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**SUBSISTENCE FOOD PRODUCTION AND MARKETING
IN
PAPUA NEW GUINEA**

A research paper presented in partial fulfilment of the
requirements for the degree of Master of Philosophy in
Development Studies at Massey University.

by

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ABSTRACT

Agriculture is the main component of the economic sector of the Less Developed Countries (LDC's) of Asia, Africa and Latin America. In most of these countries, which includes Papua New Guinea (PNG), subsistence agriculture dominates despite the tremendous advances in agricultural technology elsewhere, especially in Developed Countries, in the course of the twentieth century. The characteristic feature of these subsistence farms is low productivity which means small, if any, production surplus over consumption, which results in very little trade between the agriculture sector and other sectors of the country. In LDC's, this has often led to declining food production and increased dependence on imported food as the bulk of domestic food supply is produced by the subsistence sector. In PNG, very similar trends are noted.

This paper examines some issues affecting smallholder agriculture and implications for increasing agricultural productivity in PNG. Specifically, the research problem and the focus of this study is firstly, how to increase subsistence food production and secondly, how to effectively move the rural surplus to urban consumers where it is required.

To increase productivity, LDC's are faced with two choices; extend land area under cultivation if land is available or improve agricultural technology if land is scarce. While PNG is relatively well endowed with land (more than four times the average for developing countries), much of the land is too mountainous to convert to arable land, with only less than 0.3 per cent of the land used for annual crops and grazing. The choice of strategy thus is determined by land.

This paper shows that the PNG government has under-invested in agriculture, particularly subsistence agriculture. Further investment in research and technology is required, focusing especially on their farming systems. Traditional farmers are not traditionalist by choice. Agricultural techniques have been developed over centuries, through years of accumulated experience of generations of farmers. Extensive literature in agriculture economics show that traditional farmers cannot normally adopt technological innovations unless the circumstances in which they operate are first changed.

The important role of marketing in economic development is also underplayed. It is a common fallacy to assume that markets when left to their own devices can lead to increased productivity and efficiency within the distribution system. Government intervention is also necessary in marketing to achieve social goals of self sufficiency in food production. This study attempts to demonstrate that given the right incentives, mostly institutional and technological, subsistence food production can be increased in PNG.

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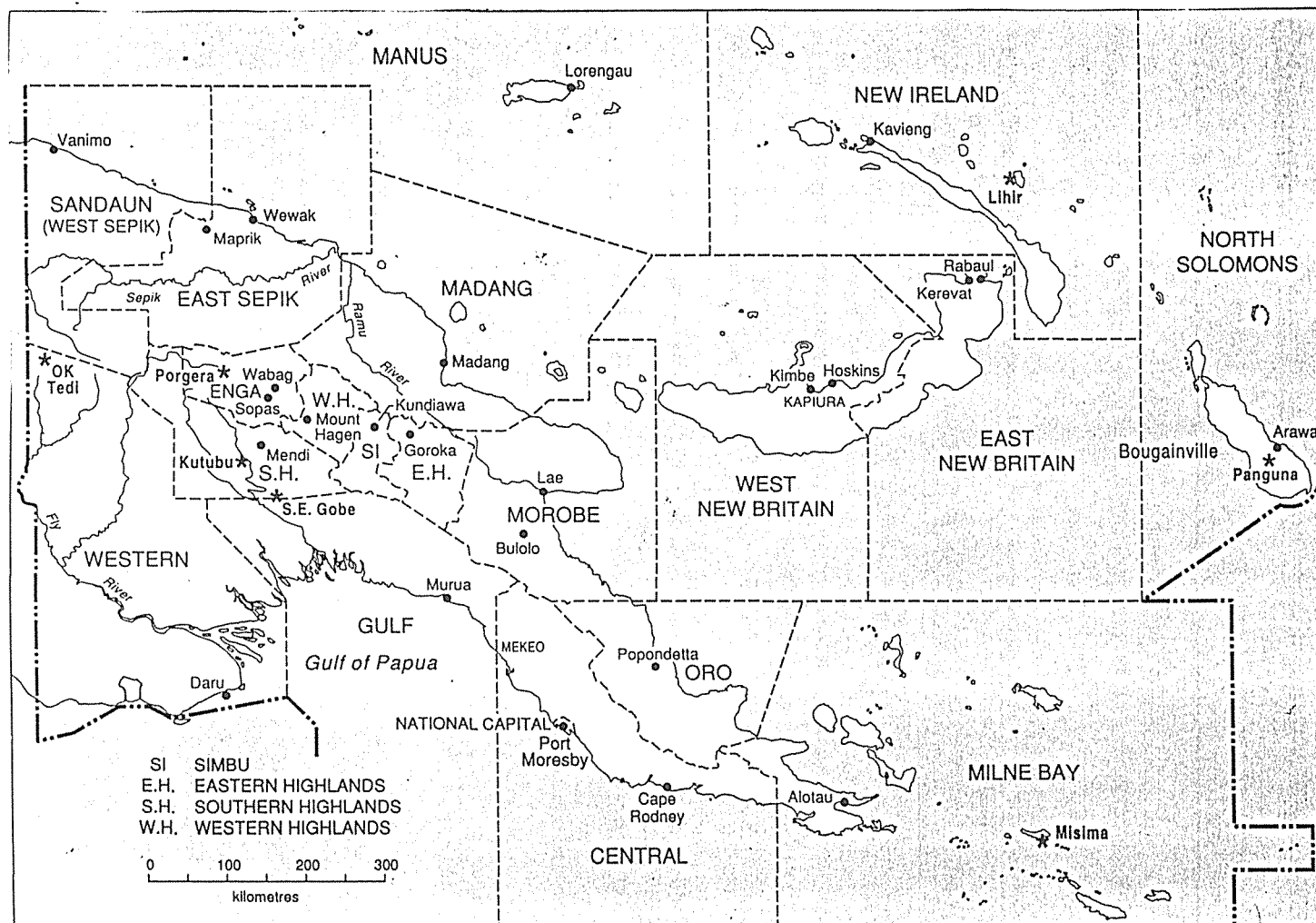
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LIST OF ABBREVIATIONS

| | |
|------|---|
| ADB | - Asian Development Bank |
| DC | - Developed Countries |
| FAO | - Food and Agriculture Organisation |
| FPDC | - Fresh Produce Development Company |
| FSR | - Farming Systems Research |
| IFAD | - International Fund For Agricultural Developemnt |
| LDC | - Less Developed Countries |
| NPO | - National Planning Office (PNG) |
| NSO | - National Statistical Office (PNG) |
| PNG | - Papua New Guinea |
| UNDP | - United Nations Developemnt Programme |

MAP OF PAPUA NEW GUINEA



CHAPTER ONE

INTRODUCTION

ECONOMIC GROWTH AND PERFORMANCE

PNG's economic performance in the 1960's was above average for developing countries. Since then, however, it has performed poorly, both in absolute terms and relative to other economies within the Pacific region (table 1) as well as outside the region (table 2).

Table 1. GNP Per Capita Real Growth Rates for Pacific Island Economies, 1989-90 in Percent

| Country | Growth Rate |
|------------------|-------------|
| Papua New Guinea | -0.5 |
| Solomon Islands | 3.4 |
| Fiji | -0.4 |
| Kiribati | 1.7 |
| Tonga | 1.5 |
| Vanuatu | 0.5 |
| Western Samoa | 1.2 |

Source: Commonwealth Secretariat, 1992

Table 2. Growth in real GDP per capita, Papua New Guinea, sub-Saharan Africa and all developing economies, 1965-86 (per cent per year)

| | 1965-73 | 1973-80 | 1980-86 |
|----------------------|---------|---------|---------|
| Papua New Guinea | 4.2 | -1.0 | -0.5 |
| Developing Countries | 3.9 | 3.1 | 1.5 |
| Sub-Sahara Africa * | 3.7 | 0.7 | -2.9 |

* Excluding S. Africa

Source: World Bank, World Development Report, New York, Oxford University Press, 1988.

