have more than offset a decline in production at the Misima mine, as a result of lower ore grades.

In 1998, the balance of trade showed a surplus showed a surplus of K1.5 billion, which was 55% more than the surplus of K0.9 billion in 1997. The higher surplus was due to an increase in the value of merchandise exports, combined with a same level import bill of 1997.

There were declines in the export value of crude oil, copra and logs, which more than offset increases in the value of mining, marine and other agricultural exports.

Higher export prices of all agricultural export commodities, more than offset the decline in the prices of minerals and timber logs. The impact of the depreciation of the kina against currencies of Papua New Guinea's major trading partners combined with the improvements in the world market prices resulted in some of Papua New Guinea's export prices increasing.

The volumes of all minerals, marine and some agricultural commodities including coffee and copra oil exported rose in 1998, compared to 1997, with the exception of cocoa, copra and palm oil. The decline in volume of some major agricultural commodities was a result of the carry over-effects of the "El Nino" related drought in 1997, which affected the tree crops.

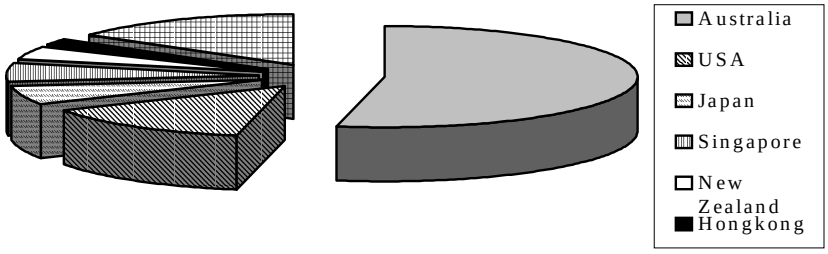
In 1998, the volume of trade with trading partners and the direction of trade was similar with previous year. Of the total value of imports, the biggest supplier was Australia with 53.7%, followed by United States of America (15%), Japan (7.4%) and Singapore (6.1%) (Table 3.24).

Australia, for many years, was the biggest supplier of PNG's imports. From Australia alone, the import of goods reached K1.2 billion in 1998, accounting for 53% of the import share (Table 3.24 and Figure 3.4) USA, Japan and Singapore contributed almost K0.6 billion, followed by other Asian and European countries. The total PNG import in 1998 was 2.2 billion.

Table 3.24 Principal trading partners (imports to PNG, million Kina, f.o.b. value).

Country	1993	1994	1995	1996	1997	1998
Australia	540.5	630.3	845.6	1,110.6	1,089.5	1,176.0
USA	111.7	199.2	240.1	264.1	287.7	313.4
Japan	97.9	107.2	90.8	106.0	159.0	139.7
Singapore	104.6	110.9	119.7	128.4	160.4	133.3
New Zealand	48.8	52.2	58.7	62.1	81.6	80.8
Hongkong	47.6	50.6	51.4	38.6	50.6	52.1
Malaysia	23.0	21.3	24.5	25.4	27.4	31.9
Indonesia	12.8	50.6	21.1	28.8	28.1	26.1
China	4.8	6.6	7.2	11.4	12.9	23.2
Germany	5.5	9.2	10.4	19.2	12.7	16.6
Rep. of Korea	7.8	15.3	17.8	17.9	19.0	12.8
United Kingdom	11.8	19.4	48.4	16.0	16.1	10.7
Others	93.2	63.2	84.3	167.5	184.0	214.4
Total	**1,110.0**	**1,336.0**	**1,620.0**	**1,996.0**	**2,129.0**	**2,231.0**

Figure 3.4 PNG's import share, by country of origin in 1998.



Of the total value of exports in 1998, Australia was the major buyer, importing 42% of the total exports, followed by Japan (12%), United States (9.3%), Germany (8.1%), United Kingdom (6.4%), Republic of Korea (3.9%) and Indonesia (3.9%). During 1998 there was an increase in the trade volume between PNG and Indonesia, with trade surplus of K120 million compared to the deficit of K26.9 million in 1997 (Figure 3.5 and Table 3.25).

Figure 3.5 PNG's export share, by country of destination in 1998.

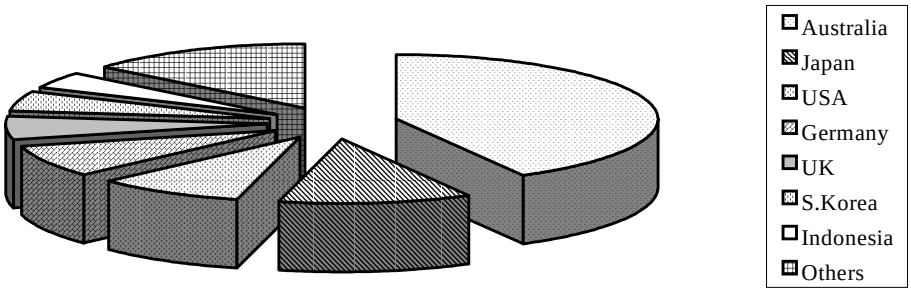


Table 3.25 Principal trading partners (export from PNG, million Kina, f.o.b. value).

Country	1993	1994	1995	1996	1997	1998
Australia	896.4	750.5	1,027.0	1,282.4	1,247.9	1,55.3
Japan	550.7	648.7	829.4	533.4	400.9	443.6
USA	101.2	133.1	135.5	243.3	268.8	345.9
Germany	163.3	159.3	340.9	232.3	222.9	301.4
United Kingdom	79.3	201.9	281.8	324.4	287.4	235.6
Rep. of Korea	256.5	252.0	243.2	148.0	99.8	175.5
Indonesia	12.3	0.9	3.7	2.5	1.2	146.1
Philippines	68.8	62.3	133.9	92.6	84.4	82.6
Netherlands	26.4	25.6	30.1	38.0	63.1	65.2
Singapore	74.6	16.1	40.6	40.7	88.2	46.1
Hongkong	8.0	54.7	63.1	86.6	79.8	26.7
China	169.4	49.3	50.0	104.5	71.5	21.3
New Zealand	18.5	86.9	35.5	46.6	11.8	15.2
Others	99.7	240.7	205.3	158.7	158.7	151.3
Total	**2,525.1**	**2,682.0**	**3,420.0**	**3,334.0**	**3,079.0**	**3,707.0**

Total exports in 1998 reached K3.7 billion in 1998. Australia was the biggest market accounting for 42% of total exports followed by Japan, USA, Germany, United Kingdom, South Korea, Indonesia, and other countries (Figure 3.5).

In 1998, PNG's trade with Australia showed a surplus of K379.3 million out of K1,555.3 million in exports and K1,176.0 million in imports between 1994 to 1998. Compared to 1997, the surplus was more than double.

The trade relationship between PNG and member economies of Asia Pacific Economic Co-operation (APEC) played a significant part, accounting for approximately 77% of PNG's exports and 92% of imports between 1994 to 1998.

The member countries of the Association of South East Asian Nations bought about 8% of PNG's total exports and supplied approximately 9% of total imports in 1998.

In 1998, the National Parliament passed the Value Added Tax (VAT) Act and a VAT of 10% was implemented throughout the country from July 1, 1999. The VAT was applied to all

goods and services except for a few specialized supplies such as hospitals and financial services and other supplies as specified in the Act. With the imposition of the VAT, import duty rates on basic items were reduced according to the Customs Tariff Act. All provincial sales taxes, which was formerly collected on goods and services, were abolished. The Value Added Tax Revenue Distribution act facilitated the mechanism of sharing VAT revenues between the national government and the provincial governments.

CPI

Generally the relative prices of locally produced goods became more expensive compared to imported foods. Table 3.26 outlines the consumer price index by expenditure group.

Table 3.26 Consumer price index – by expenditure group (base: 1977= 100).

Expenditure Group	1995	1996	1997	1998	1996	1997	1998
	Index points				% change from previous year		
Food	284.3	323.3	344.2	390.2	13.7	6.5	13.4
Drinks, tobacco, betel nut	374.1	401.5	428.9	515.6	7.3	6.8	20.2
Clothing and footwear	209.2	232.2	252.5	286.1	11.3	8.5	13.3
Housing costs	204.2	210.5	217.4	216.5	3.1	3.3	-0.4
Household equipment	249.2	281.8	293.7	337.1	13.1	4.2	14.8
Transport/communication	485.4	539.7	495.4	576.1	11.2	-8.2	16.3
Miscellaneous	230.1	286.6	327.0	303.6	24.6	14.1	-7.2
All groups	**311.9**	**348.1**	**3619**	**411.0**	**11.6**	**3.9**	**13.6**

In 1998, the inflation rate was 13.6% compared to 3.9% in 1997. This was mainly due to the depreciation of the kina.

3.5.2 Food marketing and distribution

Since rice has become such an important item in the food basket, it is used as example in understanding costs and prices by stages. A study of retail rice prices was carried by Joughin and Gimbol (1987) between July 1985 and December 1986. Of the 19 provinces 16 were surveyed and the following conclusions were reached.

- High prices tend to reflect the degree of remoteness of the area and the consequent distribution costs.
- Prices range substantially within each province. Those with the more accessible populations tend to have lower prices.
- In September 1985 to September 1986 the national average retail price of rice rose by 10.7%. While the ex-terminal price fell by over 10%.
- Traditional staples are cheaper in the rural villages than in urban areas. Rice is cheaper in the urban areas than in the rural areas.

The Government of Papua New Guinea deregulated the rice market on the basis of a submission that was prepared by the Department of Finance. Under the new arrangements 'any supplies meeting quarantine regulations and legislated enrichment requirements would be permitted to enter'.

Joughin and Gimbol (1987) asserted that the reigning paradigm at the time in the Department of Finance (benefits of the free market) was 'background' to the decision to deregulate. They also further stated that there was little consideration by the Department of Finance of neither the 'particular characteristics of the PNG market nor the effects of the PNG consumers'. It states that the finance planners: (i) were unaware of continual fall in real prices over the previous 12 years (see Joughin and Kalit, 1986), and (ii) did not seek information on

distribution margins. The planners anticipated that the freer rice market would mean more choice in brands and quality and benefit the lower income groups.

Background figures indicate that rice imports have risen over 20 years and that rice is now the urban staple (Sackett 1976; Harris 1980; Bourke et al. 1981; FAO 1986). This fits the trend in developing countries net cereal imports of middle-income developing countries almost doubled in the 1970s (Morrison 1984).

There has been a dramatic rise in the demand for rice from 24,000 tons in 1963 to 122,000 tons in 1986 (provisional figures). These figures would be a lot higher in recent times. However one must consider also the rise in population; rice consumed per person would be a better indicator along with a breakdown of rural and urban areas. Spencer and Heywood (1982) described the conflict between rising rice consumption and the push for food self-reliance as 'the paradox at the heart of the food policy in Papua New Guinea'. Tinned mackerel has made a contribution to improved nutritional status to cash crop growers who have now been able to purchase the product. The dependence on foreign foods like tinned fish undermines self-reliance.

Rice is a good source of nutritional energy and thus the paper states the paradox is extended. Whilst cheaper rice prices make it more accessible to more people, thus improving nutritional status, it also erodes the domestic markets and thus undermines food security. The paper states that, as people develop a taste for rice; demand for traditional staples will decrease and thus have negative affects for traditional staple producers. These producers are the rural population, which are the most disadvantaged in PNG. It is important at this point to remember the paper by Gibson (1995), who found through analysis of the Urban Household Survey that urban dwellers were consuming more rice as opposed to traditional staples because of the high prices of traditional staples. Food elasticity showed that a 1% increase in the staples budget found an increase in traditional staples of over 1% whilst rice was less than 1%.

Joughin and Kalit (1986) showed that real retail prices of rice have been in decline since 1971. They hypothesised (supported by Gibson, above) that the collapse in the competitive position of traditional staples was in a large part to blame for their eclipse as the urban staple.

Joughin and Gimbol (1987) have extended the work of Joughin and Kalit (1986) by including rural coverage. However it is stressed that, whilst the coverage of the rural areas is not truly representative, it can be a useful indicator and guide. At the time of the study Trukai was found to have dominance over the rice market. It was found that 74% of the total recorded was for the 'Trukai White brand' and because of this, the major analysis has been done on the prices for Trukai White.

Provincial analysis

The average unweighted retail price for the period of the study in the 16 provinces and NCD was 61.95t/kg. NCD had the lowest price 51.77t/kg; Madang (51.86t) and North Solomons (54.66t) were the next lowest. The highest price was recorded in Gulf (85.26t/kg) followed by Southern Highlands (71.74t) and Milne Bay (65.93t). These are also the most remote provinces.

These remote provinces also have the most deviation in prices from the provincial average. For example Joughin and Gimbol (1987) point out that, whilst the average in Gulf is 85.26t/kg, in Kerema the price is 57.8t/kg, which is the lowest recorded in the province. In the same province in Kotidunga 109.00t/kg and Kaintiba 100.00t/kg were recorded. Therefore the authors say that the averages should be treated carefully.

Rice consumption

Joughin and Gimbol (1987) state that FAO (1986) had the best estimates for rice consumption. The national average in 1984 was 33kg per capita; rural consumption was 27kg

and urban consumption 80kg. The study by Joughin and Gimbol (1987) did not reflect the prices of the remotest areas and thus some average prices are not too reflective of the situation.

Papua New Guinea has a high and increasing demand for rice and grains as reflected in the past and recent import figures. From 1997 to 1998, aggregate demand for rice and grain imports was estimated at 303,000 tons with a total sale value of K 526 million per annum. This gives a per capita consumption of 70kg per annum and contributes 1/5th to the total national calorie intake (NARI 2000).

District analysis

Out of the 16 provinces and NCD there was a breakdown of data for 11 of the 65 districts. The average for those 11 was 80t/kg. These 11 districts were all rural and remote; it is unfortunate (the authors state) that the number of remote districts studied was so low.

The 15 lowest readings were found in the provincial capitals. All capitals had good access and all but one has sea access. All readings were below 57t/kg, well below the national average. The average price in the major urban areas was 52.87t/kg (POM, Madang, Lae, Kieta, Goroka, Wewak, and Mt Hagen).

Joughin and Gimbol (1987) confirmed that the most remote areas have the highest prices. Also, consumption is lowest in areas that have low per capita income and poorest access to markets and services.

Price movements over time

Average Trukai rice prices for three time periods in five provinces were collected (Joughin and Gimbol 1987). They were taken in July 1985-December 1985 (58.76t/kg); January 1986-June 1986 (62.48t/kg); and July 1986-December 1986 (65.06t/kg). In the period of September 1985 – September 1986 ex-terminal prices dropped by 10%. Therefore, at this time the distributors were probably making 'excess profits'.

Joughin and Gimbol (1987) also reported that the price in NCD dropped by 5% whilst it rose in the other provinces: Morobe (25%), EHP (29%) and WHP (38%). SHP (which had data for only the beginning and the end of the period) prices rose by 23%. This shows that the cheapest area got cheaper. Joughin and Gimbol (1987) stated that, while the situation aids food self-reliance in the rural areas, it was not a planned objective. Comparing the price then to the average current retail price of K2.00/kg, there has been significant price movement over time.

Pack size and brand

The price per pack size for Trukai white decreased as the pack size increased. The national average for rice less than 10kg was 65.66t/kg whilst the average price of pack size 10kg and more was 56.28t/kg, thus making the larger packages 14.3% cheaper than the smaller packages. This trend was found in all the provinces that were tested.

Breakdown of the rice market shows that Trukai White held 73%, Asian White 0.4%, Pakistani 0.1%, Sunlong 18.6%, Trukai Brown 7.3%. Sunlong and the two Trukai brands are from Australia; together they have 99.35% of the market (1985). Thus what is shown is a real preference for the Trukai White brand. The authors note that the statement by finance about deregulation leading 'to a wider choice of qualities and that more brokens would be available for low-income consumers is groundless'.

Part of the reason that consumers favour Trukai White is that it is cheap. There were 326 observations of the other brands in the provinces and the average price for these other brands was 67.93t/kg. This is 10.3% above the Trukai White over the same period.

Rice and other energy foods

Joughin and Kalit (1986) reported that rice and wheat flour have been the cheapest sources of energy for the urban population since 1977. They reported that the real price of cereals has fallen consistently since 1971.

Prices for traditional staples are high in the urban market for a number of reasons. Troubles faced by the producers of these staples include the perishable nature, transportation (costs, poor roads), small market and low returns to widely dispersed producers.

Whilst the survey is mainly representative of the market surveyed, it does show that traditional staples are still favoured there (Joughin and Gimbol 1987).

Of the areas studied the authors state that only three places could be called truly rural: Wosera (East Sepik), Tauta (Madang), Karimui (Simbu). In these rural areas, energy (measured as kilocalories) per toea is cheaper for the traditional staples. Examples are given for Wosera and Karimui. In Wosera sago is 0.03t/kcal and in Karimui sweet potato is 1.03t/kcal. The average price for rice in rural areas is 1.96t/kcal. Thus in the rural areas rice is a more expensive form of energy.

