

1. INTRODUCTION

1.1. BACKGROUND

Papua New Guinea is an agricultural nation with a huge potential. The agriculture sector plays a significant role by providing broad based income and employment to the vast majority of the population in the country, most of which still lives in the rural areas and engaged in subsistence and semi-commercial and commercial farming.

In recent years, PNG agriculture sector faced many difficulties, and except for one or two sub-sectors, had not fared well. The estimated growth was well below expectations, and often around 1%, compared to a population growth of 2.7%. This has naturally affected the rural population that depends exclusively on agriculture for their livelihood.

A number of factors have been identified as responsible for the lack of or limited growth of the agriculture sector and the absence of a national plan for the development of the agriculture sector has been a significant factor. This National Agriculture Development Plan 2007-2016 (NADP) was formulated by the National Department of Agriculture and Livestock (NDAL) having consulted, various stakeholders and the wider community within the agriculture sector with technical and financial assistance from Food and Agriculture Organization of the United Nations (Technical Cooperation/Developing Country Program No. 3003A).

1.2. RATIONALE FOR NADP

The current agricultural development plans or programs are mainly sub-sectoral or industry-based with limited scope and collectively have limited or no meaningful impact on the overall agriculture sector development. Coordination, monitoring and evaluation are difficult at the national level. This situation has affected allocation of available limited resources to priority areas and long-term human resources development among others.

The need for NADP was formally expressed in the National Agriculture Development Strategy Horizon 2002-2012 (NADS). The NADS which has been developed by NDAL in consultation with all stakeholders in agriculture including the wider community was adopted by the National Executive Council (NEC) in September 2001. NEC directed NDAL to develop NADP. NADS proposed that any future plan and strategies developed to combat agricultural underdevelopment must come out of, or be a part of, a national strategy for rural transformation, making it imperative for such a NADP to be developed and implemented by the Government (NADS p.59).

The decision to prepare a NADP was further strengthened by the Medium Term Development Strategy (2005-2010), the Government's Program for Economic Recovery

and Development (MTDS). MTDS saw that rural development and poverty reduction can be achieved through export-driven economic growth, health, education and agricultural development. It targets 5% annual growth in real terms. The development of the primary sector that comprises of agriculture, forestry and fisheries will not only underpin economic growth but also directly improve the living standards of over 5 million Papua New Guineans (MTDS p. 13).

The need for NADP has also been reinforced subsequently by the ADB TA 4055 Report and the Functional and Expenditure Review (FER) of the Agriculture Sector, along with expressions of support from the donor community. According to the reviews of the agricultural sector (NARI, 2003 and National Extension Summit 2004), the decline in agriculture is due to the disjointed planning and coordination of agricultural development. Decentralization and corporatization have divorced provincial programmes and sub-sectoral planning from central planning. Sub-sectoral agencies and corporations have independent powers mandated by law. Investment programmes in agriculture have been implemented without a policy framework that links with a national development strategy.

The NADP is the vehicle through which Government intends to refine and implement its sector strategies as formulated in the MTDS. It will devise strategies and plans that complement the Government's overall reform program in the public sector financial management, budget execution and related areas. It also addresses the widely recognised failures in markets and governance that have become so obvious in the implementation of the Organic Law and corporatization in the agriculture sector, most notably in extension and information services to farmers.

The Plan is an integral part of the agriculture sector's restructuring and development to move forward. PNG is well positioned to capitalize on a number of opportunities and interventions to develop the sector to be competitive domestically and internationally which are important for economic development. The government policy would be to reallocate resources to sectors like agriculture, forestry, fisheries where PNG has comparative advantage.

1.3. FRAMEWORK OF NADP

1.3.1. Formulation Process

The NADP has been formulated based on an extensive consultative and participatory process. Workshops were conducted in the four regions with the following objectives: to ensure wide sectoral participation and consultation; to create awareness among the stakeholders on the conceptual framework of the NADP; to gather stakeholder inputs for the preparation of the plan; and to discuss the issues that will guide the planning and formulation process. The recommendations of NARI's consultation in 2003 and the National Extension Summit in 2004 were considered. The priorities and policies stipulated in the NADS, the recommended priority areas from the consultation and reports, the corporate plans of commodity organizations (Annex A), and available provincial plans (e.g. Bougainville, Manus, Morobe, West New Britain, Milne Bay,

Central, Enga; Annex B) were considered in formulating the priority programmes and strategies outlined in the NADP.

A Technical Advisory Committee (TAC) was also established to provide technical guidance and input during the formulation of the plan. The TAC included representatives from key government departments (NDAL, NISIT, Lands and Physical Planning), commodity boards (CIC, OPIC, FPDA) and sectoral bodies (NAQIA, NARI), Rural Development Bank, and provincial representatives.

A National Project Steering Committee (NPSC) was created to oversee and monitor the implementation of the project as well as provide technical guidance and advice to the project team. Its membership includes heads of the National Research Institute, National Council of Women, Manufacturers Council of Papua New Guinea, Institute of National Affairs, PNG Growers Association, Rural Industries Council, Public Sector Reform Management Unit, PLLG, Department of National Planning and Monitoring, National Agricultural Research Institute, and COs. The changes in the leadership of NDAL and the slow response of nominated persons to serve on the committee delayed the establishment of the NPSC. Most members, however, attended the national consultations and provided their views.

A two-day national consultation meeting was organized in August 2006 in Port Moresby and was attended by representatives of DAL, statutory organizations/authorities (CIC, KIK, OPIC, FPDA, NARI, LDC, Spice Board, NAQIA), government agencies (DNPM, DTI, PSRMU, Transport, Lands, LLG Affairs, Internal Revenue Commission, Rural Industries Council), provincial administrators and planners (Simbu, West New Britain, Morobe, Central, Sandaun, Western, New Ireland, East Sepik, and Milne Bay), farmer groups, NGOs, private sector (Trukai, Ramu Sugar, Kunip Enterprises, PNG Power, Global Commodities), donor agencies (JICA, EU, AusAID), and financing institutions (RDB, International Finance Corporation). Issues and concerns were addressed accordingly.

1.3.2. Vision

The vision of NADP is sustainable transformation of the country's agriculture sector into a vibrant and productive economic sector that contributes to economic growth, social wellbeing, national food security and poverty alleviation.

1.3.3. Mission

The Mission of National Agricultural Development Plan (NADP) is to enhance the quality of life for over 87% of the rural population in 89 districts and 19 provinces; through increased productivity, sustainable and quality production coupled with integrated planning and sustainable and environmental sustainable management.

1.3.4. Goal

In pursuing its vision, NADP has the following goals that are closely interrelated and complementary:

- (a) To stimulate growth and sustainable development of agriculture sector
- (b) To improve food security, nutrition, incomes and employment opportunities of majority of rural population
- (c) To improve the capacity of concerned institutions to generate technologies and extension services
- (d) To increase the government institutional support to agriculture

1.3.5. Purpose

- Underpin the Medium Term Development Strategy (MTDS) of the Government
- Guide the development of the sector through alignment of resource with identified priorities
- Determine the planning process and institutionalize the planning system to coordinate agricultural sector development
- Determine institutional set-up/arrangements for implementation of the national plan
- Contribute to promoting food security for PNG households
- Ensure that agricultural development is based on sound natural resource management principles and information to ensure the long term viability of communities and the resource base on which agriculture relies
- Ensure that agricultural policies, programs and development are based on participatory approaches that involve all stakeholders

1.3.6. Development Objectives

- To reduce costs of production and improve quality of agricultural produce for both domestic and international markets
- To increase income earning opportunities of those dependent on agriculture.
- To allocate resources based on priority areas
- To ensure that development is socially, economically, and environmentally sustainable
- To improve the recognition of women's contributions to rural industries and increase opportunities for women's decision making in agriculture

1.3.7. Strategies

1.3.7.1. Management Strategies

- Introduce and encourage appropriate policy interventions
- Improve coordination of programs from national to districts to provide better service to farmers

- Allocate funding for priority areas of development through competitive grants
- Encourage participation: success of NADP depends on a concerted effort of government, private sector/NGOs, and farmers. Government facilitates policies, legislation, infrastructure, research, extension, HRD training, credit. Private sector/NGOs facilitate investment, production, marketing, processing, research, extension, and credit. Farmers facilitate production, marketing and investment.
- Institute effective monitoring and controls
- Capacity building in program management, planning, communication, and technical skills

1.3.7.2. Production Strategies

- Promote extensive and intensive agriculture, considering sustainable agricultural development. Agricultural practices and technologies which increase productivity, environmentally friendly, economically viable and sustainable are encouraged.
- Promote crop diversification and smallholder farming system
- Revitalization and modernization of sector
- Promote improvement of quality of produce through better nutritive content, organic farming, and better post harvest handling
- Promote downstream processing through expansion of domestic value added investment for crop and livestock products, and processing of traditional fruits and nuts which PNG has comparative advantage

1.3.7.3 Inputs

- Integrated planning
- Improved coordination and communication of policies, research, extension, and training
- Adequate resource allocation
- Effective monitoring and controls

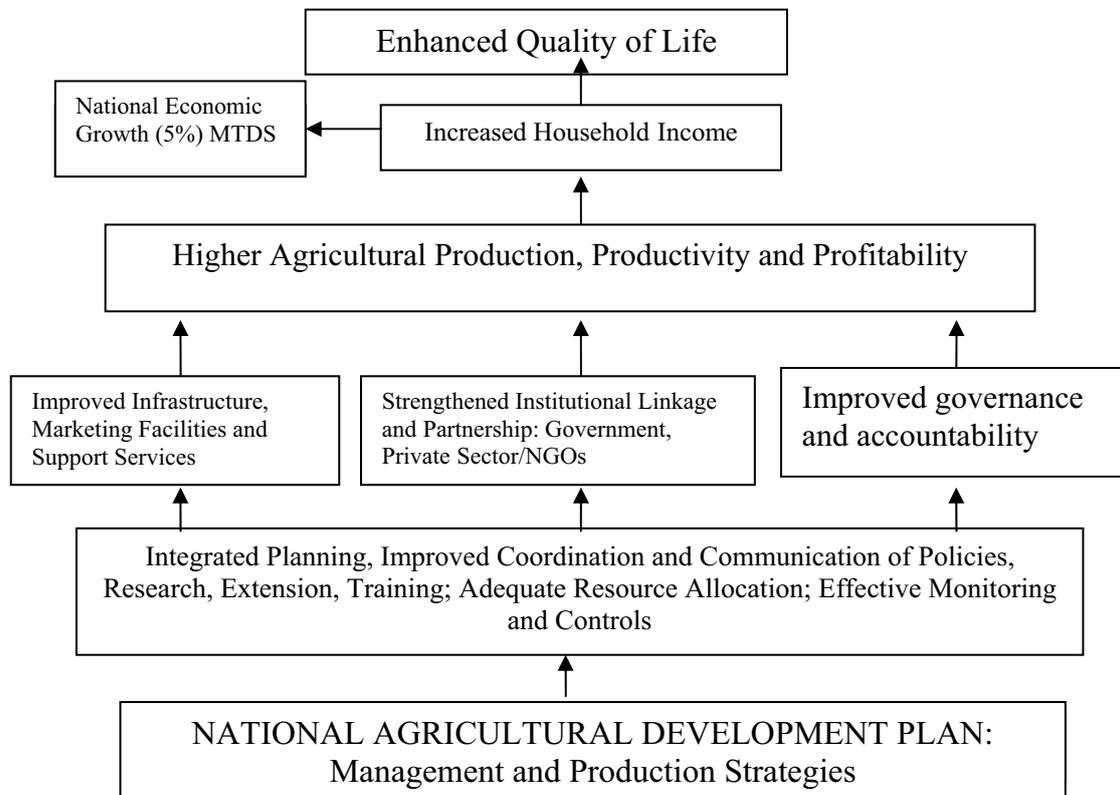
1.3.7.4 Desired Outputs

- Improved infrastructure: marketing facilities and support services
- Strengthened institutional linkage and partnership
- Improved governance and accountability

1.3.7.5 Expected Outcomes

- Higher agricultural production, productivity and profitability
- Increased household income
- Enhanced quality of life

Figure 1.1: NADP Framework



1.3.7.6. Core Values

The following values would govern NADP management:

Common vision for agricultural development could be attained by developing relevance and direction in agricultural programs which must be responsive to national goals. All efforts and resources of stakeholders should be channeled in that direction, guided by common understanding and agreements on priorities achieved through fully inclusive and participatory processes.

Cooperation means that institutions work in collaboration and partnership to achieve the development objectives. Collaborative programs between institutions can ensure maximum utilization of resources and also ensure easy exchange of information based on common agenda across many production systems and ecological zones. Cooperation could be further facilitated through clear mechanisms and lines of communication.

Transparency means that operational procedures and transactions are well documented

and open for public examination. Minutes of meetings relevant to public interest on agricultural development should be available on demand. Research results, both progress and completion, are published and publicized. Feedback should be taken to ensure participation.

Excellence and Relevance are needed to attain the objectives of agricultural development. Mediocre work is unacceptable. Program implementers should strive that their objectives are achieved through acceptable standards. To encourage high standard of work, incentives will be provided.

1.4. COMPONENTS AND ORGANIZATION

The NADP is organized into 10 chapters or sections. Each chapter deals with a specific thematic area. Chapter 1 outlines the rationale for the development of the NADP and the approach adopted in its formulation.

Chapter 2 provides general overview of the agriculture and the issues affecting agricultural development. In Chapter 3, some analysis is provided of the impact of past government policies on agriculture. It also outlines policy objectives, strategies and key areas for NADP.

Chapter 4 provides a review of issues confronting agricultural research and extension, respectively. The next four chapters of the NADP are dedicated to reviewing the status of the key sub-sectors of agriculture such as food and horticulture (Chapter 5); tree and industrial crops (Chapter 6); livestock, apiculture and aquaculture (Chapter 7); and spices and minor crops (Chapter 8). Priority areas and programmes for development are presented at the end of each chapter (Chapter 5 – 8) and these have been formulated based on the outcome of the analysis of the key constraints as well as the potentials of each sub-sector.

A proposed management set-up and the entities involved for the overall coordination and monitoring of the implementation of the NADP is outlined in Chapter 9. This is considered important to ensure that the programmes and projects are successfully implemented within the time frame of the NADP.

The final chapter reviews the present funding level of the NDAL, statutory authorities, and agricultural projects of provinces. The chapter proposes the indicative level of investment needed for a ten-year period and expected outcomes based on the identified priority programmes to be implemented. The proposed budgetary requirements during the plan period are estimated at K1,198 million. Detailed costs including Implementation framework and schedules are discussed in NADP Volume 2: Implementation Plan 2007-2016.

2. AN OVERVIEW OF AGRICULTURE

2.1. GENERAL BACKGROUND

Papua New Guinea is composed of over 600 islands of various sizes and a sea expanse of more than 2 million km². Its land area is 459,854 sq km (46.2 million ha), consisting of: raised coral reefs and littorals (4%), plains and plateaus (41%), volcanic (8%), hills and mountains (47%). Only 27% of the area is inhabited, because of the presence of volcanoes, mountain ranges, and flooded plains. About 54% of the population live in the islands and lowlands that constitute 66% of the land area. The rest live in the highlands that constitute 16% of the total land area. With a low population density of about 11 persons per sq km, PNG is well endowed with land.

Average rainfall varies from continuous (8,000mm) in some mountainous areas to low and seasonal (1000-1500 mm) in coastal areas. Most part of the country experiences high rainfall of 2500-3500mm. A few lowland areas (e.g., Markham and Port Moresby) experience monthly rainfall of less than 1,000mm. Droughts do occur from time to time. Mean maximum temperatures vary from 30-32°C in the lowlands to mild 22-25°C in the highlands. Frosts occur above 1,500m and affect crop production. Forests cover 70% of land area and water is still a bountiful resource.

Although PNG is well endowed with land, only 30% is suitable to agricultural development because of the mountain ranges, high rainfall, long dry seasons, and excessive cloud cover in several areas.

2.2. AGRICULTURE AND THE ECONOMY

Coffee, cocoa, copra, oil palm, rubber, fresh vegetables, and betel nut are grown by smallholders and provide income for 80% of population. Smallholder production of tree crops comprises 70 percent of total output of the sub-sector. Total production from commercial plantations has been on a decline since the 1980s because of rising labour and overhead costs, and fluctuating world prices. Promoting smallholder agriculture system is the key to growth of the sub-sector.

The major economic sectors in PNG are agriculture, forestry, fisheries, manufacturing, mineral and petroleum, retail and wholesale, building and construction, transport and telecommunications, finance and business trade. Agriculture contributes 26% to national GDP, while mineral sector contributes 75%. Other contributors are community and social services (12%), petroleum (11%), and manufacturing (9%).

The land tenure system has often been blamed for the slow pace of development of agriculture because 97 percent of the land is under customary ownership and only 3 percent is under leasehold or freehold title. Customary ownership of land bestows ownership of land on the clan and legislation prevents sale of customary land unless it has been converted first to leasehold land. Since most lands are not registered, it is difficult to get agricultural loans from banks which require collaterals.

2.3. AGRICULTURE AND THE POPULATION

The 2000 Census showed that PNG had a population of 5.19 million. The highest population is in the Highlands region, followed by Momase, Southern, and the Islands. Table 2.1 presents the national and regional population statistics. Growth rate of the population is estimated at 2.7% per year; hence population is projected to increase to 8 million in 2020. Population density which usually indicates the intensity of land resource utilization ranges from 1.6 persons per sq km in Western to 949.8 persons per sq km in the National Capital District. In the highlands, population density ranges from 21.3 to 48.1 persons per sq km, while the coastal regions have 1-50 persons per sq km. Over 40 percent of the population are under 15 years old.

Table 2.1: National Population and Distribution by Region

Regions	Population	
	Number ('000)	Percentage
Highlands	1,974.0	38.0
Momase	1,433.4	27.6
Southern	1,041.8	20.1
Islands	741.5	14.3
Total	5,190.7	100

Source: National Census 2000

Diversity of the population is reflected in 800 different spoken dialects with Pidgin and Hiri Motu commonly spoken. English is the official language of business and education.

Migration is common in search of wage employment and small business opportunities, more productive environments to grow cash crops, and better access to services and markets.

Income distribution within and across various regions and socio-economic groups is unbalanced, with 20% of the people having 80 percent of the income. There is high level of unemployment and underemployment in the country with 74% of economically active population in semi-subsistence sector generally remaining unemployed. Only about 5% of total population and 18% of economically active population have potential to be employed in the formal sector. Poor living standards and poverty are manifested in low life expectancy (54 years), underweight children (29%), poor health, malnutrition/under nourishment, and food insecurity (NARI, undated).

About 4.3 million rural people depend on subsistence and semi-subsistence agriculture to produce food and cash crops. Subsistence gardeners cultivate about 0.01 to 0.1 ha of

land, and smallholder farmers cultivate less than 5 ha units. Most gardens are planted with crops continuously for one or two years then fallowed for 5-15 years to allow development of soil fertility. Garden sites are cleared of vegetation by slash and burn method, without land cultivation and use of purchased input. Crops grown are sweet potato, banana, sago, taro, yams, cassava, and sugarcane. Among the livestock raised are pigs, chickens, ducks, and occasionally, fish in ponds. Locally grown food provides 80% of calories consumed by rural people (Gibson, 2001).

2.4. AGRICULTURE AND THE ENVIRONMENT

Intensive agriculture is practised among 20% of rural people living in productive environments with high population densities. They continuously cultivate the land, and use land improvement practices such as composting, mounding, drainage, legume rotation, tree fallowing, soil retention barriers. Where alternative livelihood opportunities are limited, agricultural production is intensified through shorter fallow periods, extension of cropping periods, and planting of crops which do not require much inputs such as sweet potato, taro, cassava and bananas. Such practices could in the long run lead to soil degradation which will affect their only source of livelihood. These farmers need assistance to improve agricultural production practices, management and increase their productivity.

Practices of large plantations could affect environment. Chemicals such as pesticides, oil for processing and production ensure higher productivity, but these inputs could spill into the water system or rivers or environment, and affect fishing and biodiversity. Monoculture cropping encourages growth of harmful insects and micro-organisms which can cause epidemics of infestation. Development projects need to be assessed on environmental impact, and mitigating measures should be included in the plan.

2.5. INSTITUTIONAL AND MANAGEMENT SET-UP OF AGRICULTURE

The Functional and Expenditure Review (FER) of Agriculture Sector in August 2005 identified a number of key organizations and institutions with important roles in the sector.

2.5.1. Primary Government Agriculture Bodies (PGABs)

The current roles and functions of PGABs are based on legislation, gazettal and corporate plans. They can work well provided there are clear responsibilities and linkages within the sector. They respond individually to government priorities, hence coordination between and among organizations needs to improve significantly (FER, 2005). These include:

- National Department of Agriculture and Livestock (NDAL) which administers all legislation relating to Agriculture and Livestock; promotes agricultural development and productive employment generation; assists Provincial

Governments to increase their agricultural capacity; prepare and implement appropriate investment programmes for major commodities and livestock. It liaises with the Rural Development Bank and the National Plantation Management Authority; operates experimental stations and laboratories conducting adoptive research into the production and preparation for market of primary production; advises on policies and plan of international and extra-territorial bodies dealing with agriculture and livestock organisations; and provides public extension services and scientific information.

- Provincial Division of Primary Industry (PDPI) which is tasked with extension, 5-year Agriculture Development Plan of 19 provinces and 89 districts, provincial system of collecting, storing, and analysing social, economic and environmental data in relation to the agriculture and fisheries sector
- National Agricultural Research Institute (NARI) comes under the Ministry for Higher Education, Research, Science and Technology. Its function is to generate and promote appropriate and improved agricultural technologies; develop and promote ways of improving quality, post harvest, processing and marketing; conserve and use genetic resources for agricultural development; update and maintain national inventory on soil resources, information, and outreach and liaison services. It controls national analytical laboratories and centres provide technical/analytical/advisory services for development of agriculture
- National Agricultural Quarantine and Inspection Authority (NAQIA) maintains PNG's favourable bio-security and international quarantine risk status, and develops PNG's international status as a quality assured certifier of agricultural, fisheries, and livestock commodities. It facilitates, supports and coordinates agricultural quarantine and inspection services, including surveys, surveillance, meat inspections, internal quarantine and eradication and control of pests and diseases. It operates nationwide with 20 seaports, 3 international airports and international post office, and provides veterinary services and conducts meat inspection at 5 abattoirs. It is a fully pledged statutory body organized to implement Sanitary and Phytosanitary (SPS) measures set by standard-setting organizations of WTO (IPPC, OIE, and Codex) in order to facilitate trade without compromising the pest and disease risks to PNG.
- Commodity Organizations (CO) are organizations which have been formed for management of coffee, coconut, cocoa, oil palm, spices, livestock and fresh produce subsectors. These include:
 - Coffee Industry Corporation
 - Kokonas Industri Koporesen
 - Cocoa Board and Cocoa Coconut Institute
 - Livestock Development Corporation
 - Fresh Produce Development Agency
 - Oil Palm Industry Corporation

- Spice Industry Board

2.5.2. Other National Agencies

Department of National Planning and Monitoring (DNPM)

DNPRD advises the Government on matters relating to strategic development policy, development planning and programming, aid coordination and management, and monitoring and evaluation of national development. The Office of Rural Development coordinates government initiatives for improving service delivery to rural populations, by working closely with provincial administrations, stakeholders and communities in the planning and implementation of rural development programs.

The Department of Provincial and Local Government Affairs (DPLGA)

This Department is the key link between the national and provincial/local government levels. It is the channel through which the national government primarily communicates to sub-national governments, and the mechanism by which these lower level governments express their needs and requests at the national level.

DPLGA's primary mandate is to support provincial and local level governments in their policy and legislative responsibilities, monitor and coordinate their overall governance performance. It empowers and builds the capacity of provincial and local level governments through explanatory handbooks and operating manuals on performance management, legal and policy issues, training and best practice and information sharing. It houses the office of the Provincial and Local Level Service Monitoring Authority (PLLSMA), the former National Monitoring Authority (NMA). It coordinates the Provincial Performance Improvement Initiative in 3 pilot provinces.

Department of Environment and Conservation (DEC)

The department has a key role in providing natural resource management and biodiversity information and advice. Among its services are environment protection and conservation; pollution control; nature conservation and wildlife protection; and water resources management.

Department of Trade and Industry (DTI)

DTI facilitates trade negotiations and the securing of market outlets for potential agricultural exports. It provides small business development services for commercial operations and cooperative societies, through the Small Business Development Corporation. This service is essential for the improvement of credit use.

National Institute of Standards and Industrial Technology (NISIT)

The Institute is a line agency of the Department of Trade and Industry as the National Standards Body in PNG. It facilitates standards development and adoption in PNG for trade purposes.

Investment Promotion Authority (IPA)

The IPA implements policies and programs aimed at increasing total annual investments in the country. It is a statutory organisation established in 1992 by an Act of the Parliament to promote and facilitate investments in PNG. DTI has the statutory oversight of IPA.

Department of Lands and Physical Planning (DLPP)

The Department promotes the best use of land in PNG by ensuring an orderly process to make lands available for sustainable economic and social development and that land rights are guaranteed.

Rural Development Bank (RDB)

The Rural Development Bank has been set up primarily to manage rural finance and as a mechanism through which credit could be made available to support development initiatives in the rural sector.

National Fisheries Authority (NFA)

NFA is responsible for provincial and industry liaison, fisheries management, licensing and information, monitoring control and surveillance, finance, and National Fisheries College. It focuses on optimizing returns from large-scale fisheries, and supporting small-scale and subsistence fisheries, either, coastal, riverine or aquaculture-based.

Rural Industries Council (RIC)

The RIC represents the interests of the larger organizations and companies representing in the rural industry in the PNG. It comprises 27 members representing agencies and companies.

2.5.3. Provincial and District Administrations

Their main task is to plan, coordinate and manage agricultural extension and support programs. Extension and information services at the local government levels are funded through annual provincial budgets or through the joint programs with NDAL or commodity organization and delivered through Provincial Divisions of Primary Industry.

2.6. GENERAL PERFORMANCE OF THE SECTOR

From 1996 to 2005, marketed produce was estimated from K1.1to 1.4 billion, while non-marketed produce ranged from K595 million in 2004 to K1.2 billion in 2000 and 2001. Agricultural share to GDP fell from 27% to 16.6%. (Table 2.2).

Table 2.2. Agricultural Contribution to GDP: 1995-2004 (K million)

Calendar Year	Value Added to Agriculture			GDP	Agricultural Share (%) in GDP
	Marketed	Non-marketed	Total		
1996	1,177.2	654.7	1,831.9	6,794.7	27.0

1997	1,153.7	718.4	1,872.1	7,079.6	26.4
1998	1,161.2	723.3	1,884.5	7,803.6	24.1
1999	1,165.0	871.7	2,036.7	8,828.2	23.1
2000	955.5	1,254.7	2,210.2	9,735.8	22.7
2001	803.8	1,240.0	2,043.8	10,396.3	19.7
2002	1,084.9	1,012.0	2,096.9	11,568.6	18.1
2003	1,390.8	726.2	2,117.0	11,904.1	17.8
2004	1,490.8	595.1	2,085.9	12,249.3	17.0
2005	1,409.0	690.9	2,099.9	12,616.8	16.6

Source: Department of Treasury and Planning; BPNG; compiled by: Rural Statistics Section, DAL.

Based on ten-year volume of exports, top exports from 1996-2005 are the following: oil palm; coffee; copra, copra oil, and cocoa (Table 2.3). Based on value, coffee and oil palm have almost identical export income, followed by cocoa and copra oil. Both volume and value have fluctuated within the 10-year period. The export crops contributed K9 billion to the economy for the period.

Agricultural imports include vegetable and fruits, meat and meat products; milk, butter, cheese and eggs, animal fats and vegetable oil, animal feeds, coffee, cocoa, tea and spices; agro-chemicals, and edible nuts. Total imports from 1996 to 2005 were less than exports (Table 2.4), and trend increased until 2004. In 2005, imports dropped by K96 million.

Table 2.3: Export Crops Industry Performance (1996-2005)

Quantity and Value of Exports		Cocoa	Coffee	Tea	Copra	Copra Oil	Palm oil	Rubber	Total
Quantity '000 mt	1996	41.0	62.3	9.3	99.2	49.6	267.0	2.8	531.2
	1997	38.6	59.2	6.5	90.3	48.6	274.9	4.4	522.5
	1998	26.1	83.5	6.6	58.1	53.2	213.0	4.9	445.4
	1999	29.0	79.2	8.2	63.5	50.3	253.8	3.7	487.7
	2000	38.0	66.6	8.5	67.2	48.0	336.3	3.7	568.3
	2001	36.5	51.6	8.8	46.4	27.1	327.6	3.6	501.6
	2002	34.9	63.1	5.2	15.8	28.2	323.9	3.8	474.9
	2003	40.3	68.8	6.6	8.4	47.7	326.9	4.2	502.9
	2004	41.5	63.0	8.1	19.2	45.1	339.0	3.8	519.7
	2005	44.2	72.1	6.9	22.3	54.4	295.2	4.8	499.9
	Total	370.1	669.4	74.7	490.4	452.2	2957.6	39.7	5,054.1
	%	7.3	13.2	1.5	9.7	8.9	58.5	0.8	100
Value (K)	1996	66.2	190.3	12.7	49.0	51.4	182.4	4.1	556.1
	1997	73.3	325.9	10.4	47.2	51.1	207.1	6.5	721.5
	1998	81.7	476.4	18.9	38.8	69.7	271.9	7.3	964.7
	1999	84.6	417.1	19.0	66.5	95.8	337.9	5.0	1,025.9
	2000	84.6	294.8	20.4	59.9	65.8	306.6	6.4	838.5

million)	2001	110.3	188.8	22.0	15.5	27.3	290.5	6.8	661.2
	2002	226.3	276.6	18.1	10.7	33.3	389.9	8.8	963.7
	2003	257.7	298.5	19.3	6.5	67.4	421.3	12.3	1,083.0
	2004	218.0	283.8	22.9	17.2	81.0	438.7	13.8	1,075.4
	2005	198.7	471.0	20.2	17.3	93.7	339.5	18.0	1,158.4
	Total	1,401.4	3,223.2	183.9	328.6	636.5	3,185.8	89.0	9,048.4
	%	15.5	35.6	2.0	3.6	7.0	35.2	1.0	100

Source: Bank of PNG

Table 2.4 – Balance of Trade in Agriculture, 1996 – 2004 (K million)

Calendar	Agriculture			Total Trade			
	Year	Export	Import	Balance	Export	Import	Balance
	1996	578.6	371.0	207.6	3,313.9	1,996.0	1,317.9
	1997	777.2	404.4	372.8	3,059.3	2,129.0	930.3
	1998	1,020.2	366.3	653.9	3,687.7	2,231.0	1,456.7
	1999	1,165.0	399.3	765.7	4,985.3	2,760.0	2,225.3
	2000	955.5	435.3	520.2	5,813.0	2,779.0	3,034.0
	2001	801.1	474.4	326.7	6,105.0	3,165.0	2,940.0
	2002	1,084.9	517.1	567.8	6,387.0	4,197.0	2,190.0
	2003	1,390.0	563.7	826.3	7,842.0	4,231.0	3,611.0
	2004	1,485.2	614.4	870.8	7,888.0	5,038.2	2,849.8
	2005	1,401.2	518.4	882.8	9,922.0	4,665.0	5,257.0

Source: Bank of Papua New Guinea various Bulletins; National Statistical Office.
 1991 to 1995 agricultural import data are estimates, compiled from the records of ABS Australia; NZ High Commission and APEC Trade Statistics Bulletins; 1996 to 2000 agric. import figures were estimated from the average growth rate.

2.7. ISSUES AFFECTING AGRICULTURAL DEVELOPMENT

2.7.1. Roads and Transport Infrastructure and Communication

The poor state and high costs of transport and communication are major impediments to agricultural development. Good transportation network is imperative in PNG which is being dissected by numerous river systems, mountain ranges, and many islands. Reliable internet, telephone and mass media are important for timely information between buyers and sellers.

2.7.1.1. Roads and Transport

To encourage people to participate in the cash economy, the government in the past promised that roads would be built to connect all areas of the country. Farmers in the most remote regions were encouraged to grow cash crops on the assumption that the government would provide a market and transportation for their produce. In the light of the withdrawal of the Department of Primary Industry (DPI) marketing system in the 1980s and the inability of the government to build roads to all areas of the country and maintain the existing transport network after 32 years of Independence, the government needs to re-examine its policy for bringing development to the people. The following may be strategies that could be adopted to provide solutions to this problem:

- It may be more efficient and cost effective to bring people to where the government desires more rapid development to occur. The priority of the government should be maintenance and rehabilitation of existing transport infrastructure that contribute positively to economic growth. Construction of new transport infrastructure facilities must be justified.
- Design and establish agriculture projects in areas and districts that are accessible to the market with improved road and transport infrastructure. Collaboration with the Department of Transport to know the national and district transport plans and the Department of Works to find out the construction schedule is necessary in designing agriculture plan and programs. The demand for road will be created by establishing agriculture projects. All the stakeholders should be involved at the planning phase of any agricultural projects to assure accessible roads, bridges wharves, jetties and airstrips.

The Department of Transport regulates the transport industry in PNG. There is a need to study the nature of the industry in order to resolve the high costs of sea, air and land transport. The Independent Competition and Consumer Commission (ICCC) commenced an inquiry into the cost structure of the transport sector involving both airline and sea transport.

PNG has one of the highest cost sea transport system in the Asia-Pacific region which reduces the economic viability of production for export, and limits the growth of

domestic import replacement activities. As an example, the relative advantage for sea freight from Townsville to Port Moresby makes it attractive for supermarkets in Port Moresby to order vegetables from Townsville instead of Mt. Hagen. It is cheaper to ship a tonne of cocoa from Rabaul to Singapore than from Baining to Rabaul.

Most people in areas which are not connected by roads or sea transport depend on air services. The high cost of fuel and poor maintenance of airstrips around the country are two most important issues affecting air transport services. The “Green Revolution” of the government using PNG Defense Force aircraft for transport of agricultural produce is not only short term and unsustainable but could distort the small private operations to remote airfields in the long term.

Current government and donor priorities appear to target only maintenance of major national roads or highways such as the Okuk or Highlands Highway. Most roads serving the rural sector are considered provincial roads and are the responsibility of provincial governments. Except for the few resource rich provinces, most provincial governments have very limited budget for road maintenance and almost nil for construction of new roads.

The priority for the national transportation policy should be maintenance and upgrading of existing roads instead of construction of new roads. Where necessary, the NADP should identify important agricultural roads that could be included as priority for maintenance to facilitate access for farm produce and funded under the NADP.

2.7.1.2. Communication

A good communication system provides timely and accurate two-way information flows between buyers and sellers, which are crucial to sound business decisions. While the use of modern communications systems such as internet and satellite phones is taken for granted in the main centres of PNG, the reliability of the system to function without interruption and the ability of the utility operator to recover from disaster can affect the trust of the business sector and public at large in the telecommunication system.

Of immediate importance to the business community is the cost of services. Cost of telephone services including mobile phones in PNG is believed to be one of the highest in the Asia-Pacific region because of lack of competition to Telikom PNG and its mobile phone services subsidiary - Pacific Mobile Communications. The recent announcement by PANGTEL, the communications regulatory authority and ICCC for the entry of two new entrants into the industry is welcome news.

The aging telephone infrastructure in PNG and the monopoly by Telikom PNG contributes to the unreliability and high cost structure of telephone, fax and internet services in PNG. A reliable and competitive service gives confidence to businesses, including those engaged in international business transactions, which for international commodity traders is round the clock. Domestic businesses also need reliable and competitively priced services to conduct business efficiently.

The limited coverage of the country for mobile phone services severely restricts the ability of businesses and individuals to transact business. From the CEOs of the multi-million dollar multi-national conglomerates to the betel nut seller, the need to know where opportunities are and making a timely decision is crucial. The high cost of services and limited coverage of mobile phone to the main centres of Port Moresby, Lae, Goroka, Mt Hagen, Madang and Wewak denies the majority of people to what should be a cheap and convenient communications service.

The government and private sector operate the mass media in PNG. The government through the NBC and the provincial governments operate the public broadcast radio network in 19 provinces. The two national daily newspapers and the sole commercial television network and several commercial radio stations are all privately owned. Independence and freedom of the media is important not only from the societal perspectives but also from a commercial point of view.

The private sector, e.g. Datec and Daltron, provide internet services. Internet is an important tool for transacting business, and gathering and dissemination of information. This tool could be used for forming a network to disseminate agricultural information. Its expansion to the provinces will boost communication and open potential business.

2.7.2. Law and Order

The proper upholding of the law and maintenance of order provides for harmony in the society and development of the economy. The threat posed by the inability of government to provide security and guarantee the rule of law undermines development and progress. Not only is the high cost of maintenance of law and order wasteful of public resources but also increases the cost to businesses. Most businesses emphatically pointed to theft and crime as serious problems that can substantially increase the costs of doing business. Farmers will not grow crops if they are likely to be destroyed by tribal fighting or if they are unable to get their produce to the market. The threat of break-down in law and order and the uncertainty of upholding of property rights can prevent investment and deny opportunities for employment and participation in economic development by Papua New Guineans. Among the recommendations from the National Extension Summit, 2004 to improve law and order are the following:

- Medium to long term: increase employment opportunities
- Promote youth farmer training concept as in OISCA and Banz
- Provide training and incentives to youths to participate in income generating activities

2.7.3. Land Tenure

The land tenure system in PNG is considered very complex because the majority of the land is under customary ownership and the land administrative system is inefficient and ineffective. The various legislations covering land provide for registration of customary

land and recognize ownership of title. However, the process of land registration can be quite cumbersome and the high number of cases tends to overwhelm the system.

The uncertainty and often disputed ownership of customarily owned land precludes most lending for agriculture development on traditionally owned land since such land cannot be used as collateral. Attempts by the government to enable registration of customary land were met by widespread opposition over the years.

Confidence in the land mediation and land court system has diminished because the system has been inactive due to lack of funding and inconsistent government support. Combined with the general deterioration in the law and order situation, there is widespread tendency to disregard the established process for land dispute settlement. The capacity of the system to deal effectively with the expected large number of registrations is also questionable.

It is possible to use existing legislation to make land available for large scale agricultural development. The Land Act 1996 provides that the State may acquire customary land for the grant of special agricultural and business lease. An instrument of lease in the approved form, executed by or on behalf of the customary landowners is conclusive evidence that all customary rights in the land are suspended for the lease period to the State (Land Act 1996 Part III Div. 4 Sec. 2). The Minister may grant agricultural or pastoral lease to a person or a land or business groups or incorporated body to whom the customary landowners have agreed that such a lease should be granted (Land Act 1966 Part X Div 3, 4, 9). Such lease will not exceed 99 years.

2.7.3.1. Customary Ownership of Land

The law in PNG recognizes customary ownership of land which means ownership arising from and regulated by customs. The law specifically prohibits sale of customary land (Land Act 1996 Part XX Sec 132). Yet this has not prevented people from acquiring land “use rights” from traditional landowners, often without formal title. In the long term, the government needs to address the land tenure system to ensure that people who have land are able to develop it. The proposed law on voluntary registration of customary land will enable people to raise financing (Department of Lands and Physical Planning). The Certificate of Title can only be given to an incorporated land group such as clan, lineage, family, extended family or other groups of persons recognized by custom. Although banks have not agreed to lend money on registered customary land, the registration provides an opportunity for the banks and the landowners to negotiate.

2.7.3.2. Leasehold and Freehold Lands

Only 3 percent of the land in PNG is under leasehold or freehold title. These include all lands occupied by townships and urban centres, plantations, roads, government and mission stations, special mining leases, agricultural leases, airstrips, etc. Government policy requires all freehold land to be converted to leasehold prior to sale or transfer of ownership.

The Department of Lands and Physical Planning maintains records of land ownership and administers land transactions but its records keeping system needs improvement. To make more arable land available for agricultural development, the government needs to take a more proactive role in the acquisition and leasing of land to potential developers, i.e. to both smallholders and large holders. While the experience of the government in acquiring land for special mining leases has usually been an expensive and time consuming exercise, the process for acquiring land from traditional landowners is well established.

Lease-leaseback scheme was initially used in the late 1970s and early 1980s to give coffee and cocoa smallholders and farmers a negotiable title over 20 ha blocks of customary land that they were developing so that banks could use the land as security and grant a mortgage-loan to the farmers. The scheme was later expanded to allow land of any size to be leased and leased back. The scheme means the State leases customary land for a fixed period of time (99 years or shorter), and then leases that land back to some of the original customary landowners, or to a business group, company or land group. When the land is leased back, a special State lease is designated as “alienated land.” Banks and other government and private institutions treat the lease as a government guaranteed title to the land.

A paradigm shift may be required to change the earlier approach of the government for bringing development to the people. The government must have a more direct role in agricultural development, including determining where and when priority agricultural development should take place and move people to those localities.

2.7.4. Financing

Since the mid-1960s the Rural Development Bank (RDB) has been the primary institution for channeling of government finance for agriculture and other rural development lending. The RDB successfully financed smallholder oil palm development in West New Britain, Oro, Milne Bay and New Ireland Provinces. It has also supported development projects. Credit support for food crops farmers was very minimal due to the lack of sufficient collateral for loans.

The DAL-sponsored Smallholder Agriculture Credit Scheme launched in the mid-1990s involved the RDB, commodity boards, agriculture extension institutions such as CCEA, FPDA and OPIC. Much of the loans lent under the K10 million scheme remain outstanding and may have to be written off.

The recent increase in the establishment of Micro Credit Schemes and Savings and Loans Societies is encouraging. Lessons learnt from other similar experiences elsewhere in the past need to be applied to the new schemes in order to avoid the pitfalls encountered in the past. A major factor of success for successful Micro Credit Schemes in Indonesia and elsewhere has been the low unit cost of lending. This entailed high volume of loans handled per worker and was often associated with areas which had very high population

density, good transportation infrastructure and sound communications network, resulting in effective delivery and recovery of credit with low average transaction costs.

Sound macroeconomic management by the government can keep interest rates low and stable. While the use of interest rate subsidy is generally not encouraged by international donor policies, the government should maintain a flexible position so that it can encourage farm investment.

2.7.5. Natural Resource Management

Sound underpinning Natural Resource Management (NRM) and sustainability policies are critical in ensuring sustainable communities and agriculture. Agricultural development should not come at any price, particularly to the environment and to the resource base on which agriculture relies. Using oil palm as an example, oil palm plantations are often devoid of native flora and fauna and require heavy input of fertilizers that can pollute streams and damage fish stocks. PNG has a unique flora and fauna - tourism can be a more sustainable industry than a cash crop. Each province should strive for a balance between cash crops, subsistence farming and the natural environment (which can offer alternative incomes from forestry, tourism, native foods and nuts and medicines) to help build resilient communities. Like wise as important, subsistence agriculture needs to be underpinned by sound NRM practices. New developments should be assessed for environmental impact, and measures for sustainable development are part of the implementation plan. This could include ensuring that any research undertaken by NARI etc, has NRM as a key element; extension services promote NRM; and appropriate education and training courses in NRM in any agriculture related courses.