Since the mid-1970's, three notable features emerge. Firstly, there has been slow economic growth despite large increases in export, especially mineral exports. Secondly, there is rapid structural transformation despite the slowness of growth. Thirdly, there has been aggregate decline in agricultural production, particularly food production despite increases in non-food agricultural production (table 3).¹

Since the 1960's, agriculture's share of GDP has declined from more than 40% to around 30% in the 1980's. According to the United Nations Food and Agriculture organisation, food production in PNG only grew by 24% compared to 36% for all developing countries, which represented a 7% decline for PNG, compared to 5%

1. Food includes traditional lines such as sweet potato, taro, yams, casava, bananas, coconuts and many others as well as introduced crops like potatoes, oranges, cole crop vegetables and other temperate crops.

increases for all developing countries, and 12% for all East Asian market economies. Subsistence food production has declined from more than one-quarter to less than one-seventh of total GDP and from nearly two-thirds of agricultural GDP to less than one-half of agricultural GDP.

Table 3. Food and agricultural production in PNG and other developing economies, 1975-86

| | Food | | All agricultural | |
|----------------------|-------|------------|------------------|------------|
| | Total | Per capita | Total | Per capita |
| Papua New Guinea | | | | |
| 1975 | 100 | 100 | 100 | 100 |
| 1980 | 109 | 95 | 113 | 98 |
| 1986 | 124 | 93 | 127 | 95 |
| All Developing * | | | | |
| 1975 | 100 | 100 | 100 | 100 |
| 1980 | 115 | 101 | 114 | 101 |
| 1986 | 136 | 105 | 134 | 103 |
| E.Asian Developing * | | | | |
| 1975 | 100 | 100 | 100 | 100 |
| 1980 | 116 | 103 | 116 | 104 |
| 1986 | 142 | 112 | 141 | 112 |
| Indonesia | | | | |
| 1975 | 100 | 100 | 100 | 100 |
| 1980 | 127 | 114 | 128 | 115 |
| 1986 | 168 | 135 | 169 | 135 |

* Excluding China

Source: FAO, Production Yearbook, Rome, 1986

Meanwhile the demand for food has increased rapidly in major urban areas. A review by ANZDEC Limited (1991) on the fruit and vegetable industry in PNG revealed a growth in demand of 11 percent per annum. From December 1987 to March 1991, total growth in demand increased by 38 percent. This figures only represents growth in the formal markets and does not include produce which goes through the informal (periodic) markets. A study by the Asian Development Bank (1989) noted that approximately twice as much produce flows through informal markets as does through formal markets (table 4, 5).

Table 4. Formal Market Demand for Introduced Fruit and Vegetables, March 1991 (tonnes).

| Commodity | Port Moresby | Lae | Other Centres | Total |
|------------------|-----------------|------|------------------|-------|
| Broccoli | 153 | 110 | 92 | 355 |
| Cabbage-English | 443 | 265 | 295 | 1003 |
| Cabbage-Other | 122 | 95 | 118 | 335 |
| Capsicum | 149 | 86 | 43 | 278 |
| Carrot | 253 | 135 | 155 | 543 |
| Cucumber | 110 | 47 | 49 | 206 |
| Lettuce | 255 | 105 | 91 | 451 |
| Onion | 1900 | 432 | 404 | 2736 |
| Other Vegetables | 468 | 226 | 336 | 1131 |
| Potato | 3801 | 1149 | 2313 | 7262 |
| Pumkin | 131 | 71 | 111 | 313 |
| Tomato | 349 | 139 | 54 | 542 |
| Not Specified | 114 | 74 | 90 | 278 |
| | 8349 | 2934 | 4150 | 15433 |

Source: ANZDEC Limited, "The Fresh Produce Development Company: Papua New Guinea", Auckland, 1991.

Table 5. Formal Market Demand for Introduced Fruit and Vegetables, December 1987 (tonnes).

| Commodity | Port Moresby | Lae | Other Centres | Total |
|------------------|-----------------|------|------------------|-------|
| Broccoli | 3 | 32 | 6 | 41 |
| Cabbage-English | 478 | 198 | 129 | 805 |
| Cabbage-Other | 155 | 8 | 33 | 197 |
| Capsicum | 64 | 13 | 8 | 85 |
| Carrot | 326 | 128 | 94 | 548 |
| Cucumber | 89 | 33 | 14 | 136 |
| Lettuce | 113 | 77 | 35 | 225 |
| Onion | 783 | 789 | 663 | 2235 |
| Other Vegetables | 235 | 208 | 112 | 555 |
| Potato | 3020 | 1742 | 293 | 5055 |
| Pumkin | 110 | 64 | 26 | 200 |
| Tomato | 213 | 56 | 34 | 303 |
| Not Specified | 473 | 332 | 159 | 964 |
| | 6072 | 3564 | 1570 | 11206 |

Source: ANZDEC Limited, "The Fresh Produce Development Company: Papua New Guinea", Auckland, 1991.

SUBSISTENCE FOOD PRODUCTION

The bulk of food in PNG is produced by the 85% of the population that are rural based. These subsistence producers currently produce non-food cash crops for their monetary requirements while remaining self sufficient in food production.² Several studies

2. Household consumption includes production utilized as feed for livestock. In some areas where pigs are important for prestation, production is planned according the feed requirements. See Yen, E.D., 1980, "Other Infrastructure Developments" , Ward, R.G. and Proctor, A. (eds) in South Pacific Agriculture; Choices and Constraints, Australian National University, Australian National University Press , Canberra.

have been conducted on subsistence food production and marketing in PNG. These studies indicate that very little production surplus is available to these producers which is then sold occasionally in nearby periodic markets (Shaw, 1985; Epstein, 1983; denseley, 1977). This surplus is inadequate for the urban consumers, who meanwhile have to depend on imported food. According to the National Planning Office (1980:19) approximately three quarters of the food consumed in Port Moresby was imported. This trend is similar in other urban centres and has not changed much in recent years. Jarrett and Anderson (1989) noted a steady growth of 4% in food imports since 1975. ³

Similar studies have been carried out in other Pacific Island economies (Eele, 1978; Bathgate, 1978 in the Solomons ; Tafatu 1978; Walsh, 1974 in Niue; Bonnemaïson, 1978 in Vanuatu and New Caledonia; Wai, 1987 in Western Samoa and Thaman, 1978 in Tonga). Some have focused on production and marketing (Chandra, 1978; Bollard, 1978) while others have focused broadly on traditional agriculture and urbanisation in the Pacific (Fisk, 1978). These studies indicate that food problems faced in PNG are similar to those faced by other economies in the Pacific and are brought about by increased urbanisation and population growth in the region.

3. Some food will have to be imported due to the preferences of different segments of the market especially the large expatriate population.

In PNG, there is very strong evidence that subsistence food producers will respond to this shortfall given the right incentives. A study of eight highlands villages concluded that villagers in this survey had a very strong desire for cash and little interest to supplement their diets with subsistence crops (Harris, 1975). Similar conclusions were reached by Kern et al. (1984) in studies in four provinces where villagers indicated preference for cash, markets and infrastructure. The Food and Agriculture Organisation/United Nations Development Programme (1983) also commented that most demands from rural areas were for better roads, improved communications and higher incomes for agricultural crops.

RESEARCH FOCUS AND OBJECTIVES

Declining food production, especially subsistence food production is of concern to the PNG government. Many politicians and other leaders in PNG believe it is morally wrong or shameful for the country to import food. Several reasons are noted as important for rapidly increasing food production in PNG.

Firstly, for self sufficiency in food production. This is particularly important for domestic staples including fruit and vegetables which are currently being imported but can be produced by smallholder producers.

Secondly, it is important for foreign exchange savings and creation of rural employment. According to the National Planning Office (1982), formal employment is unable to absorb more than 10 percent of the economically active population entering the labour market each year. This will require an increasing amount of agricultural and rurally-based income-earning opportunities.

Thirdly, increased production will lead to higher incomes and improved standards of living which results in enlarging the domestic market for local products. Finally, neglect of the rural poor may lead to unrest and violence as evidenced by the present high social tensions and crime rates.

The research objective is to determine the implications for increasing subsistence food production in PNG. More specifically, the first part of the paper seeks to explain why food production is important to PNG's economic growth and attempts to show how food production may be increased and sustained. The second part of the paper considers the food distribution system in PNG, particularly food marketing problems at macro (country) and micro (smallholder) level to determine how the rural food surplus may be effectively moved to urban consumers where it is required. This paper will determine whether adequate resources are being committed by the PNG government, in terms of production and marketing incentives, to increase smallholder food production in PNG.