Joughin and Gimbol (1987) stated that Daru is the most expensive. Another point is that prices of staples vary considerably indicating both considerable seasonal fluctuations in availability and relative scarcity by area. An example given is Wosera yam at 8.8t/kg whilst in Vanimo the price is 24.14t/kg. Wosera is an area of yam production whilst Vanimo is a large market with yam producing hinterlands. In Kundiawa yams are not produced and are often scarce thus pushing the price up to 98 t/kg. Obviously, it is not the price of across-the-board collection of traditional foods with which we should compare rice prices; rather it is the staple of a particular place (Joughin and Gimbol 1987).

Joughin and Gimbol (1987) revealed a startling point that there is a wide differential between rice and traditional staple prices. In the rural areas that were studied, the traditional staples averaged just over half the price of rice, while in the urban areas they are more expensive. The biggest differential was recorded in the nation's capital of Port Moresby where sweet potato is 3.5 times the price of rice per unit of energy. In Wosera, sago is 65 times cheaper than rice.

The low internal and distribution costs of rice make it cheaper in the urban areas than the traditional staples. As one gets further away from the urban centers, distribution costs increase, which increases the cost of rice and the price of traditional staples decreases.

In 1985 the Somare Government faced problems imposing the rice tax. This was hoped to keep in check the rising dependency on imports, as a tax on rice would slow the expansion in imports and push up the prices in the rural areas. The World Bank projected (1987) that cereal prices would rise by less than 1% per annum until year 2000 due to improving technology in the rice producing nations. Nevertheless deregulation occurred.

Joughin and Gimbol (1987) believe that the government should welcome the high prices in the outlying areas. They believe and rightly so that bringing down the rice prices in rural areas would accelerate consumption. They hope that there will be efforts to maintain the competitiveness of the traditional staples in the villages and widen the scope. They believe that increasing the yields, improving varieties and more efficient marketing will all help to bring down the energy costs of traditional staples and will help sustain the competitive advantage that they still enjoy in the rural area. If this does not happen they believe that there will be an erosion of traditional eating habits and preferences. Such a situation would increase rice consumption and increase food dependency.

Joughin and Gimbol (1987) reiterated that there should be an increase in research into improving production of the traditional staples. However improving the production of traditional staples is only half of the answer as there is a need for improvement in the transport infrastructure i.e. getting the traditional staples to the markets.

Marketing of fresh fruit and vegetables

In Papua New Guinea there are three principal methods of marketing of fresh fruit and vegetables that are potentially available to the producer. They include: open markets, wholesale markets, and direct selling by producer.

Open markets

In terms of trends, the method of selling has not changed substantially since their inception. The majority of producers are sellers. Produce is priced by volume and not by weight and is sold in small lots. Bargaining is significantly absence in these markets compared to equivalent Asian markets, even with the unsold produce remaining at the end of the day.

Flores and Harris (1982) reported that morning and afternoon prices tended to be the same throughout the survey week in each market. However, very substantial variations in prices occurred between days in the same market, and substantial differences were found between markets on the same day, and over the week as a whole. It was also suggested by Flores and Harris (1982), that the influence of traditional price setting resulting in inflexible prices disappeared during the 1970s and has been replaced by determination which is responsive to demand, supply and cost factors.

Markets are still dominated by staples, however, increasing amounts of locally-grown introduced vegetables are now being sold. In the highlands, cauliflower, lettuce, carrot, French beans and English potato are sold, while Chinese cabbage, pak choi, capsicum, tomatoes and cucumbers are sold in the lowlands. A few entrepreneurs are selling imported apples, potato, oranges and onions.

There is also movement of goods from province to province; for example, a lot of sweet potato is being shipped from the highlands to Port Moresby markets and a lot of betel nut from the coastal areas to the highland markets. Many Tolai women (from East New Britain Province) go over to New Ireland Province (Kavieng, Lihir) and West New Britain Province (Kimbe) to market their betel nut and other food produce.

For the market to be successful it must convince the public that it is offering what the consumers want or require and anticipate what the public wants and attempt to provide it. For years now, rice and tinned fish and meat have dominated the diet of urban people. The high expectation of return from open market sales precludes the market/seller from being able to offer an economically viable substitute for these processed goods. Thus it appears that the second option is unlikely to have much evolutionary importance in ensuring the continuing success of the markets (Atkinson and Lewis 1992).

Storage facilities and organisation of transport network are areas that require attention. Improvement in these areas is conducive for the development of entrepreneurs and commercial farmers.

Wholesalers

The wholesalers of food produce have not been very successful. The most notable is the Food Marketing Corporation (FMC), which purchased local fruits and vegetables. It was closed in 1981 due to unprofitable operations. The closure of FMC resulted in other wholesalers being established but many failed for similar reasons.

The future of wholesalers will depend on their ability to supply quality produce continuously. The expansion of a market is another strategy. For example, a reduction in the importation of overseas produce will mean an increase in the sale of local produce. Another alternative for expanding the market is import substitution, that is the replacement of imported staples such as rice with a locally grown staple such as sweet potato. Obviously the relative low cost of rice makes this an unlikely proposition. Another possibility is the development of an export crop; bananas, pineapple, taro, and pitpit are possibilities.

Direct selling

Direct selling entails the producer selling directly to the end user or retailer. Direct selling is restricted to commercial producers and subsistence farmers whose production has increased beyond the point where selling through an open market is possible.

The only large-scale commercial producers who have been successful over the years are Kabiufa High School, Athol Green, Allele Pty. Ltd and Ilimo farm. These enterprises have been successful because they maintained a continuity of supply and were aggressive and persistent in their sales and marketing.

Direct selling was one of the contributing factors to the failure of FMC (Aitkinson and Lewis 1992).

Marketing costs and margins of meat

The example of marketing costs and margins of meat given here is from Lae, the second biggest city in the country.

An efficient marketing systems encourages farmers by giving them fair returns for their produce and thereby providing a service as one of the key components for increasing agricultural productivity. The efficiency of a market is generally measured in terms of net marketing margins (net marketing margins = total marketing margins – all marketing costs) of an agricultural commodity. The smaller the net marketing margin the greater the efficiency in the marketing system and vice versa. Marketing costs and margins refer to the difference between the price paid by the consumer and the price received by the producer for an equivalent quantity of a product.

Marketing costs and margins in beef marketing in Lae were estimated by Das (1992). This study reported that the nature of costs and margins in different stages of the marketing channel indicated that the producer received only 41.1% of the consumer price, whereas the marketing margin constituted 52.9%. Modest and reasonable profit was found at the wholesale level, while profile at the retail level was almost 30% of the consumer price (Table 3.27). Over a period of four years (1979-1893), the marketing costs and margins increased from 43% of the consumer price in 1979 to 53% in 1983, thereby reducing the marketing efficiency (Das 1992).

Table 3.27 A comparison of marketing costs and margins of beef in 1979 and 1983 (carcass weight = 250 kg).

Price/Cost	1979		1983	
	Cost (kina)	Share of Consumer Price (%)	Cost (kina)	Share of Consumer Price (%)
Farmgate price (P_F)	199.74	56.7	295.50	47.1
+ Transport to abattoir[1]	5.50	1.6	17.00	2.1
+ Slaughter fee[2]	3.30	0.8	16.00	2.5
+ Profit margin of wholesaler	8.29	2.4	20.40	3.2
Wholesalers' selling Price to retailers	217.50		350.00	
+Storage	37.50	10.6	52.50	8.4
+ Packaging	7.39	2.1	10.34	1.6
+ Loss in weight	2.83	0.8	4.55	0.7
+ Other	14.95	4.2	25.54	4.1
Retailers' net margin	71.95	20.4	185.11	29.5
Meat retailers' selling price to consumer (P_R)	352.12	100	628.04	100
Price spread [3]	152.38	43.3	332.54	52.9
Net margins of all intermediaries	80.24	22.8	205.51	32.7
% marketing margin [= $(P_R - P_F)/P_F$ x 100]	763		112.5	

[1] = borne by farmer, [2]= borne by wholesaler, [3] = price spread: price at retail outlet – price at farm.
Source: Das (1992).

The high transportation costs and high net margins at the retail level were pointed out as major considerations. Improvements in the transport system and enforcement of retail price control will reduce marketing costs and margins (Das 1992). Problems in assembling cattle from the smallholder projects in remote areas were also highlighted as a major concern.

Possibilities for reducing transport costs and overcoming assembling problems include:

- Forming farmers' cooperative associations, or developing a marketing board to rationalize the transportation of cattle to the abattoir. Better management and planning could provide significant savings in this area.
- Establishment of abattoir facilities in producing centres, reducing the problems of assembling and transportation of live cattle over long distances.
- Developing the role of cattle marketing agents who purchase cattle and rationalize transport.

3.6 Food consumption

3.6.1 Rice consumption

The trend of rice consumption in the country has been a substantial increase since WW II. At the same time, domestic production has remained static. Rice has emerged strongly during the post-war era and by now has become prominent in the Papua New Guinea food basket. Rice contributes a significant part to the national nutrition and calorie requirements and thereby plays a critical role in national food security.

The consumption of rice has mostly been seen in an urban context and the limited literature that does exist has only discussed this sector (Sackett 1976; Hale 1978). In 1970-71, 47,000 tons of rice were imported. Sackett (1976) calculated that 56 kg was the urban per capita demand per annum. This figure translates to 13,000 tons for the urban population of that year. This figure could be an underestimate, making no allowance for the consumption at institutions such as corrective institutions, hospitals and educational establishments. Even increasing the estimates by 50% to nearly 20,000 tons to allow for consumption at institutions leaves over 27,000 tons unaccounted for. This infers that 57% of the total imports for that year were probably consumed in the rural areas.

It is becoming more evident that, as the purchasing power of the rural people increases due income from cocoa, copra, oil palm and coffee production, there is a corresponding increase in the consumption of rice by the rural population. For example as cited by Bourke et al. 1981 from P. Heywood (unpublished data), in 1976-78 monthly sales of rice in the highlands showed a close relationship to monthly coffee deliveries.

In the early 1960s cash income in rural PNG was low and rice consumption was almost unknown, particularly in the highland villages. By the late 1960s the rural communities enjoyed regular, even if not particularly high, income from cash crops. This, combined with improved transport systems and expanding distribution system through trade stores, meant that the rural population slowly but surely participated in the cash economy. Although rice consumption was initially low, rice appealed strongly to the locals because of widespread availability, storage capacity, efficient marketing, adaptive taste, low relative price, ease of preparation, and status attributes.

If we take the highland case, rice was introduced into a subsistence setting in which food production is relatively labour intensive and seasonal food shortages sometimes occurred. At the same time coffee cultivation was on the increase providing a source of income which allowed the people to participate in the cash economy. Coffee is still the only significant cash crop in the highlands. The relatively high prices over the years have resulted in substantial increases in real income for many non-urban highlanders. At the same time, rice, the status food that was easily stored and prepared, was readily available at low relative price. In addition, highland men returning home after stints as labourers on coastal plantations had acquired a taste for rice

consumption. In these circumstances it is not surprising that a food of this type should achieve such rapid and widespread acceptance and that a taste for it was acquired (Bourke et al. 1981).

The imports show a rising trend, with obvious and serious implications for food security and self-reliance for the nation. A marginal increase of 0.6% was recorded from 126,498 tons in 1988 to 130,352 tons in 1994 for rice imports (based on a moving average over 1987-1989). Rice imports increased from 130,352 tons in 1994 to 169,000 tons in 1998, an increase of 6.1%. Rice has become an important food item in the food basket of Papua New Guineans (NARI 2000).

Changes in food consumption patterns do not occur in isolation – they occur with, and are influenced by, the prevailing economic and social climate. In this case, the climate in PNG and in particular, the highlands, has been particularly conducive to a rapid change in food consumption behaviour. If this change in food consumption were to be modified it would be imperative to alter the social and economic climate. The net effect of the changes in food consumption behaviour, which have already taken place, has been to increase the dependency of PNG on imported foods (Bourke et al. 1981).

The growing dependency of PNG on imported foods has the following detrimental effects:

- Since these imported foods come from overseas, the supply is dependant upon events outside PNG control.
- It will generate a huge food bill.
- Consumption of imported staples means a loss of production and marketing opportunities for local food producers.
- Long-term dependence on imported food will mean that most subsistence farmers will lose the ability to produce their own food.
- Increasing consumption of imported foods is a threat to basic cultural values in Papua New Guinea, which are built on customs and traditions relating to root crop gardening.
- Once established, trends towards greater imported food dependence cannot be easily reversed.
- In most rural areas, the traditional staple, an acceptable alternative, is available.

Although the literature which has addressed the issue of Papua New Guinea's food supplies and rice imports has mostly seen the situation in an urban context, ignoring the 50% non urban consumption of rice imports, it has been unequivocal on two points:

- To avoid further large increases in rice imports, considerable attention must be paid to lifting domestic market supplies of traditional staples.
- Papua New Guinea's capacity to replace imported rice with locally produced rice is very limited.

In support of the first point, NPEP is insufficient and it is doubtful whether a significant change will occur in the economic climate, while the second point remains unrefuted.

There is a lot of support for dependency or increased dependency on rice imports. The basic argument for this view is that trade is important for PNG. In addition, PNG is a growing producer of exportable cash crops that can be readily exchanged for food. There is also the argument that it is cheaper to import rice than to grow it. Numerous statements have been made and are being made on the potential or otherwise of rice (and grain) production in Papua New Guinea, however no meaningful interventions or progress have occurred, because of the lack of authoritative knowledge and information which must be based on systematic and scientific research and testing.

A public investment program on rice and grain research has been proposed by the National Agricultural Research Institute, because of the current concern for and importance of Papua New Guinea food security

3.6.2 Per capita consumption

Per capita is generally used as a yardstick for measuring welfare. To obtain good comparisons across the community and across different levels of income, expenditure data should be adjusted to capture the differences in needs and prices faced by different households. The cost of sustaining a child is lower than that of an adult.

Estimates from the PNG household survey show that nominal per capita consumption per adult was equivalent to K 912.00 per year in 1996 (US$ 700.00). However, significant inter and intra regional variations exist. There is a significant difference in the level of welfare between the urban capital region (National Capital District) and the rest of rural Papua New Guinea. After adjustments for spatial price variations, marked differences in per capita consumption remain. For example, consumption per adult equivalent in the National Capital District (NCD) is almost twice that in the poorest New Guinea Island Region and 1.4 times the national average. Other inter-regional differences in mean consumption are less marked and not always statistically significant, due to the large intra-regional dispersions around the mean.

Papua New Guineans in general spend a large proportion of their expenditures on food, suggesting an overall low standard of living. Average daily caloric intake is almost 3,000 calories, which is well above the minimum requirement of 2,200 calories. Average protein intake of 55 grams/day/adult equivalent is also well above the minimum requirement of 45 grams/day. Although these intakes are above the average requirement, the figures mask a very strong variation in food intake across income groups.

The distribution of per capita consumption across expenditure groups has very marked disparities. The wealthiest 25% of the population have a real per capita consumption level over eight times higher than the poorest quartile. Average caloric intake of the poorest 25% of the population falls short of the daily requirement as does the protein intake of the poorest 50% of the population. The significant difference in the nutritional intake between income groups reflects a diet of the lower expenditure groups which is dominated by tubers and starchy staples, but poor in grains and animal fats and proteins.

Table 3.28 Consumption across income groups and regions.

	Consumption per Adult Equivalent per year (kina)		Consumption per Adult Equivalent per year (kina)		
	Nominal	Real*	Food share	Calories	Protein (g)
Consumption quartile					
I (poorest)	248	258	0.67	1,955	27
II	457	464	0.67	2,587	41
III	814	781	0.65	3,158	60
IV (richest)	2,135	2,127	0.55	4,200	94
Region					
NCD	2,401	1,226	0.50	2,697	82
Papuan/South Coast	1,118	902	0.68	3,326	70
Highlands	838	860	0.60	2,868	48
Momase (North Coast)	706	1,007	0.67	3,101	53
New Guinea Islands	680	642	0.66	2,685	54
Total PNG	912	907	0.63	2,974	55

* Deflated by spatial deflators.
Source: PNG Household Survey, 1996.

The distribution of consumption is more unequal than in most countries with comparable income levels. The richest 10% of the population accounts for 36% of the measured consumption and the poorest 50% accounts only for 20% of consumption. The Gini coefficient derived from the household survey consumption data is a high 46.1. For comparison purposes the Gini coefficient was also calculated without adjusting consumption for spatial price variations and adult equivalencies. This results in a Gini of 48.4, which is significantly higher than that of other countries in the region and of other countries with similar incomes (Table 3.29).

Table 3.29 Inequality comparisons.