2.7.6. Agricultural Products

Although PNG has some of the finest agricultural products in the world and has the potential to increase production and diversify into other new and exotic products, the country must ensure that its products are on the par with and meet market standards. The relatively clean environment in PNG creates potential for environment friendly and residue-free products. The potential for organic labeling of PNG coffee, cocoa, etc needs to be studied and emphasized in marketing programs to maximize the value of PNG products.

2.7.6.1. Standards

Classification of product standards and enforcement of product standards are integral to modern production systems. This ensures ready identification of products, value maximization and waste minimization. Standards define quality and give assurance to needs and requirements of customers. Compliance with international standards provides competitive edge to business.

PNG has established product standards for its main agricultural export commodities and applies quality control measures to protect these commodities. The Coffee Industry Corporation (CIC) in conjunction with the National Institute for Standards & Industrial Technology (NISIT) developed new standards for coffee. Specified standards for copra, cocoa and spices may need to be revised in the light of new market requirements. The LDC-owned and operated abattoirs are of the 1960s vintage and are outdated and in need of urgent replacement.

2.7.6.2. Quality Control

The owner of the product is responsible for quality control. An effective government inspection system not only complements the private owner's efforts but more importantly, ensures that the country's international reputation is maintained when private quality assurance systems fail.

In the absence of a government-approved inspection and control system, the private sector is responsible for vanilla grading and inspection system. PNG's reputation as an up-and-coming producer of fine vanilla suffered when farmers offered poor quality beans for export as prices exceeded K700 per kg from 2000 to 2003.

International trading in commodities depends on trust and reliable reputation of its participants. Once a country's reputation is damaged, importers from other countries either stop all orders or switch to alternative sources or the market automatically applies severe discount penalties on products from such origin.

2.7.6.3. Processing

On-shore processing is encouraged because of job creation, value-adding, and promotion of national identity and pride. The more important consideration is enhancing value to the product to benefit those involved in the value chain, including the grower. The government should support such investments with holistic appraisal considering incremental product value, employment potential, foreign exchange earnings and government revenue. Projects which merely redistribute benefits from one part of the value chain to another have low sustainability and may not necessarily provide overall long term benefits to the country.

Value-subtracting schemes which aim to penalize the grower through taxes, tariffs and other prohibitive practices which worsen the situation of the primary producer must be discouraged.

2.7.6.4. Regulations and Enforcement

Government regulations have two objectives: to define a standard, process or procedure and to ensure compliance with it. The desired outcomes resulting from the proper use of regulations are maintenance of high quality of products, minimized losses and wastage and harmonious trade relationships which lead to long term trust for stronger mutual

cooperation and benefit with trading partners.

Proper product standards and the presence of regulations are only meaningful if these are rigorously applied and tested over time. Continuous inspection and application of standards and regulations ensure awareness of existing standards and regulations; compliance with standards and regulations; facilitation of review and adjustment or adaptation to changing operating environment and international practice.

2.7.7. Marketing and Promotion

Marketing and promotion of products can be done at both the domestic market and at the international markets. Production of consumer products for sale in the PNG market should be targeted at import replacement opportunities. International market for commodities may require rigorous marketing and promotion to initially penetrate the market and subsequently to enhance product reputation, preference and loyalty in the market. There is scope for strong partnerships between the Department of Trade and Industry, Commodity Organizations, the private sector and Provincial Governments in such marketing and promotion.

2.7.7.1 Domestic Markets

With a population of over 5.2 million, the PNG economy provides a ready market for many domestically produced agricultural products including rice, wheat, beef, pork, chicken and staple food crops. Due to existing protective tariffs, PNG is virtually self-sufficient in sugar, pork and chicken. PNG has been largely self-reliant for its traditional food crops such as sweet potato, yams and cassava. Sago is an abundant source of starch in many localities and provides an important alternative to imported rice and wheat products. PNG's domestic market for rice is some 160,000 tonnes per annum and for wheat some 70,000 tonnes per annum. The estimate for meat consumption and production in PNG shows that PNG is a deficit producer of meat hence its import of some 60,000 tonnes of meat and meat products annually.

A targeted investment program should aim at self-sufficiency in production of rice, beef, and animal feed. At the same time, PNG needs to review its poultry and pork industries to ensure these can withstand international competition once tariffs are further reduced. Production of cheap domestically sourced animal feed is crucial for the livestock industry in PNG. The efficacy and viability of a variety of potential domestic commercial production of animal feed including cassava, sago, maize, sorghum and enhanced pasture using leucaena needs to be established quickly.

Projects aimed at import of live cattle for fattening and slaughter may have economic merit and warrant further in-depth feasibility study. Such projects require investment in modern abattoir facilities and can utilize cheap trainable domestic labor. Also the availability of domestic feed stock in PNG to provide a competitive advantage for production of prime beef for both the domestic and overseas markets and also canning meat for the domestic meat canneries warrants further investigation.

2.7.7.2. Agricultural Exports

PNG's main agricultural exports constitute an insignificant contribution to world trade in coffee, oil palm, cocoa, copra and coconut oil, rubber, vanilla, etc. Invariably, PNG produces and exports less than two percent of the world export volumes of any of these crops. It can therefore increase its production for export without causing any significant impact on world prices of these commodities.

In terms of its contribution to the national economy, agriculture's share of total PNG exports has declined from about 35 percent of total exports in the 1980s to less than 20 percent in the early part of the 2000s. Although the annual agricultural value of exports has increased to over K1 billion, the relative share of agriculture exports has been eclipsed by the huge increase in the export earnings by the minerals and petroleum industries.

2.7.7.3. International Markets

Access to international markets is regulated by specific product technical standards, importing country's official protocols, and international product standards and protocols. As a member of the various international trade agreements PNG's exports also fall under the standards established under those agreements. Currently PNG is a member of World Trade Organization (WTO), South Pacific Regional Trade and Economic Agreement (SPARTECA) and Melanesian Spearhead Group (MSG) trade agreements. It is still negotiating the terms of the Economic Partnership Agreement (EPA) with the EU and PICTA with other Pacific Island Countries (PICs).

PNG is also a member of the APEC commercial arrangement and together with the other PICs is still negotiating the PACER economic relationship with Australia and New Zealand. On bilateral level, PNG has a bilateral agreement with Australia under Australia-PNG Trade and Commerce Relations Agreement (PATCRA) that establishes a non-reciprocal free-trade area providing duty-free access for all exports to Australia. PNG/Fiji Trade Agreement allows certain goods to enter PNG's market at year 2000 rate with 10% VAT levy. Certain goods also enter at concessional rates, subject to quarantine approval on most eligible agricultural products.

Trade liberalization, hoped to be achieved through WTO Agreement on Agriculture is expected to lead to export promotion and import substitution for PNG agriculture and food sector in general. However, these opportunities cannot be exploited unless serious attention is paid to WTO agreements – Agreements on Sanitary and Phytosanitary Measures (SPS) and Agreement on Technical Barriers to Trade (TBT). Trading partners impose import restrictions based on food safety and quality concerns, and these concerns are legitimized by SPS and TBT agreements. To obtain maximum possible benefit from these agreements, PNG needs the following actions:

- improve its safety and quality norms to match the relevant standards
- strengthen export monitoring mechanisms so that domestic food and phytosanitary laws are effectively applied to agricultural and food items

- fair standards for strategically important food products.

The Agreement on Agriculture (AoA) is considered most effective in reforming food and agricultural sector. It aims for improved market access and export competition and reduction in domestic support, through tariffication of quantitative restrictions and time-bound reduction in existing tariffs, export subsidies and domestic support.

There is growing evidence that the world market expects ever improving quality and environmental standards in the production of its food. ISO 14001 sets standards for environmental management in the production. It will be critical of GOPNG, commodity organizations and growers to be able to demonstrate that their agricultural production is based on sound natural resources management practices.

Close geographical proximity to Australia is of no particular advantage to PNG agriculture. Having a sub-tropical climate for much of its northern region, the Australian Government naturally protects the interests of its farmers who grow a lot of tropical crops which PNG also produces such as papaya, mangos, avocado, taro, cassava, betel nut, betel pepper, sugar cane, bananas, rice, etc with a very stringent quarantine policy which is rigorously and effectively policed. It is therefore doubtful in the foreseeable future if Australia can permit imports of PNG products such as fruits, vegetables, sugar, rice, beef, pork, poultry, etc, even if PNG can demonstrate a comparative advantage for producing these products.

The development assistance provided by the Government of Australian to PNG over the past years appears chiefly to be focused on agriculture research and quarantine. To develop the vast potential of the agriculture sector in PNG, the Government of PNG needs to undertake investigations for potential markets in Asia and elsewhere for crops and livestock it may have comparative advantage in.

2.7.8. Gender, Social Issues and HIV/AIDS

2.7.8.1. Gender Issues

As in many Melanesian societies, men dominate decision-making at the household and at community levels. The participation of women and girls in decision-making is more difficult when they lack education and have limited or no income.

Empowerment of women has been advocated by many NGOs and community-based organizations (CBOs) yet women have still a long way to achieve the same status as men in many communities. Successful empowerment programs help both women and men to better understand their operating environment and jointly improve themselves.

Participation of women and girls in household decision-making to ensure that the family arrives at the best decision on matters such as allocation of daily family labour, food utilization, family planning, expenditure of family income, participation in income earning opportunities, etc. There is a need to increase women's participation in both

formal and informal agriculture activities. To ensure that the issues are part of development plans, more gender awareness trainings are needed.

The Government should develop a program to:

- improve the recognition of women's contributions to agriculture and natural resource management
- encourage more women to be involved in decision-making in these industries, including facilitating their representation on decision making fora
- increase the capacity of women to contribute to national government and industry agendas relevant to agriculture, fishing and forestry.

2.7.8.2. Social Issues

Individuals and their families are part of the community and are influenced by what the community does and what the community expects. Successful community level programs must target broad community issues such as health, personal hygiene, sanitation, family planning, child education, participation in agriculture field days, farm awareness campaigns, and adult literacy classes which impact on family values.

It will be important for all agricultural developments to be assessed to ensure that they contribute to the long term sustainability of the resource base and of the community.

2.7.8.3. HIV/AIDS

The government and the NGOs with international donor assistance are addressing the threat posed by HIV/AIDS. PNG has the highest incidence of HIV/AIDS in the Pacific region, and fits the criteria for a generalized HIV/AIDS epidemic (AusAID, 2006). A total of 12,341 cases have been reported from 1987 to June 2005, and new cases are reported annually. The disease is prevalent not only in large urban areas, but also in rural areas around primary industry sites.

There is a need to increase awareness of the devastation of the disease in order to prevent its spread and also manage those already afflicted. Poorly educated rural people are likely to be infected, and this has consequential impact on agricultural production. HIV infection leads to more sick days and a reduction in productivity which may result in loss of livelihood. The disease intensifies labour bottlenecks in agriculture, increases widespread malnutrition, and adds to the problems of rural women, especially female-headed farm households arising from gender division of labour and land rights/resources. In areas with high HIV prevalence, the impact on the affected family is huge with productivity and income losses as family members become ill and/or die and others devote time to caring for the sick, or planning for and attending funerals.

The vulnerability and risk of rural populations to HIV/AIDS is influenced by migration, access to health services, literacy and awareness, gender, marginalized populations, and

commercial sex work (World Bank, 2006). Among the recommendations to mainstream HIV/AIDS in agriculture and rural development are the following:

- Community driven development and mobilization. Communities which have identified HIV as a problem should be encouraged to develop locally owned programs to address HIV/AIDS. Community leaders and politicians should be sensitized about HIV/AIDS, and provide adequate information to address stigma and discrimination against groups with high risk behaviour who are often marginalized. The youths should be educated.
- Increased outreach to rural communities and migrant workers. Development work should disseminate information and awareness about HIV/AIDS to rural communities. Migrant workers and their families should be provided with prevention interventions (education, treatment of sexually-transmitted infections).
- Targeting vulnerable rural populations and those with HIV/AIDS. Safety nets could be targeted to the poorest households; especially those affected by HIV, before they dispose of assets, and engage in other adverse coping mechanisms.
- Partnership and technical cooperation. This means work with national level AIDS control organizations and programs for technical support, including coordination with NGOs and development partners to provide technical and financial support.

2.8. STRENGTHS AND POTENTIALS

PNG has several strengths and potentials to make agriculture the main source of economic growth.

2.8.1. Favourable Environment for Agricultural Production

A variety of crops and livestock grow well in PNG. From lowland to highland, crops grow according to their agro-ecological adaptation (Table 2.4). Floral and fauna resources are immense, renewable, and largely untapped and have potential for honey production. NDAL have land and crop suitability maps based on aerial photographs and extensive surveys of CSIRO. The maps show where development is suitable. Climate is well studied to provide regional climatic classification.

Table 2.5: Agro-ecological Adaptation of Crops and Livestock

Crop/Livestock	General Adaptability	Provincial Adaptability
Sweet potato	Highlands and lowlands	Manus, Bougainville
Banana	Up to 2200 m altitude	Central, Morobe, East New Britain, Madang
Cassava	Most provinces	Milne Bay, Central
Taro		Madang, East Sepik, Western, West New Britain, New Ireland

Sago	All provinces	Western (parts), Gulf, Sandaun, East Sepik
Yam		During dry season: Central, Milne Bay
Rice	Coastal to highlands	Central, Morobe, East New Britain, Bougainville, New Ireland, Madang, East Sepik, Eastern, Chimbu, Western Highlands
Wheat	Highlands	Eastern, Chimbu, Western, Enga
Coconut	Coastal areas	East Sepik, Madang, Milne Bay, Bougainville, East New Britain, Rabaul, New Guinea
Cocoa		East New Britain, Bougainville, New Ireland, West New Britain, Manus, Madang, Morobe, East Sepik, West Sepik, Oro, Milne Bay, Central, Gulf
Coffee		Western Highlands, Eastern Highlands, Morobe, Simbu, East Sepik, Enga, Southern Highlands.
Oil palm		West New Britain, New Ireland, Milne Bay, Oro, Sandaun
Rubber		Western, Central, Gulf, Oro, East Sepik, West Sepik, Sandaun, Manus, New Ireland
Vanilla	Sea level to 600m	East Sepik, Central, Morobe, Manus, Sandaun, New Ireland, Madang, East and West New Britain
Cardamom	1200-1700m	East New Britain, Simbu, Oro, Morobe
Chili	1500 m above	Western Highlands, Enga, Southern Highlands
Black pepper	Up to 1200m; lowland areas	East New Britain
Ginger	Up to 1500m	Eastern Highlands, Simbu, Madang, Oro, Morobe, East New Britain, West New Britain
Turmeric	Up to 1500m	Central, West New Britain, East New Britain, Oro, Morobe, Madang, Eastern Highlands, Simbu, East Sepik
Pyrethrum		Enga
Floriculture	all provinces	
Large ruminants		Eastern Highlands, Southern Highlands, East Sepik, Sandaun, Morobe, Madang, New Ireland, West New Britain, Bougainville, Central, Milne Bay, Gulf, Oro, Western

2.8.2. Idle Lands

Many customary lands are left underutilized under long fallow period, and turn into grasslands. For example, Morobe has 409,780 ha of grassland (Bilong and Galgal, 2006, unpublished cattle development proposal). These large tracks of land could be harnessed for agricultural production.

2.8.3. Entrepreneurial Attitude

Most of the 4.3 million rural populations depend on smallholder production system. Their livelihood and nutrition are hinged on agriculture. Some indicators of the entrepreneurial attitude of the rural farmers are the expansion in production of fresh vegetables and sweet potatoes, the vanilla boom in response to high prices, development of betel nut and betel pepper markets, and the high proportion of rural households engaged in commercial activities recorded in the 2000 census.

2.8.4. Disease-free Status

PNG is still free from bird flu and foot-and-mouth diseases hence its livestock can be exported, provided they are of good quality.

2.8.5. Organic Production

Most crops grown in PNG use only the rich fertile soil without any fertilizer. No insecticide sprays are used; hence there are no serious problems of pesticide residues. PNG can capitalize on the world demand for organic products.

2.8.6. Nucleus Enterprises Model

Contract growing between the management of the nucleus farm and out-growers could address farm management, input supply, and marketing. PNG could benefit from studying successful farms such as Ramu Sugar cattle and Niugini Table Birds poultry products which showed that private companies can provide extension, training and markets to smallholders under out-grower arrangements for sugar, cattle and poultry industries. Church groups, such as Seventh Day Adventist and Lutheran Church-owned Waso Ltd in Enga in 1970's developed and operated innovative participatory methods for working with people in rural and remote areas. Their efforts could be duplicated to increase productivity.

2.8.7. Demand for Food

PNG has a population of 5.2 million and would continually need agricultural food products including rice, wheat, beef, pork, chicken, roots crops and vegetables to sustain them. Food production is not keeping up with the population growth. Due to existing protective tariffs, PNG is virtually self-sufficient in sugar, pork and chicken. PNG has been largely self-reliant for its traditional root food crops such as sweet potato, yams and cassava. Sago is an abundant source of starch in many localities and provides an important alternative to imported rice and wheat products. PNG's domestic market for rice is 160,000 tonnes per annum and for wheat 70,000 tonnes per annum. The estimate for meat consumption and production in PNG shows that PNG is a deficit producer of meat hence it imports 60,000 tonnes of meat and meat products annually.

2.8.8. Demand for Inputs

Farming needs inputs such as rice, corn, vegetable seeds and seedlings of fruits and nuts, day old chicks, livestock feeds, fingerlings, queen bees, and small implements. Nurseries and seed farms for propagation and distribution to the growers are needed. Animal and fish feeds from local ingredients will boost production.

3. AGRICULTURAL POLICIES

3.1. BACKGROUND

Government sets policies and enabling environment, to guide the activities of the target population to achieve the desired outcomes. Different policies can contribute either directly or indirectly to the performance of a sector.

The Government of PNG, since independence in 1975, has formulated and implemented a number of reforms and policies that, in addition to other external and internal factors, influenced the performance of the agriculture sector; and through that, the livelihood of majority of the rural people over the last 30 years.

This chapter aims to analyze the different policies (or lack of it) pertaining to agriculture development in the country with the view to identify the shortcomings, if any, and suggest possible strategies to policy developments to meet the future challenges within the sector.

3.2. POLICIES AFFECTING AGRICULTURAL DEVELOPMENT

3.2.1 Establishment of Provincial Government

To meet the political aspirations of the different ethnic cultural groups in the country, the government established the Provincial Government system in 1977, with a mandate of agricultural extension function. The aim of the transfer was to provide an effective extension service and make other associated services more accessible to the farming community. In this context, the agricultural extension support facilities such as farmer training centres and agricultural resource farms were also transferred to the provincial government. However, over the years, for a variety of reasons, the provincial extension service did not meet the expectations and the facilities were not maintained well to serve the local farmers. The farmer training centres were progressively closed down, making access to training and other services more difficult for the farming community.

3.2.2 Establishment of Commodity Institutions

In the late 1980s, the Government became increasingly concerned about the declining productivity of the cash crops, as this subsector was becoming dominated by smallholders, and the provincial extension system was unable to meet the needs of the smallholder farmers. The Government introduced the structural adjustment to revitalize the sector. As part of this program, commodity corporations were formed to take over the responsibility of extension services to smallholders, among others. The Coffee Industry Corporation (CIC), the first of the corporations, was formed in 1991, paving the way for the amalgamation of the former Coffee Industry Board, Coffee Development Agency, and Coffee Research Institute into one entity. CIC was given the responsibility

of all functions related to the coffee industry. This policy of corporatization was extended to other sub-sectors and 14 new corporate bodies to manage major commodities, research and quarantine, governed by their own respective legislation, were created. These are the following (JICA, 2001; National Economic and Fiscal Commission, 2005):

- 1) Coffee Industry Corporation Act for the regulation of the coffee industry; incorporated as a private company but is given statutory powers relating to the control and regulation of the production, processing, marketing and export of coffee.
- 2) Cocoa Board Act (1984) for the regulation of the cocoa industry
- 3) Copra Marketing Board (1983) Act for the regulation of the coconut industry and management of copra marketing
- 4) Spice Industry Act (1989) for the regulation and promotion of the spice and essential oils industry
- 5) Rubber Industry Act (1954) for the regulation of the rubber industry
- 6) Oil Palm Industry Act (1992) for the development of smallholder producers of oil palm and the industry
- 7) Cocoa and Coconut Research Institute (2003) (under Companies Act)
- 8) Cocoa and Coconut Extension Agency (under Companies Act)
- 9) Coffee Research Institute (under Companies Act)
- 10) Oil Palm Research Association (under Companies Act)
- 11) Livestock Development Corporation Pty. Ltd. (1982) for the regulation of the livestock industry: through National Executive Council decision NG 75/82
- 12) Fresh Produce Development Company for the regulation of the fresh produce industry
- 13) National Agriculture Research Institute Act for the establishment of the National Agriculture Research Institute to conduct research program in food crops, livestock, and address the needs of the smallholder sector
- 14) National Agriculture Quarantine Inspection Authority Act (1997) for the establishment of the National Agriculture Quarantine Inspection Authority and define the functions of a national quarantine service for the sector, and regulation of agricultural imports and exports.

Commodity boards are responsible for policies affecting their respective sub-sectors. The corporatization aimed to improve the effectiveness of service delivery in order to achieve overall efficiency in production and quality of commodity crops. However, the process has fragmented the agriculture sector and did not facilitate monitoring of policy compliance, and mobilize resource support. The large number of organizations has led to a proliferation of functions and activities, most of which are inadequately funded, resulting in poor services to the producers.

3.2.3 Organic Law

In 1995, the Parliament approved the Organic Law on Provincial and Local Level Governments (OLP&LLG) that was subsequently amended by the new Organic Law (NOL). The primary objective of OLP&LLG is to improve the delivery of services for

rural development by decentralizing power and responsibility to local level government institutions. National agencies are required to support delivery systems by facilitating planning and development processes.

The MTDS describes the impacts of the Organic Law on Provincial and Local Level Governments (OPL&LLG) as having produced dysfunctional delivery systems. The following extract from the MTDS is a concise statement of the current situation as seen by Government:

“A key objective of the 1995 Organic Law on Provincial Governments and Local Level Governments was to improve service delivery by transferring significant responsibilities and funds to the provincial and local level governments. However, the reality on the ground is that in the years since the passage of the Organic Law, service delivery has deteriorated. On the whole, service delivery systems are dysfunctional and there remains widespread confusion over functional (who does what) and financial (who pays for what) responsibilities across the three levels of government. Institutional capacity to deliver services is generally poor, and in many local level government areas, is best described as grossly inadequate.

However, if the MTDS is to achieve its objectives, the system of decentralized government must be made to function far more effectively. Under the public sector reform program, the Government will intensify its efforts to identify practical solutions to address the current problems of the decentralized system, and the impediments to service delivery in particular.” (MTDS, pp. 9)

3.2.4. Minimum Wage Policy

In 1975, the Minimum Wages Board raised the minimum wage rates for urban workers from K8.00 to K25.80. The regulated increases for hired labor in rural areas were kept in line with inflation. The increase encouraged the rural-urban migration and created the law and order issues in urban centers. Although the migration reduced the supply of labor in rural areas, it is unlikely to affect the skilled labor supply for the agricultural export sector. Reasonable wages can be paid if there are sufficient returns from agricultural exports.

3.2.5. Trade Policy

3.2.5.1. International Trade Treaties

In the past, PNG is signatory to several existing international trade and commercial agreements such as World Trade Organization (WTO), Asia-Pacific Economic Cooperation (APEC), Melanesian Spearhead Group (MSG) and South Pacific Regional Trade and Economic Cooperation Agreement (SPARTECA) as well as the proposed Pacific Island Countries Trade Agreement (PICTA) and Pacific Agreement on Closer Economic Relations (PACER) arrangements. The extent to which PNG makes effective utilization of these agreements is not known. All these agreements specify reciprocal protocols for import and export of products between member states. The difference

between the PNG Ministry of Trade and Industry and Fiji over export of PNG corned beef to Fiji is an indication of the potential use and application of the international trade agreements to settle international trade disputes and for use of the agreed protocols and processes to a country's advantage. PNG needs to study carefully the provisions of the various agreements in order to gain maximum advantage for its exports and protect its domestic industries.

3.2.5.2. Tariff Policies

In the past, PNG has operated a high tariff policy (Duncan et al., 2006). In 1999, WTO indicated, that PNG's protectionist policies assisted certain products which did not provide comparative advantage to the country, such as sugar (+110% for value added), and penalized traditional export crops (0-22%) of coffee, cocoa, copra, and palm oil (quoted in Duncan et al., 2006). Under the WTO, PNG has developed a schedule for progressive reduction in its tariff schedules in 1999. While the protection for most items will decline to the lowest rates under WTO agreed schedule by end of 2006, the protective rate for sugar has been extended by the Government to 2011. The competitiveness of its poultry and pork industries will become apparent when tariffs are further reduced as per agreed WTO schedule.

3.2.6. Macroeconomic Policies

A sound and stable macroeconomic management gives confidence to the private sector and facilitate sound business decision. PNG has gone through a cycle of hard currency and low inflation period of the mid-1970s to the mid-1980s to the period of devaluation, high inflation, high interest rate and unstable exchange rate of the early 2000. To its credit, the country has now stabilized its macro-economic position. The kina has been stable with the country having sufficient foreign exchange cover for six months of non-mining imports. The banking liquidity is buoyant, resulting in commercial bank interest rates falling from the high 20s to below 10 %. Inflation is now stable at below 5 percent.

The contribution of agriculture to the export revenue has declined from about 35% in the 1980s to about 20% in 2005 because of the increase in the export of petroleum and minerals. However revenue flows from mining and petroleum industries are finite and will run out one day. The Bougainville copper mine and the Misima gold mine have already closed. The expected closure of Ok Tedi and Porgera mines in about 2012 will significantly reduce PNG's ability to pay for imports unless new mineral and petroleum discoveries are developed by then.

3.2.6.1. Exchange Rate Policy

PNG implemented “hard kina” policy which fixed exchange rate from 1975 to October 1994. The government has delegated the management of the exchange rate to the Bank of PNG (BPNG). The BPNG has adopted a managed float strategy of the kina which lowered its value by 70% against the US\$. The depreciation of kina had resulted into higher cost of imported items. Duncan et al. (2006) reported a significant deterioration in the purchasing power of export receipts in terms of local commodities. This policy is a major contributor to limited expansion and investment in export crops.

3.2.6.2. Fiscal Policy

Government expenditure impacts greatly on the macroeconomic management of the economy. The government’s objective is to reduce public debt with priority on retiring of overseas public debt. The fiscal performance of the current Government since it assumed office in 2002 has been commended by various independent observers.

3.2.6.3. Monetary Policy

The Bank of PNG uses the monetary policy to influence commercial bank interest rate. In the early 2000s heavy domestic borrowing by the government to finance the national budget forced interest rates into the high 20s and crowded out private sector investment. Many businesses including agricultural businesses folded up and very little new investment was made during the period. A stable interest rate strategy can encourage investment and provide employment and generate economic growth.

3.2.7. Industry Assistance

3.2.7.1. Commodity Stabilization Funds

Until the early 1990s commodity stabilization funds for coffee, cocoa, copra and oil palm were operated on behalf of producers by the respective commodity board. The main role of the commodity stabilization funds was to minimize the fluctuations in the incomes of producers. All producers paid a compulsory levy into the respective stabilization fund when producer prices were above a certain average threshold price and received a bounty when producer prices fell below an agreed threshold price.

The stabilization funds were supposed to be self-financing, but consistent low world commodity prices during the late 1980s and early 1990s decimated the funds. The government, much to the chagrin of the IMF, World Bank and the ADB, was forced to finance the operations of the funds until prices recovered in the late 1990s.

Studies conducted by the ACIAR and the University of New England argued against the existence of the stabilizations funds out of economic considerations. The studies indicated that the stabilization funds discouraged investment. Long term effect is economic inefficiency by masking the ability of investors to make rational economic decisions for entering or exiting the industries concerned.

The government justified commodity funds to manage import demand during periods of favorable commodity prices, avoid special taxes on agriculture export income and maintain macroeconomic stability. This measure was relevant during the period of the hard kina policy to minimize the impact of imported inflation. In terms of providing a safety net for the rural sector and the rural economy, the operations of the funds, especially with government financing, performed a very important function when commodity prices were lower than production costs.

Current government policy leaves the commodity boards to decide on reviving the industry funds. In the oil palm industry, the smallholder producers are vehemently against the re-establishment of any stabilization fund for oil palm. The CIC has established a positive fund balance of about K20 million by 2004. In contrast, the cocoa and the coconut industry funds still owe the government K30 million and K6 million, respectively. The oil palm industry price support loan was written off by the government using the EU's Stabex facility.

Apart from the social welfare function which the government can provide irrespective of the presence or absence of the commodity stabilization funds, re-establishment of the funds has no economic justification. The funds could only be justified in an era of hard currency policy. It is therefore recommended that the commodity funds concept be abolished and the enabling provisions in the respective governing legislations be repealed.

3.2.7.2. Tax Incentives under the 'Green Revolution Policy'

Based on the National Government Policy on Export Driven Economic Recovery Strategy, the government provides agricultural incentives through the Green Revolution policy, including the following:

- Double taxation (tax deduction) for agricultural research and extension expenses
- Increase tax credit rate for agricultural companies to allow maintenance for rural infrastructure
- Give new agricultural investment projects a 10% corporate tax for a minimum of 10-year period, increasing to 20% for the second 10 year period
- Allow duty free importation of all machinery and vehicles for agricultural companies
- Remove foreign tax controls that deter foreign investors
- Remove excise and duty rates on diesel fuel
- Remove all taxation assesses on dividend payments for shareholders in agricultural companies
- Freight subsidy for cocoa and coconut producers in outlying remote areas and isolated islands
- Freight surety scheme for coffee producers in isolated hinterlands of the Highland region and coastal areas
- Subsidized portable rice mills for rice farmers throughout PNG
- Subsidized small copra processing mills.

The implementation of the government's Green Revolution started in the 2004 budget and would be reviewed at the end of December 2006.

3.2.7.3. Transport Subsidies

The green revolution involves the use of PNG Defense Force aircraft for air freighting of agricultural produce. Millions of kina are spent for the green revolution. The subsidy is not only short term and unsustainable but also could lead to further distortion in the provision of air transport to remote airfields by small private operators in the long term. Studies are needed to determine the advantages and disadvantages of the subsidy as well as alternative methods.

3.2.7.4. Smallholder Credit

The DAL sponsored Smallholder Agriculture Credit Scheme launched in the mid-1990s involved the RDB, commodity boards, agriculture extension institutions such as CCEA, FPDA and OPIC. Much of the loans lent under the K10 million schemes remain outstanding and may have to be written off.

The recent increase in the establishment of micro credit schemes and savings and loans societies is encouraging. Lessons learnt from other similar experiences elsewhere in the past need to be applied to the new schemes in order to avoid the pitfalls encountered in the past. A major factor of success for successful micro credit schemes in Indonesia and elsewhere has been the low unit cost of lending. This entailed high volume of loans handled per worker and was often associated with areas which had very high population density, good transportation infrastructure and sound communications network, resulting in effective delivery and recovery of credit with low average transaction costs.

Some recommendations from the National Agricultural Extension Summit to raise funds for smallholder credit are: industry boards, corporations, farmer cooperatives as shareholders of RDB; industry boards and corporations should invest part of the revenue collected as levies in the RDB for loaning to farmers; farmer groups or communities to be guided and assisted by DOF/Bank of PNG in establishment and running of microfinance institutions/banks in the districts; self-sustaining institutions to be owned by community through shareholding; Treasury to enforce direction of 50% of derivation grant to agriculture extension; revive Smallholder Agriculture Credit Scheme with a mechanism for timely repayment.

Sound macroeconomic management by the government can keep interest rates low and stable. While the use of interest rate subsidy is generally not encouraged by international donor policies, the government should maintain a flexible position so that it can encourage farm investment.

3.3. NADP POLICY OBJECTIVES

The overall Government policy objectives relate to the importance of agriculture in the economy and the potential it offers to create a sustainable income and employment opportunities for the majority of its population living in the rural sector. The MTDS places higher priority to agriculture extension and research services, farmer training, credit facilitation and access to agricultural information. In line with the MTDS, the NADP identifies five principles for guiding the policy directives for the period 2007 to 2016 and beyond as:

- To give attention to alleviating identified sector constraints and ensure a sustainable agricultural growth;
- To concentrate efforts in investment programs having potential for high economic returns in production, exports, income and employment, and for enhancing equitable distribution of development opportunities and income among regions, with minimal adverse effects on the environment;
- To create environment conducive for greater private and commercial sector participation, especially removing macroeconomic policies that discriminate growth in agriculture;
- To ensure development of human resources for them to participate productively and improve general rural welfare and
- To ensure the long term sustainability of the natural resource base through agriculture policies, programs and developments based on balanced social, economic and environmental factors.

The policy objectives of the Government are generally aimed at alleviating the serious constraints affecting agricultural development. The White Paper on Agriculture Sectoral Policies, 1996 to 2000, focuses on enhancing the productive capacity and fostering sustainable growth, creates conditions that will enable the sector to perform its multi-functional role as a source of food, employment, income, effective management and resources delivery. The development objectives in the medium to long term are to:

- * Improve the efficiency and international competitiveness of traditional export crops by raising smallholder productivity and product quality, and by lowering production and marketing costs;
- * Assist smallholder farmers exploit any reasonable opportunities for efficient diversification of the agricultural production base, both for import substitution and exports; and
- * Foster more balanced development of the sector to generate broad based rural income and employment, reduce rural poverty, maintain food security, and promote sustainable natural resource exploitation.

3.4. KEY POLICY AREAS

3.4.1. Improve Macroeconomic and Incentive Regimes

The export led policy of the government can be realized through a continuum of production-supply-marketing. These may be taken as a continuum supported by specific government policies on each front and underpinned by a stable macroeconomic policy framework and stable and sound Central Bank policies. With simultaneous resource support to infrastructure development, the government's Green Revolution policy to the agriculture sector will raise the production level and increase the volumes of marketable or export commodities.

A greater proportion of the revenue earned by the companies in the export business should be remitted back to the country within the three-months withholding period set by the central bank. A study has showed major discrepancies in money remitted back to the country against the potential amount estimated.

Government should have policy and resource commitment to support PNG nationals to enter the export marketing business. The PNG exporters with a support provided under the government incentive program should export all their products, e.g. coffee to their overseas registered company and perform the marketing themselves. Such a government commitment to PNG national exporters would fully realize the goals of the Green Revolution Policy of the government.

Government should also have a policy on the local government as one of the shareholders in new agricultural companies, to ensure that needed infrastructures are funded.

Government must consider subsidizing transport of post harvest food items as an incentive for perishable food production.

3.4.2. Improve the Effectiveness of Public Institutions, Programs and Expenditure

3.4.2.1. Improve Coordination Capacity for NDAL

A sectoral body needs to coordinate the programs of the agriculture institutions to avoid conflict and duplication of roles, and ensure maximum cooperation between institutions. The coordinating agency needs access to critical information for planning and evaluation of the effectiveness of all agriculture related programs. Such agency must have access to budgetary information, and ability to conduct independent and acceptable standards of policy research and analysis, for evaluation of proposals for funding and also the monitoring and conduct of impact assessments of implemented programs and projects.

For improved cooperation, coordination, collaboration and cohesiveness to occur, the sector must have a spirited and proactive leadership. Naturally, the central coordinating body for the sector falls upon the NDAL. The Government must ensure NDAL has the capacity and standing to support the sector through effective influence of government policy and decision-making. It must have the capability and capacity for policy research,

planning and monitoring and evaluation. It must lead sector institutions in improving agricultural growth.

The World Bank-supported Agriculture Support Service Project in 1983 provided an effective manpower development program which built the NDAL's capability for policy research and analysis and for project formulation, appraisal and for monitoring and evaluation. However, this capability was dissipated with the transfer of its staff to various commodity corporations. With only one economist currently employed, NDAL's rural statistics function has no capability to mount any agriculture surveys or provide basic up-to-date agriculture statistics for policy analyses and formulation, or assist any aspiring potential investor. NDAL's capability for efficient policy, planning and coordination is currently non-existent.

The NDAL needs to restructure its functions and recruit experienced personnel to be more assertive in its leadership role. A revamped DAL must have the capability and capacity to perform the following functions:

- Economic and policy research and analysis, including agricultural census and databases, that can influence and contribute to policy and decision making in other portfolios to ensure that the outcomes of the NADP are supported and delivered
- Develop appropriate policies and programs and facilitate, coordinate and disseminate information of natural resource management to ensure the long term sustainability of the natural resource base and the agriculture that is dependent on it.
- Sector planning, budgeting and coordination
- Monitoring & evaluation and technical audit of NADP programs and projects
- Strategic planning, to include influencing, coordinating and delivering the collection of information and research related to sustainable agriculture and sound NRM practices
- Build private/public partnerships for NADP implementation, working closely with industry and provincial governments to capture the potential for such partnerships
- Large scale project preparation and facilitation of commercial investment by private sector
- Provision of effective secretariat to the NAC and its sub-committees
- Coordinate priority sub-sector programs identified under NADP
- In partnership with commodity boards and the country's overseas missions (high commissions, embassies & trade missions), seek and actively promote markets for PNG products
- With the assistance of NARI, NAQIA and other scientific establishments, ensure PNG has effective surveillance and management systems for dealing with important pests and diseases
- Effective coordination of agriculture sector manpower planning
- Liaison with international agencies and donors in respect of international treaties, obligations and supporting activities

- Coordinate technical assistance to provincial agriculture

3.4.2.2. Streamline and Support Corporate Agricultural Services

The roles and services of agricultural corporations and research institutes must be streamlined and supported so that scarce Government resources are used efficiently and effectively. Corporations should have a more facilitative role, collecting development levy to provide funds for development. An apex body for the tree crop sector should be set up to plan, set priorities, allocate resources, monitor and evaluate performances of the subsector. A single implementing agency is needed to monitor large commercial agro enterprises. The charter of the Livestock Development Corporation, which is growing fruit trees to raise income, should be redefined to meet the current requirements of the livestock industry. Its abattoirs will be retooled, reconstructed and privatized, as appropriate. Laws are needed to govern nucleus enterprises and safeguards are needed to protect the out-growers. It is urgent to monitor cost and prices offered to farmers. Programs and projects must support producer groups to market directly in order to reduce marketing and processing cost, and retain more money on-shore for investment in the industry. More national companies should be encouraged to participate in commodity trading.

The cooperative strategy should be supported to strengthen farmer groups. A Cooperative Development Authority should be created to play a critical role in mobilizing smallholder land and labor. Department of Commerce and Industry (DCI) unit on cooperatives needs support for this purpose.

Research institutes should form an effective research system to strengthen collaboration among institutions, extension, districts and farmers (see Chapter 4).

Commercial agriculture depends on economies of scale and applicable technologies for commercial agriculture may not necessarily be applicable to smallholder situations. Research applicable to commercial agriculture needs prioritization so that adequate resources, possibly with private sector funding, are allocated for such efforts. To a large extent, the research in oil palm and sugar in PNG have generally been privately funded. Government contribution to privately conducted research has been intermittent and government has largely taken a hands-off approach to private agriculture research. Where resources permit, government should contribute to private research considered to have public utility.

3.4.2.3. Build the Capacity of Provincial and Local Governments

Provincial and local governments play a key role in implementing NADP, particularly through the provision of extension services. Support is needed to build linkages or facilitate partnerships, provide natural resource management and economic information, and develop mechanisms for joint policy development and priority setting.

3.4.3. Foster Greater Private Sector Investments

Government can encourage more private sector investment by determining where and when agricultural development should take place. It can also provide incentives such as reduced taxes and tariffs. An effective government inspection system is needed to complement the private sector to ensure the country's international reputation. Specified standards for copra, cocoa and spices may need to be revised in the light of new market requirements. To develop the vast potential of the agriculture sector in PNG, the Government needs to investigate potential markets in Asia and elsewhere for crops and livestock it may have comparative advantage in.

Among the targeted private investment programs are increasing domestic production of rice, beef, and animal feed to reduce dependence on imports. PNG needs to review its poultry and pork industries to ensure these can withstand international competition once tariffs are further reduced. Production of cheap domestically sourced animal feed is crucial for the livestock industry in PNG. The efficacy and viability of a variety of potential domestic commercial production of animal feed needs to be established quickly.

Projects aimed at import of live cattle for fattening and slaughter may have economic merit and warrant further in-depth feasibility study. Such projects require investment in modern abattoir facilities and can utilize cheap trainable domestic labor. Also the availability of domestic feed stock in PNG to provide a competitive advantage for production of prime beef for both the domestic and overseas markets and also canning meat for the domestic meat canneries warrants further investigation.

Private sector investments are needed to rehabilitate tree crops plantations. The provincial governments need to conduct census and survey for tree crops, rural leases and status of plantations, undertake feasibility studies and develop business plans and investment packages.

On-shore processing is encouraged because of job creation, value-adding, and promotion of national identity and pride. Products should have enhancing value to benefit those involved in the value chain, including the grower. The government should support such investments with holistic appraisal considering incremental product value, employment potential, foreign exchange earnings and government revenue. Examples are industries on food processing and preservation, spices, floriculture, and pyrethrum as nucleus enterprises.

For efficient and lower costs of communication service, more private sector investments are needed in telephone, newspapers, radio and television.

3.4.4. Address Deficiencies

3.4.4.1. Deficiencies in Agricultural Production

Production of locally grown foods should be encouraged, especially rice which cost the country K250-270 million in annual imports. Although domestic production of pork and

poultry is sufficient for current demand, it is supported by high import tariffs which are due to decline further following PNG's obligations under the WTO. Current tariff rates on imported compounded feed and agricultural equipment must be reduced. Agricultural input suppliers must be linked to upstream production industries.

The lease–lease back land tenure system should be promoted for large scale extensive cattle, sheep, goats, and deer farming. This policy is needed to expand beef production and lessen importation of low grade beef and lamb.

The frequency of droughts in the past decade affected PNG's domestic food production. The Government needs to invest in drought mitigating systems and also drought resistant production systems for the food crops. Investments are also needed in linking natural resources management with agricultural production.

Household food security entails both the availability of food and the utilization of available food. Effective joint agriculture and health extension programs can increase the knowledge of food utilization and preparation at the household level.

Through improved crop and livestock technologies, downstream processing, and other innovations, agricultural production opportunities will widen and offer more income-generating enterprises.

It is important to actively encourage mixed cropping or inclusion of animal husbandry (e.g. cattle under coconuts, chickens and orchids under palm oil) on large scale cash crops production such as oil palm, coconut and rubber. Mixed cropping is environment friendly, and supports local communities in commodity price crashes, climate change, natural disasters or pest and diseases.

3.4.4.2. Deficiencies in Support Services

More research is needed to develop appropriate technologies for agricultural production systems in PNG. Technologies should be affordable, environmentally friendly, and culturally acceptable and transferred to increase yields, quality, reduce input costs and improve output efficiency. New initiatives, concepts and ideas should be encouraged.

Research is needed to improve the quality of animal and plant health. The country should be able to deal with the threat of national epidemics or possible regional and global pandemics caused by a multitude of highly contagious diseases such as H5N1 (bird flu) virus, SARS, mad cow, foot and mouth disease, swine cholera, etc. Institutions such as DAL and the NAQIA must maintain surveillance to prevent major outbreak of pest and diseases, and need adequate staffing level with proper training and adequate resources.