SCOPE AND LIMITATIONS

National development goals and agricultural strategies are expressed through national policies and implemented through policy instruments (taxes, credit, subsidies, and so forth) which affect the production process in a variety of ways and the specific agro-industries or sectors. These macro policies can be grouped together in the following categories: fiscal (revenues and expenditure), monetary (credit and interest), trade (foreign exchange and import/export control), and income (prices and wages).

The implications of each of these policies are important in determining an overall agricultural development strategy, especially to increase food production. They can alter access to inputs and markets, costs and types of inputs, competition and prices. These macro-policies, however, are not discussed because they are beyond the scope of this paper.

This study focuses only on fiscal policies, particularly public investment decisions to increase agricultural production in PNG.

STRUCTURE AND ORGANISATION

Why is agriculture important? The most important reason is its contribution to industrialization. Industrialization is one

objective of every developing country. A characteristic feature of developed and developing countries is the relative position of agriculture and industry in their economies. In developing countries agriculture generally accounts for the major proportion of national income, employment and exports, while manufacturing and other industries play as yet a small part in the economy. In developed countries, the position is reversed, and the non-agricultural sector predominates.

Because of the diminishing relative importance of agriculture as development progresses, there has sometimes been a tendency to identify economic development with industrialization and to devote insufficient resources to the agricultural sector. However, it has increasingly been realized that agriculture and industry are mutually dependent. In the 1960's, experience in a number of developing countries demonstrated that a lagging agricultural sector may jeopardize industrialization and overall growth within the economy.

The reason is attributable to the multifaceted role agriculture plays in providing requisite resources for economic growth in less developed countries. Among other reasons, healthy agricultural development can reduce poverty, provide food and earn necessary foreign exchange. It employs more people than other industries, often up to 60 to 70 percent and or more. By contrast agriculture employs less than 10 percent of the workforce in developed countries.

The role of agriculture in economic development is broadly examined in chapter 2. I have used Taiwan as a country case simply to illustrate forward linkages with other sectors of the economy. In addition, Taiwan is one of the few successful developing countries to undertake a comprehensive national effort to develop food production and achieved food self sufficiency leading to exports of the surplus. Much of this increase was achieved through investment in agricultural technology as much of Taiwan's land area is mountainous and not readily accessible to farming (excluding forestry) as is the case in PNG. It achieved high economic growth rates based on agriculture. Resource inflow into the agricultural sector, while also important for agricultural development, is not discussed in this paper.

Having noted why agricultural production, particularly food production is important for a country's development aspirations, we will consider why food production in PNG has declined. Chapter 3 examines some of these reasons.

How may subsistence food production may be increased? Chapter 4 looks broadly at the economics of traditional farming and considers the implications for expanding subsistence food production.

Available evidence suggests that traditional farmers cannot normally adopt technological innovations unless the circumstances in which they operate are changed first (Shultz, 1964; Mellor,

1978, Arnon, 1981). Chapter 5 looks at PNG government's efforts to increase smallholder productivity by examining investments in research and extension.

Chapter 6 looks at future directions in research and extension. It focuses on Farming Systems Research (FSR) as an appropriate means of transferring technology to smallholders.

Chapter 7 examines government intervention in the form of public investments in marketing and considers implications for developing a efficient food marketing structure within the country.

Chapter 8 focuses on smallholder marketing problems and considers possible solutions.

PNG's declining food production problems are not unique. One of the major problems of development is to tap an increasing rural food surplus from an agricultural sector which is declining , if not absolutely, then at least in terms of per capita. Chapter 9 examines how other developing countries achieved food self sufficiency. It examines four country cases, each with a large rural based population and considers the programmes used to increase food production.

In Chapter 10 it will be shown that an agricultural development strategy should focus on agricultural research leading to

farming practices; extension; assured markets; and input supplies for farmers.

Chapter 11 attempts to consolidate all these information into a policy framework with specific policy tasks and programmes that may be used to increase subsistence food production in PNG.

CHAPTER TWO

THE IMPORTANCE OF AGRICULTURE IN ECONOMIC
DEVELOPMENT

INTRODUCTION

Agriculture's role in economic development ⁴ is central because most people in developing countries make their living from the land. To improve the welfare of the majority of the people, it is imperative to increase the farmers productivity in growing food and cash crops and the prices they receive for those crops. Most developing countries must rely on their own agricultural sector to produce the food consumed by their people, although there are exceptions like Saudi Arabia and Malaysia, with large natural

4. There are a number of good studies that treat the role of agriculture in development including John Mellor, *The New Economics of Growth* (Ithaca, N.Y.: Cornell University Press, 1976), and his *The Economics of Agricultural Development* (Ithaca, N.Y.: Cornell University Press, 1966); Bruce Johnston and Peter Kilby, *Agriculture and Structural Transformation* (London: Oxford University Press, 1975); and Lloyd Reynolds, *Agriculture in Development Theory* (New Haven, Yale University Press, 1976)

resource-based exports and foreign exchange necessary to import much of their food. Farmers in developing countries must produce enough to feed themselves as well as the urban population. Hence, as the proportion of urban population rises, the productivity of the farmers must also rise. If productivity does not rise (and in the absence of food imports), the terms of trade will turn sharply against the industrial sector, cut into profits and eventually bring growth to a halt. ⁵

THE ROLE OF AGRICULTURE IN ECONOMIC DEVELOPMENT

In many developing countries, agriculture has been neglected by policy-makers and planners on the assumption that all, or most, of their available resources should be devoted to development of industry. Experience in a number of developing countries has shown that development is not likely to occur if agricultural productivity is not increased as a prelude to industrial growth. Agriculture makes substantial contributions which enables economic growth on a wide front. Some of these contributions are outlined.

5. For a good discussion on the important relationship between the industrial sector and the agricultural sector see; Gee, M., 1990, *"Economics of Development"*, Yale University Press, New Haven. Pg:41-46

FOOD PRODUCTION

It has been noted that agriculture should increase food-production to improve existing nutritional levels, in terms of both quantity and quality, for a rapidly increasing population. Whenever sufficient food is not produced to feed the rapidly expanding urban populations, it will have to be imported, with a resultant drain on foreign exchange and increased inflationary pressures (Arnon, 1981). Food imports to developing countries have shown a consistent trend to increase. In the 1970's, food imports to Latin America increased by 17%; Africa, 88%; Near East, 147% and Far East, 18% (FAO, 1979). A large part of these imports are cereals.

Japan was able to increase food production, within 30 years, at a rate which was high enough to outstrip the growth-rate of the population, achieving an increase in per capita food supply by over 20%, and in output per farm worker by 106% (Johnston, 1951). Taiwan's population increased threefold from 1905 to 1965 and was twice as rapid as that of Japan. The supply of food and fibres, however, continued to grow to support this growth including urban population growth, thus preventing increased dependence upon food imports (Johnston and Kilby, 1966). Farm production more than kept pace with demand and surpluses accumulated to permit an expansion of farm exports since the 1970s (Myers, 1985).

RURAL EMPLOYMENT

Agriculture also provides employment for a rapidly expanding rural population. Myrdal (1965) showed that industry is unable to absorb all underutilized labour force during a period of incipient industrialization. Therefore, any increase in population growth will have to be supported by agriculture for some time.

In Taiwan, its rural population growth rate nearly trebled over the sixty years from 1905 to 1965. However, the rural sector appears to have retained most of its own increase, at least until the 1960's. Since the 1970's "a substantial shift of rural labour to cities took place" (Johnston and Kilby, 1966:71).

SOURCE OF FOREIGN EXCHANGE

If one treats foreign exchange as a separate factor of production, agriculture also plays an important role. Most developing countries have large natural resources and agricultural products which are exported to earn necessary foreign exchange. In only a few cases, is the export of manufacturers or of services, the principle source of foreign exchange for a nation in the early stages of modern economic growth. Thus, unless a nation is rich in natural resources such as petroleum or copper, the agricultural sector will play a key role in providing foreign exchange with which to import capital

equipment and intermediate goods that cannot be produced at home. In many developing countries, tropical agricultural crops such as coffee, cocoa, copra, rubber, tea, palm products, bananas, sugar, account for the bulk of commercial agriculture. These crops usually constitute "small islands of market-orientated production", surrounded by stagnating peasant economies (Buchanan, 1971:82). However, in some countries food production has increased sufficiently to enable export.