Country	GNP PPP Per Capita US$, 1996	Gini Coefficient	Year of Survey
PNG	2,820	48.4	1996
Vietnam	1,570	35.7	1993
Pakistan	1,600	31.2	1992
Sri Lanka	2,290	30.1	1990
Egypt	2,860	32.0	1991
Bolivia	2,860	42.0	1990
Indonesia	3,310	34.2	1995
Morocco	3,320	39.2	1994
Jamaica	3,450	41.1	1991
Philippines	3,550	42.9	1994
Romania	4,580	28.7	1994
Ecuador	4,730	46.6	1994
Thailand	6,700	46.2	1992

Note: Gini coefficients are based on household consumption per capita, except Bolivia, where it is based on household income per capita, which tends to result in higher inequality.
Source: World Bank Indicators, 1998 & PNG Household Survey, 1996.

A participatory rural appraisal (PRA) was conducted in PNG as part of the 1998 Human Development Report. The PRA was carried out in sixteen traditional rural villages in seven provinces as outlined below. Village locations varied from islands and coastal areas to highlands and isolated areas.

Subsistence gardening

For hundreds of years villages in Papua New Guinea have maintained subsistence livelihoods. Subsistence farming, fishing, hunting and food gathering have traditionally provided the major sources of livelihood, with food, materials for shelter, and water derived from the physical environment.

Subsistence farming based on shifting cultivation has been the traditional means of food production. Shifting cultivation is sustainable as long as there is adequate land in relation to population size and growth. In this type of agriculture, land is left fallow for a number of years for soil fertility replenishment. Most villages still practice this slash and burn technique.

Table 3.30 Villages visited during rural appraisal.

Village	District	Province
Aberagerema	South Fly	Western
Yau	Middle Fly	Western
Maopa 1 & 2	Abau	Central
Rarai	Kairuka-Hiri	Central
Notofana	Goroka	Eastern Highlands
Marawaka	Obura-Wonenara	Eastern Highlands
Sisi	Finschaffen	Morobe
Kobau	Finschaffen	Morobe
Sanai-Terengi	Bogia	Madang
Daiden	Bogia	Madang
Malalamai	Rai Coast	Madang
Guarawan	Rai Coast	Madang
Buyang	Lorengau	Manus
Ahus Island	Lorengau	Manus
Ungan Island	Kavieng	New Ireland
Lavatkana	Namatanai	New Ireland

Source: 1998 Human Development Report.

Gardening for cash

From the PRA, it was confirmed that there is widespread interest in selling garden produce for cash income. Villages with easy access to urban centres, such as Maopa, Rarai, and Rarai and Notofana, use improved farming methods and grow vegetables mainly to sell for cash

at urban markets. In the lowland and island villages, copra and cocoa are sold for cash income. Sanai and Daiden villages produce copra and cocoa, Ungan produces copra, and Buyang produces cocoa. In the highland regions of Papua New Guinea, coffee is grown widely and forms the backbone of its economy. The village of Notofana in the Eastern Highlands is heavily engaged in coffee production, while Sisi, Guarawan, and Lavatkana also grow some coffee. Cash income generated from these activities is used to buy imported food items, luxury goods and to pay for school fees.

Subsistence fishing

Fishing is the main source of livelihood for island and coastal villages, and provides the main source of protein for the majority of the people in these areas. The most effective and sustainable methods and techniques of fishing are traditional such as fishing nets, traps and spears. These traditional methods and techniques are practiced on Ahus Island. Generally, the marine life remains plentiful and the fish caught provide adequately for each household. Data collected from the PRA showed that in Aberagerema, a coastal village in the Western Province, fish stocks are declining, a fact attributed to the Ok Tedi mine upstream.

Fishing for cash

Fish, crayfish, clams, crocodiles and other seafood are sold by coastal, island and river villages such as Maopa, Sanai, Daiden, Ahus and Ungan. The advent of modern fishing methods that use boats, strong deep sea fishing lines, and dynamiting results in immediate advantages, however the long term effects are less advantages for village communities. From my own fishing community in Kavieng, the effect of dynamiting threatens the future availability of marine products of household and subsistence needs. There is an increasing tendency for fishermen to fish indiscriminately and more frequently due to the desire for more cash. Villagers on Ahus and Ungan islands catch a high quantity of fish and a variety of fish and seafood, which improves trade in the local markets. Generally fish stocks are diminishing and fishermen have to go out further to fish. There is evidence also showing a rejuvenation of fish stocks and marine life with the cessation of dynamiting.

Subsistence hunting

Except for island villages most if not all villages practice subsistence hunting. From the rural appraisals it was obvious that hunting is an important activity for mainland villages compared to island villages such Ahus and Ungan that are engaged in fishing. For most of the villages that practice subsistence hunting, guns are becoming more and more common hunting tools. The increased use of guns for hunting has led to a decline of wildlife in the traditional hunting grounds of their communities. In the more isolated areas such as Marawaka, only traditional methods of hunting are used and villagers report an ample supply of wildlife.

Government services

Education, health care and transport are considered important issues for rural sustainability. The main concerns raised by villagers during these rural appraisals were questions relating to issues of accessibility, availability and quality of these government services.

- In terms of education, the rate of literacy was higher in areas where there was access to education. Villages appraised in the survey that had high literacy rates included Notofana, Maopa and Ugan Island. Other villagers recorded lower literacy rates.
- Similarly, health care was most lacking in areas furthest from the service. For example in the isolated areas the need for health are was most pronounced.

- Transport services are very poor in most areas of the country. Rural communities express the need for the government to improve transport services.
- Communication was the only service which they were content with. They were content with their radio as the main source of information.

Good governance was viewed positively by villagers during the appraisal. Good leaders were considered important for development. Most rural communities appreciate that the new organic law will mean more development at the local government level, however they are still confused as to how and when these benefits will come to them.

Food security

Most rural people are sustained by their own production. Root crops form the major part of the diet in country, while sago is the staple in the lowland and coastal areas. While population growth has been significant in Papua New Guinea, there has been little expansion in the area of land used for agriculture. This has resulted in the intensification of agriculture. Common methods of intensification include the shortening of the bush fallow, longer cropping periods with the adoption of more efficient crops such as sweet potato, Chinese taro and triploid bananas. Where intensification has not been matched by improved management practices, considerable pressure has been put on land resources, leading to land degradation and reduced garden productivity.

Most rural people have minor cash income through the sale of export crops such as coffee, cocoa, copra and oil palm, or domestic products such as betel nut, fresh food and fish. Remittance of cash from relatives working in urban areas is also important.

Cash earning activities have increased in recent years, particularly in areas with reliable access to markets. However, over the same period, the provision for basic services of health, education and transport has declined. This decline has been more pronounced in the less prosperous rural areas. The results of these changes are an increasing number of poor and remote communities with limited development opportunities.

In terms of food consumption there is an increasing trend to consume rice, tinned meat and fish.

3.6.3 Urban household survey

An urban household survey was conducted in four urban centres around Papua New Guinea in Port Moresby, Goroka, Wewak and Kieta/Arawa/Panguna (Gibson 1998). In 1989 and 1990 Lae and Rabaul were surveyed. The survey target was divided into four areas: high covenant housing, low covenant housing, settlements and urban villages. Below are results of comparisons that were able to be made between this survey and the Household Expenditure Survey (HES). Results recorded successive stages in budgeting process: allocation of income to the aggregate food groups, the allocation of food budget to four food sub-groups, staples, meats, pleasure goods and other foods.

Port Moresby results:

- decline in the share of meats and root crops and rise in the share of fish
- rise in the importance of lamb. Possible explanations are that sheep imports remain uncontrolled. Gibson states that other meats such as poultry have been subject to restrictions
- there was no shift in favour of or away from locally produced foods
- there was a fall in the share of bananas, but that may be seasonal
- other fruit and vegetables have become important
- increased importance of sweet potato offset by the fall in consumption of taro
- sugar became locally produced between the two surveys HES and UHS leading to a fall in sugar's share of food consumption.

Goroka results:

- decline in meats and rise in share of fish
- substitutions occurred within meats with a rise in consumption of lamb and mutton along with tinned meat
- sweet potato maintained its large share of the budget
- rise in bananas consumed
- increase in importance of takeaway foods
- Gibson notes that the value of food consumed by the average Goroka household rose by 32% between 1975/76 and 1985/86 which was a smaller increase than in Port Moresby (53%) and Kieta/Arawa/Panguna (70%).

Kieta/Arawa/Panguna results:

- large fall in the consumption of meat
- increases in shares of cereals, fresh fruit and vegetables along with root crops
- rise in the importance of tinned fish
- increase in budget allocation for bread and cereals.

Rabaul results:

- it was important that Rabaul was surveyed 2 years after the initial four urban centres
- shifts towards mutton and lamb
- tinned fish became more important though not statistically significant
- shift towards dairy products, fats and oils
- fall in the share of bananas offset by a rise in the share of fresh vegetables
- taro replaced by sweet potato but overall no changes in root crop diet
- Gibson (1998) draws attention to the fact the most marked change seen in Rabaul, but not witnessed elsewhere, is that the food budget allocated to sugar fell by almost one-half between 1976 and 1989/90
- there was also a significant decline in the share of food budget allocated to rice.

In summary it is unclear that these results signal an increase in import dependence. Taro has become less important but this is offset by increased importance in local foods.

Betel nut and tobacco

In the Urban Household Survey pleasure goods such as alcohol and betel nut were counted. They were compared to the consumption in Household Expenditure Survey. The Consumer Price Index base weights show that beer (alcohol) is more important than rice.

Alcohol: K11.80	Rice: K9.05
Tobacco: K5.87	Tinned meat: K5.72
Betel nut: K4.34	Sweet potato: K3.09

It is important to note that alcohol consumption is concentrated among a few households. However in the majority of households the value of betel nut consumption exceeds the value of sweet potato consumption. Betel nut is discouraged by the government, but there are conflicts as it is a good income earner for rural (mainly coastal) people. It is 100% locally grown which Gibson (1995) points out does not effect the balance of payments. This differs from alcohol and tobacco.

The UHS showed that the budget allocated to betel doubled in every town except Kieta/Arawa/Panguna, although in KAP there was a decrease in tobacco. However by looking at the results one sees another example of spending on tobacco exceeding tinned meat as well as rice:

- tobacco was 18.4% of the pleasure budget totaling K37.80 that translates to K9.42
- rice was 9.1% of the budget totaling K94.61 that translates to K8.61

- tinned meat was 8.8% of the budget totaling K94.61 that translates to K8.33

However the important question to answer is, regardless of how much is spent on pleasure goods, are people getting the right amount of nutrients.

The increased share in POM and Rabaul was at the expense of tobacco and at the expense of alcohol in Goroka. Soft drinks gained a larger share in the pleasure good budget, it's share doubling in Rabaul and Goroka.

Gibson (1995) estimated that the amount of betel nut sales would have been approximately K750,000:

- amount spent on pleasure goods was K750 per year
- 100,000 urban households in late 1980s
- each extra 1% of share of the budget generated K750,000

From food expenditure calculations it was found that pleasure goods were more elastic; e.g. a 10% rise in the food budget causes spending on staples to increase by 4%, while spending on pleasure goods increases by 14%. An increase in the food budget would mean that poorer households would proportionately spend more on meats. Results of the survey suggest that the poorer households respond to 'austerity by reducing the protein density of the diet' (Gibson 1995).

Some demographic effects found are:

- For a given food budget, an increase in household size causes spending on meats and other foods to fall. Spending on staple groups increases.
- A 10% rise in the proportion of prime age males (15-50 years) in the household causes spending on pleasure goods to rise by 6% for a given food budget.
- A 10% rise in the proportion of male children in the household increases expenditures in meats by 4%. This is a much stronger effect than for female children.
- For a given food budget, households headed by expatriates spend only half as much on the staples group and three-quarters as much on the pleasure goods, as do other households. This lower spending is offset by expatriate households spending more on the other food groups.

Results for staples demand

Elasticity estimates did not show that local staple crops are seen as inferior foods by urban households. The expenditure elasticity for banana and sweet potato is larger than those for rice and wheat products. Gibson points out that a 1% increase in the staples budget increases consumption of banana and sweet potato by more than 1%, while cereal consumption increased less than 1%.

Spending on rice by the households in the UHS implies consumption of about 75kg per person each year. The implied consumption of sweet potato was about 50kg per person per year in the UHS. The lowest amount of sweet potato consumption was recorded in Moresby at 14kg per person compared to a high of 108kg in Goroka. The FAO estimates that the national average consumption of sweet potato is 105kg per person. It is probable that rural consumption for sweet potato is over 150kg per person (Gibson 1995)

Sweet potato in urban areas is probably twice as expensive as in rural areas. When rural dwellers move to urban areas there is 75% reduction in the consumption of sweet potato and 30% increase in rice consumption. However, Gibson (1995) asserts that low consumption of local staples in urban areas is due more to high prices than consumer preferences. The difficulty that the local economy has in supplying urban areas with cheap food should be addressed. Poor infrastructure in the rural areas makes it difficult for rural people to get their produce to the market.

Food policy

Raising tariffs would not be a good idea. Problems include:

- too much research on introduced food crops and not enough on traditional staples
- inadequate marketing infrastructure (including advertising)
- an attitude amongst community leaders that traditional foods have lower status.

It is suggested (Gibson 1995) that increasing the supply of traditional staples as stated above would mean providing better access for people to get their produce to the markets. Supply is not meeting demand.

An interesting point to note is that households headed by highlanders consume 7% more sweet potato than other PNG households.

Results for meats demand

Meats are mainly imported and/or produced in coastal areas, which makes them cheaper in those main centres than everywhere else. The demand for tinned fish is the most inelastic meaning that a rise in spending in the meats group would raise demand for tinned fish by only 3.7%. Other meats however would increase by more than 10%. The share of tinned fish in households will decline as household income grows.

The poorest households rely on tinned fish for protein and a tariff on tinned fish would hurt this group.

Results for pleasure goods demand

For the poorest urban households alcohol comprises 4% of the pleasure goods budget, whilst in the richest households it comprises 46% of the pleasure goods budget. Alcohol has a low price elasticity and high expenditure elasticity. Tax on alcohol would be progressive.

For the poorest households tobacco comprises 35% of the pleasure goods budget, whilst it only comprises 16% for those in the top decile. Taxation would have regressive effects. Higher tax on tobacco would reduce the demand for betel nut.

It is interesting to note that in households headed by highlanders the budget share of alcohol is 5% higher than in other Papua New Guinean households, whilst in households headed by expatriates is it 5% higher than in households headed by highlanders. Furthermore, ethnicity has no effect on budget share.

Results for other foods demands

Sugar has low expenditure elasticity; as household incomes rise the budget share for sugar falls. In the poorest urban households sugar is 20% of the other foods budget whilst it is only 7% of the budget for the richest households. Local sugar producer's revenue will go down with sugar being liberalized in 1997.

Income elasticity suggests that alcohol, beef and chicken are luxury goods for poorer than average households. Rising income does not cause the income elasticity of demand for staples to fall any faster than the income elasticity of demand for cereals. Thus from the survey Gibson (1997) finds that there is no evidence to suggest that urban dwellers believe that traditional staples are inferior to cereals. Sugar along with tinned fish barely respond to income changes for households that are richer than average.

Nutrition

Badly designed policy can endanger vulnerable households by reducing their food security. Poorer households consume cheaper sources of nutrients and they do not acquire the required amount. According to the survey the average household does receive the required amount of energy and protein but the households in the poorest decile do not. In fact over one-

third of households receive less than the required energy from their diet (1995). These results are supported by the results of the HES.

Gibson states that there are basically two causes of undernourishmen, insufficient income and poor allocation of budget.

Lambert (1979) reported that, if the poor had switched tobacco expenditure to rice, the poor would have obtained an extra 18% energy.

Nutrient elasticity

Nutrient elasticity gives the percentage change in the amount of the nutrient available to the household following a 1% change in the price of food. Nutrient elasticity can either be positive or negative. It is positive if nutrient availability increases after a price rise. Nutrient elasticity is largest for the poor. Increases in rice would have the most severe effect on energy availability.

3.7 Risk coping systems

3.7.1 National economic growth strategies

Food security

Food security is concerned with the adequacy of food production to meet the nutritional needs of the growing population. Efforts to increase food production must be increased with renewed vigor. Farmers do not grow food for altruistic reasons, but to feed themselves through own consumption or sales (Noah 2000). In Papua New Guinea, the majority of the population is directly or indirectly dependent on agriculture.

According to Barraclough (1991), to ensure food security, a food system should be characterized by the following:

- The capacities to produce, store and import sufficient food to meet basic food needs for all population groups.
- Maximum autonomy and self-determination without implying self-sufficiency, which reduces vulnerability to international market fluctuations and political pressures.
- Reliability – the seasonal cyclical and other variations in access to food are minimal.
- Sustainability – such that the ecological system is protected and improved over time;
- Equity meaning, as a minimum, dependable access to adequate to food for all social groups.

A secure food system must be able to deliver inputs and outputs where and when required. A good example is the European Community. It is helpful to draw a distinction between self-sufficiency in production and self-sufficiency in farming systems. It is also important to note that the high level of self-sufficiency in production in European communities is often dependent upon heavy use of imported animal feeds and fuel. These imported materials are just as susceptible to economic or military blockade as are the foods they produce, and they provide no relief to local harvest failure (Swinbank 1992).