Information is needed to facilitate export promotion. NARI, NAQIA, and IRC must provide information on overseas market requirements, e.g. quality and quantity to tap overseas markets, procedures for preparing products, duties and taxes to be paid, organic certification processing mechanism, quarantine requirements, etc. Support is needed to

provide this information.

3.4.4.3. Deficiencies in Human Resources Development

At present, no agency has the overall responsibility for manpower planning for the agriculture sector. High school graduates, drop-outs, and retired public servants are almost unlimited resources for agricultural development waiting for a systematic plan. This labor force should be productively harnessed; otherwise it will become a source of misery and resentment which will lead to negative social behaviors such as increased criminal activities. A Youth Development Plan should be developed to concentrate on youths up to age of 25 years, with selection criteria. One possible model is that these youths will be paid by the state with some token wages and attached to an agricultural entity to gain experience. After passing certain conditions, they are provided loans through the Rural Development Bank to start an agricultural project. This model pulls youths off the street and put them into plantations to work and earn a living.

In many villages, much of this labor force cannot be utilized because of land limitations (e.g. Gazelle Peninsula, ENBP), lack of market access (e.g. Pomio District, ENBP), and lack of skills for commercial agricultural production (e.g. East Awin, Western Province). An effective government program to address this issue is to make land available and move people to those lands for participation in government priority objectives in crops and livestock development.

Retired public servants who may wish to return to their home province and use their skills, knowledge and experience can contribute meaningfully to nation building. Many retired public servants have difficulty returning to their home villages because of lack of access to land for productive investment initiatives. Agricultural land in all provinces could be leased to retiring workers who have lump sum payouts.

The NDAL maintains the Highlands Agricultural College (HAC) and the LISTC which conduct the PCD and farmer training programs. The universities provide training for professional staff. The specialized commodity research and extension institutes, NARI, and the NGOs run specific training courses for farmers. Unitech, Vudal and Goroka universities cater for agriculture education including extension. Although the popularity of agriculture in the number of university courses offered is good indication, possible duplications which may result in over-production of one category of manpower and shortage occurring elsewhere should be avoided.

At the sector level, the NDAL should ensure that the human resource development needs of the agriculture sector are sufficiently addressed by key decision-making bodies of the universities and the Office of Higher Education which provides government scholarships for tertiary students. A reintroduction of agriculture cadetships and scholarships can attract talented young people to the sector. Agriculture education should begin at an early age in the schools system so that most students will return to the land after completing their schooling. The targeting of agricultural education at the University of Goroka should be supported. A rational manpower development is needed to balance

professional needs, e.g. agricultural engineers are not adequately addressed by the local universities.

Women contribute 50-70 percent of agricultural labor, more particularly in activities such as clearing, planting, weeding, harvesting, transporting, storing and marketing. Cash income received by women from the sale of agricultural produce gets effectively spent for improving family living, nutrition, health and education. Agriculture provides employment and income to 70% of women. Rural women in PNG are disadvantaged in almost all aspects of rural life, due to limited access to and control over productive resources (lands, water, labor, inputs and technology), services (extension, training, and credit), and markets, and their limited participation in decision-making. Women receive lower wages for agricultural labor; earn less than men from the sale of cash crops, are unequally represented in the social forums, and are left out both as contributors and beneficiaries in productive economic activities. When households need to generate additional income or faced with economic crisis, women must mobilize their energies.

It is important to formulate clear policy and appropriate strategies towards welfare of women in all aspects of agricultural development. The following policies are needed:

- Encourage women's involvement in all aspects of agricultural development including research, extension, policy planning, education and training, non-formal education, vocational education, and voluntary and formal organizations. Support in the form of credit and loans are needed to undertake commercial activities possibly for export market such as floriculture.
- Promote methods and techniques that will eliminate drudgery of women, increase productivity, and provide equitable returns for their labor.

3.4.4.4. Deficiencies in Physical and Economic Infrastructure

Agricultural production is affected by lack of infrastructure such as transport and roads (see Chapter 2, Issues and Constraints). Policy recommendations include the following:

- Maintenance and rehabilitation of existing transport infrastructure that contribute positively to economic growth
- Design and establishment of agricultural projects in areas and districts that are accessible to the market with improved road and transport infrastructure
- National transport policy should be on maintenance and upgrading of existing roads. Provincial plans should identify important agricultural roads that should be included as priority for maintenance to facilitate access for farm produce.

4.0 AGRICULTURE RESEARCH, EXTENSION, INFORMATION AND TRAINING.

4.1. BACKGROUND

4.1.1. Research and Extension Situation

Agricultural research, extension, information services and training are some of the driving forces of agricultural development for rural poverty reduction. However, most PNG farmers have little access to extension and other related services for many years, and public-sector agricultural extension capacity of PNG had been declining since independence. Agricultural education and training have also been neglected by the public sector. Attempts to replace public-sector extension with corporatized and privatized services have met with limited success, and an affordable, manageable, equitable and effective national extension system is yet to emerge. Exceptions may be found in the commendable work of many NGOs, churches and donor projects, along with recent progress by some commodity institutes and agribusinesses. Collectively, these experiences offer some guidance on possible pathways out of the current dilemma.

Prior to 1980, the Department of Primary Industry, now the Department of Agriculture and Livestock, implemented agricultural research in the country. The research covered tree crops, food crops, resource management, and livestock.

In the early eighties, the International Service for National Agricultural Research (ISNAR) reviewed the Department's crop research program (Charles, 1982) which resulted in commodity research being transferred to the respective commodity organizations. They were financed through research levy on exports, and annual government grants (Sitapai, et al., 1994).

The remaining areas of research in the agricultural sector were transferred to Livestock Development Corporation and the National Agricultural Research Institute (NARI).

Other bodies undertaking some formal agricultural research are: PNG University of Technology through its Departments of Agriculture and Applied Sciences and the Biotechnology Centre, Trukai Industries, Fresh Produce Development Company, and Wau Ecology Institute (Tololo, et al., 2000).

The MTDS identifies extension services and agricultural research as high priority areas. However, cursory examination of current and recent budget allocations demonstrates that the provinces do not follow the priorities of the MTDS. Given that the major economic activity in rural areas is agriculture, very few provinces allotted/allocated minor operational budgets to the Provincial DPI (PDPI) and even less to the District/LLG extension services. Exceptions are provinces with significant donor-supported projects or government programs to which the province committed counterpart funds. In addition, the program of public sector reform and downsizing has reduced the number of staff, especially at Provincial and LLG levels. Some Districts have only one officer to service

up to five LLG areas, with no operating budget.

Following the MTDS, and in an attempt to address the identified deficiencies, the government and donor community commissioned several detailed studies and reports that impact on the extension, information and training sub-sectors, as follows:

- ADB TA 4055-PNG Report on Preparing Agriculture and Rural Development Project (Phase One): recommended guidelines for a NADP and studies to carry out the Functional and Expenditure Review (FER).
- Functional and Expenditure Review (FER) of Agriculture Sector, August 2005. Department of Prime Minister and NEC, Public Sector Reform Management Unit: recommended that each commodity organization and the NDAL conduct their own FERs and called for NADP to give the program and expenditure plan in the sector in order to assess relevance and recommendations for key roles for the National and Provincial agencies. The FER also recommended pooling the derivation grants to Provinces as a strategy to ensure funds for agricultural activities at the provincial and LLG levels, and foreshadowed structural reforms to NDAL plus major capacity building across the sector. Several FER's themes and recommendations echo throughout the NADP.
- AusAID - Papua New Guinea Agriculture Sector- Research and Extension Program Planning Study, August 2004: finalizing a new sector program that builds upon and supports the national Agricultural Research System (NARS), NARI, and AIGF. The design of this program is still under development, but may play a central role in regard to extension-research linkages and research management. However, the new program is unlikely to address the problems of extension and service delivery across the sector.

4.1.2. Extension Models/Programs

A number of extension models have been tested in PNG. The lessons from each model need to be considered in planning for an effective, sustainable, equitable and culturally acceptable system for extension service delivery.

4.1.2.1. Agricultural Extension -Patrol Officer Partnership

During the Australian administration, each district has 3 agricultural extension officers (for Crops, Livestock and Fisheries) and a patrol officer (“kiap”) to service the needs of rural communities. The extension officers come from the equivalent of the Department of Agriculture and Livestock and reports to the Patrol Officer. These officers, mostly Australians with some agricultural qualifications, were required to visit every village on a regular basis. The Agricultural Extension Officers were responsible for the delivery of technical agricultural information and limited quantities of farming inputs such as planting materials, and demonstrations of new techniques. The Patrol Officers were charged with monitoring conditions in the villages and reporting to the administration. The system deteriorated soon after independence, and was replaced with a “Didiman” or general extension system. Many older farmers and agriculturists lament the passing of a

highly effective system for extension. These observations appear to be based on some key features of the old system:

- Equity: villages received regular visits from the Patrol Officer.
- Independence: the Patrol Officers and the Administration that they represented were perceived as independent of clan and *wantok* influence. This independence appears to have been regarded as extremely important by communities, and thus conferred considerable respect and influence on the officers.
- Regular access to new technologies, basic services and information.
- The services provided to communities covered more than just food production, and dealt with many locally-important matters affecting their farm-based livelihoods.

The patrol officer system also benefited governance by regular detailed feedback to the administration on agricultural and social conditions in each village. This feedback of local conditions and needs into national planning and policy settings also deteriorated rapidly after independence, and continued to decline. The implementation of the Organic Law and decentralization policies has so far failed to restore these linkages with the grass-roots.

4.1.2.2. Farmer-to-Farmer Extension

The farmer-to-farmer or village extension worker (VEW) concept is a well-accepted extension approach in many countries. Respected village farmers act as the ‘conduits’ between communities and their external sources of information. The Fresh Produce Development Agency applied VEW approach to reach and assist farmers with production, marketing, and livelihood activities, as well as bookkeeping, related to fresh produce with heavy emphasis on marketing, quality control and post harvest problems.

The community recognizes the VEWs as ‘*good and respected farmers*’ and work with contact farmers to introduce and evaluate technologies, define and address production and marketing problems and provide feed back to the technical support agency. They receive training, information and access to inputs such as planting materials on a regular, systematic basis.

Several donors and NGOs are testing variants of the VEW and Model Farmer approach in PNG. These include the following:

- The FAO Special Program for Food Security approach reported very high adoption rates for the new technologies (Dekuku, et al., 2002). This program trained ex-DPI extension workers – now farmers – who are serving as consultants to other projects.
- The Begasin-Bugati Rural Development Program of World Vision in Madang involves a high level of genuine community support in the selection of the lead farmer and developed close links with the LLG planning. It employs a livelihood

design with components in primary health care (including water and sanitation), food security and nutrition, increasing family income and improved capacity of local communities.

- NDAL-JICA Smallholder Rice Promotion Project at Madang provides intensive training and support in rice production for its lead farmers. The ‘model’ farmers perform without compensation. Technical and input support is being provided through the DPI.

The VEW model shows considerable promise as a low-cost and effective extension method. However, it needs to be further developed and refined to address emerging issues and ensure its sustainability.

4.1.2.3. Contracted Extension Services

Governments are gradually privatizing extension services to agriculture, often with user-fees. In PNG, donors support this trend which is reinforced by GOPNG budget priorities in non-agricultural sectors, such as infrastructure, health and education. A mixed model with public funded-private delivery and contracting-out of extension services to smallholders is being tested through the Smallholder Support Services Pilot Project (SSSPP), (2000-2006), with ADB support. The key elements of SSSPP are the following:

- Assist interested communities to identify their priority technical needs and develop action plans through participatory rural appraisal and planning (PRAP).
- Create a dedicated trust fund and management unit under the Province(s).
- Advertise and award contracts to external Service Providers (SP), on a competitive basis, for the delivery of approved services in response to community action plans.
- Involve the farmers in monitoring and evaluation of implementation, supported by external evaluations of contract outputs and outcomes.
- Encourage partnerships and joint ventures in service delivery.
- Provide for the technical backstopping and capacity building of service providers.

The SSSPP has generated enormous interest and support from communities with the participation of 125 groups involving over 5,000 households, and unsolicited requests from another 68 community groups representing some 2,900 households. Over 270 service providers (SP) are registered with the project, of which 158 were awarded contracts, 20 percent of which have been to women service providers.

SSSPP faces challenges in time demands for coordination between national, regional, provincial and district staff and the project; financial resources to cover operating and SP costs; facilities and equipment, especially for District staff; and technical capacity and attitude constraints among District/LLG staff. The SSSPP contracting processes are

necessarily demanding on both administrative systems and operating costs. However, improving the timeliness of response and minimizing transaction costs need to be balanced with strict quality control over activity design, contracting processes and service provision.

The close involvement of farmer-beneficiaries in the monitoring and evaluation of service provision is an essential innovation, but there are concerns over the independence of the external (but provincially-sourced) SSSPP monitoring process. A fully independent, transparent, and uncensored monitoring process linked directly to the beneficiaries will be required.

The technical capacity of SP to respond to the increasingly complex needs of farmers over time is a major concern. The increasing difficulty of the technical problems being identified by communities, and greater focus on marketing, quality control and business management issues will demand increasing levels of technical expertise and specialization of service providers. More innovative and market-oriented farmers are most likely to seek direct contacts with research specialists in order to address their problems. For example, CCI has noted that the new generation of coffee growers is younger, better educated, and more market-driven than before and hence present new challenges for extension and research (Mitio, 2004). Regular, technical updating of already competent officers is needed to ensure that they are abreast of the latest research-based information and able to provide credible feedback to research programs.

SSSPP is upgrading the skills of service providers, which has been a prerequisite for successful contracting in the pilot stage. In the longer term however, a privatized non-government extension service assumes that sufficient technically competent people will be available to deliver the required services. These service providers will need to build their information networks, and spend considerable time collating information from available sources, e.g. internet, attending field days, meetings and conferences – at their own expense. These information-related costs will have to be reflected in overheads, operating costs and profit margins in the costing of their bids for contracts. Two consequences are likely: increased bid prices from competent SP, and the length of time required for a cadre of private-sector service providers to develop to this stage of professionalism. In the interim, strategies are needed to foster such development, without introducing unsustainable subsidies. The assumption, of course, is that the cost of competent private-sector SP to the government will be less than the total cost of an equivalent service by the public sector.

Service providers may operate as individuals or as informal partnerships or consortia in order to win contracts. Two trends are noteworthy; firstly, it is very likely that technical specialization will emerge among SP as the demands of farmers become more specific; secondly, communities may group together to contract their own private consultant (or VEW). SSSPP might usefully consider how it can respond to these and similar trends and opportunities.

Rural communities tend to rank non-agricultural problems such as infrastructure,

security, education and health ahead of production issues. Efforts to restrict extension to agricultural production risk bypassing and being constrained by these broader rural development issues. The SSSPP recognizes the opportunity for its contracting process to be adopted by other arms of local government, but the transition to a holistic government response to community development needs poses a major challenge. It also represents a major opportunity to address overall rural development needs on a cross-sectoral level. Other out-sourcing models, e.g. World Bank's Kecamatan Development Program in Indonesia, and the Kalahi Program in the Philippines, have devised strategies to address broader rural development issues, and these might usefully be considered by SSSPP.

4.1.2.4. Training Programs

The Integrated Agriculture Training Program (IATP) (Phase 1; 2002-2005), based in the University of Vudal (UoV), took an integrated, holistic approach to training through modular programs. Over 10% of 40,000 smallholder households have undergone training in 11 topics, each supported by professionally developed modules. IATP has built strong partnerships with the Province, especially in ENB, and with a wide range of public and private stakeholders. Fees have been introduced on a per-module basis, and the project has accredited 54 public and 21 private-sector trainees to deliver the modules.

The key challenges facing IATP are financial sustainability, maintaining the high technical standards in module content and delivery, and monitoring processes. User fees enable partial cost recovery of operating expenses, and there is potential for fee income from courses for the private sector and internationally.

As with other projects, the training-of-trainers approach limits depth of learning in these short courses, especially with lack of subsequent mentored/supervised practice and experience in the field. This problem becomes more apparent as the complexity of the subject matter increases. The project also has to respond to a widening spectrum of subject matter, so that the maintenance of breadth and depth will be an ongoing challenge.

The strength of the IATP design is in the effective partnerships developed with the university and the NARS, including NARI. These bodies provide a substantial resource for the essential technical backstopping, and these professional linkages will be crucial for sustaining an effective extension service.

ACIAR's Science Communication (SciCom) Project assisted researchers with their scientific writing, publication and communication skills. Based at Unitech, SciCom has designed and delivered a set of 7 modular courses that cover the principles of human learning and communication, and has trained staff at three universities in course delivery and management. The successful completion of four subjects leads to award of a Graduate Certificate in Communication of Science and Technology, accredited through Unitech or a Graduate Diploma through UPNG. Further development as a Masters program is envisaged and units are being included in the undergraduate curriculum of various Faculties.

SciCom embodies current best practice in adult education, especially in its use of experiential learning methods. The program is highly popular with scientists, lecturers, researchers, and academic leaders from a wide range of disciplines, with strong representation from the commodity institutes and the health profession. Several SciCom modules are potentially core material for extension workers and managers, but very few extension officers have enrolled to date. There is also potential for the SciCom modules to be offered by the PNG universities as part of their extension training at undergraduate and postgraduate levels. SciCom faces challenges in achieving financial sustainability and in expanding its range of modules in areas such as biometry, research methods, and knowledge systems (including indigenous knowledge).

The Farmer Field Schools (FFS) approach was developed to help farmers learn and apply the principles of integrated pest management (IPM). FFS are based on site-specific techniques, field work and hands-on experiential learning, and require a technically competent facilitator. FFS have proved highly effective in extending the messages of IPM and other complex subjects. It also builds respect among extension and staff for the complexities of real-world decision making that confronts farmers (Gallagher, undated). FFS are highly resource intensive and require well-trained facilitators, but by their nature have restricted coverage and relatively high costs.

4.1.2.5. Funding and Management

AusAID's Agricultural Innovation Grants Facility (AIGF) introduced a national competitive funding model that promotes effective application and adoption of agricultural technologies. It built partnerships based on incentives for cooperation between research and extension/service providers. Competitive funding allows government and the funding agencies to directly influence research and development priorities and to insist on transparency in financial management and accountability for delivery of agreed outputs and outcomes. Research and development organizations have become more dependent upon these mechanisms for their marginal operating and staffing budgets. AIGF approved 42 projects valued at K3.88 million, of which K1.9 had been disbursed as of 16th December 2005.

A mid-term review of AIGF noted a number of lessons and constraints: slow development of partnerships due to geographic spread of institutions; weak state of Provincial and LLG extension capacity; insufficient timelines for project preparation, budgeting and administration problems; and need to refine monitoring and evaluation procedures and feedback to institutions. These issues will be addressed in the Phase 2 design.

The AIGF competitive funding model has the potential to work effectively in PNG and to address cooperation, research focus on national priorities, research-extension-farmer linkages, transparency, accountability, and targeting of the RD&E at the problems of smallholders.

The very high transaction costs of the AIGF pilot have been a concern, though these could be attributed to the development of a new system in PNG. However the high cost of travel and communication will remain a binding constraint during implementation in PNG. AIGF will also require strategies to build capacity in framing, designing and writing of projects and reports and in project management, all of which contributed to delays and high costs during the pilot.

If these constraints can be overcome during the second phase of AIGF, the approach offers very attractive advantages as an integral component of NADP. A successful AIGF being scaled up to become responsible for a significant proportion of all national agricultural R&D funding (with integrated extension activities) is possible. This may take some years to accomplish and will require strong donor and political support, but such a system should become a clear objective of AIGF and the NADP in working towards institutionalization and sustainability.

4.2. KEY DRIVERS/ACTORS

A number of public and private institutions and agencies are involved in agricultural research and extension, some of which were mandated by legislation.

4.2.1 National Department of Agriculture and Livestock (NDAL)

The Department of Agriculture and Livestock is responsible for strategic planning of the sector. Its current responsibilities are identification and design of national sector policy and undertaking a monitoring and evaluation role. It is promoting PNG Cooperative Extension System, and implementing the SSSPPP.

4.2.2. National Agricultural Research Institute (NARI)

NARI was established by an Act of National Parliament of Papua New Guinea in July 1996 as a publicly funded, statutory research organization, under the Ministry of Higher Education, Research, Science and Technology, and conducts applied and development oriented research on food crops, emerging food and cash crops and livestock. It also provides technical, analytical and diagnostic services and other information relating to the agriculture sector in PNG. The major beneficiaries are the smallholder semi-subsistence farmers in the country.

Since 1996, NARI has released new technologies for farmers that include improved varieties and clones of food crops and tree fruits (banana, rice, taro, sweet potato, cassava, rambutan, durian, pepper and kava); biological control of chromolaena and diamondback moth; rope and washer pump; plant-derived pesticides; rapid propagation of banana, yam and taro; information packages for nutmeg, vanilla, kava, turmeric, banana pest control, and Muscovy duck and local feeds for growing rabbit; and drought coping technologies (NARI 2004).

4.2.3. Commodity Organizations (CO)

PNG Oil Palm Research Association (OPRA) is a small research organization incorporated in 1980 as a non-profit association with its head office at Dami, Western New Britain and regional bases in each of the oil palm growing areas. Research focuses on oil palm agronomy, crop nutrition, entomology, and plant pathology. Its Research Advisory Committee, which represents all producers, meets annually to review and establish research priorities. Its extension officers provide advice to farmers, conduct farm demonstrations, and provide open field days.

OPRA address only the most prominent constraints to the production of oil palm. Some of its outstanding achievements include the development of the pollinating weevil, a milestone in the industry, saving huge labour costs from hand pollination of the palms and significant increases in industry output. Among its research programmes are improvement and testing of new germplasm, biotechnology and seed production, and agronomic database linked to GIS (NBPOL, 2004).

Oil Palm Industry Corporation (OPIC) primary objective is to provide extension services to smallholders. It provides support and maintenance of the land settlement blocks, and promoting the expansion of village oil palm plantations. Its major strategy is to develop strong links and sharing of responsibilities with the respective estate and milling companies.

Coffee Industry Corporation (CIC) was formed in 1991 following the amalgamation of the Coffee Development Agency and the Coffee Research Institute. Its mandate is to control and regulate the production, processing and export of coffee, and conduct scientific research and provide extension to smallholders. Research priorities include improved Robusta and Arabica stocks, control of green-scale, improved smallholder processing, intrinsic quality of PNG coffee, waste management, smallholder production efficiency, price enhancement for smallholder coffee, and market.

Cocoa and Coconut Institute (CCI) was created in 2003 from a merger of the former Cocoa and Coconut Research Institute with the Coconut Extension Agency. It gets 50% funding from the industry levy. CCRI made a breakthrough in the control of the most serious beetle pests of coconuts, and recommended new coconut hybrids (Namaliu, 2000). A small food processing facility at the CCRI Stewart Research Station in Madang research and develop simple recipes for food items produced from coconut. CCRI also developed hybrid and clonal varieties of cocoa that has the potential to increase production (Tulo, 2000). Solar driers were developed and adopted by a number of farmers to improve the quality of cocoa.

4.2.4. National Research Institute (NRI)

NRI conduct research on policy-oriented issues and development trends in Papua New Guinea and the Pacific Islands Region. Among its objectives are to assist and independently appraise, monitor, and evaluate public and private sector development

initiatives and policies as they relate to national development; establish, maintain, and regularly update important socio-economic statistics and database; provide training opportunities for PNG graduate researchers, e.g. research methodologies. It is the sole formal research visa issuing authority in PNG. Its economic studies cover economic policy evaluation, human resource development, promotion of business enterprises and agricultural sector development policy research. Specific areas of social and environmental research are participatory land use planning, project impact studies, indicators of sustainable development, and database development for social science field research.

4.2.5. Institute of National Affairs (INA)

The INA is a privately funded, non-profit research institute. It was founded in 1976 by individuals from both the government and the private sector to promote dialogue between the private sector and government. About 80 companies contribute from K500 to K25,000 to maintain the institute. A council governs INA, and includes some of the leading businessmen and public servants in the country. It also tries to ensure regional coverage so that research and activities are not too closely identified with Port Moresby.

INA's primary role is to carry out research and to disseminate the results as widely as possible to the community, government departments, statutory institutions, learning institutions and politicians. Research has been carried out into: the economy, taxation, land, trade, coastal shipping, industrialization, law and order, agriculture, mining, small business, government expenditure, fisheries, forestry, human capital formation, and labour. It organizes the National Development Forum which brings together the government, private sector, and civil society at least annually.

4.2.6. Provincial/District Administrations/LLG

The administrations plan, coordinate and manage agricultural extension and support programs. Extension and information services at the local government levels are funded through annual provincial budgets, or through the joint programs with NDAL or commodity organizations and delivered through Provincial Divisions of Primary Industry (PDPI). At the local level, the LLG Coordinator for Agriculture or "DPI Officer" is to implement extension programs and projects, identify farmer needs, create awareness of proven crop and livestock management practices and new plant technologies, assist with the distribution of new planting materials, and monitor projects.

4.2.7. Other Research Institutions and Agencies

A number of NGOs and churches are also known to have their own research and development programs relating to agriculture, such as the Lutheran Development Services, Christian Leaders Training, and the Seventh Day Adventist Church, Trukai Industries, Lae Feed Mills and Ramu Sugar. In addition, educational and training institutions such as the University of Technology and Vudal University also carry out research programs that are linked to the courses and training programs they offer.

4.3. ISSUES AND CONSTRAINTS

4.3.1. Market or Demand Driven Research

Many agricultural research programs appear to be targeting smallholder farming systems, since the public expects that research must address the problems of majority of farmers and rural dwellers. While this argument appears logical, researchers tend to choose topics that do not reflect commonly determined priorities and reflect more personal interests or institutional bias.

Research must aim towards the need of the market. International trends and opportunities should be closely monitored and the information used in planning research programs. Local customer preferences and needs should be considered. Some examples of demand-driven research include:

- emerging crops and livestock that can be introduced to improve nutrition of the population;
- alternative crops that command high prices and its efficient production; rate of return of new technologies to farmers;
- most efficient way to market products;
- size of potential market and sources of competition; quality and packing requirements of potential importing countries;
- local by-products that can be used to substitute imported feeds with approximate protein, mineral and fiber content; simple ways to prepare livestock feeds from crops
- applicable research generated somewhere in the world that can be adapted to PNG.

4.3.2. Impact of Reforms on Extension

The downsizing, corporatization and decentralization of government services in the agriculture sector have been closely correlated with the disintegration of government extension services to farmers, especially to smallholders and subsistence farmers in remote areas. Those smallholders fortunate enough to farm in proximity to certain Commodity Organizations, donor projects or nucleus enterprises or where markets are reliable and accessible still receive a level of technical and market-based extension. The Commodity Organizations are attempting to build their extension capacity, mainly to improve production efficiency and quality in their mandated crops. However, the COs (with a few notable exceptions) reports relatively little success in engaging with the PDPs and Districts for extension purposes.

Political support and budget for agriculture at the national and provincial levels are limited, resulting in very few, if any, resources available for extension field work at LLG level. Together with alleged nepotism in appointments and political interference, staff morale is low. Planning capacity is very weak and uncoordinated at all levels. Severe staff capacity constraints at Provincial level restrict support to District and LLGs, especially in extension methodology and technical subjects.

Provinces and Districts report chronic problems in raising the priority of agricultural issues and programs with Provincial Administrators, especially those with no agricultural background or understanding. This lack of understanding of the needs of agriculture limits the allocation of adequate budget and the ability of PDPI staff to cooperate effectively and in a timely manner with the CO programs.

Most Provinces appear to have abrogated their responsibilities to agriculture under the MTDS and the Organic Law in favor of health, education and infrastructure, possibly expecting that the private sector would take care of agriculture. Ten years of market failure, with very few exceptions, might suggest otherwise.

Several Provinces (EH, ENB and Central) are currently being assisted by AusAID to improve their corporate planning processes and capacity. This should lead to the development of effective linkages between development plans at the LLG, Provincial, Regional and National levels, and possibly to a re-assessment by the Provinces of their responsibilities towards agriculture. However, Provincial governments do not show any indication of change in that direction. Since this debate has been going on for over ten years, the prospects of increased provincial support for agricultural extension are not encouraging.

The management and staff of the Provincial DPIs have been attempting to define their roles and functions, and several are formulating provincial agricultural development plans. However, these Provincial plans are not well-linked to District development plans and priorities (where these are available) or to Regional DAL plans. The formulation of the District development plans is still in its infancy stages, and LLGs reported difficulty with the planning process. Therefore, the alignment of the national development plan with provincial and LLG plans cannot yet be realized.

The functions of the PDPI are yet to be clearly defined and articulated with those of the local, district and regional levels of government. The FER notes that '*there are no formal links between the NDAL and PDPI*' and points to the need for clear linkages to be developed. A full functional review of the regional, provincial, district and LLG roles, responsibilities and relationships is urgently needed. The review should also examine the relationships and linkages of the DPI with departments that are involved with service delivery to identify opportunities for cooperation and efficient decentralised government services to communities.

4.3.3. Policy Direction and Planning

The absence of a national policy and strategic framework to guide agricultural extension and education has contributed to the generally accepted, negative impacts of the Organic Law, corporatization and the public sector reform process on the overall delivery of extension and education services to farmers. In this policy vacuum, Provincial and District Governments have under-resourced their provincial and district extension offices.

Lack of policy and strategy to guide the implementation of the Organic Law, decentralization and corporatization are, however, only contributing factors to the problems facing most farmers. Transport, security, markets, credit and poor education are widely acknowledged to be serious constraints on agricultural development. Policies and strong political will are needed to address these issues.

4.3.4. Staffing

A common problem with agricultural research and extension is the inability to retain good quality staff. All countries find it difficult in attracting and retaining experienced and competent research extension workers in isolated remote locations. Problems of professional and social isolation, often dominated by education commitments, conspire to make long-term appointments in Districts unattractive – particularly for the more experienced officer. This can also be a major constraint to the retention of both male and female extension workers in Districts, and is exacerbated by extreme security risks associated with travel in some Provinces. The appointment and retention of well qualified and experienced staff at District/LLG level present a major challenge.

Universities and educational institutions in PNG do not produce adequately trained agricultural researchers and extension officers. Bachelor degree holders are neither equipped with the necessary research nor extension skills nor have the necessary attitude and commitment. Higher degree training (at MS and PhD levels in agricultural disciplines is not available in PNG. A core of quality people in key research and extension leadership positions is an essential ingredient in achieving a payoff. There is a need for focused training and provision of incentives to retain quality staff.

4.3.5. Inadequate Linkages

Linkage between research and extension is weak and information generated from research does not reach the target farmers. Districts complain that field days reach only a limited number of farmers. Involvement of farmers and districts in research planning and implementation could improve linkages. Research could also look into farmer innovation and incorporate into farming systems approach, as NARI had started.

Joint cooperative research has great potential for cost savings and for making research results more effective and universally applicable. Some collaborative research is undertaken by various research institutions in the country, NAQIA, FPDA, Trukai,

universities, private, NGOs, church groups, and other organizations. A networking system will create better linkages.

Research should be subjected to peer review. NDAL should take a more proactive leadership in ensuring the relevance of research, wide discussion and scientific scrutiny, adoption and dissemination to improve agricultural productivity.

4.3.6. Lack of Coordinated Information System

NARI generates a range of useful information but district and provincial staff report that limited knowledge is transferred to farmers. Simplified research messages should be disseminated to mass media that can reach the extension workers or farmers. Inventory on research information is lacking, and gaps on knowledge are not known. Databases are needed to give information as needed.

A central coordinating body is needed to monitor and synthesize information generated from various institutions.

The capacity to obtain, analyse or deliver information on sound natural resource management is lacking or limited, thus such issues cannot be taken into account in policy or development decision making. Such information is the basis for effective management of PNG's natural resources and of sustainable agriculture. In particular, information is needed on the potential impacts of climate change on this sector.

4.3.7. Inconsistent Funding

Research takes time and funding is needed for its implementation. Often at times, funds are released at less than the required level. In such situation, researchers have to adjust their plans, e.g. lesser trips to gather data or meet collaborators, one trial instead of planned three trials, or worse, terminate the project. Research plans should have guaranteed funding to ensure the attainment of objectives. Adequate funding is needed to ensure that investments in research will generate the desired technologies.

Inadequate funding support for CCI does not permit the institute to enhance the capacity of coconut downstream processing which will provide high value coconut products in rural coastal areas.

Research in oil and sugar in PNG have generally been privately funded. Government contribution to privately conducted research has been intermittent and government has taken a hands-off approach to private agriculture research. Where resources permit, government should contribute to private research considered to have public use.

No government funding is allocated to OPIC. Its operational funds are based on a levy of K4.00/tonne of fresh fruit bunch from smallholders and estates contributing to support extension. A shortage of funding has affected its operations (ADB, 2004).

Although the Agricultural Innovations Grant Facility (AIGF) of AusAID is effective for short-term research and extension projects, the government should provide for long term planning and resource allocation for priority areas.

4.3.8. Farming Systems Approach

Improving the sustainable productivity and profitability of the farming/livelihood system should be the goal of both research and extension. Commodity-based extension has difficulty in responding to this challenge, due to the complexity of most farming systems. Where promising new practices have to be fitted into an overall farming and livelihood system – they are seldom adopted in isolation. Classic examples include the processing, storage, cooking and taste characteristics of new food crop varieties, and the disease and pest susceptibility of ‘improved’ varieties in new micro-environments. Management of complex farming system requires more than the application of technologies. It requires business and management skills, which include planning, budgeting, financial management, marketing, people skills and risk management. Management skills involve more than ‘book-keeping’ (the farmers’ way of expressing their needs in this area) and these skills require considerable time and expertise for effective facilitation. Research, extension and education/training are needed for the continual upgrading of service provider and farmers’ skills in these areas.

4.4. STRENGTHS AND OPPORTUNITIES FOR DEVELOPMENT

4.4.1. Excellent Environment for Growing New Crops and Livestock

PNG has appropriate environment for growing new crops and livestock, based on the needs of the domestic and export markets. Research can help in identifying opportunities and facilitate the participation of farmers. Data are needed on economics of production, on-farm evaluation of technologies, and downstream processing.

4.4.2. Method of Setting Priorities

Identifying high priority research programs that will benefit smallholder agriculture in PNG is a challenge. A wide range of crop and livestock activities, productivity, food security, equity and sustainability issues require innovative ways to identify high priority issues. NARI used an approach that deals with different types of benefits coming from a wide variety of research programs (NARI 2004). Research areas within each area of opportunity were scored and ranked according to their priority by a core group of subject matter specialists within NARI. Four criteria used were potential benefit, adoption likelihood, scientific potential and research capacity. NARI’s exercise is sound, and could be adapted for selecting projects.

4.4.3. Available Resources

PNG has rich biodiversity waiting to be tapped. PNG’s forests have floral, medicinal and fruit species that are sources of valuable products. Several ornamental plants can be

cultivated and exported. Cassava, sweet potato, plantation by-products such as copra meal, palm kernel meal, molasses, rice pollard and mill run can be used to produce cheap feeds for livestock. Sugarcane bagasse and coffee hulls can be converted into useful products. Compost from organic materials is a cheap source of fertilizer. Research offers opportunity to exploit these resources.

Many indigenous nuts, fruits and other crop and livestock species such as galip, okari, pau, mango, marita, and pitpit have not been systematically developed in terms of domestication and commercialization so that their full potentials can be utilized.

Research and educational scientists are assets of the government that can lead in agricultural development. Given the right direction, information and adequate funding, they can produce the desired results to increase agricultural productivity.

Other countries have appropriate technologies that can be adapted in the country. Networks such as Asia Pacific Association of Agricultural Research Institutions (APAARI) can be excellent venues to exchange ideas with other researchers in the region. The internet provides leads on authoritative information for networking.

4.4.4. Farmers' Initiatives

The demand for extension services in PNG had been historically related to the commercial advantages that farmers perceive in particular commodities. When a crop has a ready and profitable market, the demand for technical information and extension services is high and farmers will have some capacity to pay for this.

4.4.5. Extension Models

PNG has some successful extension and rural development projects (see Section 4.1.2). Some of these have the potential to be scaled up to the national level and be cost-effective, equitable, and sustainable financially in 10 years. A suitable system also needs to be institutionally and politically realistic and manageable; maintain high technical standards across a broad range of subject matter along the supply chains; achieve and maintain competence in a range of extension techniques; and be fully accountable to funding bodies including farmer clients. The potential of a project methodology to be scaled up as part of a sustainable, national extension and communication system is paramount.

4.4.6. Information Technology and Extension

The Christian Radio Missionary Fellowship (CRMF) in Goroka provides an excellent communication service to the highlands on a non-profit basis, including radio and internet access for many remote communities. Their HF radio network is linked to the CRMF center and modems in Goroka, then by telephone line to an ISP in Port Moresby. Installation includes antenna, modem, solar power kit and UPS, with estimated costs at K 20,000 per site. A cheaper VHF system is being tested, but is limited to line-of-sight

rather than general transmission. CRMF provide training in installation and operations.

IT holds limited potential for extension in the field, even with available Internet access. However, the transmission of information in forms such as CD/DVD offers considerable potential in allowing even remote localities to access a wide range of up-to-date information without the need for local libraries or resource centers.

4.4.7. Educational Institutions

Three universities, Unitech Lae, the University of Vudal and the University of Goroka, offer degrees in agricultural science and related disciplines. All three have undergraduate subjects in extension. Unitech currently offers postgraduate training in extension, and is '*in the pipeline*' at UoV and UoG. Recent support from ACIAR is improving post-graduate teaching capacity at Unitech, both in the Department of Agriculture and through the Science Communication program (SciCom). The ACIAR program offers training by research through Unitech, with co-supervision by Australian scientists on a visiting basis. The SciCom program offers accredited post-graduate coursework training for scientists, extension workers and educators in the principles and practice of communication and adult education.

UoG has focused on the training of teachers in agriculture, but is revising its courses to offer a new degree in Agricultural Science and Extension in order to broaden its education-extension focus. Divine Word University is introducing new courses and approaches to extension and community development in their teacher-training program.

UoV traditionally concentrated on farm management and agribusiness curriculum, but it has recently revised its program to include offerings in the natural resource management and environmental sciences. The IATP resource center is located on the UOV campus and is well integrated with the university

Vocational and technical education in agriculture urgently need major investment, as it is currently serviced by only two public agricultural colleges, plus those operated by the churches. The need to provide employable or self-employment skills for the 25,000 school leavers expected by 2010 is becoming critical. Technical education in a rural context, with emphasis on applied technology, management of small agribusiness enterprises, finance and life-management skills provides the only solutions to the increasing problem of youth unemployment. The program at St. Benedict's Agriculture and Technical School at Danip, provides a local model of the type of required training. In developing strategies for integrated development in remote communities, the early pre- and post- independence experience with the integration of agricultural subjects into the school curriculum need to be revisited. This approach is currently practiced in Making a Living (MAL) programs in schools.

NDAL needs to build its policy capacity to ensure it can influence the decisions of the Department of Education regarding the need to support education and training in agriculture and natural resource management.

4.4.8. Research –Extension Linkages

Establishment of effective linkage between research and extension has been one of the most chronic issues in the sector worldwide, and has been perpetuated by bureaucratic demarcations and institutional structures in the public sector. Research-extension links and cooperation is best achieved through people working together in the field with farmers on experiments or activities of mutual professional interest. Such work promotes respect between all parties, and generates mutual benefits and synergies. Important synergies are gained from field interaction between research and extension officers, especially where the extension officers have a sound background in science. These interactions with extension and leading farmers provide researchers with a highly fertile environment for hypothesis generation. Extension workers benefit from the close, personal ‘quality’ time spent with the researchers while traveling together and in the field – when much technical updating occurs through informal, face-to-face interactions.

High levels of competence in adaptive research and extension are developed through supervised, mentored practice in the field over time. Young, well-trained extension and research staff tend to respond rapidly when given the opportunity to interact first hand with experienced researchers. These mentoring relationships can also develop into life-long professional networks. This strategy needs to be supplemented by regular, formal, technical updating and access to up-to-date, reliable information.

4.5. PRIORITY AREAS AND PROGRAMS

Program Area 1: Development of an Effective National Agricultural Research System

Objectives:

- Strengthen collaborations among institutions, extension, districts and farmers.
- Ensure the National Agriculture Research System can support NDAL policy and development decisions in delivering on the NDAP objective of sustainable agricultural development.

Strategies:

- Based on FER, amalgamate government-funded research institutions or the NADP Secretariat assign a coordinator to direct programs, and monitor and evaluate. The coordinator is the contact point for research development of the proposed NADP Governing Council/Secretariat. The presence of a coordinator will avoid duplicity and provide for equity in distribution of programs and allocations.
- Form the National Agricultural Research System - include in the network NARI, commodity institutes, public and private, economic and socioeconomic research institutes such as INA, NRI, and universities. Membership in the network will not in any way impair or reduce the duties or functions of the member agency, unless they are amalgamated. As members of the network, agencies share their staff, laboratory,

equipment, building and other resources as needed for a research program or in addressing priority issues. The network could be members of the proposed NARES (see below).

- Coordinate the areas of excellence of each institution. Define working relationships that would increase cooperation among agencies. Assign national centres and cooperating stations based on agro climatic suitability of the area to the production of the commodity; accessibility of the centre or station to the commodity industry and target clientele; availability of research expertise, and other industry-oriented considerations. Members of the national research system are expected to align its research thrusts with the national research priorities and the needs of the service area.

National research centres (multi-commodity or single-commodity) are responsible for conducting basic and applied research across a broad range of disciplines. It packages generated technology appropriate for specific commodities and dominant farming or production systems, after successful technology verification trials in regional and cooperating field stations. A national research centre is expected to have a core of scientists backed by adequate research facilities and with easy access to scientific publications.

A regional research centre concentrates on applied research on commodities of major importance to the region. The centre verifies the output of the national research centres and fine tunes the packages of mature technology to suit regional conditions.

Cooperating field stations provide facilities or sites for field experiments. Adaptive trials are conducted to determine the reactions of crops or livestock to the soil and climatic conditions.

The capacity of NDAL will be built to influence, support and coordinate research and information dissemination across the range of research institutions, extension services, districts and farmers for the provision of timely and accurate information on natural resource management and sustainable agricultural practices.

- Peer review. Regular review of projects should be done to ensure that concerns of various sectors are addressed. Proposals should be selected based on a set of criteria agreed upon by the NARS. A panel or multi-disciplinary commodity teams should be involved in the review of proposals and the progress of the selected projects. NARES should be involved in these reviews.

Program Area 2: Packaging of Technology

Objective

The program aims at ensuring that research is planned and conducted based on complete package of technology

Strategies:

- Conduct an inventory of completed research programs of research institutions and develop into a database that provides accessible information. NAIS had started compiling research information that can be downloaded from its website.
- Analyze the gaps in information for packages of technology for extension workers, farmers, private sector. This involves analyzing the gap between potential yield of a crop or livestock and the yield in farmer's field, and determining the factors causing the yield gaps. For example, oil palm growers have low fresh fruit bunch production (tonne/ha) compared to the milling companies
- Develop programs that fill in information gaps and enable utilization or commercialization: e.g. varietal improvement, rapid propagation through tissue culture, economic analysis, improve nutritional content of food crops, improvement of agricultural practices for efficient use of labour and inputs, market information, feasibility studies, product packaging. Research programs should be based on the needs of the sub-sectors. Programs should identify minimum time to conduct research and minimum funding required. To guide funding, researcher must indicate expected results within the prescribed time.
- Socio-economic research which involves farmers in research design and implementation; gender-sensitive and vulnerable group approach to extension of new technologies; analysis of farmer perception on new technologies; and economic studies on production and marketing.
- Government policies and national issues (e.g. HIV/AIDS, needs and trends of domestic and international markets, sustainable agriculture; development of databases, statistics, incentives for researchers, sustainable funding) should be based on research and provision of information. To persuade policy makers to support more research, it is necessary to show return on investments.