In Taiwan, the total value of exports increased tenfold between 1910 and 1940, declining slightly during the war and increasing thereafter, though the war did not affect Taiwan much. Agricultural exports provided around four fifths of total exports. These crops were "rice, sugar, pineapple, banana, camphor and tea" (Lee, 1971:143).

While earning necessary foreign exchange, exports can also stimulate agricultural development. In the early 1920's, when only 30 percent of the population was living outside agriculture, "exports of food contributed approximately 105 million Taiwanese dollars or twice as much to farm cash earnings as did domestic sales" (Myers, 1985:29). Sales to foreign markets thus lifted the ceiling on output expansion that otherwise would have been imposed by the small proportion of the population in the nonfarm sectors. In 1921-25, for example, "without exports total agricultural production would have been some 45 percent lower than it actually was" (ibid: 29).

The relative contribution of the agricultural sector in net national product, however, declined from "40 percent in 1953 to 25 percent in 1964 due to faster growth in other sectors such as industry and mining" (ibid: 31). Agriculture is both the largest and the slowest growing sector of an underdeveloped economy. The optimal net flow of resources will, over the long run, be from agriculture to those sectors where the growth potential and returns on investment are higher. ⁶

SUPPORTING INDUSTRIAL DEVELOPMENT

Agriculture supports industrial development and contributes in three different ways (Malassis, 1975). Firstly, it provides raw materials for certain industries. Local production of raw materials for its own industry can give a country a great comparative advantage over those industrial countries which have to import their raw materials. ⁷ The textile industry is a case to the point. In Latin America, nearly 60% of its manufacturing is from industries that use mainly agricultural raw materials (Jones, 1971).

6. Investments in agriculture can be high sometimes. The social profitability of investment in irrigation, storage, and transport facilities were shown to increase in Taiwan at the onset of the seed-fertilizer revolution.

7. This argument applies to raw materials that can be produced cheaper than import prices.

Secondly, it contributes labour to industry. In LDC's, 70 percent or more of the population is in agriculture and the rural sector is the only source of increased labour power for the urban sector. Labour can be imported and there is usually population growth within the urban sector itself but neither of these sources are likely to be sufficient for the long term needs of economic growth.

Restrictions on the movement of labour out of agriculture to other sectors can curtail economic development as was the case in Russia in the mid-nineteenth century. Serfs were tied to their lord's land by law and hence were not free to move to the cities and into industry. Thus Russia did not begin to grow rapidly until after the serfs were freed (Gee, 1990).

Thirdly, the agricultural sector can also be a major source of capital for modern economic growth. Capital comes from invested savings and savings from income. Some authors have even suggested that agriculture is the main or even the sole source of capital in the initial stages of development but this overstates agriculture's role.⁸

8. It should be noted that in some poor countries, over half of GNP is provided by non-agricultural sectors (industry and services) and imported capital (aid or private investments) does contribute to a substantial share of domestic capital formation without drawing on the agriculture sector at all. South Korea is a case to the point.

In Taiwan, agriculture's gross transfer of resources to other sectors composed of taxes, voluntary savings, payments of rent and interest. To this was added invisible transfers which derived from a rise in the average price of non-agricultural products purchased by farm households relative to the average price of goods they sold. "Up until 1940, some three quarters of the funds transferred out of agriculture, consisted of land rent and interest payments following land reform. During the 1960's, with the income of farm households sharply up, voluntary savings became the major vehicle for intersectoral financial transfers" (Johnston and Kilby, 1975:256). The net resource outflow from agriculture represented slightly over "30 per cent of the total value of agricultural production in 1911-15" and "21 per cent in 1931-35 by which time the real value of the sector's output had increased more than two and one-half times" (ibid:258).

Finally, the rural sector of a developing country is, in some cases at least, an important market for the output of the modern urban sector. The demand for manufactured goods can be divided into two categories.

The first includes capital equipment like cultivation implements, pumpsets, and transport and intermediate inputs such as fertilizers, fuel and cement. The second includes consumer items and includes processed food and consumer durables such as an air conditioner, a car and a television set for the larger farmer; for a smaller farmer, comparable items may be an electric fan, a

bicycle and a transistor radio (Mellor and Lele, 1970:306).

A qualification has to be added in some cases because farm population in some LDC's purchase very little from modern industry. This is most likely where there is an extremely unequal distribution of income, land and other wealth. These are often controlled by the small urban and rural upper classes. In that situation, the rural population may simply pay taxes and rents and subsist on what is left over.

If income is more equally distributed, the rural sector can be an important source of demand for industrial products. If a large rural market exists, industries can continue to grow after they have saturated urban demand for their products and do not have to turn to foreign markets until they are better able to compete.

SUMMARY

Agriculture plays a very important role in the economic growth of underdeveloped countries at least at the initial stages of development. While qualitative measurement of agriculture's contribution to economic growth are limited, due to as Simon Kuznets (1966:236-56) pointed out, conceptual and empirical difficulties of measuring agriculture's contribution because of the complex interdependence between agriculture and other sectors of the economy, evidence in Taiwan does indicate agricultural

development was very important in the expansion of its foreign trade and national income. This was all achieved without declining per capita food consumption despite increased population growth during this period. Its efforts in increasing food production for export and domestic consumption are clearly remarkable, given the stagnant or even declining situation in most developing countries.

Considerable resources were also being transferred, both into and out of agriculture but mostly from the agriculture to other faster growing modern sectors of Taiwan's economy. Agriculture contributed labour towards industry especially after the 1960's. It provided employment and sustained the rapid increase in population growth since the 20th century, thus supporting industrialization. In an age when agriculture has generally tended to stagnate in most developing countries, Taiwan's rural economy appears to have contributed significantly to its long-run economic development.

However, it should also be noted that its colonization by the Japanese and consequential adoption of the Japanese unimodal approach to agricultural development, plus its proximity to the Japanese market, appear to have heavily influenced healthy agricultural development and hence, economic growth.

CHAPTER 3

AGRICULTURAL GROWTH AND PERFORMANCE

INTRODUCTION

Economic development invariably involves increasing specialization not only by product but more so by productive task. Thus it is essential for producers to grow a surplus of food to be sold at reasonable prices to a growing number of individuals, who can no longer meet their own food requirements by household production but instead produce specialist goods and services. The overall rate of economic growth in many developing countries largely depends on the degree to which the agricultural sector is ready to supply food in order to sustain an increasing number of specialists.

In Papua New Guinea, the government is concerned about the overall poor performance of the agricultural sector. In particular, the government is worried about the lack of growth in the staple food sector and the increasing reliance of the country

on imported food.⁹ Jarrett and Anderson (1989) noted that in recent years, food has accounted for one-fifth of PNG's merchandise imports and the volume of imports has been growing at about 4% since 1975.

This chapter seeks to explain why agricultural production has declined. In particular, it seeks to explain why food production per capita has declined. These questions are important because of the agricultural sector's dominance of PNG's economy as an employer and main source of food, particularly domestic staples. Through inter-sectoral links, what happens in agriculture will be reflected in other sectors and vice versa.

STRUCTURAL TRANSFORMATION

Prior to the 1970's, PNG was a dualistic economy with over 90% of the population involved in subsistence agriculture. The monetized part of the economy comprised a small enclave of foreign owned large-scale plantations. The 1962 United Nations visiting mission expressed their concern and stated:

" New Guinea lacks the basic framework necessary to support a modern economy. Its resources are only partly known and it lacks transport

9. Food policy is an emotional issue in PNG. Sir Julius Chan (1984:8) said the proportion of food imports to total imports should be a source of shame for all Papua New Guineans.

facilities, such as roads, bridges and port installations. Its economy is still based on two or three export crops, and large quantities of food still have to be imported. The money income of the population does not provide an internal market of any size and consequently internal industries do not exist on any appreciable scale. Finally, the people themselves do not have the educational background to provide the skilled personnel to grow the crops efficiently, to conduct the marketing, credit and business institutions and to carry out the research, planning and direction demanded in a modern economy (World Bank Report, 1962:10).