When considering the European Union, it is not agricultural self-sufficiency that makes it food secure. The high postwar level of economic growth, together with low population growth rate have resulted in high and growing levels of prosperity for the majority and the provision of safety nets for the vulnerable. The increasing level of agricultural productivity and total output, new technologies for food processing and storage, good distribution, infrastructures and importantly an economic system that supplies the goods and services that consumers wish to purchase have resulted in the availability of a wide range of high quality products and safe food for domestic consumption and export. Overall, the declining real prices of agricultural produce mean that the share of the food expenditure in the household budget continues to decline.

National food security does not guarantee that every household is food secure. In every society there are pockets of food insecurity, even in the richest nations of the world. The meshes of the safety net may be too large to prevent some individuals from falling through and governments of several industrial countries have tendered recently to increase the mesh size of the safety nets. Within countries, the food insecure poor comprise different subgroups, differentiated by location, occupational patterns, asset ownership, race, ethnicity, age and gender. Thus, at the household or individual level there may be problems of insecurity caused by inadequate access to food. The relationship between national and household food security is one of the most important and difficult issues confronting governments in all countries at all levels of wealth and development. It is further complicated by the fact that "having adequate household access to food is necessary but not sufficient to ensure that all household members consume an adequate diet. And consuming an adequate diet is necessary but not sufficient for maintaining a healthy nutritional status."

It is important to distinguish between chronic and transitional food security at the household level. Chronic food security refers to a continuous inadequate diet caused by the persistent inability to acquire food. Transitional food insecurity refers to a temporary lack of adequate food access for the household, arising from adverse changes in food prices, food production or household income. Food policy options for reducing food insecurity are seen as dependent on whether the case is chronic or transitory. Measures to address chronic food insecurity would include increasing the food supply through increased and improved crop production, focusing on development assistance or income transfers for poor and access to knowledge about nutrition and health practices. Transitory food insecurity could be ameliorated by stabilizing supplies and prices, assisting vulnerable groups with emergency employment programs, and transfers of food.

The essence of a good food policy is its consideration of all aspects of food insecurity with a view of providing the vulnerable with safety nets to create an environment that can lead to the eradication of endemic hunger. This requires economic growth. Since 1975, Papua New Guinea has seen negative and stagnant growth rate in agricultural production and gross domestic product (GDP) with a growing population. This has resulted in sharing of diminishing resources to an increasing number of people. Improving the equitableness of income distribution can only achieve limited results in these circumstances and, as has frequently been seen, will be strongly resisted by potential losers (Noah 2000). Implementation of measures to increase equality is less difficult if it includes the agriculture sector. One of the lessons that Papua New Guinea can learn from Europe is the importance of economic policies that discriminate against agriculture development and growth.

Reliability as a component of food security

The reliability component of food security refers both to reliability and access, however it is often confused with stability. Weather and other natural phenomena affect the stability of the supply, abrupt changes in demand affect the stability of price, and the interaction of macroeconomic and sectoral policies within and across countries can affect both (Noah 2000).

A disproportionate impact on prices of a commodity will occur, if there are fluctuations in the supply side of the production of that commodity. This happens because of the relatively small short-term price elasticity of demand for that commodity in the aggregate. Climatic related phenomena (e.g. drought) and shock oil prices are major causes of instability.

With the backdrop of changes occurring in the global village, Papua New Guinea needs to appreciate that future strategies for national food security should differ from those of the past. The food security policy should also be clear on its responses to short-term and long-term trends.

The question that remains is: what or which policy measures will ensure reliability of food availability and access, both in response to short-term fluctuations and over the long term?

Trade-related economic policies

The trade-related economic policies of Papua New Guinea influence food security indirectly through their effect on the growth of the economy as a whole and of particular sectors. They have a more direct impact on food security and nutrition status by affecting such factors as rural and urban incomes, ability to import food to meet domestic short-falls and demands for food items not produced locally, and earning of foreign exchange to finance the varying share of food imports in total.

Agricultural trade is a generator of income and provides for the welfare and livelihood of the people who are directly or indirectly involved in it. The expansion of agricultural trade has helped provide greater quantity, more variety and better quality of food to increasing numbers of people at lower prices. In Papua New Guinea and many other countries, agricultural trade has been a major source of foreign exchange necessary to finance imports and development. Copra, cocoa, coffee and oil palm are traded on the open market. The sugar industry on the other hand is protected by the Infant Industry Policy, where no competition is allowed for the product by banning all other sugar imports. This policy was put into place by the government in 1980 to allow the establishment and growth of Ramu Sugar. Due to its importance and vulnerability, Ramu Sugar was protected right from the onset from the rigors of international competition, thus avoiding political, social and economic consequences.

Rural and urban food security; growth with equity

The relationships between the urban and rural economies and the macroeconomic policies that affect the two sectors must be clearly understood before measures can be proposed for food security. An understanding of economic linkages between rural and urban areas sheds light on the effects of the policies on households in the respective areas. Of particular importance are issues of income, employment, taxation and public expenditure.

The bulk of the population is in the rural areas and, therefore, to achieve food security, it is imperative to implement policies that will encourage the rural economy. The rate of urbanization is also increasing and policies are needed to address this concern.

The livelihood of the rural community is based on agriculture. The growth of agriculture and other rural enterprises is the main vehicle by which employment and income can be increased on a large scale. An increase in agricultural production generates effective demand for goods and services produced by the domestic non-agricultural economy and, as a result relative prices (terms of trade) shift in favor of the non-agricultural sectors, while resources including labour and capital, are transferred from agricultural to non-agricultural uses, which stimulates growth in the non-agricultural sectors.

To fully address rural food insecurity, development should not focus on agriculture alone but on the rural economy as a whole. The government must make provisions for the basic services of health, education, transport infrastructures and marketing in order to fully realize rural development.

Long-term growth

Long-term growth is a pre-requisite to improving food security. As stated earlier it must involve the development of the rural economy as a whole. With greatly improved linkages within the rural economy, the agriculture sector will grow. However, while growth is important and necessary, it is not sufficient. Growth needs to be equitable for all the population, both rural and urban.

Ideally, long-term growth should be equitable for all populations. This would require the food insecure to acquire more control over resources so that benefits of growth are shared more equitably, which would lead to immediate growth. There are policies that can be implemented to improve the position of the poorest group of people.

Taxation

When the government makes changes in the tax base in order to increase revenues, the poorest group of people in the country is worst affected. These changes in the tax base can be through the imposition of direct or indirect tax. It is the indirect taxes rather than the direct taxes that generally have a disproportionate effect on the poor. Direct taxes tend to be progressive while indirect taxes are regressive. The indirect taxes become regressive if they are imposed on goods and services commonly purchased by the poor (basic food items, public transport, fuel for cooking, etc.) or if inputs into such goods and services are taxed. Indirect taxes can be designed to be progressive, if they are levied on luxury goods and services. The removal of a disproportionate direct or indirect tax burden on the agricultural sector can improve the situation in the rural areas. It must be stressed that implementation of any inappropriately designed taxes can lead to widespread bias against the poor.

Public expenditure

In recent years due to financial constraints, the government made massive cuts in public expenditure. Although cuts were inevitable, expenditures on the vital services (primary education, primary health, care, etc.) must be maintained. It is of paramount importance not to allow negative growth into the economy because it will pose more intractable difficulties. There is often a bias in favour of the upper and middle-income earners, with expenditures on hospitals, secondary and tertiary education being accorded higher priority than the provision of free access to basic services for the poor. Most often the poor can not afford these basic essential services, which are critical for their human development.

Rural farmers are often seen as food producers and benefits given to them must in the form of high agriculture prices. However, rural farmers are net food purchasers, and any increase in food prices will outweigh the income effects of farmgate prices for agricultural produce. Thus the provision of food subsidies and the form they take are important determinants of food security.

Government policies and labour market

The biggest resource the poor people have is their labour and often this is limited by factors such as (i) unskilled or semi-skilled labour, (ii) low productivity due to malnutrition and ill health, and (iii) lack of affordable education and training.

Nevertheless, employment base growth offers the most effective way of tackling poverty and insecurity of the poor in both the urban and rural areas. This requires government policies that can improve labour productivity, enabling the poor to access labour opportunities, remove or avoid anti labour bias in the factor market, and in the sequencing of policy reforms, allow for the slow adjustment of markets relative to capital markets.

Any policy to improve food security should contain the following basic information (i) who has food security problems, (ii) where the food security problem is, and (iii) how the implemented policies can alleviate the problem.

The government has the responsibility of monitoring and decisions are made in light of its national circumstances and assistance given by international agencies.

3.7.2 Strategies to reduce poverty and income inequality

Agriculture is the engine of economic growth in Papua New Guinea, however the level of government commitment to the sector has been very dismal. Successive governments have penalized agriculture through a variety of mechanisms, including export and import taxes, foreign exchange control, export licensing requirements and controls and bureaucratic marketing boards. The lack of competition and heavy government regulation, along with structural factors such as inadequate institutional and physical infrastructure and underdeveloped research and extension systems have resulted in low productivity and hence

poor rural development as a whole. Structural adjustment programs (SAPs) have been instituted in Papua New Guinea and many countries partly in response to these and many other market failures. SAPs seek to reallocate resource use in order to improve the economic efficiency and social welfare. Among other things, the programs have devalued exchange rates, the immediate effect of which was to make imports more expensive which in turn increased the farmers' costs markedly. Farmers growing export crops have benefited from the restructuring of the currency from the higher price paid on their export produce. However, most of Papua New Guinea is subsistence agriculture and the changes of SAPs have serious consequences for food security particularly for the poor majority.

Economic growth alone, even growth with equity is not the answer to the problems of poverty, food insecurity and malnutrition. I believe there must be a political will to compliment economic growth. It is true to say that redistribution of resources is easier when the whole economy is growing. Experience indicates that there will be increased political support for measures that benefit the poor as well as those that are better off. Papua New Guinea can learn from the experience of other countries that have made substantial achievements in the last 200 years.

A study on commercialisation of agriculture was conducted in the Karimui District of Simbu Province (Finlayson et al. 1991). The study was conducted in two stages, two separate periods of six months. At the time of the study no road connection existed with other provinces in the highlands. Three villages in the district were studied: Yaro, Kiliban and Boisamaru. The population was fairly young with 49% below 15 years.

The study looked particularly at household production, consumption, and growth of children. It was found that the level of participation in the cash economy affected the patterns of food consumption and expenditure. Increased cash incomes were spent substantially on buying foods that added diversity, and perhaps quality, to diets. Furthermore, the sources and types of food appeared to have affected growth of children, particularly those who were in the weaning phase. The proportion of household energy coming from purchased foods was found to have had a positive impact on social growth overall, although the impact was found to vary with economic and environmental conditions.

It was suggested from the study that the main determinant of the level of subsistence production from gardens was the input of women's time. The authors believed that this could mean a possible conflict between gardening, wage employment and the domestic responsibilities of women.

The study also found that in order for small-scale cash cropping to be a reliable source of income for the Karimui people, production and marketing difficulties needed to be overcome. In 1981 the Karimui Spice Company (KSC) was formed by combining the Chimbu Holding Enterprise (CHE) and the Karimui Cardamom Growers' Association. Large-scale cash cropping (KSC) was more successful as it offered wage earning opportunities to a large proportion of the population. These new cash earning opportunities did affect other sources of income such as in subsistence earnings. In the case of subsistence earnings there was a small decrease in income derived from this activity. The study found that when the opportunity for wage earning was low the people who had relied more heavily on wages found things harder as they had cut themselves off from subsistence food sources.

One of the characteristics of the labour market was that most workers were employed on a casual basis. This enabled a larger amount of people to be employed. The method of casual employment did not affect the larger households as much as might be expected, as the casual status allowed them time to maintain their subsistence production.

Commercialisation of agriculture should be approached with caution avoiding high levels of dependency on individual crops or projects in order to minimise risks to household food security. Some policy recommendations are suggested (Finlayson et al. 1991) as follows:

- There should by a focus by MCH on mothers with children who are weaning. Karimui mothers wean their children earlier than mothers elsewhere in the province (Groos 1988; Groos and Hide 1989).
- MCH should also focus on promoting good hygienic practices in order to help reduce the incidence of diarrhoea.
- Improvement should include the diversity, incentives and opportunities for smallholder perennial and annual cash crops, for example chicken raising projects.
- The status and income of women should be improved, so that the negative impacts of child nutrition may be reduced. It was found that women spend a higher percentage of their income on food than men do. Therefore it is believed that if men were to spend as much as women on food, the nutritional status of families and young children would improve. In 1985 a study found that 2.4% of women claimed to have attended school or received literacy training at some stage (Groos 1988). A 1987 study (Groos and Hide 1989) found that the figure might actually be 1%.

Low cash income agricultural systems

Sweet potato (KauKau) is the most important crop for 60% of the population. It is also the most commonly marketed food. The second most important crop is sago. Banana is the most important crop for 9% of the rural population; it is particularly important in areas where there is a strong seasonal dry spell (Allen and Bourke 1997). Two species of yam (*Dioscorea esulenta* and *D. alata*) are also added.

Betel nut is also one of the most marketable crops in PNG. Betel nut is an important cash crop for people in lowland areas however most of the plantings have occurred in diverse systems in the last 10 years (Allen and Bourke 1997).

Where land use intensity is low, the fallow vegetation type is characterized by tall trees, and banana and taro are as important as sweet potato. Sweet potato becomes the dominant crop when land use intensifies.

Cash income derived from agricultural products or from commodities that have been gathered or obtained from hunting include animal skins, bird plumes, betel nut, mustard, cardamom, cattle -live/meat, chillies, cocoa, copra, coffee, fish, and vegetables.

Using data from the Mapping Agricultural System Project (MASP), Allen and Bourke (1997) identified 26 systems as 'poor'. Land use intensity in PNG is low. However, in 1980 27% of the rural population was living on just over 5% of the total area; as the population increases the land will become under increasing pressure (Allen and Bourke 1997).

Table 3.31 Estimated income classes used in MASP.

	Per Household		Per Person	
Income score	Range (K)	Median (K)	Range (K)	Median (K)
0	0-10	5	0-2	1
1	10-50	30	2-10	6
2	50-250	150	10-50	30
3	>250	500	>50	100

In 1980 a little over 73,000 people lived in areas where the aggregated income score was 0 or 1 (less than K50 a year). This figure would have been under-enumerated in the 1980 census and the figure today would be 100,000 (Allen and Bourke 1997).

Systems with very low population densities, very low intensity of land use

There are 26 low-income systems; nine of these are systems with very low population densities, very low intensity of land use. In these systems there are less than 10 persons per square kilometre and less than 5% of the land is used for agriculture. Therefore all things being

equal, there is scope for expansion in agriculture in these areas. The areas these systems fall into are around the western fringes of the central highlands. These areas are also highly infected by malaria, which would probably be a factor in productivity.

In addition these areas have poor infrastructure with few airstrips and non-existent roads. They also experience little support from the government. One of the reasons that Bryant and Allen suggest is that most of these areas straddle district and provincial borders. To provincial governments these areas seem too remote and obviously not important. They add further that populations are split amongst electorates where no one takes responsibility for them.

Systems with low population density and low intensity of land use

Twelve systems fall into this category. There are 10-40 people per square kilometre and in most cases 10% of agriculturally useable land is in use in any year.

Similar to the systems discussed earlier (very low population density and very low land use intensity). The systems with low population density and low intensity of land use also have poor infrastructure. Whilst in the interior of these areas there is road access, there is little access connecting these areas to the rest of the country. The roads that do exist are very poorly kept (un-surfaced, potholed, steep gradients, etc). In these systems airstrips are more common, though it is unclear to what standard. In contrast to the earlier systems discussed, these systems see more government attention.

These areas have intensified in agriculture; however the scope for expansion is limited due to environmental constraints, steep slopes, mediocre soils and high rainfall and degradation of the resource base.

Systems with medium to high population density and medium to high intensity of land use

Five systems all occurring on off-shore islands include: Umboi Island, Malai and Tuam Islands (Morobe), Boisa Island (Madang), and Gawa, Dugumenu, Kwaiwatta (Milne Bay).

Canoe building and sailing skills have deteriorated with the introduction of outboard powered boats. The use of these powerboats is a new expense. There were traditional trade networks (shells, coconuts, nuts, etc) but now these trade networks have become involved in cash cropping (Allen and Bourke 1997).

There are poor shipping services and the former government trawler service no longer exists.

Income sources in low income agricultural systems

In comparison to the households in low income agricultural systems, households of higher income agricultural systems often earn money from a range of up to five or more sources, whereas the former usually derive from one or two sources.

Growing cash crops such cocoa and coffee is harder for the people of low income agricultural systems due to the difficulty of the terrain. Where there is chance to market their vegetables, people of low-income systems sell at very small localized markets. The demand is low and infrequent.

The implications of low cash income levels

In general, rural people with higher incomes have improved health indicators (infant and child mortality rates, etc). These improvements came with the cash crops, better government services and improved accessibility to markets (Heywood and Hide 1992).