PNG has in recent years experienced abnormal droughts, shifts in weather patterns and extreme events that have impacted on agricultural production. The effects of climate change can be expected to continue and GOPNG needs to be prepared to manage the risks and to take advantage of any opportunities. NARES could have a key role in ensuring adequate information on both the effects of and adaptation options for agriculture.

Given the above, attention will be given to designing and implementing extension development programmes in the following key areas:

Program Area 3: Introduction of the National Agricultural Research and Extension System (NARES)

Objectives:

- Provide timely and equitable access by farm households to relevant, quality agricultural extension, education and information services.
- Achieve effective linkages between extension and research through an incentive-

based funding system.

- Provide systematic capacity building program to regain and retain high levels of competence in agricultural research and extension.
- Ensure that NARES is committed to the key objective of sustainable agriculture development and sound natural resource management.

Strategies/Components:

- Expenditure Review of Services: A detailed Expenditure Review will be conducted of all agricultural extension/education and research services in the public and private sectors in PNG that receives public funds. This review, in concert with a functional appraisal to be also carried out and the FER, will define and analyse the full extent of the current public and private investments in these services in PNG. Available human and financial resources for redeployment will be determined. It will be important to define the numerical and qualitative staffing profiles of all government agencies and to reconcile budget records with the salary allocations and disbursements. This review will also address the redundancy issue, which defined under a separate component.
- Technical Appraisal of Services: A detailed technical appraisal of agricultural extension, education and research models in PNG and in the region is to be carried out for their potential to become part of the NARES. This will extend and complete the appraisals made in other components of this program, and will include an assessment of the direct-funding models for rural development currently in use in Indonesia, the Philippines and elsewhere in the region, for their possible applicability to PNG.
- Financial and Economic Analysis: A full financial and economic analysis of the potential for scale-up of the models, or combination of models will be conducted. The trade-offs between costs, effectiveness, equity, risk and manageability will be analysed.

Government will have to create and staff a small, well qualified agricultural policy research and analysis group for this immediate task and will seek donor assistance to assist and build the capacity of this group, beginning with the financial and economic analysis required under this component.

This group will require skills and capacity building in agricultural policy research, analysis and formulation with appropriate information support systems linked to national statistical databases and to a proposed new monitoring, information and evaluation system to be created at regional level. The group will support government in the further development of the NADP and monitor its progress as well as being responsible for future policy research and planning in the sector.

- Design of the NARES: This component will synthesize the findings from other components outlined above to produce the first National Agricultural Research and Extension Policy for PNG. This Policy will determine both the final scope and form

of the NARES and the financial requirement and timeframe necessary for its implementation, along with plans for the re-deployment and re-training of staff.

Guidelines for Formulation of the NARES

The NARES will be based on a mixed model, where the needs of farmers will dominate the agenda. The LLGs will define farmers' needs and priorities through the Ward Council Sub-Committees. Considerable capacity building is needed in order to discharge this responsibility. LLGs and farmer groups will monitor the implementation and effectiveness of service providers, supported and complemented by a new supra-provincial or regional capacity in M&E.

Arrangements for the delivery of services in response to the LLG agenda will be determined through the review and appraisal activities in Program 1. The NARES anticipates cost-sharing and private-sector delivery of research and extension services. Government will continue to cover most costs for the management, delivery and M&E of extension services, which will be expedited by the expenditure and resource re-allocations.

Government has to ensure that all citizens have equitable access to basic services including education, health, infrastructure and information. Service to remote rural communities demands holistic government response that cannot be provided solely by agricultural extension and education. Policies, strategies and implementation plans will be developed for equitable and effective delivery of services to remote and disadvantaged communities. This requires an integrated approach and will likely require some stratification of districts on socio-economic grounds. The most disadvantaged communities would still be required to contribute to the cost of extension services, in cash or kind, with a sliding scale of contributions up to full cost recovery for commercial operations. In most remote communities, a key development objective will be to support LLG and community involvement, ownership, and responsibility for development activities.

Basic telecommunications infrastructure is a primary building block for all services to remote communities, in combination with physical access to and from these communities by road, sea or air to support the agricultural and education extension programs set out in the NADP. Where access costs to remote communities are uneconomic and cannot attract private provision, or be constructed and maintained through 'sweat equity', government has to devise policies and strategies to ensure that such communities are not permanently disadvantaged.

The appointment and retention of qualified public servants in isolated districts is universally difficult, compounded by extreme security problems. These impact on everyone, especially women service providers who have to travel in these districts. A limited number of government officials will need to be based in these communities, relative to the numbers in more favored locations. A direct consequence is that most services will have to be provided and managed from within the communities, by trained community members. These people are an essential resource in community development

and their skills need to be fully exploited in development programs. Each community, Ward or District may have to nominate lead farmers who would travel out to interact with extension workers, receive training, and return with new information and materials. To ensure sustainability, the lead farmers of this task need compensation for their travel, food and accommodation, and, for the opportunity cost to their farming activities.

The delivery of government services to remote and disadvantaged communities will have to be centrally coordinated to ensure a consistent and cost effective approach and prevent duplication across sectors. The programs must reflect the needs of communities and be balanced against the need for national standards and practices in areas such as health, school curriculum and quarantine.

Two major programs in the region have successfully focused on service delivery to remote and disadvantaged communities. These are the Kecamatan Development program in Indonesia and the Kalahi Program in the Philippines. The GoPNG needs to observe and review these program experiences in the PNG context and in comparison with local extension models, in order to formulate detailed policies and strategies for service delivery.

In developing strategies for integrated development in remote communities, the early pre- and post- independence experience with the integration of agricultural subjects into the school curriculum need to be revisited. This approach is currently practiced in Making a Living (MAL) programs in schools.

Providing high-quality technical support to the front-line service providers is a formidable challenge. Very few qualified SP in the isolated districts, and the difficulty of access by technical support people, implies that the local SP will require reliable telecommunications/internet access in their Districts, and they will need to travel outside on a regular basis for interaction with their discipline support networks and for formal training and planning activities. Both support mechanisms will require adequate budget allocations, whether services are by public or private providers. This had potential links to broader policy analysis, competitive funding and monitoring and evaluation activities.

Program Area 4: Extension-Research Communication and Sector Linkages

The NARES will build effective linkages and partnerships between research agencies and extension service providers. This will be achieved through the following strategies/components:

Strategies/Components

- Competitive Grants for Cooperative Research, Development and Extension Projects: Competitive grants provide incentives for research, extension and lead farmers to work together on high priority projects that address the defined needs and opportunities of farmers. The motivation and incentive for cooperative activity will be provided through funding and accountability mechanisms, with the potential for

responsive institutions, people and partnerships to access significant operational funds, over and above their core funding. The incentive scheme will also require and drive a mechanism whereby national priorities are identified and addressed across sub-sectors.

The AIGF model will be expanded to become a sustainable national system for the funding of priority research and development and extension activities. A programmatic basis for research and extension design will be adopted instead of disjointed series of small ‘projects.’

Institutions or individuals who wish to access funds will apply to a national funding body through a formal proposal that addresses the advertised guidelines for the program. These guidelines specify the problems and issues that require R&D, and call for technical and financial proposals to deliver the required outputs. Outputs require the proponent to define how the results of the research or development will be transferred to farmers, and how farmers are to participate in the program.

A national funding body will set the rules of engagement and the priority areas to which it intends to direct public funds. These priority areas need to be transparent, and be identified and supported by sound policy research and analysis rather than driven by political interests.

Proponents will need to build partnerships with extension-research-farmers-farmer organizations-civil society-education institutions – as appropriate to the problem – in preparing their joint proposal. The proposal will often have to involve actors along the supply chain, and several partnerships may compete for an advertised program.

Applications are to be evaluated by an independent, high-level, non-political panel of experts in the field against explicit and transparent criteria.

The successful consortium must then implement its proposal, and report against milestones or other indicators of progress to the funding body. Monitoring will be strictly enforced with projects subject to external review, and ex-post evaluation (very much like the ACIAR and AIGF systems). Adjustments will be necessary to existing block-funding arrangements with the commodity institutes, so that at least part of their research and development funds, along with donor contributions, will be coursed through the national incentive scheme.

- Communication between Extension and Research Agencies and Service Providers: The pilot NAIS national interactive web-site will be expanded to include a registry of service providers and contact farmers, and expand membership. Currently the NAIS involves 18 libraries and information centers, and six partners (CCI, CIC, NARI, NBPOL, RSL and OPRA). DAL, FPDA and UOG are expected to join the NAIS. This is the only national information system in PNG and across the Pacific region, with potential to become a Pacific Agricultural Information System. Further development of the NAIS is needed to ensure scientific linkage in PNG.

The main limiting factor in the success of the NAIS for extension is lack of internet access in the Provinces and District. It may take time before dial-up access to the Internet is available in each District, much less broadband. Alternatively, solar-powered, radio-linked internet and phone services as available in the highlands can be provided at around K20, 000 per site. This investment may be justified for inaccessible areas, and there will be a need to monitor developments in these technologies closely.

NARES will define the need for resource centers, their roles and operational arrangements (see description in Chapter 5, Food and Horticulture, Program 1). It will also establish a dual system for communication between research agencies and extension service providers. This will comprise both Internet-NAIS/CD ROM/DVD ROM materials and hard copy for the publication and distribution of technical information. The CD–DVD format will act as a transition strategy for access by District level service providers until internet is universally available. Research agencies will be required to produce both print and CD versions of their work for distribution to extension service providers. They will also publish through the NAIS electronic system and in the mainstream technical literature. Information from research will be translated into materials for radio broadcasts and mass media dissemination with improved targeting at LLG development programs. Subject to progress with the NARES and the emergence of the national extension system, the Information Branch of NDAL will be subjected to a functional review to determine its future roles and responsibilities in relation to the NAIS and the information needs of the NARES.

NARES will provide for periodical technical review meetings or conferences. Latest research findings, both domestic and international, and their applications will be presented. The proceedings of these conferences in electronic and hard copy will furnish service providers with an accessible, up-to-date set of reference materials. Such meetings provide a forum for researchers, extension and industry personnel, and opportunities for researchers to present progress reports that would not otherwise be accessible.

Program Area 5: Human Resource Development and Capacity Building

An institutional commitment to plan and provide resources for capacity building at all levels is required to boost agricultural development. A systematic approach is needed to build the capacity at all levels of each agricultural institution.

Strategies/Components

- Capacity Development Action Plans: Sector Capacity Development Action Plans (SCDAP) will be developed to ensure that training programs address the needs of the sector. It will be linked to the annual budget allocations of the concerned ministries and agencies for implementation. A critical aspect of the SCDAP approach encompasses both building the skills and knowledge of staff along with necessary institutional and management development through a systematic planned program.

A modified UNDP ‘three-pillars’ model for capacity building could be used in SCDAP. Capacity building should address three levels: enabling environment (legislative frameworks and mandated functions); institutional systems and processes under management control; and individual and group capacities. A systematic training needs assessment is conducted at all levels of the organization. Capacity building takes into account not only human resource development but also the institutional and broader enabling environment that impact on the individual and workgroup’s ability to work effectively. The prioritized capacity building programs are integrated with the institutional budget and may be aggregated to the sectoral level.

The proposed functional and expenditure reviews link directly to the capacity building program, which will provide a mechanism for implementation of many review recommendations. The present human resource complement and competence of each institution will be determined. For research, sharing of resources among institutions will be determined.

- Professional Training: This component ensures that research and extension service providers achieve and maintain high levels of competence in technical areas and extension-education.

Research capacity building will include degree programs based on disciplines and other specific discipline needs of the subsector. For comparisons, Japan had 5,300 scientists and engineers per million people; China at 600 per million, Philippines and other ASEAN countries at 130-160 per million. If present graduates are not enough, scholarships for university degree in needed disciplines maybe included. Research institutes and agricultural universities could collaborate to develop appropriate curriculum.

Most extension service providers (ESPs) need training in both technical and extension areas, related to their new roles that will be defined under the NARES. Training should be delivered in keeping with best-practice in extension, using adult learning and experiential methods, and course work will be followed up with supervised practice, mentoring and evaluation in the field. A training needs analysis on a representative sample of present ESPs will be done to determine the precise focus of the training. Delivery of the training programs will be contracted.

Technical updates are best achieved by regular interaction between research workers and ESPs, both during field activities and in meetings and conferences, as proposed under Sub-Program 2.2. It is important that ESPs in the field have the opportunity and means to personally contact resource people as needed. These methods can be supplemented, but not replaced, by ready access to latest technical materials in electronic and hard copy.

Post-graduate training in extension is essential to develop local capacity for professional leadership in extension. A post-graduate scholarship scheme will be part of NARES.

A small support group of extension specialists will be trained to higher degree level and mandated to provide in-service training and mentoring to District and LLG service providers. These specialists would be responsible for monitoring and conduct of studies, evaluations and research into extension issues. The extension specialists would be field based, possibly in the Regions, with adequate budgets for travel throughout their regions.

To ensure that institutions get the full benefit of the training programs, each trainee attached to a public agency should be required to serve a minimum number of years, e.g. three years of service for every year of scholarship.

- Short Term Training Programs.

Among the identified capacity building priorities are the following:

- General management of programs and services
- Monitoring, evaluation and accountability
- Technical updating for extension service providers (SP)
- Extension training for SPs.
- Ongoing in-service technical support for SPs in areas such as farm business management, economic analysis, finance and marketing.
- Planning and prioritization of agricultural programs for LLGs and Districts
- Small business management, finance and marketing for farmers (especially women and youth) and all extension service providers.
- Consolidation and expansion of the Making a Living (MAL) program in schools
- Research proposal and report writing
- Study tours

- Vocational Training in Agriculture: The project will work with the relevant ministries and churches to formulate and implement a strategy to provide vocational agricultural schools or colleges in each region and develop a suitable curriculum. The curriculum will balance classroom and practicum instruction, emphasising technical skills for small-business management requiring students to apply their skills to make a profit and earn a living from their efforts. These schools will offer training at the certificate or diploma levels, possibly with accreditation and articulation to allow students to proceed to university entrance. The schools will be located on or near a commercial-sized farm, and will be required to operate on a business basis and generate a significant portion of their budget from agriculture and value-adding businesses. They will need to be well-articulated with their communities and reflect best practice in the farming systems of the area, and to engage in outreach and extension activities with the communities.

Diplomates will be well prepared to return to their villages or districts, where their new technical and business skills should allow them to succeed at farming or in starting a small rural business. Experience in the region shows that diplomates are highly valued employees because of their business and practical orientation, and tend to quickly attain positions of influence in their communities. They are also well placed to start and manage their own small business.

4.6. EXPECTED OUTCOMES

Based on an assessment of NARI's impact, the level of economic benefit arising from R&D activities is in the range of K16-22 million per annum; the economic benefit cost ratio would be in the range of 3-4:1 and the internal rate of return would be around 30-35 percent (Young et al 2003). From this study, the expected outcome from research and extension is K80 million to 110 million in five years. This could be more when research and extension have good linkages and provide farmers with needed technologies for crop and livestock production as expected.

5. FOOD CROPS AND HORTICULTURE DEVELOPMENT

5.1. INTRODUCTION

This chapter covers the current production status, issues, strengths and opportunities, priority areas, desired investments, strategies and resources allocation of the sub-sector, which include the following priority crops:

1. Staples: sweet potato, sago, banana, taro, yams and cassava
2. Fruits and vegetables (classified as fresh food)
 - Temperate vegetables - brassica (English cabbage, broccoli and cauliflower), asparagus, snow peas, tomatoes, capsicum.
 - Fruit crops – pineapple, watermelon, papaya, banana, avocado, citrus, mango, rambutan, durian, mangosteen, carambola.
 - Indigenous nuts such as galip, okari, pau and karuka
3. Rice and wheat

The staples are largely produced for home consumption and the surpluses are marketed. On the other hand, fruit and vegetable crops are mainly produced for sale although portion of the crops are consumed by the producer. The marketed fruits, vegetables, tree fruits and nuts will be included in the commercial food component. The traditional staples and commercial food crops will be regarded as fresh produce.

The development of the food sector is important because it is a multi billion kina operation and approximately 80% of the people of PNG live in the rural areas where bulk of the food production activities take place. Food crop development planning requires a careful analysis of the socio-cultural milieu under which farmers live and produce subsistence and commercial food.

5.2. CURRENT STATUS OF THE FOOD CROPS INDUSTRY

Food crops account for 55% of the total agriculture output. Its production is important to 79% of the 4.3 million rural populations that depend on smallholder subsistence and semi subsistence production system. The 1996 survey of the source of income of the rural population indicated that the sale of fresh food generated K39.6 million for 3.1 million people.

5.2.1. Production of Staples

Generally, smallholders grow a mixture of sweet potato, banana, taro, yams, and cassava and vegetables in a single garden. Bourke and Vlassak (2004) estimated the production levels of staples at 4.5 million tonnes/year (1,031kg/person/year) with a value of K2.8 billion, based on retail value of imported rice.

Sweet potato dominates food production with 63.6 % followed by banana 9.7% , cassava

6.0%, yam 6.0%, true taro 5.0%, Chinese taro 5.0%, coconut 2.2%, and sago 1.8% in 2003 (Table 5.1). This is a measure of percentage of production by weight of food produced and energy intake by the rural population.

Table 5.1: Estimated Production of Staples

Crop (2003)	Weight ('000 tonnes)	Energy (kcalx10)	Weight and Energy Produced	
			Weight (%)	Energy (%)
Sweet potato	2,872	2,728.26	63.62	62.82
Banana	436	301.18	9.66	6.94
Cassava	272	266.46	6.02	6.14
Yam species	272	228.03	6.02	5.25
True taro	229	178.69	5.07	4.11
Chinese taro	227	176.70	5.03	4.07
Coconut	101	151.40	2.24	3.49
Sago	83	296.17	1.84	6.82
Potato	18	13.32	0.40	0.31
Other aroids	4	1.12	0.09	0.03
Rice	0.4	1.39	0.01	0.03
Total	4,514.4	4,342.72	100	100

Source: Bourke and Vlassak (2004)

However, with regard to the amount of food consumed by the people, Gibson (2001) showed the major differences in the structure of rural and urban diets. On any given day, sweet potato is consumed by two-thirds of the rural population but only one-third of the urban population. Conversely, almost 90% of urban residents ate rice, compared to only 25% of rural dwellers. Rural and urban population consumes similar proportion of green vegetables.

5.2.2. Production of Grain Crops

The import of rice in PNG has steadily increased from 89,000 tonnes in 1980 to 170,000 tonnes in 2005, with a value of K250-270 million. The rate of import has been increasing at 3.7% with average consumption per capita of 31 kg (or K75-80) per person. PNG imports 98% of the demand and produces only 2%. Interest in rice growing has been increasing since the depreciation of Kina from US\$0.85/Kina in 1994 to US\$0.24/Kina in 2003 resulting in an increase in the price of imported rice by 120% (DAL, 2004). The increased cost of production and internal transport however adversely affect large scale production and makes smallholder production more favorable, especially in isolated areas. Domestic rice development policy advocates smallholder rice production for household consumption and to sell the excess to the immediate community where there is ready market. Subsistence rice growers are now selling surplus rice in the village markets.

Rice production is now being promoted throughout the country but mostly in Momase, Central, Chimbu, Eastern and Western Highlands provinces. Farmers in the highlands are also aggressive in the adoption of rice farming due to increasing population and rising demand for cash income and due to food security. Rice and wheat adds diversity to the food supply in the highland provinces and is becoming increasingly popular because of longevity in storage, ease of transportation and potential for animal feed.

Wheat production is still at the experimental stage and has yet to be developed as a commercial crop. Some farmers however have commenced planting of wheat on a trial basis and the outcome shows that wheat in the highlands is promising. In 2001, it was recorded that the Eastern Highlands produced 5 tonnes per annum (DAL, 2001). The Kandep High Altitude Research Centre recorded a yield of 2 tonnes/ha in 2000, (PRC Project Interim Report, 2000).

5.2.3. Commercial Food Production

Food crop production and supply is a competitive industry, when compared to coffee among the smallholders in the highlands (Table 5.2). In terms of national household income of the rural people, food crops contributed 20% in 1996 and 25% in 2000, while coffee contributed 33% in 1996 and 12% in 2000 (Allen, et al., 2001). These trends highlight the importance of the food crops sub-sector in providing relative stability in income of rural farming households compared to those that rely mainly on export commodities, which in turn are dependent on weather and price fluctuations in the world market.

Table 5.2: Estimated Cash Income from Agricultural Sources, Rural PNG, 1996

Product	Income (K million)*	% of Total Income	Population** ('000)	% Total Population	Average Income Per Person (PGK)
Arabica coffee	65.06	33.3	1,506.0	12.0	43
Fresh food	39.65	20.3	3,100.2	24.7	13
Cocoa	22.01	11.3	810.9	6.5	27
Betel nut & pepper	18.62	9.5	1,227.2	9.8	15
Coconut & copra	16.74	8.6	559.4	4.5	30
Oil palm	6.62	3.4	125.5	1.0	53
Fresh fish & shellfish	4.60	2.4	550.3	4.4	8
Firewood	4.44	2.3	1,032.3	8.2	4
Irish potato	3.25	1.7	573.4	4.6	6
Tobacco	3.23	1.7	694.6	5.5	5
All other product	2.82	1.4	483.3	3.9	6
Cattle	2.24	1.2	544.7	4.3	4
Robusta coffee	2.06	1.1	37.5	3.0	5
Crocodile	1.11	0.6	266.0	2.1	4
Pelt & plumes	0.94	0.5	187.3	1.5	5
Rubber	0.84	0.4	140.2	1.1	6
Pyrethrum	0.75	0.4	130.9	1.0	6
Cardamom	0.18	0.1	131.4	1.1	1

Chillies	0.17	0.1	95.6	0.8	2
Rice	0.02	0.0	4.6	0.0	5
Total	195.35	100.0	12,539.3	100.0	16

* = In 1996, 1 PNG Kina (PGK) = approx. US \$0.76 (A\$0.97)

** = Note that people may have more than one major source of cash income; hence the total population given here exceeds the actual rural population.

Source: Mapping Agriculture Systems of PNG

Fruits, vegetables and nuts are regarded as commercial food crops since they are mainly grown for sale in the formal and informal markets. A total of 227,000 growers are producing and supplying 5,000 to 6,000 tonnes per annum of fresh produce from the highlands to Port Moresby per annum (FPDA, 2005). The volume of fresh food shipped to Port Moresby markets is shown in Figures 5.1 and 5.2.

Figure 5.1: Highlands Sweet Potato Shipment to Port Moresby

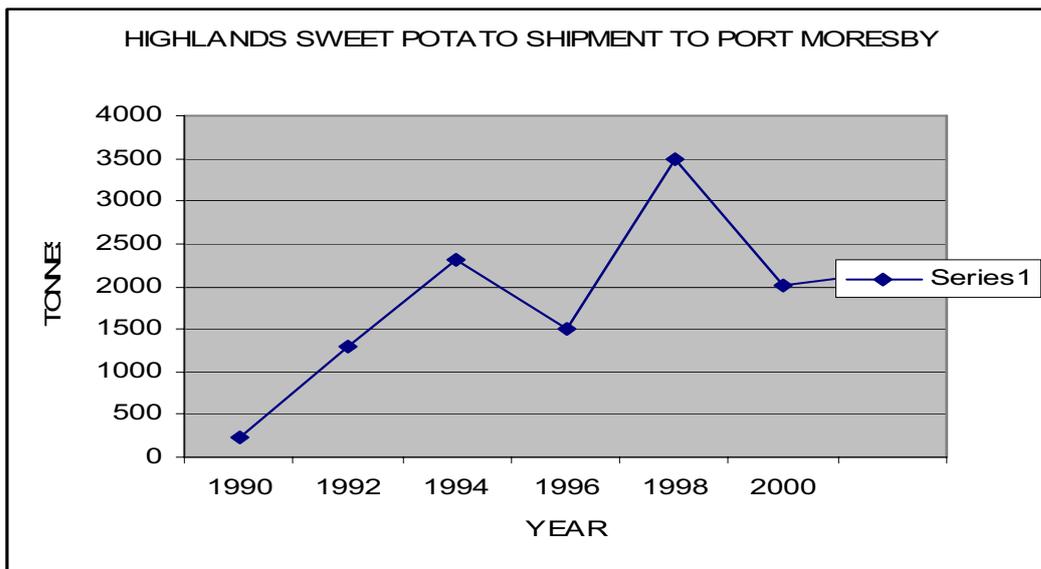
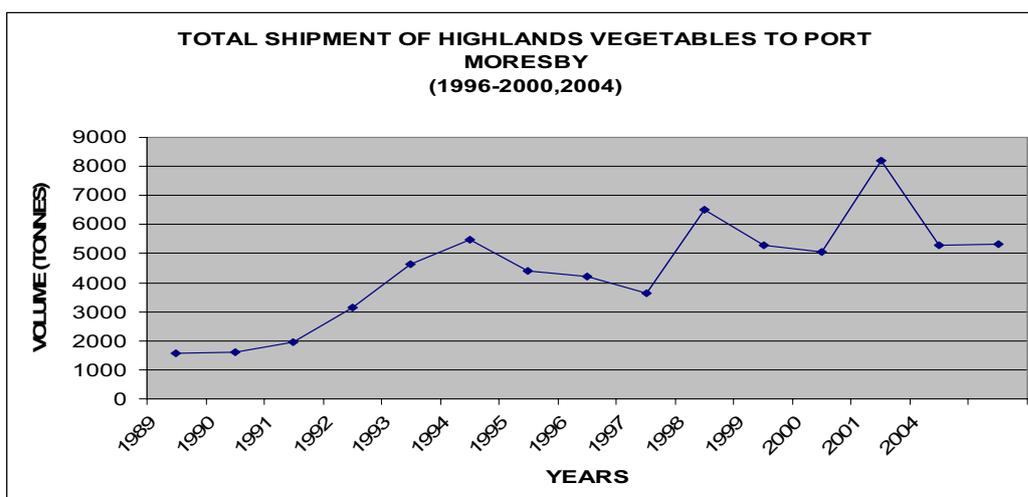


Figure 5.2: Shipment of Highlands Vegetables to Port Moresby



Source: Consort Express Shipping Line (Marketing Advisory Service/Fresh Produce Development Company)

5.2.4. Food Processing and Preservation

The FPDA established a Food Processing and Preservation Unit (FPPU) in the 1980s to develop technologies for downstream processing of domestic fresh produce. Besides, NARI has a Food Technology section that focuses on developing, disseminating and promoting post harvest and food processing technologies, information packages, training, outreach and liaison activities and assisting smallholder farmers and cottage industries.

The devaluation of the kina in 1994 inflated the costs of imports and was expected to improve the viability of local raw material processing. Consequently a wide range of food processing operations were established although many were forced to close down after operating for only a short period of time. Peanut butter and potato chips processing operations were among those that closed down. The development of freshly squeezed juice, fruit ingredients for local ice cream manufacturers and small scale jam manufacturers was minimal. Only the organically grown pineapple juice business from Sogeri survived.

5.2.5. Marketing

The majority of food crops are sold directly to consumers in small roadside stalls, government stations and large urban markets. This form of marketing is mostly done by women who are responsible for transporting (either by public transport or carrying them) the produce to the market place and wait for customers. Exact figures on quantity and prices of products sold in domestic markets are not available except for the fresh produce from the highlands where marketing is more organized and the produce are transported by trucks to Lae and shipped to Port Moresby. The costs of transportation are high and

the poorly maintained roads and infrastructure make wholesale marketing business difficult to operate.

In PNG, about 1.2 million people are living in the urban areas and expected to increase. The urban population provides a large under-supplied market for the traditional staples. There is also considerable difference in per capita consumption of the various staples for the highlands, lowlands, urban and the rural areas as shown in Table 5.3.

Table 5.3: Average consumption of staples in PNG (kg/person/year)

Staples	Rural Areas		Urban Areas
	Highlands	Lowlands	
Sweet Potato	440	100	35
Banana	60	95	45
Other Root Crops	60	95	45
Sago	0	40	30
Rice	20	30	70
Wheat Products	10	15	50

Source: Gibson (2001b)

The difference between urban and rural consumption pattern can be partly explained by the availability, affordability and taste preference of the urban dwellers. Level of consumption of staples is influenced by availability and price. Bananas and other root crops are produced on the lowlands and close to urban areas. Sweet potato prices in Port Moresby are 2-3 times higher than they are in Mt Hagen. The price of rice on the other hand could be higher in the highlands compared to urban cities of Port Moresby and Lae because of the internal freight costs.

It was estimated that an increase in the urban consumption of 10kg/capita/year of sweet potato would represent an extra market of 20,000 tonnes and an additional income to farmers of around K6 million (McGregor, et al., 2003).

Sweet potato is the major staple being grown in the highlands and marketed to urban centres of Lae and Port Moresby. On average 1,500 to 3,500 tonnes of sweet potatoes are transported from the Highlands to Port Moresby annually, with a traded value of K2-K5 million. This amount represents 0.5 % of the estimated total sweet potato production. Bourke (2003) estimated the total volume of marketed sweet potato to be between 75,000 and 125,000 tonnes annually. Based on the lower figures a commercial sweet potato industry is worth K60 million.

The increase in the supply of fresh produce is due to the success and perseverance of a wholesale company (Alele Ltd) in the transportation of exotic vegetables by road and sea.

5.2.6. Agro-ecological Adaptation

Staple crops can be grown from lowlands up to 2,800m above sea level. These

environments are defined by four farming systems:

- Sago and taro base farming system in the wet lowlands
- Yam, banana and cassava based systems in dry lowlands
- Sweet potato and taro based system in the highlands (800-1700 m altitude);
- Sweet potato and potato cropping system of the high altitude valleys.

Sweet potato is grown as single staple in the highlands and lowlands because of high yield, short maturity, and relatively free of pests compared with taro. In the coastal provinces of Manus and Bougainville, sweet potato is gradually replacing taro because of the pest problems. Banana is grown in many locations in PNG up to 2200m altitude, and is the important staple in the Central, Morobe, East New Britain and Madang provinces.

Cassava is grown in most provinces and is predominant in the diet of people in Milne Bay and Central provinces. Coconut is grown on the coast and has been gaining prominence in the diet of the highlands subsistence households. The highest consumption of coconut is in East Sepik, Madang, Milne Bay, Bougainville and East New Britain. Taro is grown in parts of Madang, East Sepik, Western, West New Britain and New Ireland Provinces. Sago is eaten in all the provinces and the greatest production can be found in parts of Western, Gulf, Sandaun and East Sepik provinces. Yam is dominant during dry season in Central and Milne Bay provinces.

Rice is growing in Central, Morobe, East New Britain, Bougainville, New Ireland, Madang and East Sepik Provinces in the coast and is extending in the Eastern, Chimbu and Western Highlands. Wheat is picking up interest in the highland provinces of Eastern, Chimbu, Western and Enga. Both rice and wheat have potential to be incorporated into the smallholder production system and provide the energy requirements in the diet.

5.3. KEY PARTNERS/DRIVERS IN THE INDUSTRY

The government initiated the Food Security Programme in May 2000, with 14 programs planned for implementation within 10 years (2000-2010). The NDAL is responsible for planning, programming and budgeting, monitoring and evaluation. Implementation of the Food Security Programme is undertaken in 89 districts under the management of the District Administrator. The management in the provinces coordinates the programmes in the 89 districts and reports to NDAL.

NDAL provides technical and information support to the provincial divisions of Primary Industry and districts. It works with the provincial departments, NARI, agencies, NGO, CBO, private sector, key government committees, and commodity organizations.

Fresh Food Development Agency (FPDA) manages the development programme of marketed fruits and vegetables industry in the country. It was established in 1989 and has

been successful in assisting highland growers and other stakeholders to supply temperate fruits and vegetables to Port Moresby and Lae. FPDA developed an extension model of training entrepreneurial villagers to become model farmers in fresh produce production and marketing. The model farmers have a network of other farmers whom they are advising in vegetable production and marketing. As Village Extension Workers (VEWs), the model farmers are the contact persons when FPDA promotes fresh food marketing program. The main focus of FPDA program in the next ten years will be management of the supply chain, development of farmer corporations, expansion of range of market, crop and product opportunities and extension of support services throughout the country (FPDA, 2005).

The National Agriculture Research Institute (NARI) conducts research into food crops production and supply in the subsistence sector to ensure the supply and quality of nutritionally balanced food for producers and consumers. NARI established research programs based on 5 agro-ecological zones, which are characterized by 50 farming systems in the country. Four priority research areas include: Staple Crops, Vegetables Crops, Tree Fruits and Nuts, and Rice and Grain. The five areas for research were given higher priority because of the potential benefits to the growers, impact to the farming communities and the economy, and the potential for growers' adoption.

5.4. ISSUES AND CONSTRAINTS

5.4.1. Low Level of Food Production

Although most food crops are produced under the smallholder farming system, it is unable to produce and supply food in the right quantity and quality to meet market demand. The low yields and poor returns to land and labor are attributed to the following:

- Poor land use: Communal land ownership makes it difficult for individual investment and development.
- Lack of technical know-how: Most farmers in the subsistence/rural sector lack technical know-how to enable them to adopt innovations and use resources effectively. Related to this is the fact that farmers lack access to information on improvement of land use and production technology. Research findings are not effectively transferred to the farmers and more often farmers' immediate concerns are not addressed through research.
- Lack of production plans and effective programs dedicated to increasing food production in the districts: There are no provincial plans and dedicated programs for increasing the level of food production and supply.
- Shortage of production inputs: Difficulties in obtaining species-wide medium term import permits pose problems in regular access to improved seeds and planting materials from abroad. At present, the National Quarantine Inspection Authority issues permit on the basis of every consignment of planting material at a cost of K110 per permit. Bulk seed imports greater than 5 kgs takes a long time to process. The high costs and restrictive procedure may inhibit the development of food industry in the country.

Rice seed distribution system being maintained between Republic of China (ROC–Taiwan) and Trukai Industries has not been coordinated effectively to supply seeds to the farmers. There is no seed supply and certification system established in the country. Seeds on the shelf are usually outdated.

Farmers do not use higher level of inputs such as fertilizers and pesticides. Farmers in the Western Highlands have difficulties in procurement of imported seeds, fertilizer and pesticide as a result of the kina devaluation in 1994. The farm mechanization program designed within the food security policy has not been implemented because it is only appropriate for commercial farming.

- Lack of appropriate working credit system. The available loans of financial institutions are inappropriate for financing food crops, which have short production season and require collateral and government guarantee for loan recovery. Financial facilities have no funds for lending to large scale farming which have long repayment terms. In addition, financing institutions require some form of security for the loans which most subsistence farmers cannot provide.

5.4.2. Lack of Support for Food Processing Industry

Food preservation and processing are necessary to increase storage life and take advantage of bountiful harvest that cannot be absorbed in the market. It also provides an avenue for increasing returns to farmers. The development of commercial and cottage industry in food processing and preservation has not progressed as well as was anticipated since the establishment of FPPU of the FPDA in 1980s. Information and technology of food processing and preservation being disseminated to the farmers and food industry is inadequate. The domestic processed food products face stiff competition from imported food products in terms of quality, volume and price. Issues on food processing are the following:

- High price of raw materials due to low volume and inconsistent supply of subsistence production system.
- Lack of government support in research and human resource development. The FPPU scaled down its operation due to limited budgetary support and manpower. Research is lacking to select suitable crop cultivars and varieties for downstream processing and preservation. Development or promotion of food processing as an enterprise or cottage industry is limited. The quality of processed food in the informal sector is not monitored. There are insufficient mechanical engineers. Procurement and distribution network for servicing and spare parts are not fully developed. Farmers have limited experience in the use of manual or animal power for rice milling.

5.4.3. Marketing

The disparity in prices of rural and urban markets is attributed to the following factors:

- Lack of marketing information and support facilities. Farmers need to know the flow of markets, price and supply, and information on post harvest handling. They produce crops with little demand at the wrong time and in the wrong quantities. Too much of similar vegetables and root crops are supplied to the informal markets in the urban markets. Retail outlets and the producers of the supply chain should be connected. Extension staff should advise farmers to produce based on market price, volume, and price.
- Infrastructure constraints. Some of the rural areas are not connected to the urban markets and to market farm produce. The existing roads in most districts are not being maintained at all. Similar constraints are being experienced for bridges, wharfs, airstrips and communication in the country. Shipping schedules are erratic. Transportation is not reliable because of road problems, law and order, and landslides. These constraints increase the cost of transportation and price of produce, and reduce interest in farming. Harvested crops are packed inappropriately for transport, resulting in sizeable post harvest losses. Consolidation centres or depots with cold storage are needed in the district to supply the urban market on demand basis and get better prices for the produce.
- Lack of wholesalers. There are only a few wholesalers to support the expansion of the fresh produce industry. Wholesale sector needs support in the supply of operating capital and upgrading and maintenance of road infrastructure and telecommunication network in the production area. Farmers are marketing their produce directly to retail outlets in urban cities of Lae and Port Moresby.

5.5. DEVELOPMENT OPPORTUNITIES

5.5.1. Production

- Technical potential for production. The fact that PNG has both tropical and temperate climatic conditions allows for the production of a wide range of crops. The government has experience in the management of production and marketing of fresh produce from the highlands to the urban cities of Lae and Port Moresby for more than 30 years now. Staples are in demand in the urban and rural areas. Rice and wheat crop production interest under smallholder farming system has increased in the highlands region after the devaluation of Kina in 1994.
- Domestic market for fresh food, rice and processed food. Subsistence gardeners will have to participate in commercial farming through participatory planning and development at the district level. The communities should be involved to ensure

support and commitment to participate in the farming project.

- Introduction of appropriate mechanization. This could be based on the needs of the farming communities. A single farmer cannot afford to acquire farm machinery and equipment, but farmers within a cluster should share ownership of farm machinery. A commercial farmer can also share the machinery at costs with other farmers within a cluster.
- Credit for commercial farming. The RDB and other financial institutions have available credit for commercial farming. The RDB, however, has difficulty in recovering the loans. During the consultative workshops, regional managers of the RDB have urged the participants to create the demand for credit and educate the farmers on loan management, farm budgeting, personal management and housekeeping, and basic book keeping. Only when farmers are trained can they access loan. Training modules are available in the country through the Small Business Development Corporation (SBDC).

5.5.2. Food Processing and Promotion

- Processed food technologies. The FFPU of the FPDA and NARI Food Technology section have developed technologies for vegetable and staple dice, slices, flakes, powder, shreds and chips. Flours from maize, cassava, sweet potato and taro were found suitable as mixture or substitute with wheat flour in bread and pies. Juice from passion fruit, citrus and pineapple were mixed with imported raw materials in the fruit juice industry. Pineapple, pawpaw and carambola jams and tomato sauce were developed. Women groups in the informal sector are processing peanut butter, root crops-based chips, sauces and jams. This is an opportune time to extend the products into the formal and informal sectors to establish food processing and preservation industry. Feasibility study is needed to determine opportunities and the constraints and develop a work plan for establishing food processing and preservation industry in the country.
- Cottage industry development. The informal sector participants want to establish cottage industries based on food processing and preservation. Feasibility studies should identify location and districts for production and establishment of an educational program for farmers to participate in commercial farming.
- Nucleus enterprise model. The food industry could be developed as a nucleus enterprise model with private sector investment. Contract growing between the management of the nucleus farm and outgrowers could address farm management, input supply, and marketing. This model would supply the raw materials to the food processing industry. Research is needed to develop appropriate cultivars and crop husbandry practices for production and supply of raw materials for processing.

5.5.3. Market Promotion

- Sweet potato and vegetables market. Selling of fresh produce provides a major source of income for the rural people. Sweet potato transported from the highlands to Port Moresby generated K2-5 million annually for the smallholders. It is estimated that the PNG sweet potato industry is about K600 million annually. Up to 5,000 to 6,000 tonnes of fresh produce valued at K10-12 million annually were transported from the Highlands to Port Moresby in 2003 (McGregor et al, 2003).
- Marketed fruits. The value of imports including significant amount of citrus and pineapples currently stands at K17 million annually. Except for apples, imports could be competitively replaced by domestic products. The experience with tomatoes and bananas showed that good quality fruits could be made available at a reasonable price. PNG has a large and fast-growing urban population which translates into a large and under-supplied market for fruits and nuts. FPDA needs to educate the farmers about the role and importance of middlemen in efficient marketing of farm produce.
- Rice and wheat. Approximately 170,000 tonnes of rice and 130,000 tonnes of wheat are imported annually with the growth rate of 3.5% and 6.3%, respectively, (Trukai Industries, personal communication, February 2006). The total imports of fresh and processed vegetables, fruits and nuts are estimated at K600 million. Import replacement plans based on comparative advantage can be pursued to promote marketing domestic production.

5.6. PRIORITY PROGRAM AREAS FOR DEVELOPMENT

Program Area 1: Improved Food Production

The programs to be developed under this priority area should aim to improve the quality of food available for household consumption and marketing to urban consumers. The principles and strategies for development of horticulture and grain crops will include:

Strategies/Components

- *Target Domestic Market:* At the semi-subsistence level, food production plan will be based on the needs of the farming communities. The need could be mainly for improvement in food and nutrition through the production and supply of quality food intake including energy and protein. The plan and facilities for cash earning opportunities will be incorporated to satisfy financial needs. Commercial food crops production plan will be based on market demand in the rural and urban sub- sectors of the economy. Feasibility study will determine the market demand based on food and nutrition quality and cash earning opportunities. This study will also determine the stakeholders who will be involved in the production and consumption and marketing of food to customers. In the subsistence, a simple farm household survey on issues, constraints and analysis will provide guidelines for establishing food

production and supply plan. The information through informal and formal production and marketing will be used for monitoring and evaluation of the output and impact.