In recent years, much of this situation has changed. Fisk (1964) and Jarrett and Anderson(1989) noted increased monetization of the agricultural sector, particularly the smallholder export sector which has expanded considerably. How does one then account for the rapid decline of agriculture in GDP in PNG despite this expansion? Agricultural production is generally expected to decline relatively as resources are shifted out of agriculture into other sectors and as international prices for agricultural products relative to non-agricultural products decline over time as the world economy grows. In slow growing economies like PNG, this decline is expected to be gradual. Why is this decline rapid in PNG?

The reason is not attributable to an expanding manufacturing sector but to expanding mineral exports (Jarrett and Anderson, 1989). This has meant increased export earnings and increasing inflow of foreign funds (project construction) which has boosted the real value of the kina which means the government and private

exporters have more to spend. An increase in income leads to an increasing demand for services. Lluch, Powell and Williams (1977); Kravis, Heston and Summers (1983); Theil and Clements (1987) show that the income elasticity of demand for services (which make up the vast majority of non-tradables) is well above unity in developing countries and tending to converge towards unity as income grows. This means the demand for tradeables (manufactured goods) as well as agricultural products will grow at a slower rate than non-tradables. This results in the price and quantity of services to increase substantially while the demand for manufactured goods and agricultural products declines despite increased productivity. This is evidenced by increases in volume of export crops (table 6) particularly smallholder volume (table 7).

Thus, the boom in mineral exports in PNG has led to a faster decline in agriculture's share of total GDP than normal in slow growing economies like PNG's. Meanwhile, subsistence food production per capita has declined (Table 8) despite expansion in smallholder export crop production. We will consider models of inter-sectoral linkages for explanations.

INTERSECTORAL LINKAGES

By postulating the theory of comparative costs, Ricardo demonstrated (in his attempt to repeal the corn law as a

precondition for free trade) that the cost of food in Britain was the crucial determinant of the cost of production and a distribution of income consistent with the requirements of economic growth. The morale of Ricardo's theory was that food production must be tackled first as the basis of development of other activities. This led to the classic rural-urban linkage model.

Table 6. Major exports by volume, 1986-94 (in '000 tonnes unless otherwise stated)

| | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 |
|-------------|------|------|------|------|------|------|------|------|------|
| Minerals | | | | | | | | | |
| Gold | 36.5 | 34.6 | 35.4 | 31.3 | 31.4 | 54.1 | 55.2 | 49.8 | 50.9 |
| Copper | 181 | 210 | 222 | 209 | 173 | 232 | 209 | 201 | 204 |
| Silver | - | - | - | 74.6 | 155 | 239 | 256 | 282 | 236 |
| Oil(bbls) | - | - | - | - | - | - | - | 31.3 | 29.2 |
| Agriculture | | | | | | | | | |
| Coffee | 53.1 | 64.8 | 44.8 | 79.6 | 60 | 50 | 57 | 59.3 | 61.7 |
| Cocoa | 31.9 | 34.4 | 37.1 | 46.2 | 35 | 34 | 39.9 | 41.9 | 44 |
| Copra | 93 | 84.1 | 76.8 | 71 | 60 | 35 | 35.4 | 35.7 | 36.1 |
| Copra oil | 41.1 | 40.2 | 36.3 | 37.1 | 35 | 31 | 32.6 | 34.2 | 35.9 |
| Palm oil | 129 | 97.3 | 103 | 136 | 160 | 165 | 207 | 218 | 229 |
| Rubber | 5 | 3.7 | 4.5 | 4.5 | 3.2 | 2.4 | 2.5 | 2.7 | 2.8 |
| Tea | 5.3 | 5.6 | 5.8 | 5.8 | 6.5 | 5.8 | 6.1 | 6.4 | 6.7 |

Source: Papua New Guinea, 1992 Budget Papers, Vol.2, 1991.

Myint (1966) showed that a rural sector with exporting peasants was different. Part of the rural sector produces food for the peasant export sector as well as the urban sector in exchange for manufactured goods from the urban sector and the foreign sector.

Table 7. Smallholder export crop production, 1969-83 (per cent of value)

| | Cocoa | Coffee | Copra | Oil Palm | Rubber |
|---------|-------|--------|-------|----------|--------|
| 1969-72 | 28 | 72 | 35 | 0 | 1 |
| 1973-76 | 39 | 74 | 42 | 65 | 5 |
| 1977-80 | 52 | 69 | 47 | 61 | 13 |
| 1981-83 | 64 | 71 | 55 | 52 | 16 |

Source: PNG National Statistical Office, Goldthorpe, C.C., 1985, Plantation Agriculture in PNG, INA, Port Moresby.

Table 8. Share of subsistence food production in GDP and in private expenditure, 1961-1980 (per cent value)

| | Agricultural GDP | Total GDP | Total Private expenditure |
|---------|---------------------|--------------|------------------------------|
| 1961-64 | - | - | 46 |
| 1965-68 | 63 | 26 | 42 |
| 1969-72 | 63 | 24 | 38 |
| 1973-73 | 57 | 18 | 34 |
| 1977-80 | 41 | 14 | 26 |

Source: PNG National Statistical Office

In the second model, intrarural specialization is a necessary condition whereby cash crops are produced for export and food is produced for domestic consumption. The basic unit of production in PNG is the rural household or smallholder which produces food

for self consumption. A part of the produce is exchanged for cash to supplement income from export crops while the smallholder-export sector produces non-food export crops to procure imported consumption goods.

Ganguli (1981) noted that this intrarural specialisation is not happening in PNG. The efficiency of the production system in PNG as well as other Pacific Island economies enables producers to move in and out of production depending on returns to labour (Shaw, 1985; Castle, 1980). Thus, the subsistence sector basically remains self sufficient in food production, while supplementing their diets with imported food through income earned from export crops and occasional food surpluses. Harvey and Heywood (1983) showed evidence of this in parts of the Simbu Province.

Substantial agricultural economics literature is available on the linkages between subsistence and cash activities. Various studies show that the impact of cash activities on subsistence production (and vice versa) depends on returns to subsistence labour in relation to those available from farm and wage activities yielding cash (Schultz, 1964; Livingstone, 1977; Nakajima, 1969; Fisk and Shand, 1969). In PNG, Stent (1984) shows evidence of this with the Abalam (East Sepik).

Shaw (1985) argued that the vast majority of the population in PNG now face choices which (to a varying degree), include

subsistence production-consumption, as well as cash earning opportunities in as well as out of the village. As subsistence food production is more labour intensive compared with the export tree crop sector and manufacturing sector, any additional unit of labour allocated to food production must be remunerative, given the high wages structure in PNG. This places a premium on labour and results in very high labour costs (Table 9) relative to labour productivity in agriculture (Fallon, 1992).

Meanwhile, the urban sector is basically a nonproductive sector serving as an administrative and distributive centre. Its production sector is one of processing or assembling with imported inputs and capital. The urban centres serve as enclaves for export and are highly import-intensive. The urban salaried public servants and workers generate demand for imports including food from the government expenditures.