An interesting note by Allen and Bourke (1997) is that the rural areas of PNG have not followed the trend of the developing world, where an increase in income has seen a decrease in nutritional status (due to change of diet). Heywood and Hide (1992) believe that this is due to

the fact that the money derived from income is used to buy food to supplement the subsistence diet, as subsistence agriculture is maintained at the same level as prior to cash cropping. However, the change for the worse is evident in the urban areas in PNG with the rise in incidence of diabetes and cardiovascular diseases.

Allen and Bourke (1997) cite an observation by Smith (1984) made from the National Nutritional Survey (1993), who noted that increased consumption of protein and fat is significantly associated with increases in length in children at 30 months of age.

Under-developed areas

Four separate studies were undertaken in order to identify areas that were least developed and, although different indicators were used in each study, certain areas were continually identified as being less developed.

- Wilson's study used six socio-economic indicators: smallholder cash crops; hospital beds per 1,000 population; administration staff per 1,000 population; enrollments at primary and secondary schools per 100 population; accessibility to the district headquarters; and the grade of local government in a district applied to sub districts.
- Heywood et al. identified districts with lowest weight and lowest length score.
- De Albuquerque and D' Sa in 1986 used 32 variable principal components to identify least developed districts (population density, sex ratios, internal migration, cash earning, education, health, etc).
- MASP: districts in which agricultural systems with estimated cash incomes less than K50 per household per year.

Common characteristics in these disadvantaged areas are environmental constraints; annual flooding, steep slopes, high rainfall, poor soils and high altitudes. They are located far from provincial headquarters, often between borders making responsibility unclear and thus no one takes responsibility.

Similarly, Allen and Bourke (1997) reported that the poor and under-developed areas are characterized by the following:

1. Very limited and low levels of cash income and the potential for raising income levels is also low.
2. Poor market access.
3. Limited development potential due to severe environmental constraints.
4. Difficult physical environment because of flooding, high rainfall, high temperatures and very high humidity.
5. High population density.
6. Extremely high rate of malnutrition and infant mortality.
7. Poor government services.
8. Extreme pressure on available land.
9. Declining soil fertility due to intensive cropping under high rainfall conditions.
10. Very poor transport access.
11. Located far from provincial headquarters, often between borders making responsibility unclear and thus no one takes responsibility.

Household strategies

Households generally adapt to the changes that occur in relation to food security. In rural communities, this may mean that they need to increase crop production. They could increase land area for food production. For those that have little land, this is possible through leasing of land for periods of 4 to 6 months as is commonly practiced in the Gazelle Peninsula. Outright purchase of land in government settlement blocks is also another strategy for the people to increase food crop production and hence guarantee food security.

People that are constrained by land are becoming innovative in their quest to sustain crop production, using fertilisers (inorganic and organic) and improved practices on their little plots. This is quite common in the poor urban areas and overcrowded villages.

A lot of households are increasing their incomes through the selling of cooked food in markets or as street vendors for those too close to urban or government stations. People are always trying out strategies to increase household incomes. Young members of the household often look for paid jobs in towns and in cities, mostly in lowly paid menial jobs. Often people open up little trade stores in the village, where they try to keep the cash flow within the village. Parents are investing more in education as a means of insurance for survival. People are adopting various strategies to increase and diversify their sources of household incomes. Coastal communities are using dynamite as a quick way of getting much needed cash, while those in the mainland are using guns for hunting game for sale and consumption. Naturally these strategies would differ from household to household and community to community.

Most households are conservative, so they increase their income opportunities simply by increasing their household savings. Others increase their income through remittance from working relatives.

In towns and cities an increase in the number of sex workers has been highlighted as a major concern. A lot of young girls and single mothers are turning to prostitution as a strategy to increase household incomes.

Informal social security safety nets (extended family, etc)

The *Wantok* system is a complex informal support system that operates in PNG. *Wantok* is Melanesian pidgin and when translated literally, it means "one talk". "Wan" means the same or similar, and often implies, solidarity, unity, a common link, a shared interest. *Toktok* would mean "talk" or "to talk".

In the urban context, the meaning of the word has been elaborated further to include people that came from the same district or sub district, even though they may not share the same language. The term is not used as frequently in the rural areas as in the urban centers, where there is felt a need to distinguish one's own group from the outside. In the rural areas, immediate family or clan is more important.

True Wantoks imply a relationship where obligations of reciprocity and rights to expect certain things. *Extended Wantoks* suggest that the individual has more freedom to choose, whether he or she would help or not.

The *Wantok* system allows for income transfers and other support from members of a particular *Wantok* to needy members of the same *Wantok* system. The household survey (Gibson 1995) reported that inter-household income transfers remain a very important means of assisting households in need across all income groups, although informal transfers do not appear to improve the income distribution in rural areas. The system has adapted relatively well to the changing economic environments and is quite important in urban as well as the rural areas.

Results from the 1996 PNG Household Survey (Table 3.32) show that more than 90% received transfers and more than 90% of households made transfers. Income transfers (receiving and giving) were important in all income groups and regions in the PNG.

In communities characterized by high levels of poverty and despair (in times of natural disasters), the *Wantok* system may be ineffective. Therefore the system requires interventions such as targeted income transfers (subsidized health and education services, etc.) and improved provision of government and NGO funded emergency and relief services.

Table 3.32 Households giving and receiving private inter-household cash and in-kind transfers in PNG.

	Receiving Transfers (%)			Giving Transfers (%)		
	Cash	In-Kind	Total	Cash	In-Kind	Total
Consumption Quartile	25.3	88.6	90.1	22.7	79.4	81.2
I (poorest)	28.3	89.0	90.0	30.5	90.1	92.1
II	38.8	92.9	93.1	38.5	91.8	95.0
III (richest)	46.7	92.2	94.5	57.8	92.6	96.8
Region						
National Capital District	45.6	84.5	89.1	71.9	82.2	90.9
Papuan South Coast	40.8	94.3	96.3	29.9	93.7	93.7
Highlands	43.3	93.4	94.2	46.6	89.0	92.2
Momase/North Coast	20.9	84.8	86.6	25.3	87.0	90.5
New Guinea Islands	38.4	96.3	96.3	44.6	89.9	91.4
Papua New Guinea	35.6	90.9	92.1	38.6	89.4	91.8

Source: PNG household Survey (1996).

Wage-linked social insurance

A small proportion of the population benefits from the country's wage-linked social insurance scheme. These include the National Provident Fund, Public Officers Superannuation Fund, and the Defense Force Retirement Benefit

These wage-linked social security schemes provide an effective safety net for wage earners and their families in the formal and public sector. Although this is only small, it is an important safety mechanism that will grow in importance as the country develops, resulting in a larger share of the labour entering the formal labour market as wage earners. This of course will depend on the government's ability to implement a series of measures that can strengthen the financial performance of these funds.

Over the years these schemes suffered from a number of factors such as:

- The lack of prudential supervision and regulation.
- Poor investments.
- Government use of pension funds for capital investment of questionable quality.
- Political interference – such as the frequent replacement and appointment of high office holders for political reasons rather than for their qualifications and expertise.
- Large government arrears to the fund for public sector employees.

It is therefore very important that these schemes be reformed to guarantee their effectiveness in the future. It is important to establish a body to regulate and supervise these funds, adopt superannuation legislation, improve governance and accountability and to revoke the power of the government to issue investment guidelines to these funds.

Price support schemes

Price support schemes for the major agricultural export crops have had a long history in PNG. They were designed primarily to protect the producers of specific commodities from fluctuations in the world market to allow a smooth flow of income. During times of low world market prices, the schemes were to pay growers a bonus. This bounty was to be collected during times of high commodity prices. These schemes were essentially self-financing from their establishment up to the end of the 1980s. However, with the collapse of world market commodity prices in the late 1980s, the stabilization funds became essentially insolvent and were replaced with government-assisted export price support programs. The government-assisted export price support schemes were extremely costly and ill targeted. During the first half of the 1990s, the average annual expenditure of the Department of Agriculture and Livestock was more than two-thirds of the overall budget in support of agricultural development (World Bank 1997). These schemes proved unsustainable due the enormous burden of maintenance. Although these schemes did help smooth the income of some export crop

producers, most of the smallholders benefited little. The bulk of the benefits accrued to owners of large estates/plantations rather than smallholders. With respect to poverty prevention, these price support schemes were not very effective. Results from the household survey and numerous other studies (e.g. Posonai 1986; Allen and Bourke 1997) show that poverty remains widespread among the smallholders. These funds would be used more effectively to boost agricultural and rural development through investments in rural infrastructure and basic social and agricultural support services.

Social development schemes

In the late 1970s a social development scheme was established, known as the Village Development Fund. It was meant to provide financial assistance to rural people. The assistance was through grants and loan-based assistance to villagers with viable projects where they made 30% contributions. The scheme was, however, transferred to a fund for parliamentarians who distributed resources to their electorates at their own discretion. More recently the fund has been put under the administration of the District Planning Committee, of which the local parliamentarian is the chairman. There was no accountability of these funds as the managers of the funds were not obligated to report on the use of the funds. Allocations have been made to those in need in the form of income subsidies, assistance with education expenses, assistance with medical expenses, assistance to disaster stricken families, and community development projects.

However, this scheme fails as a social safety net mechanism, as there are no clear criteria to define target beneficiaries and guidelines to access these funds and what the funds can finance. For this scheme to be effective it must be a social assistance scheme in the true sense, where its administration is based on well-defined, transparent rules and criteria.

It could be changed into a fund where the benefits are communal. For example it could provide those in need with support through self-target work-fare schemes. Such programs would provide unskilled low-wage work on demand at a wage rate low enough to guarantee that only those in real need are willing to participate. The labour would be used to build and maintain high priority community infrastructure in poor areas. If the scheme is properly designed and funded, it can be an effective safety mechanism to help alleviate chronic and transient poverty (e.g. economic problems, natural disasters).

Disaster relief mechanisms

In times of disasters, both government and NGOs have mechanisms to provide relief to affected communities. The National Disaster and Emergency Service is responsible for the government's disaster relief program, while the NGO programs are carried out by the Red Cross, Salvation Army and St. John's Ambulance. Although much needed assistance has been provided through these disaster relief mechanisms, their operations often suffer from limited technical know-how, lack of well developed emergency relief operational plans, and financial constraints.

Assistance in times of disasters will remain critical in PNG unless support is given to areas highlighted above. In times of disasters, the *Wantok* system does provide assistance; however, it does not appear to improve rural income distribution.

4. Policy, Information and Research Implications

4.1 The National Food Security Policy

The national strategy for achieving food security in PNG is framed along the general outline set out by the FAO Strategic Framework for 2000 – 2015, which was approved by the Council in its 30th Session, Rome, 12th – 23rd November, 1999.

The PNG national strategy for achieving food security will consist of a complementary set of documents, which together will facilitate the plan of action against food insecurity, and poverty and will become the "PNG National Framework for Food Security, 2000 – 2015". The National Framework will consist of (i) the National Food Security Policy Statements, (ii) a Medium Term Strategic Plan of Action (2000-2015), (iii) the Food Security Work Programme, and (iv) the Work Programme Budget.

Papua New Guinea National Food Security Policy shares a common purpose with the FAO of:

- Raising levels of nutrition and standards of living of people under their respective jurisdictions.
- Securing improvements in the efficiency of production and distribution of all food and agricultural products.
- Bettering the conditions of the rural populations.
- Contributing towards growth of the national economy and ensuring the people's freedom from hunger.

The government seeks to create an enabling policy environment to enhance food production and strengthen the government's capacity to achieve:

- Access of all people at all times to sufficient nutritionally adequate and safe foods, ensuring that the number of chronically undernourished people is reduced by half no later that 2015.
- The continued contribution of sustainable agricultural and rural development including fisheries, and forestry to economic and social progress and well being of all.
- The conservation, improvement and sustainable utilization of natural resources, including land, water, fisheries and genetic resources for food and agriculture.

The proposed reforms of the National Food Security Policy are generally consistent with sectoral objectives, policies and programs. Food security and nutritional security are linked in an interactive way, therefore the proposed policies seek to integrate food and nutrition research, training and awareness and promotion programs as a component of the national food security strategy. The national food standards have to be reviewed and updated to support produce standards, which can be use to monitor domestic production and processing. The quality of imported food items should be monitored.

The policies submitted here for NEC endorsement are set on a strategic national framework for the medium term, are consistent with the FAO Strategic Framework for 2000-2015. The policies bring to clear focus the roles and responsibility of all key players to strongly enforce a multi-sectoral partnership in the conduct of the National Food Security Work Program.

4.2 Programs for attaining food security in Papua New Guinea

Objective analysis of the food industry indicate that food security would result through the interplay of several factor.

Strengthening of institutional linkages and collaboration between food programs

There is a need to strengthen the linkage and collaboration between all agencies and departments that are associated with food security. This should be done both at the national and provincial levels. The newly created Food Security Branch within DAL must be given the responsibility to coordinate this. Participatory planning should be pursued to reduce duplication of activities and wastage of resources.

Strong linkage, collaboration and communication with donor agencies are important. Flexibility in donor finance packages along with government meeting all its obligations is essential. Collaboration in rural areas for effective law and order would prevent disruption of activities and help promote food security.

Implementation of programs towards increased and diversified domestic food production

To increase food production it is important to have appropriate research and extension programs. This combined with an effective extension delivery system would promote appropriate management skills for farmers to improve on traditional management practices and sustain diverse food production systems. Realization of these would depend on adequate financial and policy support from the government.

Moderate pricing and reduced tax on agricultural inputs would be necessary for economic and increased food production. A request to this effect needs to be submitted for government's consideration. A suitable land tenure system would need to be introduced to support increased production on a commercial scale. The government should look at the resettlement scheme concept used in the tree crop sector on lease and leaseback arrangement in the Ramu/Markham valleys and the Sepik plains. Relaxation on cultural taboos associated with agricultural practices would go a long way to promoting modern agriculture.

Provision of adequate support system (infrastructure, market and credit)

Without adequate support systems, agricultural production will continue to be hampered. For adequate support systems to be exist, road and transport infrastructure must be improved. Adequate market services, in terms of market information, storage and abattoir facilities, would facilitate supply of quality produce to the market.

Resource poor farmers without access to credit or government assistance will continue to remain at the subsistence level. Even those farmers who have access to some cash income still require credit to increase production. Access to credit has to be addressed not only for production but also for marketing of the produce, at a lower rate of interest and longer period of repayment. There is a need to increase and make available different types of credit schemes. Allocation of K15 million seed money for the smallholder credit scheme has to be increased. It should not only assist producers but also wholesalers and others involved in processing and marketing of agricultural produce.

Downstream processing and preservation of domestic produce

Downstream processing and preservation not only avoid wastage but also add value to agricultural produce. This requires research on downstream processing and preservation of the produce. Rural households need to have knowledge in processing of their traditional and introduced food items.

For processing and preservation to be economically viable there should be an adequate supply of quality raw materials (produce) at reasonable prices. Availability of credit facilities would be crucial to support such ventures. Further, utilization of by-products would make processing and preservation more economical.

Adequate financial support to research, extension and training in downstream processing as well as the availability of appropriate processing facilities and units are essential. Government and private sector investment in downstream processing and preservation of food items should be promoted.

4.3 Pre-requisites for achieving national food security

Favourable policy environment

A favourable policy environment and good governance are essential for agricultural and rural development, particularly, a stable macro-economic environment, at the national, regional and global levels. In order to work and invest, farmers must have viable farming operations. This requires profitable prices for farm products, and availability of inputs and credit at affordable prices. There is therefore a need for a clear and sustained government policy and adequate financial commitment to food security issues, especially in the formative or early years.

Access to land

Access to land is essential for production of crops either for food or for sale. Voluntary mobilization of clan and community land is essential for food security. Undisputed land could be developed without any danger of loss of ownership. The community and the population at large would benefit from communal land use and it should be encouraged.

Irrigation and drainage promotion (water control program)

The drought of 1997 demonstrated how vulnerable and food insecure the nation was when none of the staples were used to feed those who were hungry. Instead we relied on rice, flour and oil from overseas to feed the people in the affected areas. Irrigation is a new concept for farmers in Papua New Guinea. With irrigation, two or three crops could be grown each year on the same land instead of one or in some cases none. Thus access to water is essential for increasing food security.

Irrigation requires technical perfection and national technicians and farmers should be trained. Overseas assistance is required and bilateral and multilateral aid agencies must be approached to provide technical assistance in this field.

On the other hand, in some areas, seasonal flooding can cause heavy crop losses. This puts agricultural land out of production. Therefore, appropriate drainage systems to safeguard against crop losses should be developed.

Knowledge and skills

Farmers must be adequately trained to use new technologies, if they have to move from subsistence farming into commercial production. They need information not only in production but also in processing, post harvest technologies, marketing and pricing. By giving people formal and informal education and training we empower them to see, appreciate and to do things better than when left in ignorance.

There is a need to strengthen the overall national education system, which also includes formal and informal agricultural training.