- *Improve Supply of Production Inputs:* Supply of improved plant crop cultivars and varieties to the existing cropping system and crop mixers is encouraged. FPDA will procure vegetable seeds from existing suppliers so that it can pass to growers at an affordable price. Seed demand will be assessed and the volume and price will be the basis for establishing seed procurement system. A cost effective procurement system will be developed to make available vegetable seeds and chemical production inputs like fertilizer and pesticides for commercial food production. Government guarantees and management support will be provided to the growers so that financial institutions including RDB can provide credit to secure inputs and material support for commercial food production.
- *Establish Certification System for Fruits and Grain Crops:* Breeder seeds will be developed and multiplied at research centres. Tissue culture of vegetative materials will be multiplied for distribution to certified seed production centres. Certified seeds will be distributed to seed growers for multiplication and distribution. Seed growers close to the major production areas will be encouraged to establish their business. Seed growers will be selected to become model farmers in the adoption of improved varieties and crop husbandry practices.
- *Organize the Farmers into Viable Groups:* Existing and prospective growers will be organized into clusters and functional groups for ease of communication and mobilization. Farmer mobilization provides opportunities for involvement in decision-making and adoption process. Farmers will form associations and alliance for securing input, advisory services and increase the volume of production. Technical assistance and advisory services, training and other support services will be channeled through the farmer organization.
- *Train the Farmers:* Training need analysis will be conducted to understand the farming situations, farmer needs and aspirations, and develop training plans. In commercial farming, training need analysis is conducted to capture the needs of producers, the transporters, the wholesalers and the extension agents involved in the supply chain. The training levels will assist the farmers to base their production on market demand at the quantity, quality and price expectations of customer.
- *Establish Resource Centres:* Resource centres will be established in provincial, districts or in a central location of major production areas as a meeting place for producers, marketers, wholesalers and transporters to communicate and build up networking in food production and marketing. The resource centres are also useful facilities for dissemination of improved planting materials, agricultural information such as farming technology, post harvest handling, market prices and news; training; and hosting workshops and field days for promoting improved farming practices. This is an opportunity for NDAL, NARI, other research institutes, provinces and district administrations to work together to serve the needs of the farmers. All

players will share the facilities and costs, and plans should indicate the sustainability of the centres, and the coordinator. To test the viability of the centres and farmer response, pilot projects should be conducted in at least two provinces.

- *Support Research:* Farmers demand improved cultivars, crop production technologies and pest and disease management. Based on needs per district, budget and work plans will be prepared and memorandum of agreements signed with NARI to develop the production technologies with efficient use of resources. New technologies must be transferred for development. The recommended practices will be available as a package of technology. Funds will be made available based on project monitoring and evaluation reports.
- *Monitoring and Evaluation:* Benchmark information is needed to know the technical, socioeconomic and institutional issues affecting the production, consumption and marketing of food crops in the production plan. The benchmark information and survey will guide the design of work-plan in a given area. The information will be used to assess the output and impact of development plan during and after the completion.

Program Area 2: Development of Food Processing and Preservation Industry

The objective of the program is to develop food processing and preservation suitable for commercial and cottage industries. The commercial industry will involve development of products and supplements and filling in the bread, biscuit and pies. The cottage industry will focus on development of products for urban and rural household consumption.

Strategies

- *Conduct Feasibility Study:* A feasibility study will be conducted among those involved in the food processing and preservation industry. The study will establish guidelines to product development, the demand, volume, quality and price. This study will provide the development plan and a business plan for establishing the food processing and preservation industry in the country. This study will also determine the upstream requirement for the R& D to produce the raw materials and supply to the processing industry. The production plan for the raw materials will adopt the nucleus enterprise model of farming with contract farmers.
- *Long Term Research and Development:* Products requiring long term research and development program will be transferred to NARI. Research will focus on research on development of local staples, introduced vegetables and fruits into marketable food and industrial products. Staples of health foods will be developed from local raw materials. Nutritional analysis will be done for traditional food in order to improve processed and preserve food products.
- *Development of New Products:* Development functions for adding value to food production in the farm levels will remain with the FPPU under the FPDA. Products that will add value to fresh food produce at the farm level will be developed for

household consumption and demand in the rural areas. These products can increase farm profitability through new enterprises, create employment, reduce the freight cost and increase the shelf life.

Some of the examples from bananas include graded, packaged, chips, dried and cooked and from fruits will include candied and fermented desert. Native delicacies such as burnt pudding can be promoted from taro. Food products from coconut will be developed to generate income for rural industries. Equipment suitable for small scale processing will be developed. Studies to improve quality and safety standards and develop innovative packaging and design are needed.

- *Training and Information Dissemination:* The value added technologies developed from FPPU will be disseminated to food processing industry and farmers. The general information will be packaged to suit the needs of the clients and distributed to newsletters, radios and television. More creative ways of reaching the end-users clients will be used, e.g. tie-ups with informal sector training, demonstration classes or shows, stalls in annual shows, workshops and field days. Training will be based on the needs of the clients. It is also important to provide information on where to source the supplies and materials, e.g. packaging materials, bottles, etc.
- *Product Testing:* Both the long term research and medium term development will require well equipped laboratories to carry out testing. The food processing and preservation plan need increased human and financial capacity to perform the function efficiently. The food processing unit can generate internal revenue by charging fees for feasibility studies, training, and testing of products.

Program 3: Market Development and Promotion

The objective of the program is to develop the markets for semi-subsistence, nucleus enterprise and commercial production.

Strategies/Components

- *Improve Food Marketing for Semi-subsistence:* Plan will be developed to improve infrastructure for marketing of fresh produce in the district, ward and village. Roads, wharves, ports, and communication facilities will be built in key areas that will bring the most impact for increased production and marketing. The districts will provide materials for the construction of market sheds and distribute market information to the producers and consumers on a weekly basis. Market information will be disseminated through market notices and pamphlets. A simple food marketing plan will be presented by FPDA/DAL to all the 89 districts through a consultative workshop in the programming and budgeting phase of NADP.
- *Develop Food Market Service for Nucleus Enterprise:* This level of food marketing involves risk in purchasing and marketing of fresh produce as a business at the smallholder semi-subsistence level. Assistance to the development of agro-industry will include training of contact/model farmers as small scale traders. Courses will be

provided on management support for small entrepreneurs. Advice will be provided on formation for producer groups and cooperatives under the nucleus enterprise mode of production and marketing. Financing will be provided for construction, equipping and operations of agro-industries such as sago processing. Credit could be provided to RDB to lend and manage the loan repayments.

- *Provide Commercial Marketing Information Service:* Establish a market advisory service through market research, price surveys for linking farmers and production to market. The marketing survey will establish the demand, quantity, quality and price of fresh produce and the volume of production for each product. The market survey will be conducted on a weekly basis for one year. The market survey will provide information on the location in which each commodity is being produced.
- *Establish Effective Supply Chain:* Establish effective information system to improve supply information flows to producers and farmer groups, and be able to plan with market fluctuations. Improve reliability of supply with consistent quantity, quality and variety over seasons. Establish the VEW network as the means to transfer skills and knowledge in production and marketing to the farmers and their families. Develop marketing infrastructure for consolidating supply, for grading of standards, improving packaging, storage and transportation, enhancing shelf life of fresh produce and product presentation. Improve the post harvest qualities and shelf life of fresh food through temperature management and correct packaging. Improve skills and knowledge of fruits and vegetable wholesalers and retailers. Establish farmer cooperatives as the means for transferring ownership to the growers.

5.7. EXPECTED OUTCOMES

The expected outcomes from food and horticulture development programs are improved food security and nutrition, improved marketing of food items, greater efficiency in resource management. Revenue projections are based on the wholesale value of fresh produce worth K64.7 million (ADB, 2004, p 176). Rice policy in 2004 was projected to generate K68 million only from the institutional component of the ten year plan (2004-2014) developed by DAL in 2004. A revenue of K337.4 million can be expected from marketable food crops within ten years and K5 billion annually from food that is not marketed (Table 5.4).

Table 5.4.: Projected Revenue from Food Crops in 10 years.

Commodity	Volume ('000 tonnes)	Revenue (K million)
Sweet potatoes	120	108.0
Staples	60	54.0
Potatoes	8	12.0
Onions	3	3.4
Peanuts	6	6
Vegetables	10	15
Fruits	4	3
Sub-total	211	201.4
Rice	58	136
Total	269	337.4

6. TREE AND INDUSTRIAL CROPS DEVELOPMENT

6.1. BACKGROUND

The tree crop sub-sector which comprised mainly of coffee, cocoa, coconut, oil palm, tea and rubber, is a very important foreign currency earner for PNG. Before the opening of Bougainville mine and after the early gold rushes, PNG relied heavily on agriculture cash crops for its export income.

Tree crops are important for economic development. The sub-sector brings in foreign currency to support import bills. The trade goods sector depends on a healthy tree crop sector. The highlands and New Guinea economy revolves around coffee or cocoa while the outer islands depend solely on coconut products for cash income. The service industry in the highlands suffered after the fall in price in the late 1980's and many went out of business. It will require a revived tree crop industry for other service industries to return.

Smallholder agriculture depends on tree crops for cash income opportunity. The smallholders produce more than 85% traditional export crops except for oil palm. For coffee, 1.5 million people benefit from the industry and for cocoa about 400,000 people. Many thousands of families depending on tree crop produce for cash income suffered much with the fall of world price. Together with the deterioration of rural infrastructure, lack of market access and high cost of transport, unskilled rural population migrated to towns and cities causing social problems and straining the capacities of urban infrastructure and social services. The government institutions and agencies need to identify the problems and find solutions to address this ever growing threat to society.

In most cases, production of the cash crops has been declining and performance is weak. The sub-sector however has the greatest potential to contribute to the 5% growth target for the agriculture sector in the MTDS. The plan will address constraints facing all the industrial cash crops and presents interventions to revive and grow the industries through public investments program and institutional changes or realignments.

6.2. CURRENT STATUS

The tree crop sub-sector is made up of the commercial sector namely the estates or plantations and semi commercial or the smallholder producers who are predominantly subsistence farmers. The latter produces more than 80% of export products.

6.2.1. Oil Palm

Oil palm development is spread across four provinces: West New Britain, New Ireland, Milne Bay, and Oro. Ramu Sugar Ltd planted oil palm in 2003. Ibiy's committed 4,000 ha of its estate on aijand provided 500 hectares to village out growers in the initial phase of oil palm development. In Sandaun, a logging company being rehabilitated for development planted 1,000 ha of oil palm.

The combined performance of private milling companies has turned the oil palm industry into one of the most vibrant and successful industries in the country. A special feature which distinguishes the oil palm industry from other industries in PNG is its nucleus enterprise model. The enterprise directly engages local landowners in oil palm production and provides vital services like health, education, road infrastructure aside from its impact upon the provincial and national economy.

Palm oil production experienced an overall upward growth trend from 1998 to 2004, averaging 1.66 million tonnes per year. Oil palm since 2000 is now the leading export earner surpassing coffee. In 2004, export volume rose to 339,000 tonnes valued at K438.7 million, but this trend went down to 295,200 tonnes valued at K339.5 million in 2005. PNG is now contributing over 2% of world export of crude palm oil. Further increases in both production and export volume are anticipated for the next five years and beyond, based on current expansion activities of milling companies, and the new oil palm development by Ramu Sugar Ltd.

The oil palm industry comprises the milling companies, independent estates, smallholder farmers (inclusive of village oil palm and land settlement scheme growers), Oil Palm Research Association (OPRA) and the PNG Palm Oil Producers' Association (POPA). The Oil Palm Industry Corporation (OPIC) is a statutory organization responsible for smallholder extension and management of smallholder growers.

Private milling companies drive the industry, and provide service to farmers. New Britain Palm Oil Ltd (NBPOL) is the largest oil palm plantation and milling operation, with the West New Britain Provincial Government as one of its top shareholders. It operates 18 oil palm estates, 4 oil mills, an oil refinery and fractionation plant, oil palm plant breeding and seed production facilities.

6.2.2. Coffee

Coffee production has increased at an average rate of 3% per year since 1975. From 65,000 bags in 1975, production has increased to 1.1 million bags (66,000 tons) per year in the last 10 years. Smallholder production has increased to 85% while estate production dropped to under 20%. PNG exports have totaled 1.1 million bags in the last 10 years. The countries of destination are Germany, Australia, United States and Japan.

Although coffee grows in 14 provinces in the country, production is centered in Western Highlands, Eastern Highlands, Morobe and Simbu. These provinces account for 90% of production. Other important producers include East Sepik, Enga and Southern Highlands.

The Coffee Research Institute and the Coffee Development Agency were formed for research and later to combat the coffee leaf rust. They were later amalgamated with the Coffee Industry Board to form the Coffee Industry Corporation.

The National Census of 2000 showed that the coffee industry comprised about 397,000 smallholder families (equivalent to 2.5 million individuals), 250 blocks, 60 plantations, an estimated 500 roadside buyers, 50 dry processors, 40 wet processors, 13 green bean exporters and 4 roasters (1990 figures).

6.2.3. Cocoa

Cocoa has earned an average of K192 million per annum over the last five years, peaking at K258 million in 2003. It accounts for 18% of agricultural exports and 3.5% of total exports. Coffee production provides direct employment for approximately 50,000 people and cash income for over 151,000 households (approximately 1 million people) in 12 coastal provinces. Growth of production and export of the crop have been steady averaging at 40,000 tonnes per annum. Smallholders produce 87% of the crop while plantation has been on a decline with 13%. Major cocoa producing provinces in the country are East New Britain, North Solomons, Madang, East Sepik, New Ireland, and West New Britain (Table 6.1).

Table 6.1: Cocoa Production by Smallholders (S) and Plantations (P), 2002-2004.

Province	2002			2003			2004		
	P	S	Total	P	S	Total	P	S	Total
East New Britain	3,038	20,844	23,882	2,154	14,766	16,920	2,276	15,373	17,649
North Solomons	37	9,958	9,995	141	11,384	11,525	110	7,126	7,236
New Ireland	350	1,162	1,512	221	970	1,191	195	1,059	1,254
W/New Britain	31	738	769	39	744	783	14	746	760
Manus		21	21		10	10		7	7
Madang	665	1,380	2,045	1,536	2,907	4,443	1,409	3,799	3,799
Morobe	448	392	840	657	500	1,157	389	403	792
East Sepik		4,125	4,125		3,291	3,291		1,409	1,409
West Sepik	49	104	153	152	447	599	108	437	545
Oro	7	354	361	43	976	1,019	4	336	340
Milne Bay		3	3		5	5		10	10
Central									
Total	4,625	39,032	43,707	4,943	36,000	40,943	4,505	29,296	33,801

Source: Cocoa Board of Papua New Guinea.(2002-2004)

From 2002 to 2003, production figures were slightly above 40,000 tonnes. It decreased to 33,801 tonnes in 2004. Production for 2005 was estimated at 44,000 tonnes.

The Cocoa Board regulates the industry while the Cocoa Coconut Institute undertakes

research and extension. There are 15-20 registered exporters, and an estimated 18,000 direct and indirect employment in service sector. Five thousand people are employed in plantations while approximately 80% of cocoa production is done by smallholders (Namaliu 2000; Tulo 2000). Much of CCIPNG's research, development and extension programs target the smallholder and village based farmers.

6.2.4. Coconut

The coconut industry is the oldest agricultural industry in PNG. The total area under coconut cultivation is estimated at 260,000 ha; 40% of which is under large plantations, and the rest with smallholder plantings and village plots. The industry provides employment for 309,417 households (2000 National Population Census), representing 57% of total households in the coconut growing regions and 31% of total households in PNG. At 7 persons per household, the total number of people involved with coconuts is over 2 million. The rural households now account for over 80% of PNG total copra production.

Coconut is the fourth most important agricultural export commodity of PNG. Export earnings from coconut products have fluctuated over the last two decades, from K38 million (1981 to 1990), to K77 million (1991 to 2000), to K53.5 million (2001 and 2003). Highest earnings were achieved in 1999 at K162 million, which was equivalent to 14% of the total export earnings from agricultural products. Copra production levels are influenced by the world copra price fluctuations and competition from other vegetable oils on the world market.

Apart from the exported coconut products, it is estimated that an additional 316 million nuts (equivalent to 52,300 tonnes of copra) worth about K131 million annually, are consumed domestically in daily diets. The importance of coconut as a food source has also spread to the highlands of PNG, where it has become an integral part of daily food trade. Coconut is also gaining importance as home-made fuel. It is sold at K2/liter, compared to K3.20/liter for diesel, and two shipping companies in Rabaul have largely replaced diesel for their ships with coconut oil (PNG Post-Courier, August 14, 2006, p. 1).

The coconut industry is composed of the following entities:

- The Kokonas Industri Koporesen which was formed under the KIK Act 2002. It is a regulation agency at the forefront of PNG coconut industry. It collects levies from the industry and then invests it on coconut development projects.
- Smallholders: copra producers from coconut plantings of 10 ha or less
- Plantations: more than 10 ha
- Traders or middlemen which buy dry coconuts or coconut products from smallholders or small scale agribusinesses and sell these products to local markets in urban areas, supermarket or pharmacy outlets.
- Exporters

- Processors: 2 copra mills (Coconut Products Ltd Copra Oil Mill at Rabaul, and Coconut Oil Production Madang Ltd at Madang) process copra into crude oil and copra meal; 1 processor of desiccated coconut (Collins Leahy Ltd); 2 cosmetic oil and soap processors (Tropic Frond Oils and Buka Metal Fabrication).
- Associations: a number of farmers association has recently or is currently being formed
- Cocoa Coconut Institute of PNG: for research development and extension
- Provincial and District Administrations: New Guinea Islands and Momase

6.2.5. Rubber

Rubber has been cultivated in the country for over 100 years, but its contribution to GNP remains marginal. As many as 40,000ha were planted with the same tonnage produced and exported annually, however, only 18,230ha still exist, with only 6,000ha in production (Table 6.2). Rubber provides income for more than 5,000 smallholder rubber growers and direct or indirect employment for 20,000 people. The smallholder sector contributes 50% of the total natural rubber output.

Table 6.2: Existing Rubber Development by Settlement Schemes, Estates and Village Planting

Scheme	Province	No. of hectares
Settlement	Central, Gulf, East Sepik	4,140
Estate	Central	9,505
Village Planting	Western, Central, Gulf, Oro, East Sepik, West Sepik, Manus, New Ireland	4,535
Plantation (Bisianumu)	Central	50
Total		18,230

Source: NDAL

Natural rubber can be a major foreign exchange earner. From 2000 to 2003, average annual rubber export averaged 4,140 tonnes, earning an annual income of K7.15 million at US1.30 per kg, at par with other rubber producing countries. Exports from 1996 indicated increasing volume and value then decreased by 34% and 44%, respectively the following year (Table 6.3). Volume remained more or less the same level from 1997 to 2002 while value fluctuated until 1999, and increased from 1.3 to 44% until 2005.

Table 6.3: Volume and value of rubber exports from 1996-2002.

Year	Volume (000 tonne)	Value (K million)
1996	7.0	11.9
1997	4.6	6.7
1998	4.7	5.6
1999	4.4	5.6
2000	4.4	7.0
2001	4.1	7.4
2002	4.1	10.9
2003	4.3	12.5
2004	4.5	15.5
2005	5.2	15.7
Total	47.3	98.8

Source: NDAL

Of the total 18,230 ha planted to rubber, only 30% are in production, mainly due to poor road conditions and lack of technical and logistical support. In the last ten years, only the Western Province have new plantings of 2,200 ha of rubber from 2000-2003. Although there are sufficient rubber trees, these trees are not effectively tapped and managed. An expected tonnage of 10,000 per year can be achieved with proper management, and current factories can process this tonnage.

The industry is under the management of the National Department of Agriculture and Livestock. It manages projects (Cape Rodney Agriculture Development Project), settlements in Bailebo, Central, Murua, Gulf), estates (SIPEF/BNGD-Belgium Co. Estate; Sogeri Rubber Development Corporation, EPO and other small estates) and village plantings in Western, Central, Gulf, Oro, East Sepik, West Sepik, Manus, and New Ireland. Four technically-specified rubber (TSR) factories process rubber (Cape Rodney, Doa, North Fly and Gavien). The two privately owned factories, Galley Reach Holdings and North Fly are still in operation. The other two are government-owned factories and the currently operate below capacity because of insufficient supply of rubber.

6.2.6. Tea

Tea was introduced as an experimental crop in Garaina, Morobe in the 1950s. However, smallholder tea production could not compete with coffee, because of high labor, input requirements and poor prices. Six foreign-owned factory-estates operate in Western Highlands, covering 3,000 ha. Exports remain at about 8,000 tonnes per year in the past 20 years, and there are no plans for expansion because of land tenure systems.

6.3. MARKET

The domestic coffee market is competitive enough that growers who sell their coffee factory doors realize between 60-70% of the prevailing free-on-board (FOB) price. Export prices usually trail world prices, with the addition of premiums and subtraction of discounts. Delivered-in-store (DIS) and factory door prices for parchment also follow FOB prices, but sometimes they have been low while export prices were relatively high.

Average FOB prices ranged between K5.50/kg and K3.50/kg between 1997 and 2003, whereas the range for DIS was K3.50/kg and K3.00/kg for the same period. The factory door price in green bean terms ranged between K3.00/kg and K2.00/kg. Exporter margins have varied, while processing margins have been relatively stable. The increase in margins does not reflect profitability of the market operators, as costs have risen dramatically during the period when overall marketing margins have been high.

The private sector operates the tree crop market. The Copra Marketing Board was deregulated in 2002. With WTO pushing for free trade policies, only a few large corporations are operating in importing countries. This constricts the market and large scale exporters are leaving the industry. The NADS provides the strategic option for smallholder industry to take ownership of the industry, through the cooperative movement and NE model. The industry needs right government support, e.g., active promotion to find new markets support to ensure survival of the industry.

6.3.1. Competitiveness of the Tree Crop Sector

The ADB and WB categorized PNG as not competitive or comparative compared to other low cost producers due to high labor and other input costs related to the hard Kina policy. The government has addressed this by regulating rural wages and floating of the Kina. The fundamental concern of productivity and profitability aspect of the industry however has not been addressed. The private sector must make profit in order to remain or to invest. Industry stakeholders have not critically examined the cost structure of the industry to advise the government in policy formulation.

The NZEIR report (Duncan 2006) stated that the enterprises were not making profit. Sensitivity analysis indicated that it was competitive at the export point than at the producer point where it matters. The CIC observed the PNG producers receive the lowest factory door price compared with other producers (Table 6.4). It also reported high overhead cost for the 2-3 largest foreign owned exporting companies, who also offered

lower price than other nationally owned exporters.

The farmers are organizing themselves to market their produce directly, in order to increase their income, with some getting K0.40 to K0.80 more for their produce. This is a good incentive for smallholders to expand new planting. For oil palm, the management and transport costs are high but no one is doing anything for the out-growers and tensions are building up. There is an urgent need to address these structural and administrative problems, if the industry is to continue to grow.

Table 6.4: Factory Door Price of Coffee Paid to Growers in Exporting Countries, 1998-2002 June in US cents per pound

	1998	1999	2000	2001	2002
Columbian Milds:					
Colombia	98.21	88.41	72.77	55.62	53.32
Kenya	156.65	88.04	62.68	74.84	62.77
Tanzania	94.08	67.30	63.82	35.07	-
Other Milds:					
Burundi	57.39	46.67	38.96	29.26	-
Dominican Rep.	80.48	75.51	67.01	36.72	51.71
El Salvador	75.80	-	-	18.72	17.56
Guatemala	120.17	81.98	71.77	50.60	48.26
Honduras	88.86	58.69	52.35	34.54	41.16
Jamaica	274.89	128.79	230.02	153.16	51.98
Mexico	98.75	82.67	63.72	54.93	35.82
Papua New Guinea	75.53	69.62	50.56	35.70	31.07
Rwanda	62.30	49.03	37.25	25.75	13.90
Uganda	139.28	90.89	81.82	50.30	-
Zambia					
World Average	107.90	75.92	74.39	50.40	40.76
PNG % of World Average	70.00	91.70	67.97	70.83	76.24

Reference: ICO, quoted by CIC (1998)

6.3.2. Government Price Support

The Government provided price support for tree crops in the early 1990s because many people depended on it. The price support was a measure to balance the industry after the stabilization funds were exhausted when commodity prices fall. In 1993, total price support was over K70 million for the four tree crops (coffee, cocoa, oil palm and coconut) and rose until 1997 (Table 6.5). The corporations have to repay the government which affected their effectiveness to plan long term and fund projects to revive the failing industry. This huge support created price distortion and presented many developmental problems including displacement of PIP investments that were needed to increase productivity. The sector finds itself in a very weak position since then and now needs government support to improve productivity and competitiveness. Alternative solutions to price support, e.g. more active promotion for new markets are needed to help the sector.

Table 6.5: Estimated Cost of Price Support, 1993-1997

Year	Coffee	Cocoa	Copra	Palm Oil	Total K Million
1993	52.6	13.2	3.9	1.13	70.80
1994	55.3	13.5	4.1	1.18	74.08
1995	58.0	14.2	4.3	1.23	77.73
1996	61.2	14.9	4.6	1.30	82.00
1997	64.4	15.7	4.9	1.36	86.36
Total	291.5	71.5	22.1	6.20	390.17

Source: World Bank (1997)

6.4. ISSUES AND CONSTRAINTS

The export tree crop sector cannot be expanded without removing the present constraints related to technical efficiency and commercial viability under the uncertain international prices and market trend.

6.4.1. Low Price

Since 1998, PNG coffee growers receive a lesser price, compared to that received by

growers in other coffee producing countries. Together with high road transport and shipping cost, profitability would be lower, a disincentive to reinvest in yield enhancing inputs and other technology. The relationship between the farm-gate and export prices needs to be evaluated to determine why comparative advantage and competitiveness are lower at the farm level than at the export level, particularly in the oil palm industry (Kanapiran 1999). Related to this is the need to establish the marketing margins of exporters to explain to farmers the reason for the big difference between exporters' price and that received by growers.

6.4.2. Low Production and Productivity

Many plantations are senile and many have been abandoned. Investments are nil except for oil palm. New land for large scale development has been low or negative. Where there is land, insecurity is a problem.

Smallholder productivity of coffee is low at 0.5 tonnes /ha with a 'gap' of 1 tonne/ha. Many producers are in debt because of lack of profitability.

The amount of cup lumps of rubber produced is not sufficient to enable a factory with a capacity of 3,000 tonnes of dry rubber per annum to operate on a break-even basis. Growers do not tap their trees regularly because of inaccessible roads, and irregular visits of buyers.

6.4.3. Lack of Credit

Financing tree plantation development bears risks recognized by both the farmer and the bank. The long gestation period of trees inhibits decisions to lend because of the uncertainties. Many things can happen, ranging from natural or man-made destruction to imposition of government regulations and falling prices at the world market that could adversely affect tree planting activities. Credit access has always been a problem to farmers because of bank terms and conditions. Banks require collateral, mainly in the form of land, which the farmers cannot provide because of customary land ownership.

6.4.4. Poor Infrastructure and Services

The domestic markets/purchase points are located very far from production areas and no access at all in outer islands. To make matters difficult, the country's rugged terrain and scattered islands makes conduct of business very expensive during the time of low world price. In some areas, there is no access at all, thus resulting in loss of crop and income for both local farmers and milling companies. Transport costs are high. Farmers of Unggai Bena pay as much as K20,000 a year to engage youths to carry coffee bags for two days to a road access (Weekend National, May 5, 2006 p. 2). Law and order problems result in high security costs and negative impact on operations. Lack of maintenance of wharves and bridges have resulted in poor shipping services and declining port use. Fewer ships for delivery and export of products have resulted in excessively high storage costs and loss of income. Many government departments are perceived as inefficient,

lethargic, and too many layers, resulting in delays and lack of action on issues affecting the industry.

The replacement of the Copra Marketing Board with Kokonas Industri Korporasen, a regulation agency, has resulted in the cessation of copra production in some areas of PNG such as Gulf and Central Provinces due to lack of licensed private sector copra buyers. Rubber also faces similar situation of lack of buyers from the districts.

6.4.5. Lack of Sustainable Funding

Institutions were able to carry out their mandates with large donor and government funding support, but when commodity prices fell and donor funding ceased, sustainability became a major concern. The commodity organization carried out regulatory, research and extension functions and had to cut back on staffing and programs, even amalgamating research and extension to survive. This cut back had affected the services to the farmers. Some organizations have changed their approach to be more open to network and work with provincial DPI, private sector, and civil society. A proper financial and expenditure review or institutional audit is needed to determine their profitability and efficiency.

6.4.6. Foreign-owned Exporters

Exporters are dominated by foreign-owned companies with the profits repatriated offshore. Many have exited the industry with the poor world price and increasing cost of transport and production. This has restricted the market outlets for many farmers.

Few national exporters have emerged and provided much needed support services in a difficult environment. Working capital is the problem for the operations of these national exporters. More support and domestic investments are needed and should be encouraged.

6.5. STRENGTHS AND OPPORTUNITIES

6.5.1. Farmers

Smallholders are efficient producers despite their meager resources. They are familiar with a wide range of crops adapted to local conditions. They can access community support in their farming. They are responsive to financial incentives. In the same vein, large holders have entrepreneurial talent and drive, industry knowledge and expertise, and access to information and domestic and overseas market.

6.5.2. Competitive Advantage in Smallholder Production

The smallholder production trend is increasing. In traditional cash crop growing provinces like Eastern Highlands and Western Highlands, a growing younger population is under pressure to maintain a livelihood in the village and have gone into new planting

of coffee (e.g. Dei Council). Current productivity is low at 0.4-0.5 tonne/ha. There is a big potential in increasing production in the smallholder by 40% to 60% by basic improvement in drainage, weed control, shade and pruning. This can be further improved up to 200% with fertilizer and pest and disease control. The incentive of profitability is needed to encourage the growers. Smallholders are beginning to see the benefit of direct marketing (PNG Coffee Federation) and improved price from quality produce. This needs to be supported. The adoption of CIC coffee rehabilitation packages has been poor because the “one price payment” marketing system did not reward quality.

6.5.3. Resources Available

Abandoned large agriculture investments maybe rehabilitated through new enterprise model and restructuring. This includes the many run-down plantations in the New Guinea Islands, the run down rubber resettlement scheme in various locations e.g. Cape Rodney and Gavien, tea and coffee land in the Southern Highlands, and large coffee plantations in Eastern and Western Highlands. Some will require some public investment to get them productive immediately. A census and survey will show the number of plantations, hectareage, and magnitude of resources required. A program management or implementation unit will have to carry out this task.

Undeveloped rural leases are scattered throughout the country. The government through the Lands Department has the power to assess and review each case and forfeit titles and put them out on tender for private investors to come in under public-private partnership arrangements.

There is great opportunity for agriculture development of tree crop in resource rich provinces for sustainability of the provinces’ future after extraction of resources. The Western Province under the PNG Sustainable Company has given the rubber development a new lease of life through a program to develop 10,000 ha to new rubber planting and to revive old village rubber development. Similar ventures need to be planned and implemented for Enga, New Ireland, Central, and Southern Highland Province. Enga invested in a new coffee processing factory, which creates opportunities for remote communities even in bordering WHP to find a nearer market.

No mechanisms are in place to ensure sustainable agriculture development in resource rich provinces under present arrangements. New mining leases must include sustainability development included in the mine closure plans which must be implemented by a third party as soon as royalty money is paid. Tax credit schemes may be tied into sustainable development. There is a need for better coordination and implementation for sustainable development. This must include a review of the forestry agriculture levies paid by forest developers. In West Sepik, developers planted oil palm without any processing facilities and marketing infrastructure. As a result, land owners face difficulty in developing the industry. This is an example of lack of coordination and monitoring by relevant government agency. Southern Highlands has large potential for coffee, pyrethrum, wheat and livestock development.

Coconut oil is being used as bio-fuel. Coastal and island provinces with ample plots and plantations of mature coconut trees have the opportunity to produce coconut oil to replace diesel. The Bureau of Statistics showed that PNG imported 152 million liters of diesel fuel in 2005 at a cost of K191 million. Domestic use of coconut oil as bio-fuel could save the coconut industry, and help the environment.

6.5.4. Organic Production for Niche Market

PNG has a big potential for niche markets which needs to be developed with a comprehensive development plan. Great tasting coffee comes from Milne Bay, Oro, and Southern Highlands. PNG cocoa is regarded as having fine flavor and is well regarded in major traditional cocoa markets. The Garaina tea has special quality and has a history which needs to be developed and marketed. PNG needs an organic certification agency affiliated with the international organization to facilitate this trade.

PNG is unique but is not known by the market. The country needs to be promoted. With market promotion, PNG finds new market, which is good for the local market because this increases competition and eventually better price for the producers. PNG needs to be serious in market promotion and development, to open up new opportunities for the producers.

6.5.5. High Quality Products

PNG cocoa quality standard is high by world standard, and is well respected by overseas buyers. The International Cocoa Organization has classified PNG cocoa as 75% 'fine or flavor' and 25% as 'bulk' in 1973. In 2003/2004 cocoa year, PNG produced only 15% of fine or flavor cocoa while 85% (28,077 tonnes) of that was bulk cocoa. Fine cocoa usually attracts higher prices than bulk cocoa, but since most cocoa traded is bulk, their price movements are parallel.

6.6. PRIORITY PROGRAMS FOR DEVELOPMENT

Goal: To improve productivity of tree crops sub-sector to contribute to the 5% increase GDP projected for the Agriculture sector in the MTDS.

Objectives: To improve industry structure of management; to improve data/collection and monitoring of large-scale enterprises; to mobilize and empower plantations and smallholders

Program Area 1: Development of Linkages and Making Policy Changes

Goal: To streamline the industry for coordination and cost effective management

Objectives:

1. To form an apex body for the tree crop sector, for planning, priority setting, resource allocation and M&E and auditing technical as well as performance review.
2. To establish a single implementing agency for large commercial agro enterprises.
3. To bring back the confidence of the financial institutions.

PNG is a small producer country; however many commodity organizations govern the individual sub-sectors like CIC, KIK, CIB etc. Other neighboring countries with huge population and land mass under tree crop development like Indonesia, Malaysia, Thailand, and Vietnam have simpler structures than PNG. PNG commodity organizations came into being for efficiency and stakeholder control to grow the industry. However, the institutional changes to the tree crops industries have resulted in fragmentation and duplication. Implementation of program and projects have become an impossible exercise requiring review and design of better implementing vehicle. The commodity organizations did not provide plans for plantation rehabilitation. The CIC operated the Technical Management Advisory Service for five years and provided training but no suitable program was developed. CIC should have linked up with RDB management agency (Smallholder Rural Project Management Company), which has also closed down due to lack of funding.

The ADB loan-funded Nucleus Agro Enterprises Project (NAEP) was viewed as the vehicle to revive the tree crop industry. The final loan package did not quite match the industry expectations including that of the government. A large portion (70%) of the loan was devoted for feasibility study which left very little for actual development. After the identification of potential sites and field assessment, the loan was terminated. The Government of PNG funded a couple of pilot projects that has encouraging results. Several lessons can be learned from these projects to form entity that would implement large investment projects in the tree crop sub sector.

Strategies:

- Financial and Expenditure Review: This review must be carried out to amalgamate or streamline commodity organizations (CO) for cost saving and effective management. The role and functions of CO must be limited to industry regulation, market development and policy only. CO should be encouraged to collect development levy to provide funds for development, through intermediaries or service providers. Thailand collects rubber replanting levy which resulted in high growth rate in the rubber industry overtaking Malaysia as No.1 world rubber producer.

A reservoir of Subject Matter Specialists must be maintained for packaging of technical information for training and extension. Visiting agency services must be done using local specialists based on research stations to improve technology transfer and adoption. They can also be involved in monitoring and 'back-stopping' of service providers and strengthen nucleus enterprises.

- Establish Tree Crops Management and Development Agency. The agency will look at new investments and development, and manage plantation rehabilitation and supply chain. A similar entity for cooperative development is needed also to facilitate capacity building of farmer growers who will then be able to mobilize land and labor for productive agriculture development.

It is vital that a Project Management Unit or agency is established to implement the Tree Crop development. Experiences suggest that weaknesses in project coordination hamper effective project implementation. The role and responsibilities of each stakeholder in the sub sector must be defined clearly to ensure that these are understood and accepted by all partners when funding under NADP commences. The agency will be the principal national counterpart for program implementation with donor agency, responsible for facilitating the interaction among stakeholders.

- Establish Tree Crops Research and Extension Council. This body will coordinate, prioritize and carry out timely technical audit and provide the linkages and network with regional institutes and source funding to support the national agricultural research systems.
- Monitor nucleus enterprise management. Nucleus enterprise creates opportunity for smallholders to produce under contract to supply a processor, receive support services, and have assured market for their produce. There must be laws to govern and protect all parties concerned, and a mediator or regulator for safeguard measure. The operation of oil palm and rubber industry that largely depend on out-growers should be reviewed in order to plan for an effective system of operation. The oil palm transport and management cost in PNG are very high. The rubber industry offer low prices which make settlers and village producers reluctant to tap their rubber. Prices should be monitored and transactions studied to determine the best way to assist producers. The role of the Commodity Working Group of the NDAL and the Independent Consumer Competition Commission of the Consumer Affairs Council needs to be strengthened and working relationships defined.

The current ‘weak’ state of the industry problem must be addressed. The oil palm industry however, has been the most successful tree crop, declaring huge profit and even invested in Solomon Islands. The others (coffee, cacao, coconut and rubber) have seen negative investment, largely due to declining productivity. Major stakeholders have exited the industry, leaving the industry in a weak state as it is now. It requires major investment to revive the industry.

The comparative advantage has been identified at the export level and not at the producer level. More national exporters should be supported to retain the surpluses for reinvestment in the industry for sustainability. The cost of processing and management are generally high for foreign owned exporters. There is a need to identify where the funds have gone, because obviously the producers had not gained anything. It is urgent to monitor cost and prices offered to farmers. Programs and projects must support producer groups to market directly in order to reduce marketing

and processing cost. The CIC has opened up competition by getting more national companies participate in commodity trading. The cooperative strategy should be supported.

- Policy interventions for changes. Policies are needed to generate funds for development of the subsector:
 - Derivative grants to be quarantined for agriculture development fund per province. Establish equity fund from non renewable resources for new agriculture developments. Encourage exporters to retain more revenue on shore for reinvestment in the industry.
 - Government to under write investment in agriculture by super-funds, and support 6 to 10 large land development schemes under nucleus enterprise model.

Program Area 2: Nucleus Enterprise Development and Rehabilitation

Objectives

1. to build the capacity of the private sector to revive plantations through subsidized management.
2. to build management information system of large agro enterprises to fill the vacuum of data and information.
3. to link all stakeholders and pool resources for the tasks above including possible management of development funds collected by commodities or provided by donors.

The first priority is run down plantations with some structures needing management and small capital to get back into business. This should be followed by land mobilization for development of large land mass in run-down plantation, undeveloped rural leases and settlement schemes. Most of these lands are occupied by illegal settlements or by traditional landowners. Development options with appropriate structures or enterprise model would appeal to all concerned.

Strategies

- Conduct census and survey for tree crops, rural leases and status of plantations to determine where nucleus enterprise, plantation rehabilitation, replanting, expansion to other areas are applicable.
- Undertake feasibility studies and develop business plans and investment packages. Determine the conditions needed to start or rehabilitate plantations, infrastructure requirements (roads, wharves, ports, communication facilities), freight surety/subsidy scheme to bring produce to exporters, banking and business requirements, government permit and licensing procedures, the local capacity building program.
- Carry out pilot projects (1-2 nucleus enterprise per district) – identify activities from establishment, plant cultural management, pest control, harvesting, marketing, transporting until it reaches exporting agent. Develop pest prevention and control

program through regular surveillance, training the producers on the indicators to be monitored and where it should be reported. Research and development programs will develop appropriate technologies for production, such as high yielding and pest resistant varieties, nursery and propagation, farming systems, pest management, and plan for technology transfer training. Processing mills or facilities will be built to produce quality products.

- Promote proposals and invite local and overseas investors
- Collect and collate all relevant development statistics and information and distribute to appropriate clients. Network with international organizations to keep up with the trends on pest control and other important information.
- Establish Agriculture Development Fund through collection of development levies.

Program 3: Cooperatives and Market Development

Objective: To mobilize and empower smallholders to market their products.

Producers have formed themselves into marketing groups in order to reduce costs and be more competitive. They will need management training and assistance in market promotion and operate as nucleus enterprises to provide support services to its members. OK Corporation in Western Highlands Province is 100% locally owned coffee estates with 4-6 large out-growers owned by shareholders. It is the largest coffee group owning more than 600 ha effective coffee area under their management. Mainland Holding returned to coffee business as a processor acting as nucleus enterprise with its shareholders canvassing coffee from individual and business group members. The RDB has given out loans to Mainland Holding shareholders which enabled them to purchase trucks for their coffee business. Kongo Coffee Ltd., a processor, has effective coffee marketing arrangement with smallholders in Simbu. Its example can be done in other areas such as Jimi, Maprik, and Tari for coffee. For coconut products, Bogia cooperative stands out.

Strategies:

- Establish toll processing facilities e.g. wet or dry coffee processing units. Feasibility studies are needed to determine the profitability, efficient operations, maintenance, and target clients.
- Facilitate cooperatives development. More growers will be encouraged to join cooperatives to add value on price and quality. Credit cooperatives will be formed to facilitate coffee marketing. Farmers will be organized into business entities and trained on technologies to build into business. Downstream processing will be encouraged to develop high value products that can be marketed during low commodity price depressions.
- Marketing and promotion. Transparent marketing system will be encouraged through close monitoring of prices and marketing margins, providing market information to stakeholders, and facilitating better working relationships between growers and

exporters. Products will be promoted at overseas markets, and direct contact between growers and overseas buyers will be facilitated through international coffee shows and exhibition, collaboration with international marketing entities. Market studies will be conducted.

- Quality standards and control. Increased surveillance and inspection programs will promote and maintain quality standards. ISO certification could be one way to ensure quality standards.
- Training and marketing. National exporters will be trained on the requirements of export markets. Training on market-based risk management mechanisms and price insurance schemes will provide better management of price fluctuations.

6.7. EXPECTED OUTCOMES

A modest increase from the current level of production by 10-20 % is possible through rural infrastructure maintenance and improvement programs. Most of the produce not reaching the market will have better access and farmer organizations established to facilitate marketing will contribute to this increase. Balance will come from rehabilitation of coffee and rubber plantations and new plantings of oil palm. For cocoa, a big increase will be contributed from the donor funded new plantings in Bougainville; however in other leading provinces, cocoa pod borer infestation will limit expansion and production increases. The overall additional export income of K400 to K500 Million is projected (Table 6.6)

Tree crops are perennial crops requiring 5-7 years to come into full production. The fruit of investment is expected to yield in the next 5-year plan. It is important that the planned program is implemented, starting with capacity building and infrastructure rehabilitation. This will be the foundation for the subsector development.

Table 6.6 : Expected Outcomes from Tree and Industrial Crops Development

Crop	Increased number of ha. (000)	Employment Generated	Production (000 tonnes)	Present Export Qty (000 mt)	K Million	Increase in production (%)
Oil Palm	30 -40	15,000	140	295.7	200	20 – 30
Coffee	2	14,000	20-30	66.9	100	10 – 20
Cocoa	25	15,000	20-30	37.0	80	10 – 20
Coconut	5	1,500	20-30	49.4	40	10 – 20
Rubber	10	15,000 families	15-20	4.0	40	30 – 50
Others	5	20,000	8-10		20	40 – 50
Total					400 – 500	

7. LIVESTOCK, APICULTURE AND AQUACULTURE DEVELOPMENT

7.1. INTRODUCTION

Appropriate livestock, apiculture and aquaculture industries should be introduced to improve farming systems for increased production and productivity leading to efficient resource use in specific agro-ecological zones. Revitalizing livestock, apiculture, and aquaculture industries in PNG will ensure that affordable and quality meat, honey products and fish is within the reach of the people. The plan covers the following:

- Livestock – pig, poultry and eggs, beef and dairy cattle, sheep, goats, rabbits, quails
- Apiculture - honeybees
- Aquaculture – rainbow trout, tilapia, carp, barramundi

7.2. LIVESTOCK DEVELOPMENT PLAN

7.2.1. Current Status

The livestock industry in PNG contributes 13 % of the total domestic food production. Its share of agricultural GDP is estimated at 12% (Vincent and Low, 2000). Meat consumption is increasing at 5% per annum, as indicated by increasing cost of importing livestock products which exceeds K140 million per annum. Consumption trends have also changed with more imports of low priced mutton off cuts and canned trimmings which substitute for quality beef.