Lam (1978) concluded in his study of the Port Moresby market that increases in minimum wages and real wages were responsible for food price increases since the 1970's. This is supported by Ganguli (1981) who showed that foods produced by the subsistence sector are perishable and face competition from tradeable substitutes such as canned and dried fruit and vegetables and rice for sweet potato or taro. This forces their prices to move in line with these substitutes rather than independently of them. In a technologically static environment, an equilibrium is established. Shultz (1964) demonstrated that the subsistence

Table 9. Land and Labour productivity in agriculture, Papua New Guinea and other developing countries, 1970-85 (1970 = 100)

| ----- | | |
|---------------------|-------------------------|-------------|
| Agricultural Output | | |
| | Per agricultural worker | Per hectare |
| ----- | | |
| Papua New Guinea | | |
| 1970 | 100 | 100 |
| 1975 | 104 | 111 |
| 1980 | 110 | 124 |
| 1985 | 118 | 140 |
| All Developing | | |
| 1970 | 100 | 100 |
| 1975 | 106 | 112 |
| 1980 | 111 | 127 |
| 1985 | 122 | 149 |
| Indonesia | | |
| 1970 | 100 | 100 |
| 1975 | 118 | 118 |
| 1980 | 146 | 153 |
| 1985 | 185 | 168 |
| Malaysia | | |
| 1970 | 100 | 100 |
| 1975 | 125 | 127 |
| 1980 | 145 | 149 |
| 1985 | 173 | 178 |
| ----- | | |

Source: FAO, Production Yearbook, Rome, 1986

producer is economically rational and is efficient in reaching this equilibrium. Jarrett and Anderson (1989) noted that increases in domestic food production (supply) will result in reduced demand, thus affecting returns to labour. Low food

surplus, coupled with an high population growth (2.3 percent), particularly urban growth rates (over 5 per cent), has led to declining per capita food production in PNG.¹⁰

In sum, rural and urban linkages, forward and backward, do not emerge, whereas the commanding linkage in the domination of the foreign sector over the domestic economy as a whole (Sawyer, 1981; Baxter, 1977; Amarshi, Good and Mortimer, 1979; Donaldson and Turner, 1978; Fitzpatrick, 1978; and Ganguli, 1981).

SUMMARY

The structure of the economy makes PNG heavily reliant on agriculture. The agriculture sector supports about 85 per cent of the population and accounts for about 30 per cent of GDP. Cash cropping constitutes about 55 percent of total agriculture with the remainder being subsistence agriculture. As already noted, agriculture's share of GDP is expected to decline while there is a boom in mineral exports as resources move from the tradables to the non-tradables sector. Thus the agricultural sector is destined to grow less rapidly than it otherwise would. For this

10. For the population figures see Walsh, C., 1992, "Circular migration in Melanesian Towns" Institute of Development Studies, Massey University.

reason, agricultural productivity growth has to be substantially greater than other sectors of the economy to offset the decline in the relative price of agricultural goods.

The focus therefore, should be on improving the productive capacity of smallholder agriculture, both export crops and food crops. Because mineral resources are non-renewable, it is imperative that policy makers have in place structures to increase the productive capacity of the agricultural sector, through utilizing the benefits from the windfall in mineral exports. Improving the productive capacity of the agricultural sector will lead to higher agricultural incomes and strengthen forward and backward linkages. Elek (1991) showed evidence of this approach in the East New Britain and North Solomons Provinces. These provinces have enjoyed relatively high rural incomes as well as high standards of education and health.

CHAPTER 4

THE ECONOMICS OF TRADITIONAL FARMING

INTRODUCTION

"The man who farms as his forefathers did cannot produce much food no matter how rich the land or how hard he works. The farmer who has access to and knows how to use science knows about soils, plants, animals and machines can produce an abundance of food though the land may be poor" (Shultz, 1964a:3).

This statement by Theodore Shultz in his *Transforming Traditional Agriculture* attempts to explain the characteristic features of traditional agricultural farming and implications for expanding food production. Studying the economics of traditional agriculture involves finding out why there has been low productivity and slow growth by examining how technological, economic and institutional variables affect traditional farming. It provides economic explanations for the continuing existence of traditional farming in PNG as well as other Less Developed Countries. This chapter, while not strictly confined to PNG basically follows the Schultz-Mellor model for investment in research and technology as PNG has very little land of

agricultural use (excluding forestry). It examines available empirical evidence to determine whether the traditional farmer is economically rational in terms of allocative efficiency, and considers the implications as well as means for increased agricultural production.

TRADITIONAL AGRICULTURE

We have noted the importance of expanding agricultural production. Agriculture plays a multifaceted role in the economic development of a country. Expanded agricultural production may provide food and other consumption goods as well as raw materials, unskilled labour, foreign exchange and capital investments and serve as a product market for the non-agricultural sectors.

To increase productivity, LDC's are faced with two choices; extend land area under cultivation if land is available or improve agricultural technology if land is scarce. While PNG is relatively well endowed with land (more than four times the average for developing countries), much of the land is too mountainous to convert to arable land, with only less than 0.3 per cent of the land used for annual crops and grazing.

It is necessary at this stage to distinguish between two basic types of agriculture in the world today. The first type comprises

the 'highly efficient agriculture' of developed countries where substantial productive capacity and high output per worker permits a very small number of farmers to feed entire nations. This is contrasted against the "inefficient and low productivity agriculture" of developing countries where the agricultural sector can hardly sustain the farm population, let alone the increasing urban population, even at minimum level of subsistence (Todaro, 1983:257).

The basis for this comparasion is much debated by various authors, most prominently Shultz (1964) and Mellor (1969) among others, who consider the peasant as behaving in a economically rational manner and efficiently allocating limited resources in a static physical, economic, and cultural enviroment. Within this school, there are those like Balough (1966); Lewis (1965); Dalton (1967); Boeke (1967) among others who feel that non-economic (cultural, institutional) forces weigh more heavily against economic forces. ¹¹

TRADITIONAL FARMERS

What is traditional agriculture and who is the traditional

11. For further discussions on cultural and institutional restraints see Balogh, J., 1966, *The economics of Poverty*, Weiden & Nicolson, London.

farmer? If we classify subsistence farmers as those who sell for cash or barter less than 50 percent of the production of their farms, no one really knows exactly how many farmers there are in the world. In 1936, however, it was estimated at "1.6 billion or 60 percent of the world's population" (Whittlesey, 1936:241). In the late 70's, this figure increased to 2.4 billion people and is further estimated to increase to 3.1 billion people or approximately 70 percent of the world's population by the year 2000 (Todaro, 1983:251). For these farmers food sales are a significant source of income. Their farms are small and farming practices are mostly traditional, using very little use of 'modern' inputs. Producers of this type provide a large volume of food to local produce markets but the quality and quantity of output may vary considerably from time to time.

The vast majority of the world's poorest people are located in rural areas and engaged primarily in subsistence agriculture which is characterized by low productivity. In PNG 85 percent of the population are rural based and depend on subsistence agriculture. The question then follows why they remain this way and how to transform traditional agriculture in its present state into a highly productive one.

LOW PRODUCTIVITY

From a large body of empirical information on traditional

agriculture, available since WWII, four central characteristic features emerge. The first finding is that the average productivity of land, labour and livestock is low. Secondly, evidence available suggests that farmers in traditional agriculture do respond to economic incentives. The third finding is that small farms (less than 10 acres) are more productive than large farms. The fourth finding is that there is high uncertainty and variability in traditional agriculture due to little control of crop growing variables and widely differing health and farming skills of farmers. ¹²

This body of knowledge exposes but provides no explanation for the economic realities of traditional agriculture. It is hoped that the standard neoclassical tools of economic analysis may shed some light on understanding why productivity remains low in traditional agriculture. ¹³ The fundamental concept in this analysis is that traditional agriculture exhibits little change in technological, institutional, economic and cultural variables over long periods of time.

13. There has been some debate on use of neoclassical tools to explain the economics of traditional societies. See Reynolds, L., 1971, *The Three Worlds of Economics*, New Haven, Conn., Yale University Press. (Chapters 8 and 9) for an alternative view of the economics of traditional societies.

12. See Stevens, D & Jabara, C., 1988, *Agricultural Development Principles*, John Hopkins University Press, London.

This leads to a particular type of economic equilibrium where the agricultural sector has exhausted all the profitable production and investment opportunities present in the existing 'state of the arts' (knowledge and technology). This "state of technological stagnation is not due to the subjective attitudes of the farmer but to an economic environment over which he has no control. They have through a process of trial and error, gradually arrived at an optimal solution to the allocation of limited resources available to them" (Mellor, 1967:127).

Shultz (1964) showed from his two studies of farming in India and Guatamala that resources are allocated efficiently in a static environment and that better resource allocation using existing technologies would provide little growth. In addition, more savings and investment in the presently available factors of production offered little growth opportunities because of a low rate of return.