Gender and food production

It is estimated that in many developing countries, including Papua New Guinea, women are responsible for 60-70% of the work involved in food production, storage, marketing, processing, preparation and consumption. Therefore, the empowerment of women must be given priority, and women must be integrated into all activities as decision makers, and as resources for sustainable development.

The Department of Agriculture and Livestock, in compliance to the Rome World Food Summit Declaration, has established a Gender Unit within its Policy, Planning and Budgeting Division, to address gender related issues in agricultural development. The unit should be strengthened and adequately resourced to play an active role in food security.

The Department of Health has endorsed this and expressed its support to all activities undertaken by this unit to address food and nutritional security.

Farmers' organisations

Genuine farmer organisations promote farmers' interests and welfare. These organisations should be encouraged to actively participate in future agricultural development programs. It is vital that farmers should be able to express their views and needs in a coordinated manner for the purpose of self organisation, influencing decision-makers, and making effective alliances. This can only be done through strong farmers' organizations.

The participation of women farmers and young farmers, and their involvement and integration in the decision-making structures is vital for the strength and future of farmers' organisations.

Agriculture, food and nutrition data

Available data on domestic food production, distribution and nutritional status are still either inadequate or outdated for all provinces. It is imperative therefore to encourage all stakeholders to give a high priority to the collection and provision of these data. This would facilitate planning interventions, strategies and mechanisms to enhance food production. Adequate funding and resources should be provided to undertake this task.

National food and nutrition standard

Food security and nutritional security are linked in an interactive way. Hence there is a need within the national food security policy to integrate food and nutrition research, training and awareness and promotion programs as a component of national food security strategies. The national food standards have to be reviewed and updated to support produce standards that can be used to monitor domestic production and processing. Quality and safety standards of imported food items should be monitored.

Buffer stocks and redistribution schemes

Food security should include the provision of food to urban non-food producers. It should also address the need for a continuous supply of food, including during transitory or emergency situations such as famine, drought, frost, flood, crop failure, volcanic eruptions, tsunamis, and political/economic instability. Therefore, there is a need to establish and manage buffer food stocks as a component of food security.

Food insecurity is found even in countries where food is abundant, indicating available food is not equitably distributed.

4.4 Current policies and programs that may influence food security status

New organic law on provincial and local level governments

The new organic law on provincial and local level government introduced in July 1995 stipulates that the planning and implementation of all development programs and projects be based at the district level to satisfy the needs of the people in the district. Therefore, there is a need to channel development resources directly to the rural areas to be used for human development and improvement of their living conditions. It is imperative that an integrated planning team, consisting of representatives of all the departments that contribute directly to food security, must be involved in the planning of district programs.

National Health Plan (1996-2000)

The National Health Plan (1996-2000) focuses on five priority policy areas. They are:

- Increased services to the rural majority
- Expansion of health promotion and prevention of diseases
- Re-organization and restructuring the national health system
- Developing staff to enhance professional, technical and management skills
- Upgrading and maintaining investment infrastructure.

No serious implementation or effect has been seen yet. No doubt, poor health correlates positively with food insecurity. The health delivery system in all provinces needs to be improved.

The National Education Plan (1994-2000)

This plan aims at providing quality education for all through awareness campaigns, school construction, subsidized school fees, teacher training, curriculum reform, and provision of text books, equipment and material, etc., and an education reform aiming for increased enrolment and avoiding early dropouts. These are generally being implemented but with limited success at the moment.

Ignorance and/or lack of appropriate knowledge retard food security program formulation and/or implementation. Education on food and nutrition needs to be introduced or strengthened in school curricula at appropriate levels.

The 1996 Rome World Food Summit Policy Submission

A policy submission on the "implementation of the Rome Declaration on World Food Security and World Food Summit Plan of Action and Program on Plan of Action for Papua New Guinea ", was adopted by the National Executive Council (NEC). However, the recommendations are either not yet implemented or partially implemented. These need to be addressed.

On-going programs in support of food security need to be evaluated and the appropriate ones fully supported to contribute significantly to food security. The following programs that are currently implemented (and the agencies assisting) in support of the national food security need to be supported: (i) FAO Special Program in Support of Food Security, (ii) National Agricultural Research Institute (NARI), (iii) National Agricultural Quarantine and Inspection Authority, and (iv) National Rice and Grain Development Project.

The bilateral programs include: (i) 2KR project (JICA), (ii) highland inland fisheries development through JICA, (iii) rice and vegetable development assisted by R.O.C. (Taiwan) Technical Mission, (iv) Fresh Produce Development Company supported by New Zealand Overseas Development Assistance, (v) Trukai Industry Rice Development Program, and (vi) the

recently initiated Smallholder Support Services Pilot Project funded by the Asian Development Bank.

Agriculture days and awards

To boost agriculture and food security, days should be set aside and celebrated each year as agriculture days. Perhaps this may coincide with World Food Day at the national level. Activities relating to this may be held first at the district level, later at the provincial level and finally at the national level with exhibits and displays from the best farmers. Prizes and awards should be given to each category of exhibition. This would encourage farmers and would give due recognition to agriculture as a noble profession.

5. Summary and Conclusions

5.1 Summary

Papua New Guinea is a very mountainous country, with the mainland rising to 4,500m, and a significant part is not available to agriculture. More than 50% of the land is at an elevation of more than 600m.

In 1995, the PNG population was estimated at 4.03 million (excluding the population of North Solomon and PNG citizens abroad), with a sex ratio of about 110.4. The majority (85%) of the population live in the rural areas deriving their employment and livelihood from agricultural activities. The urban population makes up the remaining 15%. The average population growth of Papua New Guinea between 1980 and 1990 was 2.3%; at this rate the population will double in 30 years.

PNG is rich in natural resources, with gold, copper and agricultural products comprising the most important sources of export earnings. Despite the potential offered by its rich natural resource base, Papua New Guinea's economic development has fallen short of expectations. In the two decades since independence in 1975, the economic development of PNG has been driven by a small modern enclave sector, mainly based on mineral resource extraction, commercial logging and tree crop plantations. Government policies have almost exclusively focussed on fostering the development of these activities. Because it is heavily based on natural resource extraction and plantation agriculture, the performance of PNG's economy is substantially driven by world market commodity prices. Overall, PNG's enclave economy experienced significant but fluctuating growth in output and exports throughout the last two decades, with little impact on the rest of the economy, particularly the agricultural sector.

The traditional sector, mainly subsistence farming, supports more than 80% of the population. Most villages are self-sufficient and only small surpluses of produce are available for trading. The growth of towns has, however, encouraged small-scale cash cropping in nearby villages, and these crops are sold by village people in town markets.

Papua New Guinea's social indicators are well behind those of other members of the group of middle income economies, close to those seen in the lower income group. The benefits of economic growth may have been unevenly distributed and that poverty remains a development problem in PNG. Life expectancy is estimated at 53 years and the literacy rate is 63%. Women remain at a fundamental disadvantage due to cultural factors, heavy workload associated with subsistence production, relatively poor health conditions and historically poor access to educational opportunities and training.

When the first Food and Nutrition Conference was held in 1983, the national policy on food production and nutrition had two primary objectives:

- To reduce the country's dependence on imported foods
- To improve the nutritional status of the population.

Papua New Guinea produces enough starchy food tuber crops and bananas, but imports a lot of cereal-based products. Domestic pork and chicken production is adequate, however, to satisify the current requirements, the industries still depend on imported feeds. Food imports have escalated from over K200 million in 1994 to K325 million in 1995 to the current value of almost K600 million.

The government faces a dilemma. The government is understandably concerned about rising food imports and dependence on overseas suppliers of vital food items. The more so considering that PNG has extensive fertile land, and from a purely physical point of view can supply all its needs. But the marked price and institutional conditions do not facilitate food production.

Improving food security will mean addressing the malnutrition problem in the country. Since more than 80% of the people live on subsistence agriculture, more emphasis should be focused on improving and sustaining the agricultural system.

Cash income is very limited in the rural areas and the government is challenged to provide and increase income generating opportunities. Low income areas, must be properly identified and formally recognized at the national level, probably at the census division rather than the district level.

Transport and access to markets are often major constraints. If these constraints can be overcome there are possibilities for increasing cash production. Building roads willy nilly into poorly accessed areas is not the solution. The national road network needs to be planned and funded nationally and rationally. Too often money is thrown away trying to provide cheap access to isolated areas using the bulldozer driver as surveyor-cum-engineer approach. This leads to badly aligned and constructed roads that do not last the first wet season.

The health services should be a priority in the push for rural development. This is particularly true for the remote rural areas where the rate of malnutrition is often high. Better support and supervision need to be given to health workers and teachers working in remote poor rural areas. In exchange for improved support, they should agree to deliver a minimum standard service to the people of the area.

Children in most isolated areas have adequate intakes of energy. The matter of how to provide them with greater intakes of protein should be examined.

Government services are very poor in the rural areas and continue to deteriorate. Health, education and agricultural services are non-existent for a majority of these rural communities. Even where these services exist they operate at very low efficiency, providing services only to the station population and not to the surrounding population.

Past developmental projects should be examined for what worked and what did not. This does not need to be a major exercise in cost-benefit analysis but a largely qualitative assessment of the project objectives and achievements. This should be carried out in close consultation with the people who were supposed to benefit. A lot of rural development projects failed and left almost no trace; it is important to know why to avoid making the same mistake in the future.

The National Food Security Policy launched in 2000 has as its primary objective the creation of awareness and seeking support to increase and diversify food production, processing and preservation, marketing and distribution in order to achieve greater self sufficiency in food and the attain security at national, provincial, district and household levels by the year 2015. This can be realized through agricultural production and productivity, income earning through domestic agricultural production and productivity, income earning through domestic marketing and exports and a rise in living standards.

Although the policy strategies and recommendations are directed at individual departments and agencies, food security is an outcome of interactions of many influences, including agricultural, health, education and social factors. The policy pays attention to education, nutrition, health and environmental interactions with food security.

5.2 Conclusions

In conclusion, the long-term sustainability of national food security in Papua New Guinea is precarious, based on the present trend of over-dependence on imported foods. To reverse this trend, PNG should seriously look at developing and strengthening its own capacity to improve the domestic food supplies with proper supportive structures and measures.

However, food security does not necessarily mean that we have to grow all our food. The proportion of imported and locally produced food should depend on relative prices and what products PNG can produce best. In planning for food security, the government has the role of providing research and development of food and cash crops. It is the markets and producers who will determine the type of crops and locations they will be grown in. Inefficient production of

crops that PNG is not good at will only use up valuable resources that could be better used for crops with a competitive advantage.

Food security is a complex issue involving a wide range of social, environmental and economic factors. There is a need for greater integration of the different sectoral entities. Agriculture, forestry, fisheries, health, education, and environment and conservation departments, NGOs, and others need to link their respective activities in a more collaborative and coordinated way.

It should also be recognized that the tragedy of widespread of food shortages could not be eliminated through government action alone. Thus, a broad mobilization of public and private sector commitment, as well as collective and individual investment, would be necessary to deflect the course of food insecurity in PNG.

The recent drought of 1997 has shown how hard it is to attain food security and this will be almost impossible if the macro economy is not run properly. In future it should be possible for a well-run economy to borrow to get over such catastrophes. PNG has to ensure that its farming systems are able to cope with the growth in population and that it is not depleting the soil through overuse and that new systems being developed that will be sustainable over time.

The improvement of food security will depend on the degree of cooperation and coordination between various government departments and agencies, NGOs, the private sector, donors and other stakeholders. Improving the food security will address some fundamental inequalities in the country. This could be seen as an important step towards meeting the national goals contained in the preamble to the constitution.

6. References

Allen, B.J.; and Bourke, R.M. 1997. Poverty and Agriculture in Papua New Guinea: An In-depth Description of Six Agricultural Systems. Department of Human Geography, Research School of Asia Pacific and Asian Studies, Australian National University, Canberra, ACT, Australia.

Allen, B.J.1985. A review of Socio-economic Data Sources Relevant to Papua New Guinea Export Tree Crops. ACIAR, Project 8552.

Atkinson, G; and Lewis, H. 1992. Recent and future trends in the marketing of fruits and vegetables in Papua New Guinea. *In* Proceedings of the First Papua New Guinea Food and Nutrition Conference (Edited by Malcolm P. Levett, Jane Earland and Peter Heywood) University of Papua New Guinea Press and Department of Agriculture and Livestock. Held at National Sports Institute, Goroka, 31 October to 4 November 1983.

Barraclough, S.L. 1991. An End to hunger ? The Social Origins of Food Strategies. A Report for UNRISD and the South Commission based on UNRISD Research on Food Systems and Society. London and Atlantic Highlands, NI, USA.

Barrau, J. 1965. Witnesses of the Past: notes on some food plants of Oceania. Ethnology 4:282-294.

Bellamy, J.A.; and McAlpine, J.R. (comps) 1995. Papua New Guinea Inventory of Natural Resources, Population Distribution and Land Use Handbook. 2nd edition. PNGRIS Publication No. 6 Prepared by CSIRO for AusAID, Canberra.

Bleeker, P. 1974. Soils. *In* Papua New Guinea Resource Atlas. Ed. E. Ford. The Jacaranda Press.

Bleeker, P. 1983. Soils of Papua New Guinea. CSIRO and ANU Press.

Bleeker, P. 1988. Soils of Papua New Guinea: [map with explanatory notes]. Scale 1:1,000,000. Natural Resource Series No. 10. CSIRO, Division of Water and Land Resources.

Bourke, R.M. 1977. A long term rotation trial in New Britain, Papua New Guinea. *In* Proceedings of the Third Symposium of the International Society for Tropical Root Crops (Leaky, C.L.A., ed), pp 382-388. International Society for Tropical Roots Crops in collaboration with The Institute of Tropical Agriculture, Ibadan, Nigeria.

Bourke, R.M. 1982. Agronomic Field Trials on Food Crops in Papua New Guinea: 1928-1978. Technical Report Report No.82/83. Department of Primary Industry, Port Moresby.

Bourke, R.M. 1992. Fifty years of agricultural change in a New Guinea Highland village. *In* Proceedings of the First Papua New Guinea Food and Nutrition Conference (Edited by Malcolm P. Levett, Jane Earland and Peter Heywood) University of Papua New Guinea Press and Department of Agriculture and Livestock. Held at National Sports Institute, Goroka, 31 October to 4 November 1983.

Bourke, R.M.; Carrad, B.; and Heywood, P. 1981. Papua New Guinea's Food Problems: Time for Action. Research Bulletin No. 29. Department of Primary Industry. Port Moresby.

Bradley, C. 1985. Attitudes and practices relating to marital violence among Tolai of East New Britain. *In* Toft, ed, Domestic Violence in Papua New Guinea, Law Reform Commission, Monograph No.3, pp.32-71.

Bray, R.S.; and Anderson, M.J. 1979. Falciparum malaria and pregnancy. Transactions of the Royal Society of Tropical Medicine and Hygiene 73:427-431.

Brookfield, H.C.; and Hart, D. 1966. Rainfall in the Tropical Southwest Pacific. Research School of Pacific Studies, Department of Geography Publication G/3, ANU, Canberra

Bureau of Mineral Resources. 1972. Geology of Papua New Guinea, 1:1,000,000, Canberra.

Carmen, K. 1989. Soil Loss and Runoff from Demonstration Gardens in Matalau Village, East New Britain Province. Technical Report 89/4. Department of Agriculture and Livestock. NCD. Papua New Guinea. 19 pp.

Chao, M. 1984. Leadership. *In* D. Whiteman, ed, An Introduction to Melanesian Culture. The Melanesian Institute, pp. 127-148.

Cook, K.K.; Kurika, L; Ling, G; Moxon, J.E.; and Nivenimo, T. 1989. A Rapid Rural Appraisal of Cocoa and Coconut Based Farming System in the North East Lowlands of the Gazelle Peninsula of East New Britain Province 2-14 October, 1988. Unpublished Report, Department of Agriculture and Livestock. LAES. Kerevat, E.N.B.P.

CSIRO Land Research Series (1964-1976) publications.

Cundall, J.; Cook, K.; Qually, W.; Ling, G.; Nivenimo, T; Levett, M.; Kurika, L.; Latain, O.; Paon, K.; and Tokugerewa, M. 1988. Small holder preferences and agroforestry potential in the northeast lowlands of the Gazelle Peninsula of East New Britain. Unpublished Report, Dept of Agriculture and Livestock. L.A.E.S. Kerevat, E.N.B.P.

Das, D.K. 1992. A study of marketing costs amd margins of meat in Lae. *In* Proceedings of the First Papua New Guinea Food and Nutrition Conference (Edited by Malcolm P. Levett, Jane Earland and Peter Heywood) University of Papua New Guinea Press and Department of Agriculture and Livestock. Held at National Sports Institute, Goroka, 31 October to 4 November 1983.

Department of Agriculture. 1941. Annual Report of the Department of Agriculture for the year ending 30th June, 1940. New Guinea Agriculture Gazette 7:77-166.

Department of External Territories. 1950. Report of the New Guinea Nutrition Survey Expedition 1947. Government Printer, Sydney.

Department of Trade and Industry. 1999. Statistical Digest. 1989/1999.