Subsistence pig production is an important component of the local agriculture system, especially in the highlands, with an estimated population of over 1.6 million heads. Pigs are raised for subsistence and social purposes hence over half of the population are involved in its production.

Table 7.1 shows a static growth trend for village pig meat production, and slight growth in commercial pig production. Small scale and village level production of beef has slight growth. Sheep production at semi-commercial and subsistence levels has declined, while goats have moderate growth. Large scale commercial poultry meat and egg production has strong growth. Total livestock production growth trends have been in the range of 3 – 5 % per year for the past 10 years.

Table 7.1:
Estimated Numbers, Values, Growth Trends of Various Livestock in PNG

Component of PNG Livestock	Number of animals	Value (K000) ^a	Growth trends
Pig meat:			
- Village	1.6 – 1.8M	36,000	Static
- Commercial	2,150 sows	3,450	Slight growth
Beef			
-Large scale	63,000	40,000	Numbers decline
- Small scale & village	17,000	75	Slight growth in production
Sheep meat	15,000	160	Declining
Goat meat	20,000 -30,000	200	Moderate growth
Poultry			
Large scale			
- meat	20,000	80,000	Strong growth
- eggs	2,496	15,000	Strong growth
Small scale meat	10,000	45,000	Strong growth
Village meat	1,548,000	25,272	Static
Village eggs	226,000	1,224	Static
Total		213,656	3-5 % growth per year

^a July 2000, 1 Kina (K) = US\$0.40: this value was based on the total numbers of animals killed or sold as a proportion of the total number of available animals.

Source: modified from Grant, ACNARS Project, 2000(quoted by Maika, 2000)

Most local beef is produced on large ranches and production declined in the last decade but has increased slightly in recent years (Fahey, personal comm., 2006.) due to greater output from the ranches. Failure to reinvest and lack of incentives in smallholder cattle production has led to decline in numbers and static production. There is slight growth in smallholder cattle production in Morobe and Eastern Highlands due to improved marketing and close proximities to abattoirs.

Cattle under coconut management system were promoted under large coconut plantations, mainly in the New Guinea Islands and mainland coastal provinces to optimize productivity and production of cattle and copra. An introduction of goat and

sheep in the system is an option worth considering. The ideal breeds under such system would be Javanese Zebu cattle, black belly sheep and improved breed of goats.

Demand for meat in PNG is expected to grow at the rate of five percent per year. This is due to population increase of 2.7 percent and factors associated with urbanization, availability of cash and changing lifestyle and demand for improved diets. Red meat consumption has tripled over the past 20 years, and bulk of it (90%) is attributed to low priced lamb flaps. Imported trimmings have substituted quality beef, pork, and poultry meat.

The demand in developing countries is projected to increase at 3.9% for poultry, 2.9% for beef, and 2.4 % for pork. However, demand in PNG might exceed these figures because of its high population growth.

Dairy cattle were introduced in the 1960s by missions and other institutions for consumption and to improve the nutrition of their members and the local community. Christian Leaders Training College (CLTC) in Banz produces fresh milk and sells to government institutions and supermarkets in Mt. Hagen. The Evangelical Brotherhood Church (EBC) owns a dairy cattle herd located at 5-Mile, Lae.

Sheep and goat production has been integrated into traditional farming systems and their numbers are limited (Table 7.1). Levett (1992) found that 56% of farmers graze their sheep in food gardens and 67% use sheep manure in their gardens. A flock size beyond 15 would pressure land use. About 13% of the farmers graze sheep among cash crops with a stock number of 30-50 ewes under plantations or grass fallow.

Imported goats were introduced in the late 1800s to village communities. An estimated 20,000 to 25,000 goats are in the country, mostly in Morobe, Eastern Highlands and Simbu. No serious promotions of improved management, nutrition, disease and parasite control, and systematic crossbreeding are done for goats. Despite this, the goat industry has expanded considerably due to local interest and religious preferences.

A highly successful and vertically integrated commercial poultry industry has been developed since 1983 under import ban, which was replaced with 70% tariff in 1992. Current tariff rate is K2.20 per kg which was progressively reduced from K3.15 per kg in 2000. About 250 out-growers supply 16,000 tonnes of frozen and fresh chilled chicken to the local market. Demand is increasing for Day Old Chick (DOC), usually packed in 50 DOC per box, to be grown for the local live markets. Commercial operators sell 120,000 DOC per week. This market is expanding and likely to match the commercial production of frozen chicken.

Other minor livestock species like rabbits, guinea pigs and ducks are taking prominence, particularly in the areas with limited opportunities for other agricultural activities due to physical and environmental limitations.

Demand for rare and beautiful flora and fauna, particularly insects and butterflies found only in PNG is increasing. Butterflies, moths, and beetles attract collectors and overseas buyers. The Wau Ecology Institute has germplasm collections and storage of dried specimens for export.

7.2.2. Livestock Production Systems

Two systems of livestock production are used: open grazing and close confinement. There is a range from cattle in feedlots to chickens or rabbits in battery cages. Grazing of animals confined at high stocking rates on pasture as practiced, for example, in the New Zealand dairy industry can be regarded as intensive, as distinct from the free range grazing systems. Ideally, commercial production would entail permanent confinement in some kind of housing, and possible expansion on semi-commercial free range system.

The ideal model for smallholders is to form clusters of production units owning feed manufacturing and distribution, abattoir and processing plants, keeping their labor less than market wage rates, and making small farms more efficient to generate profits per unit output. The cluster groups can join with larger nucleus operations for processing and marketing in order to have “large economies of scale” in poultry production. Similarly for pigs, nucleus breeder farms could be developed to be the source of supply of weaners and growers, feed, veterinary support and extension/training to private commercial operators.

Physical conditions in PNG are favorable for intensive production of meat and eggs to meet the projected increasing demand. PNG has an abundance of crop residues and surpluses and land to support animal production, and also an enviable low disease risk status. Research support is sufficient, but NAQIA must be vigilant of effective disease monitoring and border surveillance

The only successful integrated business using the nucleus estate concept is that of the Niugini Table Birds. It entails strict central management, adequate financing, excellent training and support for staff and the contract growers, adequate but manageable sizes of grower operations and realistic expectations of profits to be earned by participants. The keys to success in any livestock production business are forward planning and continuous feed supplies at pre-arranged prices, farmer training and extension support, negotiated profit margins and, of course, care and attention to the needs of all animals. However, at present, this system is implemented at few localities only with limited number of participants, but has the potential to expand to other areas to create employment opportunities and hence stimulate the local economy.

Although the concept of the nucleus pig breeder farm of the Rural Development Bank and Koita Oro Boroma and the beef cattle breeder farms operated by NDAL and LDC was correct, the enterprise failed because the enterprises were not transferred to private sector to operate as commercial activities. Ilimo Farm failed for a variety of reasons, which had little to do with the ability of contract farmers to grow chickens.

7.2.3. Marketing Practices and Network

Large estates and small scale cattle and pig industries have continued to slaughter their animals at LDC-operated and privately-owned abattoirs. Whole carcasses are marketed to private butcheries and supermarkets in the urban areas. Marketing price and demand and supply information are not readily available to sellers and buyers in the formal sector. Abattoirs with downstream processing facilities for deboning, forming different cuts, and rendering machines of offal for stockfeed present an opportunity to add value to livestock products and by-products. LDC abattoirs do not have these facilities. Private abattoirs are linked to upstream production as vertically integrated part of the operation. The Ramu Sugar beef, Numundo beef and Pelgens pork processing, are linked to butcheries and supermarket and retail shops. Pricing and marketing information are determined by farmers or estates and not regulated.

The “singsing or live market” is not organised and seasonal. It is vibrant but untapped market and could be better assessed and organized for both urban (peri-urban) and rural (subsistence) production systems.

In the past, co-operative marketing for cash crops has failed mainly due to poor marketing infrastructure, accessibility and bad management. Co-operative marketing network largely organized and operated by state agencies have not been successful. The Ramu Sugar cattle and Niugini Table Birds poultry products experience showed that private companies can provide extension, training and markets to smallholders under out-grower arrangements for sugar, cattle and poultry industries. Church groups, such as Seventh Day Adventist and Lutheran Church-owned Waso Ltd in Enga in 1970's developed and operated innovative participatory methods for working with people in rural and remote areas. Examples such as these could be assessed and adopted in perspective to different cultural and social settings in PNG, where public and private services are inaccessible for vegetables and horticultural markets.

7.2.4. Key Partners/Drivers

The Livestock Section in NDAL, which housed Research and Development, Field Veterinary including Quarantine and Laboratory Services, Extension, Education & Training and Production Unit and their field stations, was disbanded by policy decision in 1983 to establish the LDC.

LDC took over the cattle stations at Bayer River, Bena Bena, Erap, Launakalana and Urimo and the Goroka piggery. The main objective was for these cattle stations to operate as commercial nucleus breeding and distribution centres, in joint partnership with smallholder operators, to promote commercial livestock production. LDC also took custody and ownership of major physical state assets like abattoirs, stockyards, and piggeries. To date, most if not all of these assets are underutilized; stockyards and fences are irreparable; and operating abattoirs at Port Moresby and Lae are in appalling conditions and in dire need for reconstruction.

Livestock research and development was under Agriculture Research Division, and field veterinary services, diagnosis/laboratory test, quarantine and inspection remained under Agriculture Protection Division until NARI and NAQIA were created by Act of Parliament in 1997. Respective functions were transferred from NDAL to NARI and NAQIA which remained as statutory bodies under the Ministry of Agriculture and Livestock.

NARI has since developed R&D programmes with emphasis and focus on smallholder agriculture and livestock family farms. Aspects of family management and labour inputs, employment generation, food security and health benefits from improved nutrition are considered under the area of research opportunities (AROs). Technology development is aimed at high farm productivity which generates incomes and improved nutrition through greater availability of livestock products. Their research and development area covers pigs, poultry, rabbits, goats, sheep, cattle and inland fisheries and aquaculture. Under Food Security Program, NDAL links with Provincial DAL which in turn provides link to districts and LLGS to promote livestock production, processing and marketing. Livestock marketing has remained uncoordinated, complicated by inaccessibility to transport, unreliable input supply and lack of credit facilities to purchase farm inputs.

NAQIA's primary role is to enhance agricultural production by creating an environment that reduces threats to PNG agricultural systems, especially by minimizing the risk of introducing harmful pests and diseases to plants, animals and the people of PNG. It also maintains quality assurances for imported goods and ensures that PNG's export products meet importing country standards and requirements.

Rural Industry Council (RIC) consists of representative of growers' associations, e.g. PNG Cattleman's Association, Poultry Industry Association, PNG Pig Grower's Association, and others. The government receives advice on agricultural policy matters through the RIC, which raises the profile of the respective livestock industries.

7.2.5. Issues and Constraints

7.2.5.1 . Poor Production and Management Practices

Poor skills in animal and pasture management, poor veterinary and quarantine services, lack of extension support to smallholders, lack of suitable credit facilities, land tenure and ownership and social problems have contributed to poor productivity and efficiency. Farmers do not take care of pigs because of the view that pigs are self-supporting assets that create wealth from crop surpluses. Inbreeding and low levels of nutrition and management cause poor growth rate, low mature body weight and inferior carcass characteristics of small ruminants (Kohun, 1998, Benjamin et al. 1992). Most pigs have saturated gene due to inbreeding, particularly in smallholder herds. Improvements in nutrition and management, parasite and disease control, systematic crossbreeding of exotic breeds should improve the productive traits for commercial production.

7.2.5.2. Low Level of Adoption of Technology

Fresh milk production through small dairy farms failed because the activity was confined to missions and institutions, and technology to milk and process for other value added dairy products were not promoted. In addition, traditionally PNG farmers are not dairy farmers and not accustomed to daily routines required in dairy operations. Technologies for improving growth rates of livestock and breeds adapted to PNG conditions, and local feeds are needed.

7.2.5.3. Insufficient and High Cost of Inputs

High feed cost is the most important constraint for commercial poultry and pig production, and aquaculture (70% of total production cost). Attempts to improve small-scale commercial pig production have been unsuccessful due to high feed costs in conventional commercial production systems. PNG lacks animal feed industry, thus all compounded feeds are imported. Import tariff on compounded stock feeds (compounded stock feeds attract a tariff of K64/tonne sold in bags of more than 50 kg, while feed ingredients have zero tariff) and high internal transport costs to bring the feed to the farm gate increase feed costs. If commercial small-scale pork production is to be competitive, feed costs must be substantially reduced, breeds improved, and quarantine and veterinary services readily made available.

7.2.5.4 Lack of National Government Directives and Support

The performance of livestock was inadequate because of lack of prior investigation and consultations. In most cases, the likely fit between the new and appropriate livestock species and the existing farming system were not adequately assessed. The government also lack support in developing human resources to manage livestock production in the country.

7.2.6. Strengths and Potential

7.2.6.1. Long Fallow Grasslands

Large tracks of land under leasehold or freehold grassland in PNG could be put under cattle, sheep and goat production, particularly under customary land ownership which are left underutilized under long fallow period. The Clan Land Use Agreement (CLUA) or the current Incorporated Land Group (ILG) under Lease-Lease Back Agreement (LLBA) could be applied for the purpose.

For example, 409,780 ha of grassland (Bilong and Galgal, 2006, unpublished cattle development proposal) in Morobe could be put under large and small ruminants production. Given the favourable climate, soil and natural physiographical conditions of these grasslands, the area could be put under productive use without immediate threat to direct competition for land for food production. With a stock density for cattle at 1 animal per 3 ha, the area has the potential to carry about 130,000 heads.

7.2.6.2. State Assets

LDC owns large tracks of land, which presents an opportunity to establish herds with genetically improved breeds and crossbreds under the nucleus concept. Initially, public and private sector partnership and then private sector will run the enterprise as breeding and distribution centre, and buy back fatteners from participating communities for slaughter, processing and marketing. LDC's role could be redefined through repeal of the Act for its establishment.

The huge land bank held by LDC, the RDB physical assets, and the slaughter facilities of LDC, through private and public sector funding and investment could be revitalized and expanded. Incentive funds will greatly promote local livestock production.

7.2.6.3. Readily Available Day-old Chicks (DOC)

Commercial broiler DOC are sold to agricultural input suppliers and distributors. Most suppliers are linked to upstream producers such as NGTB, Zenag, and Banz CLTC. Smallholder commercial producer will continue to produce and sell fresh chicken with readily available supply of compounded commercial feedstock, necessary equipment like feed troughs, water troughs, fencing materials, veterinary supplies and access to transport. The important factor is the high demand for fresh chickens at an affordable price at K20/bird.

7.2.6.4. Disease-free Status

PNG enjoys disease-free status except for Sac Brood and Chalk Brood, which are manageable without medication. Livestock diseases in other countries such as mad cow disease, foot and mouth disease and Avian flu and swine fever are absent in the country.

7.2.6.5. Private Sector Investments

Under crop intensification and diversification program, beef cattle and sheep production is integrated. Private sector investment is being promoted under the nucleus concept among smallholder customary landowning clans on the fringes of large estate. Ramu Sugar Ltd. proposes to increase its herd size of beef cattle from 16,000 to 26,000 within 2-3 years (Kuniata, personal communication, 2006). This expansion will improve marketing and processing facilities which will enable farmers to have gainful return. The Trukai Industries Ltd. is intensifying cattle production through pasture improvement with *Leucaena* hedge and other tropical legumes and grasses. To date, five live cattle shipment have been undertaken using out-grower and nucleus production and marketing concept through distribution of weaners and yearling to smallholder fattening units. These private sector initiatives should be facilitated and supported with specific investment programs and incentives.

7.2.6.6. Large Demand

The large demand for pork, poultry and other livestock in the urban areas is an opportunity for semi-commercial and small-scale peri-urban commercial producers. Accessible feeds, commercial DOC, improved breed weaner pigs, and market will render commercially viable and sustainable enterprises. Improvement of LDC-owned slaughter facilities, better coordinated marketing, and readily available marketing information will improve efficiency and productivity of the livestock industry.

7.2.6.7.1. *Animal Traction and Draft Animals*

With increasing population pressure on land or improved access to markets for agricultural products, Papua New Guinea has to change from digging stick agriculture, walking and carrying means of transport to the use of animal for tillage and intermediate means of transport. Local transport solutions reduce the drudgery, save time and increase the efficiency of rural women, men and children. For example, using a bicycle, pack animal or cart, a painful 15 kg back load can be replaced by much larger load (80-120kg) transported with more ease and speed.

Farmers with carts or trailers can increase their crop production through greater use of manure. With timely on-farm transport, less of the harvest is lost. Farmers can increase the productivity of their animals by transporting and stocking crop residues. Farmers are more likely to purchase farm inputs, such as fertilizers if they have access to transport.

The National Draft Animal program using water buffaloes have ceased due to lack of funding support from the government. Demand for water buffaloes is increasing as costs of motorized transport and farm equipment, parts and fuel are increasing. The aim is to stimulate the adoption and growth of local transport solutions (including animals) with sustainable and affordable supplies, training support and maintenance provided by the private and public sector partnership.

7.2.6.7.2. *Adaptability of Other Emerging Livestock*

Draft animals, rabbits, crocodiles, guinea pigs, Muscovy ducks and quails are potential livestock species for PNG. Crocodile hides are in demand and command high prices. Rabbits and ducks are being promoted as good sources of meat. More research is needed to know their adaptability to existing farming systems and their commercial potential. A system to monitor and evaluate diffusion and adoption by farmers is needed. Technology packages developed outside of existing management and farming system and brought to the farmer without proper assessment, adaptation, and diffusion have failed. They should be tested and evaluated jointly by researchers, extension workers, and farmers to suit the particular location, cultural and social settings.

7.2.7. Priority Program and Strategies for Development

Program: Nucleus Enterprise Livestock Production

Objective: To improve livestock production, processing and marketing.

Strategies

- Establish breeding and distribution centers for genetically improved breeds and crossbreds under the nucleus enterprise concept, initially with public sector and private sector partnership arrangement. Private sector investments should be counter funded through Public Investment Project. Distribution stations will be linked to ongoing Livestock Development Program by NDAL under food security program in consultation with Provincial and District Livestock Officers will incorporate various species of livestock for animal traction and draft purposes. Hatcheries will be established per region to cater for the high demand for DOC, ease of delivery, and preventing high mortality upon arrival at farm gates. Importation of fertile eggs of genetically improved poultry breeds and semen for artificial insemination and live import of genetically improved breeds of pigs and poultry will be an on-going program to upgrade performances of breeding stock. Hatchery and distribution centers could start with institutions, capitalizing on available expertise and facilities within regions.
- Support R&D program. Locally available feeds will be evaluated for its nutritive quality against imported feed. Potential and available feed especially locally available agro-industrial by-products such as copra meal and wheat millrun will be evaluated and improved for its nutritional value. The research for specific localities based on different agro-ecological zones of NARI and the University of Technology (UoT) will be supported. The adaptability to existing farming system of emerging livestock such as draft/traction animals, rabbits, crocodiles, guinea pigs, Muscovy ducks and quails will be studied. Research will have to be participatory – farmers are consulted and involved in testing and demonstration of new ideas, and helped in aiming for realistic goals in production using available resources.
- Support training programs. The capacity building and training undertaken by NARI and UoT should be expanded to include farmers, researchers, students and extension officers. Special training program for veterinary and para-veterinary studies should be introduced at the agricultural universities to produce qualified professionals to be deployed into the sector and bring back the vibrant status of the subsector.
- Support disease and border surveillance. With the potential of exotic diseases threatening the livestock industry in PNG, NAQIA should be resourced adequately to boost its mandatory roles and regular disease and border surveillance of the borders and installation of equipment on border ports to destroy infected specimens entering PNG.
- Commercialize cattle, sheep and goat industry through integration with tree crop (oil palm, coconut and rubber) plantations, food gardens, and grassland fallows. Improve productivity by using appropriate breeds and management practices.

- Encourage smallholder commercial production of pig and poultry near urban centers where feed, transportation and processing facilities are accessible to farmers, in order to meet urban market demand.
- Promote cooperative marketing under nucleus concept and vertical cooperation strategy using cluster groupings. Cooperative arrangement will be made for livestock farmers. The LDC, NARI, NAQIA will facilitate to breed and distribute livestock, access to production, inputs and product marketing, and veterinary services.
- Privatize processing and marketing. This will include upgrading of the abattoir facilities which are environmentally friendly. All operation will be retooled with an option to rebuild the rundown LDC abattoirs, and replace slaughter equipment (such as coolers, pumps, electrical equipment), and maintain holding paddocks to improve quality of the carcass. All imported meat should be whole carcass so that veterinarians and meat inspectors can conduct meat inspections. Deboning and packaging will be done locally to ensure quality meat can be sold to consumers, improve livestock marketing research and timely information to determine correct price for all the livestock species. All marketing and processing should be undertaken by the private sector under nucleus enterprise and cooperative arrangements.

Policy Considerations:

- (1) Cross cutting issues such as extension, communication, high cost of inputs and lack of technology
- (2) Review LDC's role and redefine as appropriate to meet the current requirements.
- (3) Retool/reconstruct and privatize operating LDC abattoirs
- (4) Reduce current tariff rates on imported compounded feed and agricultural equipment
- (5) Link agricultural input suppliers to upstream production industries
- (6) Promote lease-lease back land tenure system for large scale extensive cattle, sheep, goats, and deer farming.

7.3. AQUACULTURE DEVELOPMENT PLAN

7.3.1. Current Status

Subsistence carp and tilapia culture was introduced into PNG in the early 1950s to alleviate malnutrition. Inland fishery was integrated with livestock activities, and rivers, waterways and lakes were seeded with fingerlings. Commercial aquaculture development was ignored. Tilapia (*Tilapia mossambicus*) was introduced near Bomana and Goroka in ponds but its rapid breeding ability resulted in overcrowding and stunted growth. The common carp (*Cyprinus carpio*) proved successful under pond conditions with record weights up to 0.9 kg in 6 months (Kovari, 1986). This led to interest in and rapid expansion of common carp culture in inland areas.

Numerous ponds were constructed without proper technical specification, and demand for fingerlings exceeded supply from government stations at Aiyura in Kainantu, EHP and Dobel near Mt. Hagen, WHP. Even without government support, enthusiastic farmers have thrived, often sourcing fingerlings from natural breeding ponds. An FAO study in 1993 confirmed that farmers in PNG were keen and productive in carp culture.

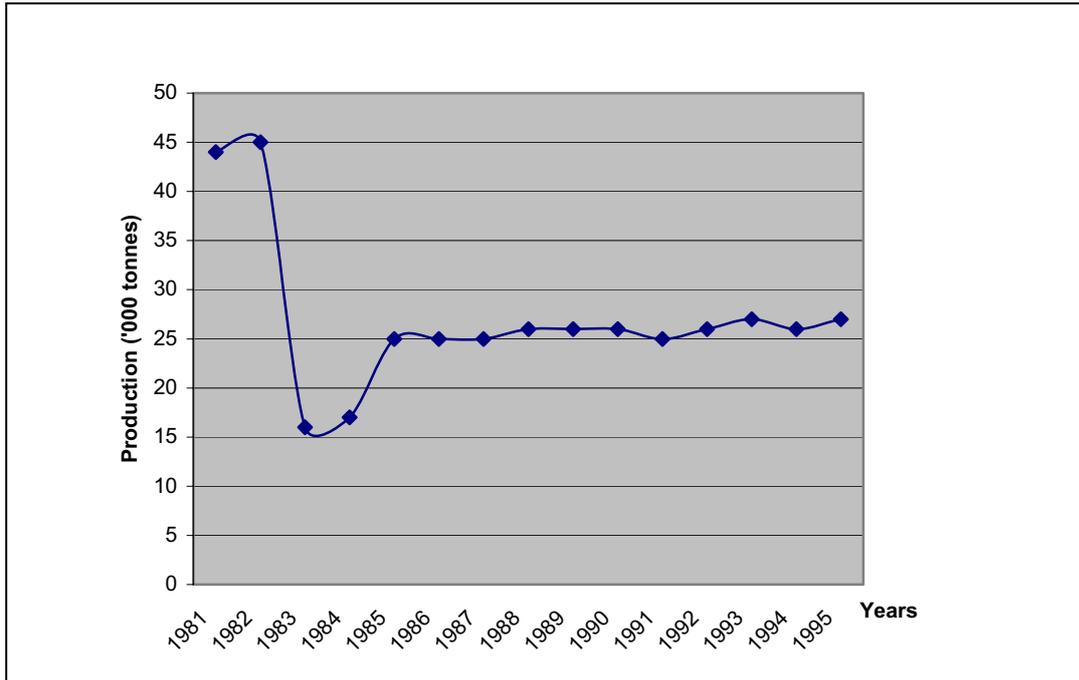
Current inland fish production is estimated at 100 tonnes per annum. About 350,000 fingerlings are produced annually, 71% from Highlands Aquaculture Development Center (HAQDEC) and 29% from provincial breeding centers and skilled breeders in the villages. A privately owned trout farm produces and supplies 100,000 fingerlings annually.

The households and immediate community consume most of the fish produced. Aquaculture contributes to household food security and provides cash earning opportunities to all sectors of the community.

7.3.2. Aquaculture Production System

Two common modes of production are artisanal/subsistence aquaculture and commercial aquaculture. Currently, most aquaculture activity is concentrated at the artisanal/subsistence level despite lack of suitable feeds and feeding regimes, technical know how, insufficient fingerling production and distribution, and extension support.

Papua New Guinea is rich in fish stock. Subsistence coastal fisheries are important source of animal protein for coastal villages. FAO statistics show domestic production of fish varied from a high 45,000 tonnes in 1983 to 25,000 tonnes from 1985 to 1995 (Figure 7.2). Large offshore fisheries are dominated by tuna taken by foreign boats. Currently, most tuna caught in PNG waters are canned by RD Tuna Cannery Ltd. The International Food Corporation imports canned mackerel under the brand name 'Besta'. About 15,000 tonnes of fish are imported each year for canning.



Source: FAO (quoted in Vincent & Low, 2000)

Figure 7.2. Estimate of Fish Production

Most artisanal aquaculture use carp, rainbow trout (*Onchornyctus mykiss*), and Genetically Improved Farmed Tilapia (*Tilapia nilotica*) or GIFT. GIFT was introduced from the Philippines in 1999 and is a popular aquaculture species due to its fast growth and late sexual maturity. Subsistence fish farms total 11,000 with an estimated annual production valued at K5 million in the inland areas of PNG. This is equivalent to 883 tonnes of fish at the current fish price (carp) of K6.00/kg. The ACIAR survey showed marked increase in number of new farms especially for GIFT, an indication of aquaculture's popularity and preference for the new tilapia. The Western Highlands Province alone has 6,000 new farms established from 1999 to 2002. Most of these ponds are not fully stocked due to low supply of fingerlings from HAQDEC. The EHP staffs of HAQDEC lack skills and resources to produce increasing number of fingerlings to meet the high demand. Due to shortage in fingerling supply, the price of fingerlings has increased from K0.05 to K0.50 per tilapia and carp fingerling, which has suppressed interest in aquaculture.

In the past, the government has largely ignored commercial aquaculture development because of the view that PNG has abundant natural fisheries resources. Private sector operated a few farms with minimum government support. The following are the major commercial aquaculture operations:

- Trout farms: Kotuni Trout Farm (Goroka), Betty Higgins Trout Farm (Gembogl District, Simbu Province)
- Barramundi farm: Bismark Barramundi Farm (Madang)
- Pearl farms: Samarai Island Pearl Farm, Milne Bay, and Coral Sea Mariculture, Milne Bay and Western Province
- Tilapia farms: Anton Yagama, (Madang), Yonki Cage and Norbert Barakove (EHP).

Most of these farms were funded from foreign investments and have enjoyed some success, but some were abandoned due to management and technical problems relating to species under culture. Some commercial aquaculture ventures are still operating at present.

One factor for success of companies is the nucleus farm concept. Bismarck Barramundi Ltd. provides juveniles, feed and technical assistance to village farms. When they reach market size, the nucleus farm collects, processes, and markets the fish. The company retains costs and fees and the balance paid to the villages that participated. The concept is a successful means to assist small-scale farmers who are to source seed materials, pontoons, feed and markets. In 2004, the European Union's Coastal Fisheries Project for Rural Development nominated in 2004 Bismark Barramundi Ltd., as a private sector partner to assist barramundi farmers along the north coast area. The project provides soft loans in the form of farming materials such as pontoons, fingerlings, technical advice and fish feed through the private sector partner.

7.3.3. Issues and Constraints

7.3.3.1. Insufficient Inputs

Sufficient number of fingerlings are lacking as well as extension services for farmers.

7.3.3.2. Lack of Technical Knowledge and Skilled Human Resource

Thirty two years on and only three trained individuals at Masters level, and nine with diplomas and certificates in aquaculture are serving in the government and the private sector. Those working in extension have received little or no training in aquaculture. There is a need for skills training and increased human resource development. Curriculum development on aquaculture is needed at primary, secondary and tertiary level education. Farmers and extension officers should be familiar with the species that are farmed for aquaculture in PNG. The courses conducted at Aiyura through JICA should be reviewed to include specific subjects relevant and targeted to the needs of officers and farmers. The NFA/NDAL should take charge in organizing and conducting these training after JICA programs terminate.

7.3.3.3. Lack of National Government Directives and Support

Since 2004, the government has no policy on aquaculture. Though the Fisheries Management Act (1994 and 1998) specifically identified NFA as the lead agency, no strategies were developed on aquaculture development. The 2004 Aquatic Development Policy specified commercial aquaculture but it has no definite policy on artisanal/subsistence aquaculture and the agency responsible for this, except NDAL's implementation of programs/projects under its Food Security Programs.

Given the recent restructuring of NFA and the subsequent transfer of facilities and functions to provinces, responsibilities of aquaculture research and extension are not clear. Most provinces are understaffed and believe that NFA is the national body responsible for aquaculture and therefore tend to refer all queries and clients to NFA, only to be turned away.

NDAL Village Livestock Activities include inland fisheries under the Food Security Program. There is no clear demarcation of roles and responsibilities in artisanal/subsistence fish farming between the NDAL and NFA. The mandate to oversee fish production, processing and marketing is with NFA, but it is only concerned with commercial aquaculture. A MOA between NDAL and NFA should define the roles to implement inland fisheries and aquaculture programs.

The HAQDEC at Aiyura was transferred to EHP whose staff has limited technical skill and funding and cannot perform national role. The EHP is utilizing the facilities as its breeding and distribution centre for carp and tilapia. The current programs of JICA and ACIAR use the centre for farmer training. The NDAL research facility at Erap is grossly underutilized due to insufficient funds. The NFA plans to develop mariculture research facility in Nago Island, New Ireland and collaborate with NDAL and EHP to enable HAQDEC to meet its national obligation.

7.3.3.4. Quarantine and Translocation of Exotic Species for Aquaculture

No quarantine measures and checkpoints are in place in between and intra-provinces through waterways, lakes and land to prevent potential risk of spread of exotic pests and diseases to PNG's indigenous species of inland fish and aquaculture. No disease surveillance and routine specimen collections are done to diagnose and maintain disease free status.

7.3.3.5. Lack of Postharvest Facilities

Market access is restricted to communities due to lack of post harvest technologies, ice making, packaging, smoking and cool room facilities and transportation to markets. Marketable size fish are consumed at household level and potential wastage could be disincentive for farmers to pursue as commercial venture.

7.3.4. Priority Program and Strategies for Development

Program: Aquaculture Development Program

Objective: To promote aquaculture development for household food security and income generation

Strategies/Components

- (1) Research programs to develop aquaculture feed using locally available feed ingredients, feed formulation and milling, fingerling production, pond management systems and feeding practices, and aquaculture potential for indigenous species
- (2) Technical training for farmers; specialized training for officers; promotional materials for farmers and industries engaged in aquaculture.
- (3) Set up hatchery to reproduce genetically improved fish species for distribution to farmers. Establish district and provincial fingerling distribution centers.
- (4) Establish cooperative marketing arrangement under nucleus concept under vertical cooperation arrangement. Conduct training for farmer and extension officer on farm management. Create credit scheme for input supply, and marketing

Policy Consideration

- (1) Clarify the roles of NFA and NDAL and respective Provinces through MOU/MOA to effectively implement aquaculture (inland fisheries) programs/projects.

7.4. APICULTURE DEVELOPMENT PLAN

7.4.1. Apiculture Production

The European honey bee (*Apis mellifera*) was first introduced to PNG from Australia in the 1940s by hobbyists and missionaries for their own use. Further introductions in 1960s and 1970s made this species ubiquitous in almost all parts of PNG. It is more commonly well established and colonized in the highlands approximately 1,500 – 2,000m altitude. The provinces with significant number of beekeepers are EHP, Simbu and parts of WHP (Rere, 2005) while provinces with potential are Morobe and Gulf, especially in Kaintiba District.

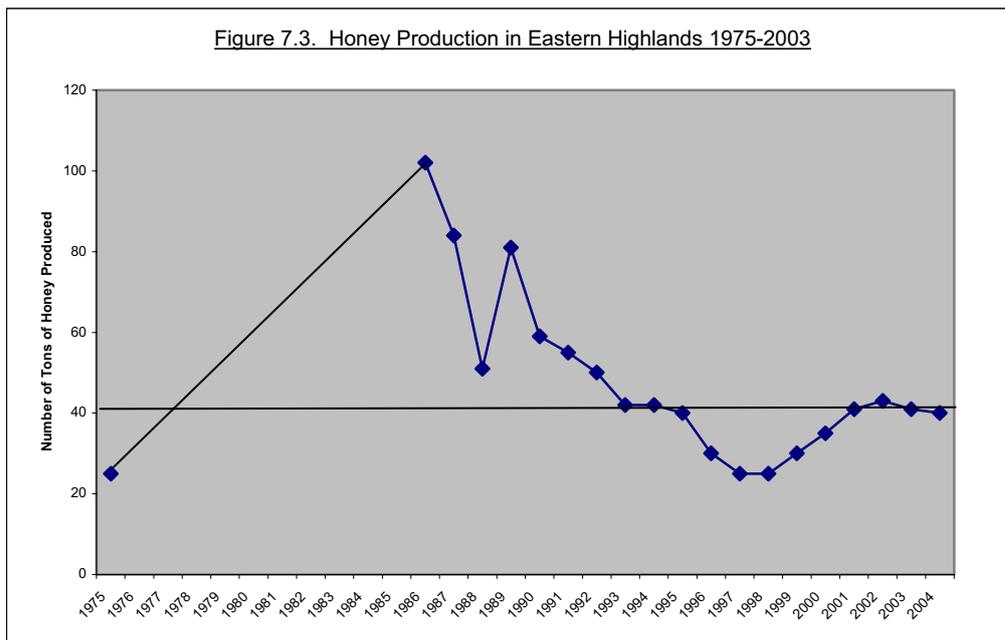
Since 1975, the industry experienced steady growth until 1989 when beehives peaked at about 4,000, with 500 farmers producing more than 100 tonnes per year. The success was due to effective research and extension services of the Highlands Honey Producers Co. Pty Ltd. The honey produced in the highland provinces were centrally processed, packed and exported from the processing plant in Fimito, EHP. A smaller extraction, processing and wax foundation were done at Korn Farm, WHP. A sawmill for production of beehives and frames was also established.

For the past 10 years, however, production declined progressively due to bad management of the Highlands Honey Company Co. Pty Ltd, low prices, loss of main processing and marketing sector (honey producers' cooperative), decline in per colony yields due to poor management, competition from invading Asian bee (*Apis cerana*), and climate and nectar source changes following the "El Nino" of 1997. Honey production

declined steadily from 120 tonnes in 1987 to 35 tonnes in the early 1990s and to 20 tonnes in 1996. The honey yield per colony also declined from 30 kg to 20 kg in early 1990's.

However, in recent years, the industry is slowly recovering with improved prices and some strategic provincial government interventions in the areas of training and incentives to farmers to increase honeybee colonies. The New Guinea Fruit Company helps as the principal buyer, processor, and marketer of EHP honey. The historical trend of honey production in Eastern Highlands is illustrated in Figure 7.3.

Domestic demand is estimated at 200 tons per year (Rere, 2005) with the shortfall being met by imported Australian honey. Export market potential is high with a minimum standing offer of 40 tons per year not being supplied, and additional overseas markets identified. Honey production data also includes an estimate of 20 tons per year produced and consumed on the “informal market”.



Source: Hardie et al, 2005

Attempts to rejuvenate the beekeeping industry by NDAL through the Food Security Division, Provincial DAL in the beekeeping provinces and other financiers need to focus on the existing beekeepers in EHP, WHP and parts of Simbu. There are currently 320 registered honeybee farmers or beekeepers in Eastern Highlands Province, keeping more than 2,400 honeybee colonies. Eight district beekeeping clubs and the Isten Hailans Bi-Kipas Asosiesen (IHBA) represent these farmers.

Honey production is estimated at more than 40 tons per year with New Guinea Fruit

Company processing and marketing 50% of the production. The “informal” market by 14 small-scale, on farm extraction and processing enterprises handles the other half. Production is consumed domestically. There are 2 equipment suppliers and 4 equipment manufacturers, with the market being shared evenly between domestic and overseas manufacturers. Seven farmers are breeding approximately 1,000 queens annually for sale, and supply a minimum annual demand for 500 nucleus colonies.

A full time honeybee specialist works with the Provincial Department of Agriculture, and two part-time honeybee technicians are with the NDAL. Two volunteer honeybee specialists were working with IHBA and PDAL until May 2006.

Floral and fauna resources are immense, renewable, and largely untapped and have potential for honey production. Honey products can be determined by type and source of flora from which nectar and pollens are collected.

7.4.2. Issues and Constraints

There is no clear direction on who should undertake R&D and extension at the national level for apiculture. Roles and responsibilities of government departments and industry participants are both unclear and poorly achieved, with limiting human, capital, and institutional capacity.

There are insufficient training, follow-up, and extension resources (human, capital, and institutional) in apiculture (Hardie, et al, 2005)

7.4.3. Strengths and Opportunities

7.4.3.1. Organic Production

Apiculture in the Eastern Highlands Province has very low risk of contamination by veterinary medicines. No antibiotics, miticides, pesticides, or fumigants are being used, manufactured or imported for use on honeybees. This organically produced honey has a huge market in Europe, especially Germany.

7.4.3.2. Large Demand

The demand for honey is an opportunity to increase the number and productivity of both bee-farmers and bees through improved quality of training and extension, and improved access to training and extension. Quality queen bees and bee colonies are needed to encourage apiculture industry expansion. Raising of queen bees and bee colonies for sale, (essential for industry health and growth) can become a viable and sustainable business in itself. Incentives to purchase locally manufactured wooden equipment are needed to lower production costs.

7.4.4. Apiculture Development Program and Strategies

Objective: To increase the viability, profitability, and sustainability of small-scale honeybee farming to enhance rural livelihood especially in the highlands of Papua New Guinea.

Strategies

- Strengthen Isten Hailans Bi-Kipas Asosiesen (IHBA) which has some 3,000 members organized into 8 district clubs. Help to district clubs, associations, and cooperatives through technical advice, infrastructure support and “capacity building” will result in farmers becoming collectively more self-reliant, self-supporting, and self-regulating, ultimately reducing the need for government services. Develop programs for Vocational and Secondary Schools, Mobile Farmer Training, new bee farmer training, woman beekeeper training, district Livestock Officer Training, Specialized Trainings, long term training (college and university), improved quality of training and extension, and improved access to training and extension. With practical and applied skills based training in basic apiculture, and more specialized training in specific industry support skills, production will increase, product value will increase, and the cost of that increased value and production may well decrease.
- Specialized training in queen bee breeding, commercial queen breeding and honeybee production enterprises through price support to “certified” and tested queens. Direct subsidies to farmers for the purchase of “quality” queens and bees will encourage both new beekeepers to start and existing beekeepers to expand. Hive numbers will increase, as well as hive productivity, and the raising of queens and bees for sale, (essential for industry health and growth) can become a viable and sustainable business in itself.
- Establish equipment retail outlet for locally produced equipment through IHBA and PDAL facility at Lopi, Goroka. Assistance in the establishment of local (district) honey extraction facilities will alleviate transportation costs and constraints, add value to the product, and diminish the need for individual farmers to invest in expensive, imported equipment, lowering production costs, and providing spin-off business opportunities. Bee equipment manufacturers will be trained in effective production of quality wooden beekeeping equipment. Incentives will be provided to encourage local production, which will lower production costs and promote less reliance on imported equipment and profitable spin-off manufacturing businesses.
- Review existing legislation (Animal Disease and Control, and Quarantine Acts) as they relate to the importation of honeybees, and honeybee products, and ensure the enforcement of these guideline/statutes. Clearly defined and resourced government service roles and responsibilities will ensure adequate industry support in the areas of training and extension, breeding stock quality, research and development, honey quality, and honeybee health.

Policy Consideration

- (1) Immediately fund and resource IHBA to operate as nucleus to collect, extract honey, process and market.
- (2) Address cross cutting issues in extension, communication, high input cost and lack of technology.

7.5. PROJECTED OUTCOMES

Within five years, expected outcome from the well coordinated and implemented subsector's programs are enhanced livestock production/productivity, income and employment generation and improved nutrition of the people. Projected income is estimated at K84.75 million (Table 7.2): K77 million from livestock; K3.53 from apiculture; and K3.96 million from aquaculture.

Table 7.2. Projected Income from Livestock, Apiculture and Aquaculture Development.

Description	Present Value (K000)	% growth	Projected Income (K000)	
Pig meat				
Village	36,000	5%	1,800	
Commercial	3,450	8%	276	
Beef				
Small scale	75	5%	3.75	
Sheep	160	6%	9.6	
Goat	200	8%	16	
Poultry				
Large scale	140,000	15%	21,000	
Village	26,496	10%	2,649.6	
		Subtotal	25,754.95	Increased income in 1 yr
			77,264.85	after 3 yrs
Aquaculture	5,298,000	10%	529.8	1 yr
Assume K7/kg in Yr 4&5			3,532.0	5 yrs
Apiculture (meet present local and int'l demand)	240 t		0.8	1 yr
K3.30/kg honey)			3,960.0	5 yrs

8. SPICE AND MINOR CROPS DEVELOPMENT

8.1. BACKGROUND

Spices are strongly flavored or aromatic substances of vegetable origin, commonly used as condiments and for other purposes based on their fragrance and preservative qualities. More than 100 plants are used as spices, and their uses are highly localized. The main cultivated spices in PNG are vanilla (*Vanilla fragrans*), chilli (*Capsicum sp.*), black pepper (*Piper nigrum*), cardamom (*Elletaria amomum*, *E. afromum*) ginger (*Zingiber officinale*), turmeric (*Curcuma longa*), and nutmeg and mace (*Myristica fragrane*).