EXPANDING TRADITIONAL AGRICULTURE

The implications of the Shultz-Mellor 'efficient but poor' hypothesis is that traditional agriculture cannot be expanded therefore, traditional factors of production must be reallocated. Relevant non-traditional factors for production of non-traditional products must be introduced. This meant new technology and adaptation of new farming methods to upset this

economic equilibrium and break the poverty cycle and increase the real income level.

The diffusion model of agricultural development emerged from this theory and assumed that highly productive technology available in developed countries could be easily diffused to low productive countries. This, however, proved to be difficult and in the 1960's this led to the emergence of the high pay-off model.¹⁴ Shultz (1964) advocated strongly that the key to transforming a traditional agriculture sector into a productive source of economic growth was investments to make modern high-payoff inputs available to farmers in poor countries in a form that is appropriate to local conditions. He suggested farmers be supplied and adopt these new inputs (tools, machinery, chemicals, soil and genetic attributes of plants and animals), and for farmers to use these inputs more efficiently (Shultz, 1965:p.60).

Non-economic factors do have an influence in the economic development of agriculture and it is important that they be considered. However, it is also equally important to identify the main economic variables that will stimulate more rapid growth as well as those factors which inhibit growth to devise an appropriate agricultural development strategy.

14. *ibid*, pp 89-90

DEVELOPING IMPROVED TECHNOLOGY

Five economic factors were identified by Mosher (1966) which are considered very essential for agricultural development. These are: (1) transport, (2) markets for products (3) new farm technology (4) availability of purchasable inputs and (5) incentives. Similarly, Wortman and Cummings (1978) noted that an improvement in the farming system, extension, supply of inputs and availability of markets led to increased productivity regardless of the size of landholding.

Mosher also identified five accelerators which while not essential can make a contribution to increasing the growth rate. These are (1) education, (2) production credit, (3) farmer associations, (4) improving or expanding the land base, and (5) planning.

The absence of accelerator institutions is one of the characteristics of subsistence agriculture. The number of accelerators required, and the intensity and complexity of their application depend on the following three factors (Kulp, 1970).

Firstly, it depends on the novelty and complexity of the innovation. Accelerators will not be required if the innovation is similar to traditional practices. New crops such as potatoes, beans, maize and casava have been adopted by farmers in Africa from the Americas without the benefit of any accelerators.

Similarly, in PNG sweet potato has become a staple food crop after being introduced from South America.

Secondly, cost is an essential consideration. Innovations that require substantial amounts of capital for their adoption, increase the importance of accelerators such as credit and planning. The third factor is profitability. The greater the returns from an innovation, the more inclined the farmers will be to adopt the innovation, even without accelerators such as credit.

These elements (essentials and accelerators) proposed by Mosher (1966) can be grouped into four related functions (Aarnon, 1981; Wortman and Cummings, 1978). Firstly, new technology must be generated to improve farming systems. This implies research and has to be appropriate to the specific conditions of a region and its resources. The innovation must be productive and profitable, with an acceptably low level of risk than is currently available to the farmer. Secondly, this technology must be transferred to the farmer who should be instructed, on his farm or nearby, how to use it and why this technology is better. This involves education and training as well as an effective extension service between the researcher and the farmer. Thirdly, essential conditions must be provided. This include incentives like credit as well as complex infrastructure to service agriculture and provide necessary supplies and facilities, as well as markets for crops.

Finally, an appropriate strategy for promoting technological change must be formulated. Technological change must be planned, decisions on strategy and priorities must be taken, and the economic and social consequences of these decisions must be anticipated (Arnon, 1981).

SUMMARY

Until recently, agriculture has been neglected by policy-makers and planners in most developing countries including PNG. Evidence elsewhere suggests that overall development is unlikely to occur if there is low productivity in agriculture. Past and present development programmes in PNG have sustained the growing population at a marginal level, with factors of production allocated relatively efficiently among alternative activities and among different provinces. Returns to factors are approximately equal to costs. Investments in agriculture are low because returns to new investments are low. There has been little technological change to lead to decreasing input costs. Increased taxation would lead to decreased production.

The important question here is how to disturb this equilibrium and increase productivity. The task becomes how to integrate these farmers into the formal cash economy or more specifically, how the process of progressive modernization can be started and

sustained in these farms to increase food production. Examples in other countries such as Taiwan and India show that given a favourable socio-economic and technological environment, small farms can be high yielding and quite progressive.

The transition from traditional, subsistence agriculture to modern, commercial agriculture cannot occur without some form of government intervention. Improved technology of itself is not a sufficient condition to guarantee increased agricultural production. Other conditions necessary are reliable extension services, input supply systems and product markets where farmers can dispose of crops at remunerative prices. Successful efforts to force the pace of agricultural development must also involve the simultaneous provision of all other necessary services including roads and transport facilities, suitable price, credit and land policies as well as farmer training and education and national planning, some of which will extend across across different commodities and regions.

The challenge to expand agricultural production in PNG is to adopt new farming techniques and technologies, bearing in mind the differences in climatic and resource endowments including noneconomic socio-cultural variables subjecting traditional farmers. This is highlighted by Penny (1969) in a study of eight villages in North Sumatra where he recorded extremely diverse response to economic opportunities despite operating in the same environment. During the study, some demonstrated the capacity to

make rapid changes to become commercial farmers while others remained tradition bound and made no changes in their farming methods or way of life while yet others were in a transition from subsistence to commercial farming.

CHAPTER 5

RESEARCH AND EXTENSION

INTRODUCTION

The agriculture sector in PNG is very important. If productivity growth is slower in agriculture than other sectors, we have noted that this contributes to the relative decline of agriculture in the economy. This stresses the importance of increased productivity in agriculture, particularly subsistence agriculture. Productivity growth is defined as an increase in output per unit of (one or all) inputs (land, labour, capital).

We noted in chapter 4 that to expand agricultural production in land scarce production areas, the challenge is to adopt new farming techniques and technologies, bearing in mind the differences in climatic and resource endowments including non-economic socio-cultural variables subjecting traditional farmers and different regions. Is this being reflected in government agricultural investment policy in food production in PNG?

The purpose of this chapter is firstly, to find out how much PNG is investing in agricultural research. Secondly, to determine whether the allocation of research resources between export (tree) crops and food, particularly domestic staples, is appropriate. Thirdly, this paper focuses on who benefits most from the types of innovation produced by research stations. This will enable us to determine future directions in research.

ECONOMICS OF AGRICULTURAL RESEARCH

Economic policies have adversely affected domestic food production in many less developed countries. Protection of the farm sector in industrial nations has resulted in expanded grain supplies and depressed international prices. Faced with food scarcities, governments of many less developed countries have chosen to subsidize the importation of food grain rather than invest in research, extension and related programmes in support of domestic agricultural production. The result has been to depress food crop prices in developing areas and to discourage local production of root crops.

In PNG, Jarrett and Anderson (1989); Fallow (1992); Ganguli (1981); and Shaw (1984) have shown that problems of land tenure, high input costs (high rural wages and high real costs of obtaining finance for subsistence farmers) and low output prices due to government stabilization policies and the effects of the

mining boom has led to slow productivity growth in agriculture, particularly subsistence agriculture.

Public investment is another factor which interacts with the above factors to enhance profitability in agriculture. Public investments can be divided into research and extension, human capital (education) and infrastructure development. This chapter only focuses on the importance of agricultural research and extension in enhancing land and labour productivity in subsistence agriculture, especially in food production. Extension activities are only considered in the context of disseminating research results.

INVESTMENT IN AGRICULTURAL RESEARCH

The rate of return to additional investment in agricultural research will decline as the level of investment expands. In this case, the relevant question should be what the optimum level of investment should be. This paper, however, is only concerned with determining how much resources (aggregate) have been committed to agricultural research in PNG.

Judd, Boyce and Evenson (1986) showed that in 1980, developing and developed countries committed close to 1 per cent and 2 per cent of the gross value of agricultural production to agricultural research respectively. Jarrett and Anderson (1989)

indicated that the Department of Agriculture and Livestock in PNG, from 1986 to 1987, committed only K5.2 million which represented 0.5 percent of the gross value of agricultural production which is well below government investment in other developing countries. According to the International Service for National Agricultural Research (ISNAR), PNG had about half the number of scientists in low income economies and a third of scientists in middle income economies.