Dow, D.B. 1974. Geology. *In* Papua New Guinea Resource Atlas. Ed E. Ford, Jakaranda Press.

FAO. 1986. Rice Development Policy: an Analysis of the Options for Meeting Future Rice Consumption Requirements in Papua New Guinea, Rome.

Finlayson, M.; McComb; Hardaker, B.; and Heywood, P. 1991. Commercialisation of Agriculture at Karamui, Papua New Guinea: Effects on Household Production, Consumption and the Growth of Children. Report of a Joint Project of the PNG Institute of Medical Research, Madang, and the University of New England, Armidale.

Flores, A.S.; and Haris, G.T. 1982. The marketing of fruits and vegetables in Port Moresby. Pacific Viewpoint 23:146-160.

Ford, E. 1974. Climate. *In* Papua New Guinea Resource Atlas, ed E. Ford. Jakaranda Press.

Gibson, J. 1995. Food Consumption and Food Policy in Papua New Guinea. Institute of National Affairs Discussion Paper No.65. Port Moresby, Papua New Guinea.

Gibson, J. 1998. Urban demand for food, beverages, betelnut and tobacco in Papua New Guinea. Papua New Guinea Journal of Agriculture, Forestry and Fisheries 41(2):37-42.

Gillet, J.E. 1990. The Health of Women in Papua New Guinea. Papua New Guinea Institute of Medical Research Mongraph No.9:55, Goroka. EHP. Papua New Guinea.

Green, E.C. 1941. The cultivation of native food crops. New Guinea Agric. Gaz. 7:44-99, 225-235.

Groos, A.; and Hide, R.L. 1989. 1987/1988 Nutrition Surveys of Karamui and Gumine Districts, Simbu Province. Final Report from the Papua New Guinea medical Research Institute of Medical Research to the South Simbu Rural Development Project. PNG Institute of Medical Research, Madang

Groos, A.1988. Nutrition Surveys of Karamui District, South Simbu, 1985/86. Reports to the Department of Simbu, Simbu Province, PNG Institute of Medical Research, Madang.

Haantjens, H.A. 1970. Soils. *In* An Atlas of Papua New Guinea. Ed Ward, R.G. and Lee. D.A.M. University of Papua New Guinea and Collins Longman.

Haantjens, H.A. 1970. Soils. *In* An Atlas of Papua New Guinea. (Ed.) Ward, R.G. and Lee. D.A.M. University of Papua New Guinea and Collins Longman.

Haantjens, H.A.; Reynders, J.J.; Mouthaan, W.L.P.J.; and van Baran, F.A. 1967. Major Soil Groups of new Guinea and their Distribution. Royal Tropical Institute, Armsterdem, The Netherlands.

Hale, P.R. 1978. Rice. *In* D.R.J. Densley (Ed). Agriculture in the Economy. Dept. Primary Industry.

Hanson, L.W.; Allen, B.J.; and Bourke, R.M. 1999. Mapping Land Resource. Draft Technical Report. Department of Human Geography. Research School of Pacific and Asia Studies. The Australian National Univeristy, Canberra.

Harding, P.E.; Bleeker, P.; and Freyne, D.F. 1986. A Handbook for Land Suitability Evaluation for Rainfed Arabica Coffee Production in Papua New Guinea. Coffee Research report No. 3. Coffee Research Instituite, Kainantu, PNG.

Harris, G.T.1980. Replacing Imported Food Supplies to Port Moresby. Development Studies Centre, Occasional Paper No.17. Australian National University. Canberra. Australia.

Hart, D. 1970. Rainfall. *In* An Atlas of Papua New Guinea. Ed Ward, R.G. and Lee, D.A.M., University of Papua New Guinea and Collins Longman.

Heywood, P.; Singleton, N.; and Ross, J. 1988. Nutritional status of young children – the 1982/83 National Nutrition Survey. Papua New Medical Journal 31:91-101.

Heywood, P.F.; and Hide, R.L.1992. Nutritional effects of export crop production in Papua New Guinea. *In* Papua New Guinea National Nutrition Workshop. Port Moresby. Institute of National Affairs Discussion paper No. 54

Heywood, P.F.; Allen, B.; Fandim, T.; Garner, P.; Hide, R.; Joughin, J.; Junemberry, J.; Mathie, A.; Numbuk, S.; Ross, J.; and Yaman, C. 1986. A Rapid Rural Appraisal of Agriculture, Nutrition and Health in Wosera Sub-District, East Sepik Province. A report prepared by the Papua New Guinea Institute of Medical Research, pp 1-120.

Hiawalyer, G.1996. Health information system for non communicable diseases. *In* Report on Course in Nutrition Education (Diabetes). 7-11 October, 1996. Port Moresby.

Hipsley, E.H.; and Clements, F.W. 1950. Report of the New Guinea Nutrition Survey Expedition 1947. Dept. External Territories. Canberra.

Holloway, I. 1976. The situation of women in Papua New Guinea. Papua New Guinea Medical Journal 19:74-78.

Humphrey, W. 1996. 1994 Annual Report of Soil Conservation and Management Section at L.A.E.S. Kerevat. *In* Agricultural Research Division Staff, 1994 Annual Research Report. Department of Agriculture and Livestock. PNG.

Igua, P.; and Binifa, J. 1999. The Effect of Selected Hedgerow Species as Erosion Barriers on Sloping Land on Valocanic Derived Aoils of the Gazelle Peninsula. National Agriculture Research institute, Lowlands Agricultural Research Station, Kerevat. Papua New Guinea.

Jarrett, F. 1985. Innovation in Papua New Guinean Agriculture. Institute of National Affairs, Port Moresby.

Jorari, A.; and Laisa, M. 1996. Population Projection for Citizen Population of PNG for Period 1990-2020. Research project No.4 of Project PNG/94/POI,NPO/NSO/UNFPA/ILO, Port Moresby.

Joughin, J.; and Gimbol, C. 1987. Variations in Food Energy Costs – An Analysis of Rice Prices in Papua New Guinea. Technical Report 87/2. Department of Agriculture and Livestock, Konedobu.

Joughin, J.; and Kalit, K. 1986. The Changing Cost of Food in Papua New Guinea: an Analysis Prices in Five Urban Markets. Technical Report 64. Department of Primary Industry, Port Moresby.

Kesavan, V. 1992. Agronomic research in Papua New Guinea: past efforts and future prospects. *In* Proceedings of the First Papua New Guinea Food and Nutrition Conference. (eds: Malcolm P. Levett, Jane Earland and Peter Heywood). National Sports Institute, Goroka, E.H.P. Papua New Guinea. October 31 to November 4 1983. Pp: 80-89.

King, T.; Sugden, C.; and Cook, A. 1996. The Economy of Papua New Guinea: 1996 Report. Australian Agency for International Development. International Development Issues No. 46.

Koley, C.; and Waliji, Z. 1992. Farming patterns in food gardens: an analytical approach. *In* Proceedings of the First Papua New Guinea Food and Nutrition Conference (Edited by Malcolm P. Levett, Jane Earland and Peter Heywood) University of Papua New Guinea Press and Department of Agriculture and Livestock. Held at National Sports Institute, Goroka, 31 October to 4 November 1983.

Lambert, J. 1979. The Nutritional Implications of the Household expenditure Survey. Mimeo National Planning Office.

Leng, A.S. 1992. A review of methods of maintaining soil fertility in Papua New Guinea farming system. *In* Proceedings of the first Papua New Guinea Food and Nutrition Conference (Edited by Malcolm P. Levett, Jane Earland and Peter Heywood) University of Papua New Guinea Press and Department of Agriculture and Livestock. Held at National Sports Institute, Goroka, 31 October to 4 November 1983.

Loffler, E. 1974. Explanatory Notes to the Geomorphological Map of Papua New Guinea. CSIRO Land Research Series No.33 (CSIRO: Melbourne).

MacDonald, M. 1984. Melanesian communities: past and present. *In* D. Whiteman, ed, An Introduction to Melanesian Cultures. The Melanesian Institute, pp. 213-230.

Macewan, J.M. 1978. Subsistence Agriculture. In Agriculture in the Economy (Densley, B., ed.) Department of Primary Industry

Marks, G. 1992. Effectiveness of Current Nutrient Programmes and Action Plan for 1991-1995. Mission Report, WHO and Government of Papua New Guinea.

McAlpine, J.R.; Keig, G.; and Rex Falls. 1983. Climate of Papua New Guinea. CSIRO and ANU Press, Canberra.

McAlpine, J.R.; Keig, G.; and Short, K. 1975. Climatic Tables for Papua New Guinea. CSIRO Div.Land Res., Tech. Paper No.37.

McKillop, B. 1976. A history of agricultural extension in Papua New Guinea. *In* Department of Primary Extension Bulletin 10.

Mola, G.; and Aitken, I. 1984. Maternal Mortality in Papua new Guinea 1976-1983. Papua New Guinea Medical Journal 32:65-71.

Morrison, T.K. 1984. Cereal imports by Developing Countries. Trends and Determinants. Food Policy February 1984.

Muirden, N. 1973. Family Planning. *In* C.O. Bell, ed, Diseases and Health Services of Papua New Guinea. Department of Public Health, pp.481-485

National Agricultural Research Institute (NARI). 2000. Rice and Research Programme: Addressing Papua New Guinea Food Security. Five-Year Public Investment Programme (PIP): 2001-2005. Lae, Papua New Guinea.

National Nutrition Survey (NNS). 1982-1983.

National Statistics Office (NSO). 1990. Population Census.

National Statistics Office NSO). 1994. Report on 1990 National Population and Housing Census in Papua New Guinea. National Statistical Office, Port Moresby.

Newton, K.; and Jamieson, G.I. 1968. Cropping and soil fertility studies at Kerevat, New Britain, 1954-1962. Papua New Guinea Agricultural Journal 20:25-51.

Noah, J. 2000. Food Security: Some Macroeconomic dynamics in ensuring food security. Paper read at the Papua New Guinea Food and Nutrition 2000 Conference. Rose Kekedo Convention Centre, Papua New Guinea University of Technology, Lae. 26–29 June 2000.

Noel, J. 1992. Food Production and nutrition – a policy perspective. *In* Proceedings of the First Papua New Guinea Food and Nutrition Conference (Edited by Malcolm P. Levett, Jane Earland and Peter Heywood) University of Papua New Guinea Press and Department of

Agriculture and Livestock. Held at National Sports Institute, Goroka, 31 October to 4 November 1983.

Ollier, C.D.; and Bain, J.H.C. 1972. Geology of Papua New Guinea. *In* Encyclopaedia of Papua New Guinea, (ed Peter Ryan) 1:479-85.

Papua New Guinea National Nutrition Policy Workshop. 1992. Department of Agriculture and Livestock. Institute of National Affairs Discussion Paper No. 54.

Papua New Guinea Resource Information System (PNGRIS).

Posonai, E.P. 1986. Household Food Security: with Particular Reference to the Identification of Households with Food Security Problems in Four Selected Districts in Papua New Guinea. Monograph Series 2, Port Moresby: Department of Health.

Price, A.V.G.; and Tulloch, J. A. 1966. Diabetes mellitus in Papua New Guinea. The Medical Journal of Australia 18:645-648.

Rashimah, N. 1992. Community-based processing industries for Papua new Guinea: Experiences with the Situm Banana Chip Enterprises. *In* Proceedings of the First Papua New Guinea Food and Nutrition Conference (Edited by Malcolm P. Levett, Jane Earland and Peter Heywood) University of Papua New Guinea Press and Department of Agriculture and Livestock. Held at National Sports Institute, Goroka, 31 October to 4 November 1983.

Ruthenberg, H. 1980 Farming Systems in the Tropics. 2nd Edition. Clarenden Press. Leng, A.S. 1992. A Review of Methods of Maintaining Soil Fertility in Papua New Guinea Farming System.

Sackett, M.A. 1976. The future requirements for staple foodstuffs in the urban sector of Papua New Guinea. *In* Wilson, K. and Bourke, R.M. (eds). Proceedings of 1975 Papua New Guinea Food Crops Conference. Department of Primary Industry. Konedobu.

Sinha, A.K. 1996. Diabetes. Diagnosis, management and complications. *In* Report on Course in Nutrition Education (Diabetes). 7-11 October, 1996. Port Moresby.

Spencer, I.T.; and Heywood, P.1982. Staple foods in Papua New Guinea: their relative supply in urban areas. Food and Nutrition Bulletin 5:40-46.

Swinbank, A. 1992. The EEC's policies and its food. Food Policy p.53-64.

Taufa, T. 1996. Changing lifestyle, mine development and its consequences. *In* Report on Course in Nutrition Education (Diabetes). 7-11 October, 1996. Port Moresby.

Townsend, P.K. 1985. The Situation of Children in Papua New Guinea. A report prepared by Papua New Guinea Institute of Applied Social and Economic Research for the Department of Finance and Planning.

Tyler, J.M. 1993. Smallholders Opinion about Management of Sustainable Agroforestry in the Gazelle Peninsula. M.Sc. Thesis. Dept. Graduate Studies, University of Guelp.

Walters, C.L. 1963. Survey of Indigenous Agriculture and Ancillary Surveys 1961-62. Bureau of Statistics, Konedo bu. Papua New Guinea.

Webster, D. 1977. Educational Indicators for Community Schools Sector. Department of Education, Management and Planning Unit.

Webster. 1989. Asia and Pacific Program of Educational Innovation for Development (APEID) 1989. *In* Gillet, J.E. 1990. The Health of Women in Papua New Guinea. Papua New Guinea Institute of Medical Research Mongraph No. 9: 55, Goroka. EHP. Papua New Guinea.

Werner, D. 1977. Where There Is No Doctor. Palo Alto; The Hesperian Foundation.

Whyte, M. M. 1958. Body fat and blod pressure of natives in New Guinea: reflections on essential hypertension. Australasian Annals of Medecine 7:36-46.

Wilson, R.K. 1974. Socio-economic Indicators Applied to Sub-Districts of Papua New Guinea. Melbourne University, Australia.

Wohlt, P.B. 1986. Subsistence Systems of the Enga Province. Department of Enga Province Technical Bulletin No.3. Division of primary Industry, Subsistence Unit, Wabag.

World Bank. 1995a. World Development Report 1995- Workers in an Integrating World. Oxford University Press, New York.

World Bank. 1995b. Papua New Guinea: Delivering Public Services. Volume III –Main report, Country Department III, East Asia and Pacific Region, Report No. 144414- Papua New Guinea.

World Bank. 1997. Papua New Guinea: Accelerating Agricultural Growth – An Action Plan. Washington DC.

World Bank. 1998. World Development Indicators. Washington D.C.

Yen, D.E. 1974. The sweet potato and Oceania. B.P. Bishop Mus. Bull 236.

Young, 1986. *In* Gillet, J.E. 1990. The Health of Women in Papua New Guinea. Papua New Guinea Institute of Medical Research Mongraph No.9:55, Goroka. EHP. Papua New Guinea.

Appendix Tables

Table 1 Papua New Guinea value of imports, exports and balance of trade 1985-1998.

Year	Exports	Imports	Balance of Trade
1985	917.4	866.9	50.5
1986	1,017.1	904.1	113.0
1987	1,096.5	993.0	103.5
1988	1,248.3	1,133.4	114.9
1989	1,231.1	1,254.0	-22.3
1990	1,197.9	1,141.2	56.7
1991	1,456.6	1,336.0	120.6
1992	1,938.8	1,275.0	663.8
1993	2,525.1	1,110.0	1,415.1
1994	2,682.0	1,336.0	1,346.0
1995	3,420.0	1,620.0	1,800.0
1996	3,334.0	1,996.0	1,338.0
1997	3,079.0	2,129.0	950.0
1998	3,707.0	2,231.0	1,476.0

Source: National Statistical Office for historical, Exports up to 1993 and Imports up to 1990; Bank of Papua New Guinea, Balance of Payment System, for export 1994 to 1998 and imports 1991 to 1998.

Appendix

Table 2 PNG exports, imports and direction of trade 1994-1998.