Alternative crops such as pyrethrum (*Tanacetum cinerariaefolium*) and cut flowers offer good income. Pyrethrum is grown for its natural insecticidal oil which is fast acting on insects but leaves no residue in the environment. Ornamental plants and flowers such as roses, orchids, anthuriums, and heliconias attract tourists. Some flowers are sources of essential oils.

Spice and minor crops are suitable to be included in the smallholder farming system to provide income. Women in particular can generate income with the sale of ornamental plants from their backyards. PNG highlands with sub-tropical climate and fertile lands are suitable for all spice and minor crops. A study of the Department of Trade and Industry (DTI) in 1996 revealed that development of a viable spice export industry in PNG depends on capturing at least 3% of the international spice trade with an approximate volume of 15,000 tons of different spices with a value of US\$60 million. Vanilla fits into this specification at present.

The National Department of Agriculture and Livestock and Provincial Division of Primary Industry implemented under a Public Investment Program the Alternative Crop Extension and Diversification Program (ACEDP) from 1989 to 1995 to encourage farmers in spice crop farming. The program covered 9 provinces under three phases:

Phase 1: Simbu, Central and East New Britain

Phase 2: Southern Highlands, Enga and Oro

Phase 3: Eastern Highlands, Milne Bay and Western/Gulf

The ACEDP was very successful with the participation of over 28,000 farmers from 648 villages. The program supported the production of spices such as chilli, cardamom, pepper, pyrethrum and vanilla.

Following the decentralization process, the program was transferred to the provinces in 1995. Lack of funds resulted in many provinces disbanding or scaling down their ACEDP activities.

8.2. CURRENT STATUS

The Spice Industry Board survey showed that 19.5% of the total households cultivate various spice crops (Table 8.1), with an estimated total production of one million tonnes valued at K90 million per year. Eastern Highlands, Western Highlands and Simbu have the most number of households involved in spice production.

Table 8.1: Number of Households Involved in Spice Production

Province	Total Households ('000)	Households involved in spice production	
		Number ('000)	%
Western	14.4	2.2	15.3
Gulf	10.4	1.1	10.5
Central	22.2	2.4	10.8
Milne Bay	27.1	4.6	17.0
Oro	13.7	2.5	18.2
Southern Highlands	51.4	5.2	10.1
Enga	39.2	4.8	12.2
Western Highlands	61.8	14.0	22.6
Chimbu	40.4	9.0	22.4
Eastern Highlands	62.7	23.6	37.6
Morobe	51.7	9.5	18.3
Madang	31.8	5.6	17.6
East Sepik	45.8	7.7	16.8
West Sepik	23.9	3.9	16.3
Manus	5.0	0.7	14.0
New Ireland	16.1	2.9	18.0
East New Britain	30.9	4.8	15.5
West New Britain	18.7	3.1	16.6
Total	567.2	110.5	19.5

Source: National Census 2000

8.2.1. Production

The spice and minor crops industry is one of the cash crop industries recognized and promoted by the Government. The industry is still in its early stage of development and has already contributed substantially in foreign exchange earnings.

Vanilla production and revenue significantly increased in 2003, brought about by weather disturbances in other parts of the world. A strong cyclone in 2001 destroyed most of the harvest in Madagascar, a major vanilla producing country. Many plantations in Indonesia were destroyed by severe El Nino drought in 1997-1998. The decline in the world supply caused price hike from US\$ 50/kg to US\$ 200 /kg in 2001. PNG vanilla production and revenue significantly increased in 2003. However, since 2004 both production and revenue declined. Total vanilla production and revenue for 2001-2004 were 316, 269 tonnes and K141 million respectively (Table 8.2).

Table 8.2: Vanilla Production and Revenue, 2001-2004

Province	Production (00 tonnes)				Revenue (K'000)			
	2001	2002	2003	2004	2001	2002	2003	2004
East Sepik	33.68	35.14	41.05	35.14	8,312.85	10,494.5	21,826.22	10,494.50
N.C.D.	0.065	1.05	5.44	1.06	8.93	216.22	2,930.38	216.22
Morobe	1,163.27	1,416.57	69.58	14.17	3,155.41	3,168.37	49,770.38	3,168.37
Manus			6.37	20.72			2,299.51	
Sandaun		20.72	6.83			8,049.52	272.86	8,049.52
New Ireland			0.025				7.50	
Madang			12.26				8,528.03	
East New Britain			0.16				48.01	
Total	46.38	71.08	141.72	710.79	11,477.19	21,928.61	85,682.88	21,928.61

Source: S.I.B Compiled by Rural Statistics-DAL (2001-2004)

Note: Information provided by registered exporters is incomplete.

High world demand for vanilla in 2001 encouraged the vanilla boom in PNG, resulting in

unscrupulous dealings by certain buyers and exporters. These buyers and exporters sold their produce across the PNG-Indonesia border without proper inspection, resulting in poor quality produce and, consequently, low price. Most of them do not have adequate financial resources to purchase the produce regularly from the growers. Law and order problem (armed holdups) and stealing of beans from the garden had also discouraged the growth of the commodity.

Cardamom production expanded very rapidly in the seventies in response to high world prices until mid-eighties when prices slumped. Large areas were also planted in Simbu and Madang provinces particularly as a result of offshore investment. However, since 1987, with the decline of smallholder interest, production declined. Approximately 205 ha is under production by 663 farmers. Production and revenue of cardamom declined from 29,710 tonnes and K416, 466 in 2003 by 34% and 87%, respectively in 2004 (Table 8.3).

Other spice commodities, such as chilli, nutmeg and turmeric were also produced in small quantities in 2005 (Table 8.4). Lack of statistics in the last 5-10 year period makes it difficult to analyze the production trends of these commodities.

Table 8.3: Cardamom Production and Revenue, 2003-2004

Province	Production ('000 tonnes)		Revenue (in K 000)	
	2003	2004	2003	2004
East New Britain	29.73	6.81	416.47	22.46
Simbu		12.77		32.60
Total	29.73	19.58	416.47	55.06

Source: S.I.B. Compiled by Rural Statistics- DAL(2003-2004)

Table 8.4: Other Spice Production and Revenue, 2005

Commodity	Quantity (Kg)	Revenue (K'000)
Chili	350	3.49
Nutmeg	100	2.15
Turmeric	200	1.10
Total	650	6.75

Source: S.I.B. Compiled: Rural Statistics -DAL (2005)

Pyrethrum is the oldest established alternative cash crop in the country. It was introduced in the high altitudes of the Highlands as it is the only cash crop with a large and stable market and could be grown at altitudes of 2,000 meters above sea level and higher. Production has been erratic and declined substantially since 1986. Factories such as Stafford Allen Pty Ltd and the one at Kagamuga in Mt. Hagen have shut down because of shortage of supply. Therefore, plantations of this crop are needed to assure ample supply. In the past annual export earnings never exceeded K1 million.

8.2.2 Production System

Major part of the production is based on smallholder and family units. Ideal village family unit for vanilla is 200 plants and number of plants per ha is 2,500 (Peni, 2004). For family unit pepper garden, more than 100 plants are recommended and 1 ha will grow 1,534 plants (Wright, 1975).

For chilli, 0.25 ha is recommended for a family unit as manageable (Magei, 1975). Data for other crops are not available.

Farmers highly accept and value spice crops because of their suitability in intercropping. The common practice, as observed in ginger farms in Eastern Highlands, is to intercrop spice crops with other traditional food crops, such as taro, sweet potato, tapioca, and tree crops such as banana, sugar cane and pawpaw. Smallholders in densely populated areas in the highlands accept spice as ideal alternative cash crops. This system not only provides land space, but also offers better crop management. The producer is able to maintain several crops which provide cash while waiting for longer term crops to generate cash income.

In the case of vanilla, harvested produce is sold to the private buyer (e.g. individual, private marketing companies) as green beans or sun cured which are then sold to the exporters. In many cases, exporters buy directly from the farmers. Currently, 24 exporters are registered with SIB.

Most smallholders are in remote areas with no central processing facilities and other production inputs such as planting materials (cuttings, etc) in the farming locality. Often, no feeder roads connect the main roads to farming districts and provincial urban centers.

Lack of processing facilities forces the farmers to individually cure/sun dry the beans before selling to the private buyers. NARI's survey (2001-2002 p.60) conducted in East New Britain showed that farmers are poorly informed on production and processing techniques. Complaints about the poor quality of PNG vanilla is due to incorrect processing and/or harvesting of immature beans. Introduction of low level technology

such as low cost sun drier will enable the farmers to process better quality produce for higher return. Co-operative system of enterprise will enable individual farmers to pool their limited resources to build their central facilities (processing, transport) and minimize the production cost.

Individual curing/sun drying of harvested crops takes longer time. Establishing proper processing facilities in the farming locality will minimize mould formation as a result of prolonged curing/sun drying process.

Local varieties of ginger and turmeric are currently produced and sold locally as raw or processed (powdered) form. Some farmers in the EHP are producing and processing ginger, turmeric, chili and cardamom. They expressed the desire to promote their products for export, and they are concerned over the lack of improved varieties, especially ginger. Samples need to be tested overseas to establish the quality and standard. Research is therefore needed to select the right types and high yielding varieties to establish planting material multiplication plots in the farming localities.

8.2.3. Major Production Areas

Two types of vanilla are grown in PNG: i) *Vanilla fragrans* (*Vanilla planifolia*) grows best in higher altitudes from 150 m to 600 m above sea level; and ii) *Vanilla tahitiensis* grows from sea level to altitude of 600 m. Vanilla production is strong in East Sepik, Central, Morobe and Manus.

Cardamom grows at altitudes 1200–1700 m, and produced in East New Britain and Simbu. Records indicate that cardamom was also produced in the 1970s by both smallholders and central plantations at Afore in Oro, Pindu, Morobe and West New Britain.

Chilli grows and produces well at 1500 m altitude and over. Birds-eye chilli is popular as it offers high price and suitable for under developed areas where no other means of earning income is available.

Black pepper grows at altitudes up to 1200m and in temperatures of 25° Cs to 35° C, and prefers evenly distributed heavy rainfall. It is grown in East New Britain Province and in all lowland areas of Papua New Guinea (Aburu and Kukup, 1975).

Ginger grows well at altitude of 1500m with rainfall of 1500 mm yearly. Production areas for ginger include Eastern Highlands, Simbu, Madang, Oro, Morobe, East New Britain and West New Britain.

Turmeric can be grown up to 1500m in 20°C with annual rain fall of 1000mm or more. Suitable production areas include Central, West New Britain, East New Britain, Oro, Morobe, Madang, Eastern Highlands, Simbu and East Sepik.

A total of 1,055 hectares is already under various spice and minor crop cultivation (Table

8.5).

Table 8.5: Total Spice and Minor Crop Production

Commodity	Area Planted (ha)
Cardamom	390
Chili	10
Vanilla	283
Pyrethrum	266
Nutmeg	20
Pepper	86
Total	1,055 ha

Source: ACEDP, DAL 1995

Pyrethrum is cultivated in Sirunki and Liagam areas of Enga, contributing about 90% of the total provincial production. Enga's production ranged from 145 tonnes (1978) to 324 tonnes in 1985, with an average of 242 tonnes each year. Country total was 352 tonnes. Enga produces high pyrethrum yields containing 1.6% pyrethrum. Increase in prices paid to growers resulted in increase in production. Growers indicated interest to grow on a larger scale. Current low production is due to low prices, poor extension services and infrastructure, and law and order problems.

8.2.4. Marketing

8.2.4.1. Product Use

The major uses of different spices are presented in Table 8.6. Promoting the different uses will enable the commodities to survive the changes in market demand.

Table 8.6: Uses of Spice Crops

Spice	Use
Vanilla	drinks, bakery products, ice cream, cure for impotence, pharmaceutical flavouring
Cardamom	meat products, curries, condiments, perfumery
Pepper	meat products, sauces, soups, condiments

Chili	food products, condiments, bakery
Ginger	meat products, condiments, bakery, beverages
Turmeric	coloring agent
Nutmeg-mace	food products, perfumery products, condiments

Source: International Trade Centre (1982)

8.2.4.2. Marketing Spices

The need to cure/dry, clean, grade, pack, transport, store, and ship for export influences the farmers' decision to venture into spice production.

Vanilla marketing involves the farmer, buyer, exporter and the importer. The farmer/producer grows, harvests, and processes his crops. The buyer gets from the farmer either green pods or cured/dried beans, and then sell to the exporters who classifies the product into grades and then pack for export. A shipping agent sends the shipment to the importer. Importer completes the payment after the exported products are received. Prices are determined by the quality and grade of products on arrival at destinations.

8.2.4.3. Transport

In Rabaul, produce from farm/villages is transported by sea using outboards to the central buying points. This produce is then transported by coastal shipping to major sea ports for export by the exporters. In the highland areas, produce is transported by road and air. High cost of transport either by sea or land is one of the factors that influence the likelihood of crops been accepted by producers; eg. cost of PMV from Kerema to Port Moresby is K100/person and K20 per cargo, the hire of PMV for the same route is K1,000 return.

For sea transport, for example, travel from North Coast to Oro Bay costs K70 per person and K50 per cargo. It costs K700 or more to hire a motorised boat for the same route.

8.2.4.4. Export Destination

From 2001-2005, PNG exported various quantities of spice to different countries. Vanilla was mainly exported to Indonesia, Australia and Europe (Table 8.7). Cardamom was exported to Australia, New Zealand and Germany (Table 8.8). Small quantities (100-350 kg) of chilli, nutmeg, and turmeric were sent to Japan.

Table 8.7: Export of vanilla, 2001-2005

Destination Country	Quantity (in percentage)
Indonesia	61
Australia	11
USA	4
UK	2
Europe	7
Asia / Pacific	4
Others	11

Source: NAQIA 2002

Table 8.8. Export of cardamom and chili, 2003-2004

Commodity	Destination (Country)	Quantity (KG)
Pepper	Australia	n/a
Cardamom	Australia, NZ, Germany	49,312.70
Chili	Japan	350
Nutmeg	Japan / N.Z	100
Turmeric	Japan	200

Source: S.I.B. Compiled: Rural Statistics –DAL (2003-2004)

8.3. KEY INDUSTRY PARTNERS AND STAKEHOLDERS

8.3.1. PNG Spice Industry Board

The National Parliament passed the Spice Industry Act in 1989, and the PNG Spice Industry Board (SIB) was established in 1991. Its task is to regulate, promote and develop the spice industry and the minor crops sub-sector.

Spice development programs on extension services, research and training were funded and implemented by NDAL through Alternative Crop Extension and Development Program (ACEDP), a public investment program that was implemented until 1998. It was aimed at diversifying export crop base. The program ceased in 1999 under the decentralization reform, and the functions were transferred to provinces without funding. In 2003, some funding was made available to PNG SIB to implement its tasks.

The industry does not operate under properly established guidelines in relation to production, marketing and processing. SIB Corporate Plan for 2003-2007 identified production areas, but did not set quantifiable targets such as number of hectares. Low

cost technology (sun/hot air driers) should have been introduced as part of production system. Downstream processing (extraction plant) for each region or major production areas for crops such as vanilla should be indicated.

The management of PNG SIB is weak, resulting from the following:

1. Ineffective leadership and lack of staff/technical capacity. The SIB has staff strength of one Chief Executive Officer and part time administrative staff from NDAL. It needs economist, planners, crop specialists, corporate manager, and administrative staff.
2. Lack of rules/regulations to effectively guide the development of the industry. Use of recommended low level processing technologies such as solar/hot air driers and proper processing should be introduced as compulsory part of production.
3. Insufficient budgetary support from the government. From 2002-2003, SIB received K1.55 million. There was no PIP in 2005. Those amounts were not enough for the operation of SIB.

Several considerations as outlined below will minimize the current constraints facing the industry:

- Fully corporatize the Spice Industry Board and give it self accounting status. The government will maintain monopoly over the industry over a specified period and provide a cut off date for phasing out to self accounting status.
- Challenge the board to meet certain specific tasks (Production levels, marketing, quality controls).
- National government to approve a cost effective management and operational structure of the Board, consistent with MTDS and overall government policy on Agriculture Driven Economy.

8.3.2. National Agricultural Research Institute (NARI)

The National Agriculture Research Institute is responsible for food crop and alternative crop research including spices and minor crops. It is responsible for assessment of existing varieties, evaluation of commercial production and processing, low cost technology development, monitoring and management of pest, commercial clone evaluation (yield and quality) and information. NARI contributions to the industry are as follows:

1. Vanilla, chilli, nutmeg and mace, pepper: identification of the best production and environment for growing the crops
2. Vanilla, pepper, cardamom, chili: assessment and management of pest and disease problems
3. Vanilla, pepper, nutmeg and mace: commercial evaluation of yield and quality

supply of quality planting materials; adaptation of commercial clonal propagation techniques

4. Vanilla, nutmeg and mace, cardamom: post harvest and curing technologies
5. Turmeric: development of technology package.
6. Chilli, nutmeg and mace, cardamom and pepper: training and extension materials.
7. Pyrethrum: improving planting materials, production practices and post harvest handling of pyrethrum.

8.3.3. National Agricultural Quarantine and Inspection Authority (NAQIA)

NAQIA provides quality control and inspections to ensure that export products are free from disease, pests and any other symptoms in keeping with the requirements of the importing countries. It issues certificates and permits to ensure protection and quality assurance.

8.3.4. Shipping Agent

Shipment is done through the shipping agent usually nominated by the importer who also approves the route and sets the time limit for export to reach its destination. Private testing laboratory carries out quality and standard testing for the importers. Price and payments depend on the tests. The shipping agents continually upgrade and improve containerized cargo space with cooling system and ventilation.

8.3.5. National Department of Agriculture and Livestock (NDAL)

NDAL is responsible for the design of national agricultural development strategies, advice on resource allocation and coordinate implementation of the policies and the strategies in the districts/provinces.

8.4. ISSUES AND CONSTRAINTS

8.4.1. Lack of Local Market Infrastructure

Local markets are needed at farming locality/district where farmers can travel to obtain all the necessary input (seed, seedlings, etc) and return the same day. Transporting planting materials/cuttings from farming districts, provinces and research centers is always expensive, time consuming and risky. High transport cost, long distances and bad road conditions are just some of the constraints faced by the farmers. No feeder roads link farmers located in the remote areas of the country and lack of appropriate land transport for specific needs makes it difficult to maintain the quality and standard of produce to the buying points or export facilities. Most farming districts and provinces do not have processing and packaging facilities. Many private buyers lack financial backing to

provide regular buying service. Information on domestic market price, buying schedules, production trend, and other farming news are needed to assist farmers on making better informed decisions.

8.4.2. Lack of Market Promotion

To increase demand for spice and minor crops, product promotion is needed both within Papua New Guinea and international markets. Organic products from PNG are not strategically advertised/promoted through information and international road shows to gain importer/ consumer confidence.

Papua New Guinea lacks internationally accredited quality standard testing laboratory to enable electronic standard certification for instant sale of export products. Importing countries carry out their own tests.

8.4.3. Lack of Human Resources Development

There are no technically qualified subject matter specialists or officers in the districts due to lack of regular in-service training to update and upgrade their knowledge and skills. Training institutions based in the regions are not well resourced and utilized.

8.4.4. Farm Model

Major part of spice and minor crops production is based on family units and smallholders who usually intercrop with subsistence food crops. Smallholders range from small plots to a couple of hectares exclusively planted with spice or under the tree crops. These farming units operate individually and located in remote rural areas, hence have to deal with production problems themselves. Present outputs are low because of high production costs such as transport, planting materials, processing, etc. Co-operative system of farming will not only empower, but also enable the small farmers to share costs of processing, storage, packaging, market and transport. With better quality and standard produce, farmers get higher returns. Nucleus development with central plantation and facilities will enable smallholders and family units to access vital production and market services.

8.4.5. Research and Extension

Research and extension are needed to provide farmers with affordable planting materials (cutting, seedlings) at farming localities. Local varieties need improvement to increase yield and meet consumers demand. Farmers need to know the most effective and profitable farming practices, hence technologies must be adapted to local conditions.

8.5. STRENGTHS AND POTENTIALS

8.5.1. High World Market Price and Demand

Current world market price of vanilla is US\$ 50/kg. Cardamom is the most expensive spice in the world market. Trial consignments of PNG cardamom exported to Kuwait have been well received and the quality of the spice is regarded to be good. Returns for good quality vanilla can exceed K10, 000/ha. Current world price of chilli is K10, 000 per tonne.

Markets for PNG spices have been identified in Europe, the Middle East, Asia and the United States. PNG vanilla is well regarded for its aroma in the European market, and vanillin content is higher than the world standard (Weekend National, June 9-12, 2006 p. 26). Countries such as Australia, Singapore, UK and Germany requested for huge quantities of chilli, ginger, cardamom, and many others (Knuttsen and Kavanamur 2000).

Pyrethrum is gaining importance around the world as environmental awareness grows. Fast acting and broad spectrum, the insecticide is safe to use everywhere from homes to broad-scale operations. It is one of the few insecticides approved for use on organic farms in Europe, the US, and Australia. Total world pyrethrum market is worth half a billion US dollars (New Agriculturist on-line, 2006: <http://www.new-agri.co.uk>)

Orchids, anthurium, cordiline leaves, and heliconias have high export demand, especially during winter seasons in temperate countries.

8.5.2. Short Cultivation Time

Spice crops take shorter time from planting to first production compared to other commodities such as cocoa, coffee, coconut and oil palm. The length of time each crop takes from planting to first bearing and its economic life span influence the farmer perception and acceptance in terms of income generation (Table 8.9).

Table 8.9: Length of production and economic life of some spice crops

Crop	Number of months for first production	Economic Life (years)
Vanilla	18 - 36	8

Cardamom	18	18
Pepper	29 – 36	4.4
Chili	4	3

Source: DAL Farming Notes; Rural Development Series Handbook Nos. 6, 7.

Flowering plants produce satisfactory flowers between 3-6 months and bring early returns to supplement household income.

8.5.3. Employment Generation

Financial returns from spice and other alternative crops are higher than those from other cash crops. The current price of cured vanilla bean is K40, 000/tonne compared to K500-700 for a tonne of copra. Such higher returns create employment opportunities for men and women, especially for the unemployed youths in the villages.

8.5.4. Natural Product

Natural vanilla in the world suffered due to competition from artificial substitutes. One of these is vanillin, made from waste sulphate liquor from paper mills and from coal tar extracts, and much cheaper to produce. The similarity of vanillin to vanilla often confuses consumers. However, labelling legislation by importing countries such as USA, and also the discovery of carcinogenic substance in vanillin has made the future demand for natural vanilla very promising.

In PNG, most of the spices are produced organically without chemicals or fertilizers. This enables PNG to supply organically grown spices which are in demand all over the world. Danisco, a Danish company with offices in more than 100 countries and deals directly with giant food manufacturers, will assist PNG to acquire organic certification to allow PNG to bid for higher prices in the world market (The National, May 11, 2006, p. 29).

PNG has rich biodiversity and has a number of unique native tropical flowering plants and leaves. Together with fertile soil and favourable climate, opportunities exist for small and large scale floriculture enterprises.

8.5.5. Ease of Handling

The high value nature of spices makes them ideal for remote areas to cover excessive transport cost and provide a reasonable profit margin to the producer. Madang is promoting cardamom in remote areas (Madang Agriculture and Livestock Plan, 2003-2007).

8.6. PROPOSED DEVELOPMENT PROGRAMS

The development strategy for the subsector covers three main areas: promotion, production, and marketing.

The priority crops for short term development program are based on their growth/expansion potential, favourable growing conditions, farmers' knowledge/expertise, market demand, and current production level. These are vanilla, cardamom, chilli, pepper, floriculture, and pyrethrum. Priority provinces are based on the following criteria: current production and export, and favourable conditions such as soil, climate, water availability, road network, market and processing facilities.

Program Area 1: Promote Increased Participation in Production

Objective:

To introduce, encourage, and promote spice and minor crops production as alternative export commodities.

Strategies:

- Survey of communities. It will be necessary to survey potential farmers in the districts to gauge people's opinion on the new technologies and willingness to participate in increased production of spice and minor crops. Surveys will cover districts where spices are already grown and exports made. Surveyors should have information on the profitability of the crops and where and how it can be marketed. Women's groups and individuals will be included in the survey, especially those directly involved in production. Their opinions on the constraints of production should be noted. [Districts, private sector]
- Feasibility studies and site identification. This will be carried out in the farming districts to identify immediate growth potential areas, based on surveys. Targets to increase production: vanilla – 100 ha; cardamom – 50 ha; pepper – 25 ha; other spices – 50 ha; floriculture – all districts; pyrethrum (identified in Enga). Expansion sites are areas where growing conditions such as soil, climate and water availability are favorable, and have reliable transport link to major ports. Availability of technologies that promise substantially higher production of at least one or two major crops will be assessed. This will be done through NARI, PNGRIS, and the districts.
- Production cost analyses. Studies will be conducted in farms already growing spice and minor crops. Costs of farm inputs such as planting materials, labour, equipment, land improvement, transport, processing, administration, etc will be considered in order to determine the profitability of production. The advantages of cooperative system and nucleus farms will be assessed, too. Expected harvests will be priced according to the latest market information. NARI and the Districts should collaborate on this work.
- Demonstration farms. Based on the results of the feasibility studies and site identification, demonstration farms will be established (minimum of 0.1 ha per farm). The purpose is to show farmers the proper way of cultivating the crop and how much profit can be expected. Information materials on crop production, e.g.

vanilla Toktoks and Tok Pisin of NARI could be distributed. Local verification of technologies will be conducted, with research, extension and farming working together. These farms should be located in areas representative of the local conditions and accessible to other farmers. NARI, the Districts, SIB, and the NDAL are key players in establishing the demonstration farms.

Program Area 2: Spice and Minor Crops Production

Objective:

To improve and promote production of spice and minor crops.

Strategies:

- Organize the farmers. Individual smallholders and family units will be organized into groups or co-operatives to empower and enable sharing of costs and benefits. Past experiences in the successful production of cardamom shows that there is a considerable scope for the development of nucleus type schemes for spices and ornamental plants similar to oil palm. Cooperative members should be trained on their roles and responsibilities. Mechanism to monitor the performance of the cooperatives should be in place to safeguard cooperative funds. [Private sector, SIB, Districts, NDAL]
- Train the farmers. Farmers will be trained on improved cultivation techniques, from nursery to harvesting. The use of low cost and low level technologies will be demonstrated, and if possible, mandated. The principles of harvesting will be taught to farmers to get good quality of their produce. For example, flowers should be harvested when field heat is low, ideally in the morning, shaded thereafter and packed into suitable containers which are designed to reduce bruising, puncture wounds, and to limit heat build up (Kagena et al 2005). [Districts, NARI, Private sector]
- Provision of support. Districts will provide centres where high yielding and right varieties of planting materials are available. Central processing facilities will be built in farming localities and downstream processing (extraction plant) established in each major producing regions. Provision of extension/research services is imperative. Market research will establish the preferred species or types of flowers. [Districts, SIB, Private sector, NDAL]

Program Area 3: Marketing of Spice and Minor Crops

Objective:

To improve marketing linkages and post harvest handling of spice and minor crops.

Strategies:

- Establishment of linkages. A service to link growers with buyers/exporters is necessary for sustained increase in production. A directory listing both the growers

- and buyers will be useful to establish contacts. [DCI, Districts, SIB, NDAL]
- Proper post harvest handling. The requirements for marketing products are quality, reliability and consistency. Establishment of packaging and storage facilities in the farming community and regions will encourage and boost confidence and interest of farmers for production, create market demand, control and preserve international quality produce. Demonstration of proper techniques on post-harvest handling will minimize deterioration of quality through prolonged preparation. Provision of training on various aspects of crop product preparation will make farmers aware that they will lose their market if they do not produce and deliver high quality produce. Scars on flowers will render them unsaleable or sold at discounts.
 - Compliance with standards. Inspection and issuing of certificates for spice crops to ensure quality and standard is necessary for the health of consumers. Inspection standards should meet competitive international benchmarks. A realistic number of exporters should be maintained, deregistering those who do not comply with standards.

Selection and size grading procedures to achieve high standards are essential for marketing ornamental crops in overseas markets. Principal criteria will include: minimum and maximum sizes, condition and appearance of the flower, cultivar, stage of maturity, and uniform sizes in the individual cartons (Kagena et al, 2005). [NARI, NDAL, SIB, NAQIA, Districts]

- Trade promotion. Trade will be enhanced when the quality and uses of PNG spices are advertised to local and international markets. Multi-media advertising through newspapers, TV, radio (Man on the Land Program) will increase demand for the products. Recipes or product samples using spices in the market will raise awareness of the products. Trade attaches or special missions could help in promoting the spices in international trade fairs and magazines.

8.7. EXPECTED OUTCOMES

Development of the spice and minor crops industry will provide opportunities for income generation and employment. Expected revenues include; K311.2 million from vanilla, K10.88 million from cardamom, K2.902 million from chilli, K230 million from floriculture and K5 million from pyrethrum, with a total of K470.4 million over the ten year period.

9. NADP MANAGEMENT

9.1. INTRODUCTION

Under the current administrative set-up of the agriculture sector with numerous agencies working in isolation resulting in unfulfilled roles and responsibilities, duplication of efforts, and lack of service to farmers, sustainable agricultural development is impossible to achieve. NADP needs a well-coordinated concerted effort of all stakeholders in order to achieve coherence and sustainable development of the sector. Well coordinated agricultural programs ensure that resources, especially human resources, are used effectively and efficiently with minimal or no duplication of effort. Coordination is a key element to provide services to the farmer.

9.2. COORDINATION MECHANISM

Coordinating agricultural development will involve existing institutions with their functions retained but some changes may be needed to coordinate activities. It is imperative that the organizational changes are **legally mandated** and guidelines clearly stated to empower coordinators and ensure smooth operation of the implementation process.

The coordinating mechanism entails an organizational structure involving several agencies and a Secretariat. The terms Council and Board only illustrate the organization. Existing agencies are suggested, as follows:

- Governing Council (GC): the National Agricultural Council
- Technical Program Planning and Review Board (TPPRB): technical advisors
- Secretariat: the NDAL

9.2.1. The Governing Council

A Governing Council oversees the national policies and direction for NADP, to ensure that only one body is responsible for policies, monitoring and evaluation, and allocation of resources. It assures the sustained relevance and responsiveness of programs to address critical issues in agriculture. It brings into focus plans, programs and policy initiatives, and development strategies and guidelines for a more efficient and effective management of agriculture sector, guided by priority of the subsector and the provincial governments. It approves donor funded or assisted programs. Heads of national agencies that comprise the agricultural stakeholders (see Chapter 2) along with the private sector, non-government and other organizations are members of the GC.

For PNG, the **National Agricultural Council** could be the GC. It was established in the late 1990s to provide a consensus voice for the agriculture sector in order to prioritize the concerns of stakeholder. It reviews agriculture development in PNG for research, training and skills building and to report these to the Secretary of NDAL. It has approved

major policy reforms and programs for implementation through the annual budget process and endorsed important policy agenda for the sector. Its current membership includes all chairpersons of the provincial government (20), commodity boards and authorities (10), NGOs and the private sector (10). Convening 40 people in regular meetings may be representative but not productive in getting the desired direction. Therefore, it is necessary to limit the national body to eminent people to represent the cross section of the sector. Regional Agriculture Councils or Committees maybe established to get more representations from the provinces and districts.

9.2.2. Technical Program Planning and Review Board (TPPRB)

The TPPRB serves as the technical advisor of the GC. Ideally, the TPPRB should have representations from commodity organizations, universities, community-based organizations, etc., depending on the program needs. The GC appoints the TPPRB members based on their technical capabilities and experiences. Suggested qualifications are agriculture background, high educational attainment (preferably at MS and PhD level), and extensive work experiences. The Board determines the technical soundness of programs and projects to be included in the plan and review the progress of the programs.

9.2.3. The Secretariat

As indicated in Chapter 3, a sectoral body needs to coordinate the programs of the agriculture institutions to avoid conflict and duplication of roles, and ensure maximum cooperation between institutions. The Secretariat needs access to critical information for planning and evaluation of the effectiveness of all agriculture related programs. To enable evaluation of proposals for funding and monitoring and conduct of impact assessments of implemented programs and projects, the Secretariat must have access to budgetary information, and the ability to conduct independent and acceptable standards of policy research and analysis.

The NADP Secretariat executes the overall directions of the GC. The Secretariat analyses the programs; formulates plans, strategies, policies and programs for sustainable agricultural development, cross sectoral linkages, and public/private partnership; allocates funds from government or external sources; monitors and evaluates programs. It prepares the documents for planning, monitoring, evaluation, and reporting of various agricultural development initiatives. It has a calendar of activities, from the districts to the national level, and organizes events such as meetings, reviews, and consultations. It is also the initial point of contact to source or channel donor assistance. The Secretariat is the responsibility of **NDAL**.

To ensure a systematic coordination, regional, provincial and district coordinators or committees are needed (Figure 9.1). The regional coordinators oversee the development and implementation of subsector programs of the provinces; the provincial coordinators are responsible for the districts. Provincial programs such as Provincial Economic Impact Projects, Agriculture Economic Intervention Program and Green Revolution will be aligned with NADP priorities, screened carefully, and supported by the LLG and the

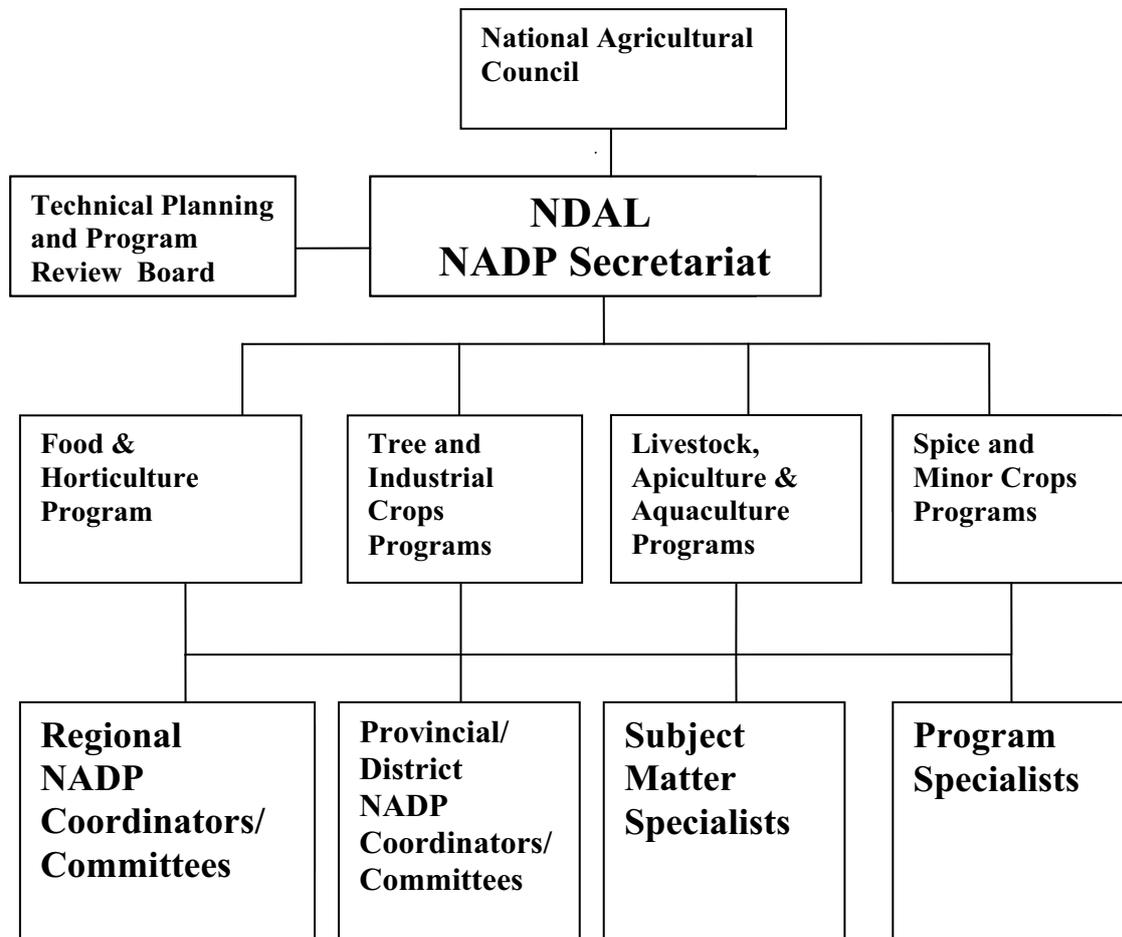
communities in the project site. All coordinators must ensure conformity with NADP priorities through a monitoring system.

The Secretariat consists of technical and administrative personnel. Technical personnel are Subject Matter Specialists (SMS) and Program Specialists (PS). The SMS are mainly responsible for monitoring the trends of the sub-sectors and packaging of information for dissemination. The PS are responsible for programming and monitoring.

Commodity development teams assist the Secretariat. These teams are recognized experts, extension workers, and representatives from the private sector, participating on “on-call” basis. NB: This NADP coordinating system to be reviewed

Figure 9.1: NADP Coordination System





NADP recommends that research institutes be amalgamated or a coordinator among the institutes (possibly through rotation of assignments among them or NADP personnel) be assigned. The research coordinator will work with the NADP Secretariat as the contact point for other research institutes.

It is important that the coordinators have good public relationship, be team players, with facilitative skills and good grasp of agricultural situation. Such qualities should also be imparted to staff to provide good service to the public. Figure 9.1 illustrates the NADP management organizational structure.

9.2.4. Core Values of NADP Management and Coordination

The core values that would guide NADP are pursuit of **common vision, cooperation, transparency, excellence and relevance.**

Common vision, as defined in Chapter 1, is enhanced quality of life and economic growth through sustainable agriculture industry that creates employment, contributes to foreign exchange earnings, attract new technologies and contribute to national,

community, family, personal prosperity, food and social security. This vision could be attained by developing relevance and direction in agricultural programs which must be responsive to national goals. All efforts and resources of stakeholders should be channeled in that direction, guided by common understanding and agreements on priorities. The only agenda should be agricultural development.

Cooperation between institutions can lead to better understanding of the roles of the different agriculture institutions with respect to the needs of the farmer. It would improve cooperation and coordination if an agency has the power and authority to call on any department, bureau, office, agency, university, commodity organization, and other instrumentalities of the government for assistance in the form of personnel, facilities, and other resources as the need arises in the discharge of its function. Presence of central agencies involved in national planning and financing, private sector, etc. in NADP planning and monitoring would ensure close coordination of district and provincial agricultural programs with national development programs, and appreciation of the requirements of the sector. Collaborative programs between institutions can ensure maximum utilization of resources and also ensure easy exchange of information based on common agenda across many production systems and ecological zones. Cooperation could be further facilitated through clear mechanisms and lines of communication.

Transparency means that operational procedures and transactions are well documented and open for public scrutiny. For example, proposed policies, guidelines, fees, job vacancies, contracts and appointments are published in prominent public places, websites, or in newspapers, as appropriate, to reach as many stakeholders as possible. Minutes of meetings relevant to public interest on agricultural development should be available on demand. Research results, both in progress and on completion, will be published and publicized. Feedbacks should be taken to ensure wider participation.

Excellence and relevance are needed to attain the objectives of sustainable agricultural development. Mediocre work is unacceptable. Program implementers should strive that their objectives are achieved through acceptable standards. To encourage high standard of work, incentives will be provided. This could come in the form of greater availability of funds, recognition, and other appropriate forms to motivate the staff and management involved. The key incentives for cooperation will be through the ability for responsive research, extension, private sector and farmer organizations to access significant funds over and above the core funding provided by their host institutions. Successful project completion will, over time, enhance the reputation of partners and their organizations and strengthen their capacity to attract future funding. Recognition in the form of citations would focus public attention on agencies and institutions with outstanding achievements. Awardees are recognized for their significant contribution to the welfare and well-being of their countrymen, their communities, and the country. They are held as inspirational examples for other workers in agricultural development. Excellent proposals would also merit funding.

9.3. STRATEGIES FOR COORDINATION

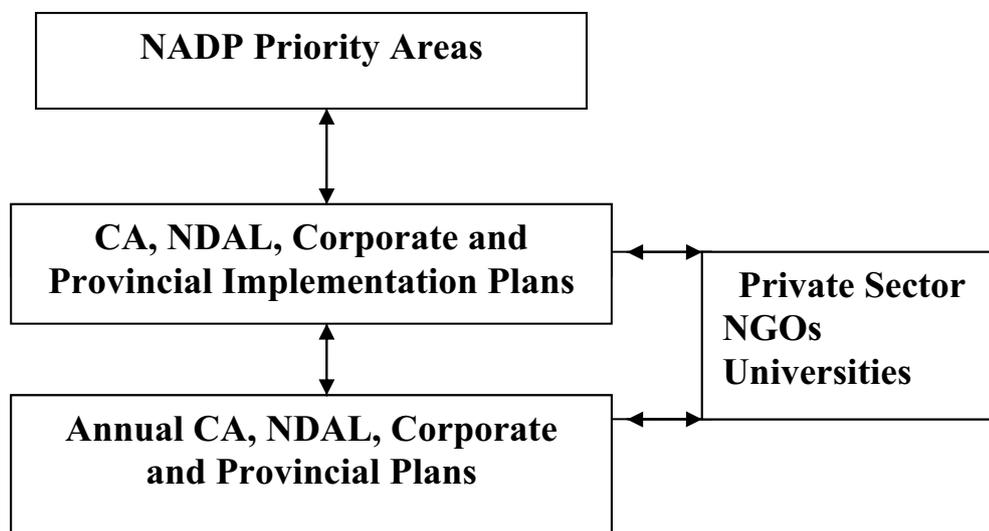
Effective coordination would need the following strategies:

- improve policy analysis by creating a dedicated unit for policy and planning for agriculture. This unit will gather information or commission studies to bolster decision making. Statistics on production, prices and market trends will be regularly updated. Policy analysis should be based on well studied data, considering possible short and long term impacts and presents options to the management.
- build capacity of national, regional and provincial secretariat for coordination, monitoring and evaluation, and systematic and timely data collection
- participatory approach through regular consultations and dialogues with provincial and national agencies/corporations. This will build ownership of the activities and foster cooperation.

9.4. COORDINATION ACTIVITIES

Initially, the NDAL, commodity/sectoral organizations, provinces and districts prepare 10-year implementation plans based on NADP (Fig. 9.2). Implementation plans could be patterned after NADP, covering subsector/provincial/district current production status, issues and constraints, development opportunities, project strategies, priority areas, framework of implementation (methods, schedules, partners, target outputs, reports), and resource allocation. Priority areas for development are NADP priorities and allocation of resource would depend on production status and local situations (infrastructure and support from provincial government). Implementation plans should define where private sector participation or investments are needed. NDAL defines the policy areas to be studied, coordination meetings and reviews, monitoring and evaluation targets and schedules, and knowledge/information management.

Figure 9.2: Linkages of NADP, NDAL, Corporate and Provincial Plans based on NADP priority areas



To ensure orderly coordination, the following activities should be done in sequence.