Exports	**Unit**	**1994**	**1995**	**1996**	**1997**	**1998**
Total Exports	K.million	2,682.0	3,420.0	3,334.0	3,079.0	3,707.0
Annual growth Rate	%	6.2	27.5	-2.5	-7.6	20.4
Agricultural Exports (1) (excluding manufactured agricultural goods)	K.million	267.7	314.2	321.7	496.5	643.6
Annual growth Rate	%	86.7	17.4	2.4	54.3	29.6
Market share	% of total	10.0	9.2	9.6	16.1	17.4
Agricultural Exports (including manufactured agricultural goods)	K.million	374.6	498.0	578.6	777.2	1,020.2
Annual growth Rate	%	54.1	32.9	16.2	34.3	31.3
Market share	% of total	14.0	14.6	17.4	25.2	27.5
Mineral Exports	K.million	1,782.7	2,435.4	2,244.6	1,838.9	2,452.1
Annual growth Rate	%	-0.4	36.6	-7.8	-18.1	33.3
Market share	% of total	66.5	71.2	67.3	59.7	66.1
Forestry Exports (logs)	K.million	483.1	436.7	464.8	409.3	154.2
Annual growth Rate	%	16.6	-9.6	6.4	-11.9	-62.3
Market share	% of total	18.0	12.8	13.9	13.3	4.2
Manufactures Exports	K.million	118.2	196.8	272.4	305.0	395.6
Annual growth Rate	%	0.0	66.5	38.4	12.0	29.7
Market share	% of total	4.4	5.8	8.2	9.9	10.7
Marine Exports	K.million	10.3	16.7	10.4	9.6	42.2
Annual growth Rate	%	35.5	62.1	-37.7	-7.7	339.6
Market share	% of total	0.4	0.5	0.3	0.3	1.1
Direction of Export	**Unit**	**1994**	**1995**	**1996**	**1997**	**1998**
APEC (2)	K.million	2,082.6	2,578.2	2,604.1	2,376.4	2,872.4
	% of total	77.7	75.4	78.1	77.2	77.5
ASEAN (2)	K.million	83.5	185.9	144.6	182.8	282.8
	% of total	3.1	5.4	4.3	5.9	7.6
Australia	K.million	118.2	196.8	272.4	305.0	395.6
	Growth Rate	16.3	36.8	24.9	-2.7	24.6
	% of total	28.0	30.0	38.5	40.5	42.0
Japan	K.million	648.7	829.4	533.4	400.9	443.6
	Growth Rate	17.8	27.9	-35.7	-24.8	10.7
	% of total	24.2	24.3	16.0	13.0	12.0
Export Price Index (3) (1980 =100)	K.million	147.6	207.1	204.2	226.2	259.4
Imports						
Total Imports	K.million	1,336.0	1,620.0	1,996.0	2,129.0	2,231.0
Annual growth Rate	%	20.4	21.3	23.5	6.7	4.8
Source of Imports						
APEC (4)	K.million	1,252.1	1,486.8	1,832.8	1,965.5	2,003.6
	% of total	93.7	91.8	91.8	92.3	89.8
ASEAN (4)	K.million	182.8	165.3	204.8	244.3	195.6
	% of total	13.7	10.2	10.3	11.5	8.8
Australia	K.million	630.3	845.6	1,110.6	1,089.5	1,176.0
	Growth Rate	16.6	34.2	31.3	-1.9	7.9
	% of total	47.2	52.2	55.6	51.2	52.7
United States	K.million	199.2	240.1	264.1	287.7	313.4
	Growth Rate	78.3	20.5	10.0	8.9	8.9
	% of total	14.9	14.8	13.2	13.5	14.0

Source: National Statistics Office, Bank of Papua New Guinea and Internal Revenue Commision

Note: (1) Excludes palm oil, copra oil and black tea
(2) Exports to Thailand 1994, 1995 and 1998 not available
(3) Exludes crude oil exports
(4) Imports from Philipines 1994, 1995 and Thailand 1994, 1995 &1998 are not available
APEC – Asia Pacific Economic Co-operation
ASEAN – Association of South East Asian Nations
MSG – Melanesian Spearhead Group

Table 3 Principal exports (quantity), 1996-1999.

	Unit	1996	1997	1998	1999
Minerals					
Cooper	Ton ('000)	127.7	77.8	109.5	30.7
Gold	Ton	46.9	44.3	58.2	12.7
Crude oil	Ton ('000)	39,307.7	27,972.2	28,033.6	7,347.5
Agricultural					
Coffee	Ton ('000)	62.3	59.2	83.5	10.7
Cocoa	Ton ('000)	41.0	386	26.1	7.3
Palm oil	Ton ('000)	267.0	274.9	213.0	68.9
Copra oil	Ton ('000)	49.6	48.6	53.2	18.1
Copra	Ton ('000)	90.3	90.3	58.1	12.4
Tea	Ton ('000)	6.5	6.5	6.6	1.8
Rubber	Ton ('000)	4.4	4.4	4.9	1.3
Forest products					
Timber logs	Cu.m ('000)	2,607.4	2,375.9	1,066.9	323.7
Marine products	Ton ('000)				
Marine products		2.8	2.2	10.0	0.3

Source: Bank of Papua New Guinea.

Table 4 Principal exports (value), 1996-1999 (Million Kina, f.o.b).

	1996	1997	1998	1999 up to March
Minerals	**2,244.6**	**1,838.9**	**2,452.1**	**562.9**
Cooper	387.0	259.8	395.7	98.2
Gold	773.6	718.7	1,227.8	278.9
Silver	10.1	8.2	15.5	3.3
Crude oil	1,073.9	852.2	813.1	182.5
Agricultural	**556.1**	**721.5**	**964.7**	**215.1**
Coffee	190.3	325.9	476.4	47.6
Cocoa	66.2	73.3	81.7	25.4
Palm oil	182.4	207.1	271.9	97.9
Copra oil	51.4	51.1	69.7	28.3
Copra	49.0	47.2	38.8	9.4
Tea	12.7	10.4	18.9	4.9
Rubber	4.1	6.5	7.3	1.6
Forest products	**480.3**	**433.6**	**173.2**	**52.9**
Timber logs	464.8	409.3	154.2	50.7
Others[1]	15.5	24.3	19.0	2.2
Marine products[2]	**10.4**	**9.6**	**42.2**	**3.9**
Others[3]	**42.6**	**75.4**	**74.8**	**25.2**
Total PNG exports	**3,334.0**	**3,079.0**	**3,707.0**	**860.0**

Source: Bank of Papua New Guinea.

Notes: [1] Others including timber, plywood, wood chips.
[2] Marine products including prawns and fish.
[3] Other agriculture products, manufactured goods, immigrant effects.

Appendix

The total value of exports increased by 20.4% in 1998 compared to 1997. This was due to the significant increases in the value of cooper, gold, agricultural and marine products. Mineral exports accounted for 66% of total exports in 1998 (Figure 1).

Figure 1 Composition of total export value in 1998.

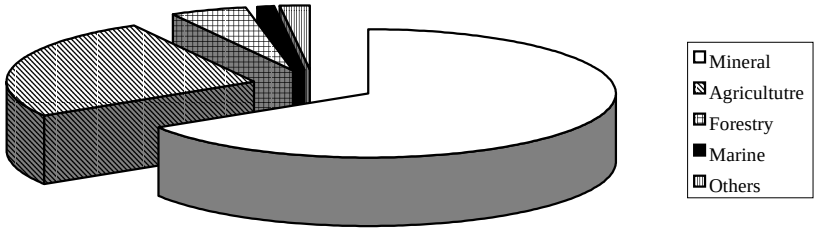


Table 5 Principal trading partners (export from PNG, Million Kina, f.o.b value).

Country	1993	1994	1995	1996	1997	1998
Australia	896.4	750.5	1,027.0	1,282.4	1,247.9	1,55.3
Japan	550.7	648.7	829.4	533.4	400.9	443.6
USA	101.2	133.1	135.5	243.3	268.8	345.9
Germany	163.3	159.3	340.9	232.3	222.9	301.4
United Kingdom	79.3	201.9	281.8	324.4	287.4	235.6
Rep. Of Korea	256.5	252.0	243.2	148.0	99.8	175.5
Indonesia	12.3	0.9	3.7	2.5	1.2	146.1
Philippines	68.8	62.3	133.9	92.6	84.4	82.6
Netherlands	26.4	25.6	30.1	38.0	63.1	65.2
Singapore	74.6	16.1	40.6	40.7	88.2	46.1
Hongkong	8.0	54.7	63.1	86.6	79.8	26.7
China	169.4	49.3	50.0	104.5	71.5	21.3
New Zealand	18.5	86.9	35.5	46.6	11.8	15.2
Others	99.7	240.7	205.3	158.7	158.7	151.3
Total	**2,525.1**	**2,682.0**	**3,420.0**	**3,334.0**	**3,079.0**	**3,707.0**

Total exports in 1998 reached K3.7 billion in 1998. Australia was the biggest market accounting for 42% of total exports followed by Japan, USA, Germany, United Kingdom, South Korea, Indonesia, and other countries (Figure 2).

Figure 2 PNG's export share, by country of destination-1998.

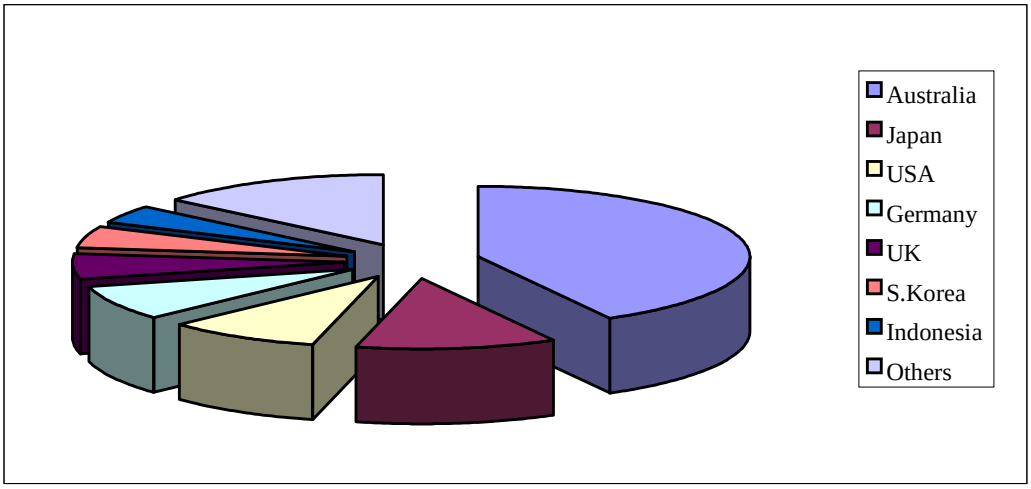


Table 6 Principal trading partners (imports to PNG, Million Kina, f.o.b value).

Country	1993	1994	1995	1996	1997	1998
Australia	540.5	630.3	845.6	1,110.6	1,089.5	1,176.0
USA	111.7	199.2	240.1	264.1	287.7	313.4
Japan	97.9	107.2	90.8	106.0	159.0	139.7
Singapore	104.6	110.9	119.7	128.4	160.4	133.3
New Zealand	48.8	52.2	58.7	62.1	81.6	80.8
Hongkong	47.6	50.6	51.4	38.6	50.6	52.1
Malaysia	23.0	21.3	24.5	25.4	27.4	31.9
Indonesia	12.8	50.6	21.1	28.8	28.1	26.1
China	4.8	6.6	7.2	11.4	12.9	23.2
Germany	5.5	9.2	10.4	19.2	12.7	16.6
Rep. Of Korea	7.8	15.3	17.8	17.9	19.0	12.8
United Kingdom	11.8	19.4	48.4	16.0	16.1	10.7
Others	93.2	63.2	84.3	167.5	184.0	214.4
Total	**1,110.0**	**1,336.0**	**1,620.0**	**1,996.0**	**2,129.0**	**2,231.0**

Australia, for many years, is still the biggest supplier of PNG's imports. From Australia alone, the import of goods reached K1.2 billion in 1998, accounting for 53% of the import share (Table 16 and Figure ……) USA, Japan and Singapore contributed almost K0.6 billion, followed by other Asian and European countries (Figure 3). The total PNG import in 1998 was 2.2 billion.

Appendix

Figure 3 PNG's import share, by country of origin in 1998.

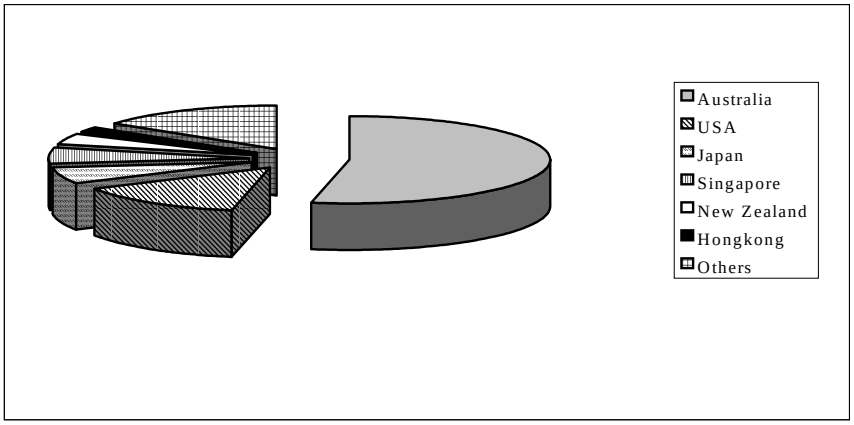


Table 7 Balance of payments, 1995-1999.

	1995	1996	1997	1998	1999 (up to March)
Balance on current account	**859**	**411**	**-161**	**124**	**-141**
(a) Trade (Net)	1800	1338	950	1476	309
Merchandise exports	3420	3334	3079	3707	860
Merchandise imports	-1620	-1996	-2129	-2231	-551
(b) Services (net)	-1034	-1022	-1204	-1539	-436
Invisible credits	443	611	619	699	128
Invisible debits	-1477	-1633	-1823	-2238	-564
(c) Transfer (net)	93	95	87	187	-14
Private (net)	-138	-69	-46	26	-14
Official (net)	231	164	133	161	0
Balance on Capital Account	-556	58	30	-364	50
(a) Official Capital Flows	-25	14	-89	-92	-31
(b) Private Capital Flows	-193	-147	134	-189	-91
(c) Non-Official Monetary Sector Transactions	35	-46	-61	31	33
(d) Change in offshore Account Balances	-373	237	46	-114	139
Revaluation	0	0	0	0	0
Errors and Omissions	-59	-37	14	-23	16
Overall Balance	244	432	-123	-263	-75
International Reserves	**357.4**	**789.1**	**666.9**	**404.1**	**328.9**
Months of import cover:	R	R	R	R	R
Total Import cover	2.6	4.8	3.8	2.3	1.8
Non-mineral cover	3.4	6.3	4.8	2.9	2.4
GDP (nominal) K'm	6308.6	6914.0	6824.2	7713.5	8505.1
Share of GDP (%)	**r**	**r**	**r**	**r**	**r**
Balance on Current Account	13.6	5.9	-2.4	1.6	-1.7
Balance on Capital Account	- 8.8	0.8	0.4	-4.7	0.6

(Source: Bank of Papua New Guinea, Department of Treasury and Planning)

Table 8 PNG-Major Export Commodity Prices, 1995-1996 (Kina per tonne, f.o.b)

	1995	1996	1997	1998	1999 up to March
Cocoa	1559	1615	1899	3130	3256
Coffee (all grades)	3893	3055	5505	5705	4448
Copra	427	494	523	668	764
Copra Oil	897	1036	1051	1310	1629
Palm Oil	762	683	753	1277	1449
Rubber	1481	1464	1477	1490	1271
Tea	1286	1366	1600	2864	2764
Timber Logs (Kina/m^3)	174	178	172	145	161
Crude Oil (Kina/barrel)	22.37	27.32	30.46	29.00	24.83

Source: Bank of Papua New Guinea
Note: Figures are annual averages unit values

Table 9 International commodity prices, 1995-1999 (Kina per tonne, c.i.f)

	1995	1996	1997	1998	1999 up to Mar.
Cocoa (London, Ghana)	1971	2068	2447	3658	3497
Coffee (New York, Mild Arabica)	4222	3493	5889	5922	5218
Copra (Philipines, Rotterdam)	556	650	632	856	1021
Copra Oil (Malaysia, Rotterdam)	873	1012	960	1366	1636
Palm Oil (Malaysia, Rotterdam)	825	709	787	1368	1286
Rubber (London, No.1 RSS)	2166	1952	1556	1660	1702
Gold (London) US$/fine oz	384	388	332	295	287
Copper (London, Wire bars) US cents/lb	132	103	104	76	64
Crude Oil (f.o.b., U.K, Brent) US$/barrel	16.91	20.42	17.99	12.74	11.28

Source: Bank of Papua New Guinea and Department of Petroleum & Energry
Note: Figures are annual averages prices

Table 10 Exchange rates, 1994-1998

	1994	1995	1996	1997	1998
Foreign Currency Units per Kina					
Australian Dollar	1.0927	1.0716	0.9653	0.9365	0.7708
U.S.Dollar	0.8485	0.7545	0.7553	0.6971	0.4856
Japanese Yen	84.71	76.79	82.17	84.23	63.43
Deutches Mark	1.3178	1.0866	1.1369	1.2073	0.8564
Pounds Sterling	0.5442	0.4899	0.4845	0.4264	0.2933
New Zealand Dollar	1.3220	1.1948	1.1032	1.0520	0.9043
Singapore Dollar	1.2392	1.1105	1.0691	1.0324	0.8132
Hong Kong Dollar	6.5663	6.0602	5.8647	5.4004	3.7673
SDR	0.5828	0.5079	0.5203	0.5065	0.3583

Source: Bank of Papua New Guinea
Note: (1). 1994 Rates are as of 31 December. As from 1995, rates are average of the year

There was a steep fall in 1994 due to the currency devaluation and the subsequent floatation