9.4.1. Setting Priorities

The Secretariat recommends to the TPPRB and GC a set of criteria for selection of projects with assigned evaluation weights. For example:

- Economic importance (potential return on investments, foreign exchange earnings, revenue)
- Environmental importance (will the project be sustainable? Any likely environmental impact?)
- Social importance (benefits to group of population, employment possibilities)
- Immediate need (urgency of the project)
- Staff capability (based on educational background and experience, applicability to the proposal, time available to devote to the project)
- Creative solution to a problem (innovations are needed or else it is business as usual)

TPPRB studies and deliberates the justifications and soundness of the proposals and recommends to GC. Once an agreement is reached, priority projects that will increase agricultural output at minimum cost are determined. Funds are allocated per priority area. All input requirements to achieve a reasonable level of growth are determined. Projections of economic growth rate that can be achieved in terms of the volume of agricultural production to be targeted, foreign exchange earnings and savings to be made,

and the direct and indirect employment created and the impact upon per capita agriculture income will be made.

The GC could also set the level of funding that each organization can approve, provided that projects are within the NADP priority. A caveat though is the possibility to subdivide projects so that the maximum funding level stays within the organization. Some mechanisms must be in place to avoid this problem.

9.4.2. Defining Objectives

These apply from the national to district levels and can be done through joint meetings and consultations for common understanding. Objectives are based on the national priority areas and strategies, applicable to the agro-ecological conditions of the provinces and districts. The NDAL, commodity organizations, provinces and districts prepare implementation plans for a period of time, e.g. 10-years (Fig. 9.2). Annual plans adjust the objectives for the year.

9.4.3. Identifying Programs

Each organization, national to district level, identifies projects and formulates capsule proposals within the priority areas of NADP (Figure 9.2). In effect, any organization can prepare proposals for NADP. Capsule proposals are 1-2 pages only, containing information on rationale and justification of the program or project, short description of the activities or strategies, proposed budget, where it will be conducted, duration, and proponent. Projects are defined along the cultural, political and organizational traditions of the country. Goal and objectives are defined for a time frame, and resource requirements are specified. Allocation of resource for provinces and districts would depend on the production status and local situations.

Programs will include capability building to fill in manpower requirements for the sector, research and surveys, credit to be made available, incremental import requirements in terms of farm inputs and the foreign exchange requirements of funding the plan, subsidies required, area of land to be brought under production including areas to be rehabilitated and new areas to be brought into production for the first time. Supportive transport infrastructure must be identified and rehabilitated and any necessary legislative reforms carried out. For large scale agriculture development projects, the cost of transport and communications infrastructure, social infrastructure (schools, health services, law enforcement, etc) and direct agricultural development costs are included. Participation by private sector can enhance the NADP and also minimize cost and project risks to the government.

9.4.4. Recommendations to the National Planning Office

Agricultural organizations submit proposals to the Secretariat, which summarizes projects and programs according to the priority development needs. The Secretariat submits proposed programs to the National Planning Office for budget appropriation.

During the deliberation of the budget, the Secretariat represents the agriculture sector, and explains the programs and budget, with assistance from the implementing agencies. Hence, it is important that the programs are presented clearly.

9.4.5. Technical Appraisal of Projects

When the budget is appropriated, the Secretariat informs the proponents to prepare full proposals. The GC reviews the proposals for balanced programming, i.e. equal distribution among sub-sectors and provinces or reprogramming if budget is inadequate. A review panel conducts technical appraisal based on adequacy, clarity and attainability of objectives; soundness of methodology as related to the objectives; feasibility of task schedules based on the methodology; reasonability of budget estimates; and capability of the project leader and staff. The proponent modifies the proposal based on the recommendations of the review panel. Once the technical requirements are fulfilled, the Secretariat recommends fund release, and the projects are implemented.

9.4.6. Reviewing Progress

An annual review of on-going projects is undertaken in connection with the preparation of annual budgets. Project/program leaders submit progress reports periodically. The Secretariat could schedule peer review or seminars open to interested persons. Paper reviews and field visits are conducted to determine the progress of the projects and programs and improvements that can be done, if any. Updates on progress are needed to know whether changes have taken place during implementation, and would require new set of direction or approaches. The review would determine the plans for the coming year and identification of new projects.

9.4.7. Monitoring and Evaluation

Monitoring and evaluation is necessary to ensure that programs and projects are implemented within the planned period and budget, and they achieve their objectives (MTDS, p. 62). This will be a regular joint effort of the coordinating agency, commodity organizations, provinces and districts (coordinate with National Monitoring Authority). Evaluation is based on progress reports, financial reports from the accounting groups of the implementing agencies, field visits, and personal observation of the evaluation team (Secretariat PS, sub-sector expert, and agency representative). Involvement of the community in monitoring the projects/program would be advantageous. The project is evaluated in terms of its relevance and value at the current conditions. Incentives are provided for outstanding work, criteria of which are set by the GC. Non-performing projects or studies should be terminated so that funds can be used meaningfully.

Accountability of public funds is already a requirement of the PFMA 1995 and the Auditor General Act. To ensure effectiveness of agriculture programs, technical audit of programs and projects including physical achievements must be evaluated to provide feedback to the executive arm of government, i.e. the NEC through the CACC. By providing feedback to policy makers and project planners of the audits, lessons learned

from past experience can be used to improve future policy formulation and project planning.

9.4.8. Reporting System

The system will involve defining procedures and formats, frequency of reporting and preparation of manuals such as mandates and authorities, laws, rules and regulations, standard operating procedures (SOPs), organization, reports that will guide implementation. The Secretariat consults the network for their input to the reporting system.

9.4.9. Information/Knowledge Management

The Secretariat manages information and knowledge, through its subject matter specialists. Information or findings generated from projects are assembled in packages that facilitate dissemination to target clients, e.g. policy makers, news media, researchers, extension workers, farmers. Each target audience will require specific approach of communication – message, presentation, and media. Databases, e.g. GIS are created for easy retrieval of information. Information should be posted in websites and newspapers, broadcast through radio or TV, and public places in order to increase awareness of the users. Information dissemination can be facilitated through the NARES (see Chapter 4).

9.5. TRAINING

NADP coordinators should be technical people who understand agricultural programs. Short term courses could help technical staff to become effective coordinators. The following courses are indicative training for coordinators:

- Project management – includes participatory planning, monitoring and evaluation, database development and management; impact assessment; time management
- Proposal preparation
- File management
- Leadership/supervisory course
- Technical training – to understand the technical side of subsector programs
- Communication skills and effective/clear writing

9.6 EXPECTED OUTCOMES

The Secretariat will take care of policy analysis, agricultural census and databases, consultations and meetings, monitoring and evaluation, training, office management, and gender issues. The expected outcomes for coordination are the following:

- Well researched policies
- Improved statistical bases to aid policy decisions
- Increased interaction of national agencies, regions, provinces, and districts in formulating and monitoring agricultural plans
- Improved monitoring system and accountability

- Improved capability in coordination, program management, monitoring and evaluation
- Increased awareness of importance of gender issues in development

10. PROPOSED BUDGETARY REQUIREMENTS OF NADP

10.1. REVIEW OF BUDGET ALLOCATIONS FOR AGRICULTURE

Between 2000 and 2004, budgetary allocations to NDAL and other statutory organizations for agricultural development fluctuated widely (Tables 10.1 and 10.2). Only two provinces allocated funds for agricultural development: Enga for pyrethrum development and Bougainville for coconut genetics. Of the total recurrent budget received by NDAL, 70 to 85% were used for personal emoluments and only 13 to 20% for operational purposes (Table 10.3).

Table 10.1. Actual Development Expenditures (K'000) of the NDAL , Statutory Authorities, and some Provinces, 2000-2004

Agency	2000	2001	2002	2003	2004
DAL	3,107.2	4,774.2	4,364.2	2,145.1	4,602.6
Cocoa Coconut Extension Agency	1,526.4	23,812.4			
Cocoa Coconut Institute	1,214.5	1,544.6	1,995.5	8,800.7	1,890.0
CCRI			780.9		
Cocoa Board			200.0	160.0	127.5
CIC	0	0	455.7	220.0	500.0
FPDA		2,082.9	509.1	150.0	500.0
OPRA		324.5	350.0	250.0	400.0
OPIC	8,017.0	21,145.2			
NARI	10,399.6	27,703.6	1,378.6	1,065.6	600.0
NAQIA	17,085.5				
Livestock Dev Corporation					
Enga			1,500.0	330.0	300.0
Bougainville	2,355.0				
Eastern Hlands					
Total	43,705.2	81,387.4	11,534.0	13,121.4	8,920.1

Source: Department of Finance and Treasury

Table 10.2. Actual Recurrent Budget (K'000) of the NDAL and Statutory Authorities (2000-2004)

Agency	2000	2001*	2002	2003	2004
DAL	3,437.90	10,092.80	4,364.2	5,006.4	9,656.5
CCI	0	0	2,252.0	1,994.7	4013.2
CCRI	1,420.3	1,289.5	0	0	0
FPDA	0	0	1,407.5	1,525.8	2,000.0
NARI	1,999.9	0	2,452.1	3,073.7	4,455.5
NARI	0	2,193.1	3,031.5	0	0
NAQIA	792.2	867.5	861.1	1,349.7	1,507.6
Total	7,650.3	14,442.9	14,368.4	12,950.3	21,632.8

Source: Department of Finance and Treasury

* Appropriation figures for statutory authorities

Table 10.3. Expenditures of NDAL Recurrent Budget (K'000), 2001-2004

Expenditure	2001	%	2002	%	2003	%	2004	%
Personal Emoluments	7,305.4	72.4	412.7	9.5	4170.5	83.3	7511.9	77.8
Operating Expenses	1,958.3	19.4	923.8	21.2	682.2	13.6	1506.2	15.6
Current Transfers	768.4	7.6	2,187.7	50.1	153.7	3.1	506.9	5.2
Capital Outlay	60.7	0.6	840.0	19.2			131.5	1.4
Total	10,092.80	100	4,364.2	100	5006.4	100	9656.5	100

Source: Department of Finance and Treasury

10.2. PROJECTED BUDGET FOR THE SECTOR

The MTDS projected higher funding for the agricultural sector, as part of the Income Earning Opportunities. It includes programs of national departments/agencies, cocoa and coconut, coffee, palm oil, and derivation grants of provinces (Table 10.4), and noticeably none for NDAL. However, the sector gets only 3.7 % of the estimated recurrent and development budget for 2006 and 2007, which is relatively small compared to education, health, infrastructure, law and justice (Table 10.5). While it can be argued that the government has to take care of health, education, and law and order, agriculture also needs greater support to enable the people to earn a living. When they have adequate income, people can afford to pay for quality education and health services, and law and order problems will decrease. In spite of the support for the other sectors, services are still deteriorating. It is time to shift attention to agricultural development.

Table 10.4. Indicative MTDS Funding (K million) for Income Earning Opportunities, 2006-2007

Program	2006		2007	
	*R	*D	R	D
National Departments/Agencies	0.0	64.2	0.0	69.2
Cocoa and Coconut	0.0	2.2	0.0	2.6
Coffee	0.0	2.5	0.0	2.8
Oil palm	0.0	0.5	0.0	0.5
Derivation Grants	12.1	0.0	12.4	0.0
Total	<i>12.1</i>	<i>69.4</i>	<i>12.4</i>	<i>75.1</i>

*R – Recurrent * D-Development

Table 10.5. Indicative MTDS Funding for priority sectors, 2006-2007.

Sector	2006 (K million)			2006 (K million)			Total for 2006 & 2007	%
	R	D	Total	R	D	Total		
Health	210.0	149.7	359.6	222.1	161.5	383.6	743.2	16.3
Education	465.1	154.8	619.9	491.9	159.8	651.7	1,271.6	27.8
Infrastructure	30.3	433.5	463.5	31.3	434.9	466.2	929.7	20.3
<i>Agriculture*</i>	<i>12.1</i>	<i>69.4</i>	<i>81.5</i>	<i>12.4</i>	<i>75.1</i>	<i>87.5</i>	<i>169.0</i>	<i>3.7</i>
Law and Justice	162.9	563.5	726.4	167.0	562.5	729.5	1,455.9	31.9
Total	880.4	1370.9	2250.9	924.7	1393.8	2318.5	4569.4	100

Source: MTDS R – Recurrent; D - Development * excludes forestry and fisheries

Adequate and sustainable funding is needed to support agricultural development. Two options are available for NADP funding, depending on negotiations with the Department of Finance and the Planning Office.

10.3. ESTABLISHMENT AND MANAGEMENT OF THE FUNDING SYSTEM

10.3.1. Endowment Fund

To ensure sufficient funds are allocated and made available for financing of the NADP, the government could establish an endowment fund, called the National Agriculture Development Endowment Fund (NADEF). Funds earmarked for agriculture development under the NADP could be channeled into this fund that

include national government's contribution, special levies collected for financing the NADP, and donor's grant for establishing the endowment. Provincial governments, as recommended by the FER, could also contribute their derivation grants for funding of agriculture projects in their respective provinces as part of the NADP.

The NADEF should be established on-shore and managed by a board of trustees, appointed by the GC. Its management must have no political interference, and all operations and transactions properly documented and audited. If organized and managed properly, the NADEF could become a perpetual fund and operate as a "one stop shop" for agriculture. It would facilitate and finance investment in major agriculture projects in joint venture partnerships with the private sector and also directly contribute to research and extension of smallholder agriculture.

10.3.2. Contestable Pool of Funds

In the initial years of NADP, it may not be possible to harness all funds of the different stakeholders for agricultural development. Alternatively, a nationally contestable pool of funds will be established and appropriately legislated, in collaboration with the Ministries of Agriculture and Livestock, Finance, and Planning and Rural Development Management. Funding for the proposed competitive grants scheme would be based on the AIGF model, initially through donor support. The NADP proposes that the AIGF model become further developed and institutionalized within GoPNG during the extended AIGF program. Eventually, donors might channel much of their R&D assistance to the sector through this Fund and may be willing to provide technical assistance for its administration during the initial 5-10 years. Ultimately the fund is expected to become self-sustaining, and high-level technical assistance from donors should guide the government on how to attain sustainability.

Initially, the Fund will concentrate on supporting adaptive research, development and extension, as in the present AIGF. The Commodity Organizations and Universities will continue to undertake most of the applied research through their own budgets. The incentive for the COs, Universities and other service providers to collaborate will be the potential to access additional funds through the national competitive mechanism. NARI already operates along these lines in accessing significant research funds from multiple external sources.

This Fund will need to be supported by increasing GoPNG contributions, in the first instance possibly through the mechanism recommended by the FER – quarantining portion of the derivation grants to the Provinces. Approximately K9 to K14 million were allotted as derivation grants to the Provinces from 2000 to 2004 (Table 10.6.) These derivation grants should be used for the provinces' development projects.

Table 10.6. Actual Derivation Grants, 2000-2004 (K'000)

Province	2000	2001	2002	2003	2004
Fly River	302.8	9.2	10.7	6.5	290.3
Gulf	158.8	6.3	4.0	55.6	740.7
Central	49.7	91.7	66.7	119.6	225.0
Milne Bay	1,393.2	637.1	463.3	324.1	636
Oro	206.7	908.4	642.1	416.2	824.9
Southern Highlands	44.7	77.9	51.5	171.3	27.0
Enga	104.4	419.6	81.2	78.3	58.1
Western Highlands	1,662.8	2,828.7	2,187.7	1,368.0	920.9
Simbu	202.4	765.9	447.1	314.0	200.4
Eastern Highlands	1400.6	2,164.9	1,512.2	891.5	617.8
Morobe	288.8	590.9	446.1	294.9	281.7
Madang	1,488.3	568.9	397.3	282.9	420.0
East Sepik	238.5	460.0	321.4	217.9	212.9
Sandaun	25.5	44.6	32.4	30.9	221.3
Manus	555.4	25.6	18.6	67.7	86.3
New Ireland	1,016.1	655.3	476.5	315.2	529.6
ENB	1,070.0	1,693.4	1,177.9	772.7	1,575.8
WNB	1,035.8	3,046.4	1,986.2	1,278.5	2,728.5
Bougainville	3,365.3	476.4	363.3	268.1	443.4
Total	14,610	14,091	10,686	9,277	13,045

Source: Department of Finance and Treasury (2000-2004)

Additional GoPNG budget support will also be necessary, both to meet the transaction costs of operating the fund in the initial years and to provide core funding in support of national priorities. It is not proposed that existing core research funding arrangements with the Commodity Organizations be modified in the first instance, but that GOPNG funding to the COs for development and extension may need to be aligned with the new national fund and priorities over a period of time.

Additional sources of funding may be feasible through the tax-deductibility of donations for R&D from the private sector, although this may well prove conditional upon fully transparent and accountable management of the national fund. It may be unlikely that other donors would be prepared to contribute to an Australian-managed fund due to difficulties with 'identity', but this may become less of an issue when the

Fund comes under GOPNG management. The issues of grower levies and government matching contributions are sensitive matters and ought not to be allowed to detract from the establishment of the proposed national fund. They may need to be re-visited at a later stage of NADP implementation.

10.3.3. Provincial Commitment to Agriculture

Aside from quarantining provincial derivation grants, a policy could enforce the provinces to set aside funds for agricultural development, defined in the provincial implementation and annual plans. MPs are provided annual appropriations through the Public Investment Programme, and the Cabinet must ensure commitment of the provinces to set aside agricultural funds. No funds will be released unless documentations show solid plans for agricultural projects. Monitoring and evaluation will ensure that provinces have the projects in place. Incentives could be provided, e.g. additional funds based on agreed upon criteria with the Department of Finance and National Planning.

10.4. ESTIMATED BUDGETARY REQUIREMENTS

The estimated ten year budget requirements of NADP priority programs, and the expected outcomes are presented in volume two. The programs are prioritized, based on priorities identified during consultations. As stated in Chapter 9, priority areas of Commodity Organizations, provinces, districts and LLGs will be set based on agreed upon selection criteria.

About K1.198 billion (K119 million per annum) is needed to manage and provide services for agricultural growth in the next ten years (Table 10.7). The investment will cover development of different agricultural sub-sectors. This amount exceeds the MTDS estimate for the sector (Table 10.5). The resource requirements for the agriculture sector over the planning period are provided in the Implementation Framework in Volume 2 of NADP with Implementation Schedules and Budgets for each of the priority programs by commodity, agency, province and district.

With an annual investment of K119 million, the estimated return will be K2.4 billion which is about 40% of GDP. Development of agriculture needs financing and concerted efforts, but returns will be attractive. Agriculture is an essential key to economic growth of PNG.

Table 10.7 NADP Budgetary Requirements for 10 years (K million)

NADP Component	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Total
1. Research Extension, Information & Training	25,450	27,185	26,870	36,755	26,030	23,695	25,695	24,375	23,190	25,035	26,4235
2. Food & Horticulture Crops	22,660	18,950	16,930	15,880	12,790	12,790	11,400	10,790	10,150	10,040	142,380
3. Tree & Industrial Crops	109,337	92,280	61,320	56,400	48,920	51,610	41,530	49,060	43,220	49,820	603,537
4. Livestock, Aquaculture & Apiculture	8,720	6,830	7,390	6,860	6,530	3,690	3,330	3,230	2,760	2,360	51,700
5. Spice and Minor Crops	4,135	2,935	2,500	1,950	1,950	2,000	1,850	1,860	1,860	1,820	22,860
6. Gender, Social, HIV/AIDS	3,115	1,665	1,315	1,245	1,305	1,145	1,195	1,155	1,195	1,165	14,500
7. Regulatory and Technical Services	8,991	7,219	7,244	7,329	7,424	7,279	7,209	7,244	7,379	7,264	74,582
8. NADP Management	5,500	3,650	3,650	3,650	3,650	1,200	1,100	1,100	850	850	25,200
TOTAL	187,948	160,714	127,219	130,069	108,599	103,409	93,264	98,814	90,604	98,354	1,198,994

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ANNEX A : Commodity Organizations' Priorities and Strategies

General:

1. Promote cooperatives. Through cooperative marketing system, growers can add value on price and quality. The coffee component of the Smallholder Agricultural Credit Scheme (SACS) has been successful with K3.96 million credits to coffee growers and K1.1 million repaid. The scheme has been extended to form credit cooperatives in order to facilitate coffee marketing. The cooperatives have successfully pooled their coffee, processed into green bean and exported through an agent. The Cocoa Board will establish 6 cooperative societies in 6 provinces. KIK will inform all stakeholders to form associations and mobilize cooperatives.
2. Mode of production through nucleus enterprise, plantation rehabilitation, replanting, expansion to other areas. Rehabilitation of plantations and gardens will be through marketing groups and cooperatives, and compliance with banks' normal terms and conditions. CIC will promote nucleus estate model of oil palm sector. The Cocoa Board in close consultation with the CCIPNG will support strong research and breeding program to meet the demands of production. CCIPNG will also develop appropriate coconut hybrids and coconut-based farming systems,
3. Freight surety/subsidy scheme. Rural areas have nil or poorly maintained roads and bridges not linked to the main business centers and marketing ports. This has handicapped exportable cash crops from reaching the main marketing ports. The Cocoa Board estimated that 10,000 tons of cocoa valued at K40 million in export revenue are stranded in remote and isolated rural areas of the country. Coffee Industry Corporation (CIC) identified remote communities in PNG that are inaccessible by sea and road where quality coffee is produced and the only crop grown. CIC's freight surety program recovers freight cost at the point of sale of the coffee.
4. Establishment of nurseries. The Cocoa Board with the technical input from CCIPNG will develop central seed and budwood gardens for distribution to cocoa growers through a subsidized scheme. CIC will propagate and disseminate both traditional and improved planting material to farmers for replanting and new developments.
5. Processing. The main quality problem with smallholder coffee is pulper-nipped beans due to old and improperly adjusted hand pulpers. Growers cannot buy new pulpers due to high costs (K800 per unit retail). CIC plans to procure pulpers in bulk and sell to farmers at cost plus handling, revolve the fund, and provide training on pulper maintenance. Central processing mills for coffee would cater to smallholder groups, associations and cooperatives, and individual blockholders. Downstream processing relates to production of soluble or instant, roast and ground coffee. CIC will review the feasibility study in 2000 to cover other areas, e.g. small capacity factory. The Cocoa Board will establish two downstream processing centers.
6. Smallholder credit scheme. The Cocoa Growers and Producers Savings and Loan Society will be strengthened to meet the credit and finance requirements of cocoa growers. CIC plans to establish savings and loan society for coffee growers.

7. Marketing and promotion. CIC will promote transparent marketing system through close monitoring of prices and marketing margins, provide market information to stakeholders and facilitate better working relationships between growers and exporters. Products such as cocoa will be promoted at overseas markets. KIK together with CCIPNG will develop strategies to monitor buying and selling prices of coconut products in domestic markets, as well as determine the suitability of exporters' market margin technique. CIC plans to facilitate direct contact between growers and overseas buyers through international coffee shows and exhibition. It will facilitate collaboration with IPA, JETHRO, SCAA, Ministry of Foreign Affairs, TPA, Japan, USA, Europe and Scandinavia. It plans market study and will establish a marketing unit in PNG and overseas.
8. Quality standards and control. Increased surveillance and inspection programs to promote and maintain quality standards. The Cocoa Board will seek ISO certification of PNG cocoa quality standards, and will design and introduce a centralized cocoa inspection system.
9. Training and marketing. The Cocoa Board plans to train national exporters . CIC will undergo training on market-based risk management mechanisms and undertake a pilot project on price insurance scheme with selected grower groups.

Specific

1. CIC – review regulatory framework and relax licensing guidelines to facilitate the entry of more nationals into the exporting sector and investment in rehabilitation and production; strengthen its institutional capacity with minimal staff.
2. OPIC – infrastructure development and improvement
3. Cocoa pod borer threat – CCIPNG is optimistic about the strategy that can contain and eradicate the pest within six months.
4. Growth projections
 - Coffee - 1.19 Million Bags. MTD 1.7 Million bag
 - Cocoa -100,000 metric tonnes by 2013 (target divided into 14 cocoa-growing provinces)
 - Copra – 200,000 mt. by 2013 (divided into 14 coconut-growing provinces)
 - Sugarcane - 40,000T of sugar
 - Pyrethrum - 8000 kg of 25% oleoresin each year (in Enga Province)

Livestock Development Corporation

1. Increase output, quality and availability of livestock products
2. Generate income from livestock production, processing and marketing.
3. Develop new technologies to increase productivity
4. Develop infrastructure needs of the industry

ANNEX B: Provincial Plans

<i>Provinces / District</i>	<i>Crop</i>	<i>Strategies</i>
BOUGAINVILLE		
Buka, Kieta		Direct export of commodities
Arawa, Buka		Establishment of Commodity Board and Corporation <ul style="list-style-type: none"> - identify and drawdown of powers and functions - establish inspection depot - develop corporate plan and design infrastructure - develop Act and legislate
Tsitalato, Teop, Tinput, North Nasioi	Cocoa	Integrated cocoa disease management
		Plantation management and restoration <ul style="list-style-type: none"> -study into customary ownership/rights - introduction and establishment of plantation mgt scheme
Plantations, Buka	Coconut	Introduce downstream copra crusher
Buka, Arawa, Buin		Agricultural and cultural show
		Market facilities improvement <ul style="list-style-type: none"> - market research - crop storage - market maintenance - market awareness on new market opportunities
		Agricultural training program <ul style="list-style-type: none"> - establishment of seed capital - contracting of service providers - coordination of training program
		Establishment of Organic Agric. Training Center
Buka		Develop food security policy (Buka) <ul style="list-style-type: none"> -create awareness into food security (region-based) -develop appropriate farming methods (region-based) -provide machinery and farm equipment to Regional Food Security Centre (Buin) -conduct on farm trials (Buin) -identify crop species for downstream processing (Atolls, Siwai)

Buka		Development of the alternative food crops farming into rice production <ul style="list-style-type: none"> - development of rice policy - provide rice seedlings and training
		Establish cooperative marketing <ul style="list-style-type: none"> - establish commodity marketing cooperatives - conduct awareness into cooperatives
CENTRAL		
Hiri East, Hiri West, Vanapa/Brown. Koiari	Cocoa	New development: 25 ha Rehabilitation: 40 ha Training: 120 farmers Nursery: 33,000 seedlings Processing: 20 tons, facilities
Hiri East, Hiri West, Vanapa/Brown, Keapara, Rigo; Hiri	Coconut	New development: 40 ha Construct driers Training: 30 farmers Nursery: 30,000 seedlings
Sogeri, Mt. Koiari, Vanapa/Brown	Coffee	New development: 50 ha Rehabilitate: 100 ha Nursery: train 300 farmers; 94,500 seedling requirements Marketing: 110 tonnes; establish markets
Sogeri, Vanapa	Rubber	New development: 5 ha Rehabilitation: 10 ha Nursery: 10,000 seedlings Production: 15 tonnes
Rigo	Cashew	Extension Market
	Cassava	Research and extension Donor linkage
Goilala	Other crops	Integrated programs of various cash crops
Hiri, Abau	Vanilla	New development: 10 ha Awareness campaigns: crop culture, promotion Nursery: 4 ha
	Chili	Development
Rigo, Hiri, Kairuku	Food security	Onions research trial: awareness and crop culture Rice: establish milling facilities; supply seeds to identified farmers; improve existing blocks Staple crops: training on seed culture; integrated programs Horticulture: rehabilitation (25 ha); nurseries (2 ha)
Kairuku, Goilala, Balawaia	Livestock	Cattle breeding Rehabilitate Balawaia Cattle Ranch Chicken hatchery/transit house Semi-intensive piggery Integrated livestock farming

Kapari, Magarida, Maopa, Moreguina	Market establishment	Upgrade market shelter
EASTERN HIGHLANDS		
Rice: Asaroka, Gahuku, Lower Bena, Yagaria, Saviya Fagonofi, Yonki Fish: Daulo, Gahuku, Fagonofi Avani Honey: Gahuku, Ungai Bena, Yagaria, Kafetina, Purosa, Yonki	Rice, fish, honey, potatoes	Increase production in outlying areas of the Province Production and distribution of planting materials Raise revenue to sustain operations Establish resource center for training and seeds Research
Drought food, bulb onion, : all districts Potato: Goroka, Ungai Bena, Michael, Kuru, Okapa, Ktu, Obura Stock feed: Benabena Chicken: Goroka, Kainantu Fruit trees: Ungai Bena, Yagaria, Heng, Yonki Vanilla: Heroana, Yonki	Drought food crops, goats, potatoes and bulb onions, stock feed/chicken, fruit trees, vanilla	Promote to broaden economic base Research Farmer training Raise internal revenue
Market: Daulo, Goroka, Heng, Okapa, Ktu Village chicken: all Spice crops: Ungai Bena, Lufa, Heng	Market depot, rural credit, village chicken, spice crops	Establish markets Provide credit facilities
EAST SEPIK		
Maprik (noni, pepper, soy bean); Wewak (ginger, soybean, pepper); Yangoru/Sausso (turmeric, pepper); Wosera/Gawi (turmeric, pepper, noni, kava), Angoram, Ambunti/Drekikir	Minor Crops (vanilla, cashew nut, chili, peanut, fruits and nuts)	Expansion and diversification
Wewak (Yawasoro, Sowam: cocoa); Yangoru/Sausso; Angoram (Gavien: rubber); Ambunti/Drekikir (Gawanga: oil palm and rubber)	Rubber, Oil Palm, Cocoa	Smallholder development Resettlement schemes
Maprik, Wewak, Yangoru/Sausso	Rice	Multiplication and distribution
Wewak, Yangoru/Sausso, Wosera/Gawi	Betel nut	Production
Maprik, Wewak, Wosera/Gawi, Ambunti/Drekikir	Fruits and vegetables	Marketing
Yangoru/Sausso	Cassava	Ethanol production
Maprik, Wewak, Yangoru/Sausso, Wosera/Gawi, Angoram,	Food crops	Multiplication and distribution Downstream processing Marketing

Ambunti/Drekikir		
Maprik (aquaculture), Wewak, Yangoru/Sausso (aquaculture), Wosera/Gawi, Angoram, Ambunti/Drekikir	Livestock	Small livestock development – breeding and distribution Smallholder cattle rehabilitation Abattoir renovation and slaughter slabs development Urimo feral buffalo eradication Aquaculture Smallholder wildlife programs – crocodile production and tannery, butterfly and insect farming, management areas
Maprik (ABTC). Wewak, Yangoru/Sausso, Wosera/Gawi, Angoram, Ambunti/Drekikir	Management	Improvement and capacity building Monitoring and evaluation Coordination and liaison Cash crops census and statistics
<u>ENGA</u>		
Sirunki, Yokonda, Kepelyam, Pangu, Kandep	Pyrethrum	Organize mobile extension teams Establish nurseries at all selected locations for distribution Purchase splits from existing growers for distribution Clonal improvement and distribution Liaise with Enga Pyrethrum Company to increase farmgate purchase price (50,000 kg in 2006 to 300,000 kg by 2010) Conduct quality improvement awareness at buying points
Kompam, Wapenamanda, Wabag, Porgera	Coffee	Rehabilitation of existing coffee trees Establish coffee nurseries for seedling production and distribution Encourage new plantings in all coffee growing districts Conduct awareness campaign Sampling and chemical analysis of Enga coffee Set up liquoring facilities in existing coffee factory Attend coffee expos USA/Europe Assist parchment processing and drying facilities and better processing at the farm Conduct farmer trainings and field demonstration on all aspects of coffee management
	Spice	Conduct awareness campaign Production and distribution of improved varieties Purchase products and resell to processors Improve processing infrastructure
Ware, Kompam, Wapenamanda, Porgera, Kandep, Wabag, Laiagam	Food security: Potato, vegetables, food crops	Sufficient seed potato production and distribution Improve production, downstream processing, marketing and utilization
Murip, Kandep	Wheat	Field days and agricultural shows

		<p>Publication and information distribution (with Radio Enga)</p> <p>Credit support</p> <p>Price support scheme</p> <p>Improved transport services</p> <p>Training</p>
<p>Taluma</p> <p>Yogos</p> <p>Taluma</p> <p>Kandep, Sirunki</p> <p>Minamb, Kandep</p> <p>Mukurunanda</p>	<p>Livestock</p> <p>Aquaculture</p> <p>Apiculture</p>	<p>Central piggery</p> <p>Sheep and goat breeding and distribution center</p> <p>Duck and austrorlors breeding center</p> <p>Establish dairy farms</p> <p>Establish fully operational abattoir</p> <p>Carp and trout hatchery</p> <p>Queen bee breeding scheme</p>
MADANG		
<p>Madang, Sumkar, Bogia, Middle Ramu, Usino Bundi, Rai Coast</p> <p>11,386 ha; average prodn of 6790 tonnes/yr</p> <p>870 sq km (1.8%) –very high to high; 980 sq km moderate</p> <p>High potential: Karkar, Bagbag, Kumil Basin, Kaukumba River, Gogol River and Aiome Area</p> <p>Moderate: Bogia to Yara in Rai Coast</p>	<p>Cocoa (5 medium to large scale projects; 1/district</p>	<p>Liaise w/ CCRI and Cocoa Board for recommended planting materials; w/ CCEA and districts for recommended planting materials and information</p> <p>Facilitate construction of improved fermentaries</p> <p>Districts to produce regular reports for monitoring and evaluation</p> <p>Assist districts and other agencies to stage field day.</p> <p>Facilitate establishment of cocoa farmer group exporting company</p> <p>Coordination and dissemination of technical information in cocoa technology.</p>
<p>20,000 growers, 30,000 ha</p>	<p>Coconut</p>	<p>Distribute and plant recommended varieties</p> <p>Liaise for reasonably priced copra driers.</p> <p>Stage field days</p> <p>Coordinate and disseminate technical information.</p>
	<p>Coffee</p>	<p>Field days and demonstration</p> <p>Dialogue and consultation with CIC and Coffee Growers Association</p> <p>Feasibility study for large-scale investment projects.</p> <p>Coffee and population census</p> <p>Look for funding of coffee pulpers and wet factories</p> <p>Encourage mixed cropping of coffee with other crops.</p>

Tran Gogol (multiplication and distribution center)	Vanilla	Organize and conduct training for officers and farming Consult experts on appropriate design and construction of processing facilities. Encourage districts to establish cutting, multiplication and distribution centers. Collate and disseminate technical information.
Hinihon, Wanuma, Tauta, Walium, Balbe, Meibu, Simbai, Trans Gogol, Karkar	Cardamom	Collate, compile status, economic potential of the crop Encourage farmers to maintain existing plantings and expand new planting. Facilitate and distribute recommended planting materials.
	Kava	Conduct awareness program Coordinate training programs and field days Establish planting material production and distribution centers Circulate available technical and market information.
	Other minor crop (chili, turmeric, pepper, tobacco)	Improve extension Collate and disseminate technical and market information.
Tep Tep, Simbai, Madang, Usino Bundi, Bogia, Sumkar, Rai Coast, Middle Ramu	Food security (K257,000/yr)	Establish seed multiplication and distribution centers Joint planning with districts on food production programs Field days (2/district) Training on food processing Provincial rice farmers cooperative
	Livestock: Cattle	Strengthen extension Secure funding with RDB
	Sheep and goats	Promote sheep and goats Coordinate the purchase and distribution of stocks. Encourage tethering. Govt to discourage/reduce importation. Coordinate and assist in marketing of local sheep and goat meat.
	Pigs	Coordinate and liaise on pig breeding and distribution. Feed formulation with available local by products. Coordinate and assist training of officers and farmers. Review and disseminate technical information.

Usino Bundi, Danip, Middle Ramu	Buffalo (draft)	Establish breeding center Purchase stock from existing project to distribute to interested farmers. Conduct training for new buffaloes and refresher for existing units Monitor feral buffaloes and eradicate where necessary.
Chemica, Agmark and Madang	Poultry	Coordinate the purchase and distribution program of small animals. Establish transit holding facilities. Encourage establishment of small animals breeding centers. Develop feed mixing formulas.
Sagalau	Abattoir	Improve road to abattoir Maintain and repair holding paddocks
	Produce Marketing	Awareness program Radio program with NBC Madang – produce prices Districts to carry out produce extension services Liaise with export companies
	Staffing	District Programme Mgrs responsible to Advisor ALF and District Administrators.
MILNE BAY		
All districts	Food security	Rice development Food crops Small livestock Vegetables Resource centers
Rabaraba Inland, Esa'ala, Alotau	Cash crop development	Coffee development Expansion and rehabilitation Marketing Downstream processing
Alotau, Valeba and Suau Coasts, Samarai/Murua, Woodlark	Oil palm development	Expansion Downstream processing
All districts	Cocoa/Coconut	Rehabilitation of cocoa/coconut plantations Exporting Downstream processing Marketing
All districts	Spice development	Vanilla, pepper, chili, nutmeg
Alotau	Livestock	Cattle farming (Midino, Rabaraba and Bolubolu Cattle Ranches) Marketing
Atoll Islands	Atoll Farming Projects	Research
MOROBE		
	Export commodities: coffee, cocoa, copra, vanilla	Improve production: cocoa (3000t/yr); coffee (5000t/yr); vanilla (1500t/yr)

	Food crop and livestock	<p>Improve production and utilization: rice (5000t/yr)</p> <p>Improve productivity of cattle in smallholders</p> <p>Increase small livestock numbers among smallholders</p> <p>Improve 25% of subsistence to semi-commercial</p>
	Management	<p>Improve skills, knowledge and resource capacity of extension staff</p> <p>Provide support facilities and services to foster agriculture production, processing and marketing</p> <p>Improve management of program, projects, and systems</p>
NEW IRELAND		
	Food security	<p>Farmer training: 2 training centers; 500 farmers trained</p> <p>Awareness and extension</p> <p>On-farm trials and applied research</p> <p>Staff training</p> <p>Germplasm, multiplication and breeding center</p> <p>Financial credit scheme</p>
	Increase household income	<p>Farmer training</p> <p>Awareness and extension</p> <p>Export commodities propagation centers</p> <p>On-farm trials</p> <p>Commodity processing and marketing</p>
	Increase gender participation in agriculture	<p>Gender training and recruitment</p> <p>Awareness and extension</p> <p>Gender credit scheme</p>
SANDAUN		
Aitape, Lumi, Nuku, Vanimo/Green	Cocoa and Coconut	<p>Training program</p> <p>Pod borer containment and eradication</p> <p>Smallholder rehabilitation</p> <p>Establish cocoa marketing depot</p> <p>Establish cocoa export company in Vanimo and Aitape</p> <p>Coconut extension/seed nut distribution</p>

Aitape, Lumi, Nuku, Telefomin, Vanimo/Green	Food security	Rice production and promotion Rice seeds multiplication and distribution Milling of rice Training programs Poultry development and training Poultry distribution for day-olds Vegetable development and training Inland fish farming/fish pond extension Cattle farm expansion Citrus/fruit trees development School nutrition program Livestock development (sheep and goats, piggery, rabbit) Wildlife monitoring
Aitape, Lumi, Nuku, Telefomin, Vanimo/Green	Spices	Training program Vanilla smallholder rehabilitation and development Establish 2 curing sheds/yr Establish vanilla marketing depot Establish and document vanilla export companies
Aitape, Lumi, Nuku, Vanimo/Green	Coffee	Establish coffee marketing depot Production and promotion Smallholder rehabilitation Farmer training Establish nursery
	Oil palm	New plantings of seedlings Plantation forest clearance Build factory and bulking station Develop Bewani Oil Palm Ltd
WESTERN HIGHLANDS		
Anglimp South Waghi, North Waghi, Jimi, Dei, Mul Baiyer, Hagen Central, Tambul Nebilyer	Coffee	Establish central nursery in 4 DPI centers for seed supply Rehabilitation and expansion Farmer training in rehabilitation Quality control and marketing Establish district cooperatives Production data collection from buyers, processors and exporters
Anglimp South Waghi, North Waghi, Mul Baiyer, Hagen Central, Tambul Nebilyer	Food crops (traditional staples, fruits and nuts, rice and wheat, citrus, English and sweet potatoes)	Vegetable production trial and distribute healthy planting materials Establish central seed multiplication gardens Pest and disease control Distribute certified rice seeds Train extension officers, farmers, NGOs Purchase and distribute 4 rice mills to 4 districts
Anglimp South Waghi, North Waghi, Dei, Mul Baiyer, Hagen Central, Tambul Nebilyer, Jimi	Apiculture	Identify farmers and stock honey etc (1 honey farmer/district x 7 districts) Purchase and distribute processing equipment Train farmers on bee keeping

Anglimp South Waghi, North Waghi, Jimi, Dei, Mul Baiyer, Hagen Central, Tambul Nebilyer	Aquaculture (carp, tilapia, trout)	Establish central breeding ponds (200m) in 13 subdistricts Establish production ponds Distribution of fingerlings Seeding of 2 rivers/district x 7 districts Advise farms on animal hygiene Treatment of infested animals
Anglimp South Waghi, North Waghi, Jimi, Dei, Mul Baiyer, Hagen Central, Tambul Nebilyer	Livestock (sheep, poultry, rabbits, ducks, piggery, goats)	Provide extension and free advisory services Assist marketing Train farmers
Anglimp South Waghi, North Waghi, Jimi, Dei, Hagen Central	Produce marketing	Collect data on agriculture and livestock activities in the province, plantations and estates (Commodity data base) Price information Construct market depots/warehouse at Banz
Anglimp South Waghi, North Waghi, Dei, Mul Baiyer, Hagen Central, Tambul Nebilyer	Spice and minor crops (chili, cardamom, ginger, turmeric, pyrethrum, floriculture)	Establish central seed multiplication gardens Distribute certified seeds/bud woods Variety trials Train extension officers, farmers, CBOs, NGOs, TOTs Advertising and promotion Secure markets
WEST NEW BRITAIN		
Talasea Kandrian	Food security (qty of nutritious food produced and properly prepared to rural population)	Introduce improved food crop planting materials Establish improved food crop planting materials demo garden
		Conduct awareness/mtg field days Introduce supplementary protein source, improved pig and poultry breeds Extension officers trainings Training on food preparation techniques Educate farmers on nutritional value of food and animals Farmers training on new pig breeds Piggery demo farms New rearing methods using village poultry Establish provincial nutritional committee
	Copra	
	Cocoa (Qty of cocoa dry beans sold; # of cocoa hybrid planting)	Purchase cocoa seeds/poly bags Establish cocoa nurseries Improve extension services Establish bud wood gardens Training on cocoa husbandry

	Vanilla (# of farmers involved in vanilla dev; qty and quality of dry beans sold)	Increase vanilla cuttings Multiplication gardens and plots Training on vanilla husbandry/processing grading Encourage farmer interest Increase success rate of pollination Ensure available markets
	Rice (# of farmers in the district growing rice; actual rice production annually)	Extension officers training on rice cultivation Purchase rice varieties to be distributed to farmers Farmers' training Awareness program Purchase additional rice mill machine
	Processing facilities (# of crop processing facilities constructed)	Establish credit facilities Supervise and monitor processing facilities construction Construction of storage facility
	Market establishment (markets for agric. Crops established)	Revive produce purchase advances Negotiate with stakeholders involved in marketing of agric. Commodities Revive farmers cooperative service
	Capacity building (no. of field visits and patrols conducted annually)	Purchase machinery and equipment Purchase required materials and equipment for training Conduct necessary agric. Surveys Purchase housing materials Maintenance and construction of extension officers houses Improve dialogue with stakeholders Training of extension officer District staff meetings Improve evaluation/monitoring systems
	Spices development (# of farmers involved in spice crops activities)	Identify farmers involving in spices crops Establish demonstrations and multiplication gardens Source markets Purchase planting materials