UNDERINVESTMENT IN FOOD RESEARCH

Available evidence show very little research effort focused on food production, particularly domestic staples. Jarrett and Anderson (1989) showed large variation in the degree of underinvestment in research between different export commodities and export crops and non-export food crops (Jarrett and Anderson, 1989: Pgs 83-84).

Similarly, Hau'ofa, Proctor, Ward and Yen (1980) noted research bias away from food crops towards export crops in PNG as well as the Pacific Islands. Several perspectives are noted. Some especially Collinson (1971) consider that this is because of the lack of a market as a denominator between the subsistence and the cash crop sectors of traditional farming systems which means there is no guide as to profitable lines of research. The market evaluation of subsistence production then becomes a complex

matter of the opportunity costs of family labour.

Coursey (1977) attributed this partly to cultural-historical factors leading to an identification of European cultures with grain and its product, and the consequent assumption of the inferiority of cultures based on non-grain crops (Coursey, 1977:11).

Others like Woolfe (1992) noted that improved yields and post harvest systems for cereals and export crops reduced their per unit costs thereby stimulating their use. Domestic food crops on the other hand were noted not to have benefited from crop improvement programmes and have become more expensive to produce and consume (Woolfe, 1992:12).

The bulkiness of root crops and their low cash value per unit of weight, and difficulties associated with their storage and transportation in tropical conditions have resulted in a very low level of importance in international trade and the bulk of these crops is still used or sold for domestic purposes (ibid: p.11)

TRADITIONAL AGRICULTURAL RESEARCH

Ward (1980) noted in PNG and other Pacific Island economies that field trials in agriculture benefited plantation crops with improvements in crop spacing, manurial trials, pest and disease

control. This sector is capital intensive and requires greater capital resources which means there is comparatively little influence on the subsistence sector. The problems of translating field results are often noted to be compounded by extension difficulties because of the remote and dispersed farm areas. In addition, trials are usually always conducted on flat grounds. Subsistence producers in PNG tend to occupy, by necessity or predilection, slopping grounds in hilly terrain. Spacing, fertilizer and plant protection recommendations are of questionable applicability to such environments.

Collinson (1972) noted several factors in LDC's which made research routines inflexible and perpetuate an orientation in research programs unsuited to the requirements of traditional farming systems. Firstly, most researchers are expatriates or locals trained in developed countries who focus on research objectives consistent with requirements of developed countries but are not consistent with the requirements of developing countries. Most researchers also concentrate on maximizing physical yields per acre as opposed to return to labour and capital and to food security, which is important for traditional farmers.

Secondly, while some adaptive research is done, it is limited to the natural resources, the climate and the soils of these areas, ignoring the economic and motivational peculiarities of traditional agriculture.

Thirdly, the methodology of research (based on returns to land as the crucial factor in the production process) are confined by this narrowness and become too preoccupied with the administrative complexities of work in developing agriculture to question the suitability or utility of their research techniques.

The insular character of expatriate researchers and the enclave nature of their presence in LDC's often interact with these aspects of focus and technique to create an inflexibility of approach which hinders reorientation of research efforts to the problems of traditional farmers.

Who benefits from investments in agricultural research? Jarrett and Anderson (1989) demonstrated that investments resulting in process innovation (reducing unit production costs) for export commodities in PNG accrue to producers while in food crops, benefits accrue to both producers and consumers. Evidence from other countries show that there are high social rates of return to further investment in agricultural research (Evenson and Kislev (1975); Arndt, Dalrymple and Ruttan (1975)).

SUMMARY

We have noted that the PNG government is underinvesting in agriculture relative to other developing countries. In particular research in food production is very small with research focused

on export crops. While PNG has a long history of agronomic research and a network of research stations, research on food production is considered to have little influence on the subsistence producers who constitute the bulk of food producers. The main beneficiaries appear to be the plantation sector which in PNG is dominated by export tree crops. Research problems are compounded by lack of research staff, research facilities and services and inadequate plant collection for genetic material.

The important role of agricultural research in diagnosing weaknesses in existing farm systems and evaluating possible improvements to increase resource productivity is widely acknowledged. In traditional agriculture this role is more enhanced because efforts to increase agricultural productivity through the use of new and profitable technologies often don't include farmers as end users to determine the appropriateness and/or acceptance of the technology. The reason is noted as the wide gulf between farmers and researchers. In most cases this results in a one way communication flow and blanket research programs, characteristic of LDC's with scarcity of funds and skilled manpower.

Public investments can enhance the quality and quantity of resources in agriculture. PNG is missing out on benefits from agricultural research, particularly food production, as both producers and consumers benefit. Investment in research and extension is the key to increasing agricultural productivity.

Given the importance of food in economic development, equal consideration in terms of investment in research, must be given to food as well as cash crop production.

CHAPTER 6

FARMING SYSTEMS RESEARCH

INTRODUCTION

We have noted in chapter 5 that the PNG government is under-investing in agriculture, particularly food crop research. In addition, evidence available suggests that the type of research conducted is not appropriate and consequently of little value to the smallholder producer. This chapter looks at farming systems research as an appropriate means of transferring appropriate technology to smallholder producers to increase productivity. Farming systems research stresses the importance of farmer participation because a farm operation is a very complex one involving a wide variety of activities, carried out to maximize resource utilization and reduce risk.

The Farmer-Back-to-Farmer Research Model in farming systems literature is noted in this context and is considered as an appropriate model for technology transfer in PNG. This model is based on the belief that problem-solving agricultural research

should begin and end with the farmer and relies on interdisciplinary teamwork in all phases of a continuous research/diffusion process. Although not entirely novel to agricultural research, the farmer-back-to-farmer model offers a rarely followed but viable alternative to traditional agricultural research and extension. I have used a case study of the model in Peru which I hope will be useful in illustrating the usefulness of farming systems research.

FARMING SYSTEMS RESEARCH

Farming Systems Research has been noted for its relevance to the subsistence sector in PNG although it has been rarely implemented. The IFAD Special Programming Mission to PNG (1980:107) noted that many research stations in PNG have already developed the needed components like identification of high yielding varieties of common food crops such as potatoes, pulses, cereals and other fruit and vegetables. The mission stressed that these systems should be urgently adapted to the physical and social environments in different parts of the country.

The 1989 Government White Paper on Agriculture stresses its importance but notes research and extension difficulties in implementation. Ward and Proctor (1980) noted similar difficulties. An extension study by Harris and Fleckenstein (1975) revealed widespread dissatisfaction that farmers were

directed rather than advised, with less time spent on-farm. This is supported by evidence from similar studies (Mckillop (1974); Tovue (1974); Densley and Dick (1977). Academics confine its application to training and academic discussion (O'Collins, (1987); Flinn (1978).

O'Collins (1987) defined farming system as "the complex arrangement of soils, water resources, crops, livestock, labour, and other resources and characteristics within an enviromental setting that the farm family manages in accordance with its preferences, capabilities and available technologies" (O'collins, 1987:1).

Similarly, Hildebrand (1986) noted that a farming system is the result of a complex interaction of a number of interdependent components. At the centre is the farmer who must make specific decisions with respect to allocating different quantities and qualities of land, labour, capital and management to crops, livestock and off-farm enterprises to maximize, within the limits of the knowledge possessed by the household and local circumstances, the attainment of the family's goal(s).

The basic philosophy upon which the farm systems research is based, holds that successful agricultural research and development must begin and end with farmer participation. In practice, this means obtaining information about, and achieving an understanding of, the farmer's perception of the problem and

finally to consider the farmer's evaluation of the solution. It is therefore very important that intervention intended to create change must be carefully evaluated to prevent imbalances that would otherwise occur due to the tedious balance of the system. Farming system research strives to close the circle, from proper identification of the problem to farmers' acceptance or rejection.

STRATEGY FOR FARMING SYSTEMS RESEARCH

To induce agricultural productivity on small traditional farms, proven technology is imported from developed countries.

Hayami and Ruttan (1985) identified three phases of technology transfer in LDC's namely, material, design and capacity transfer. Profitable agriculture and livestock technology require institutional arrangements that facilitate interaction between developers of new technology and farmers.

Stevens and Jabara (1984) stressed that effective agricultural technology creation and delivery involves three steps. Firstly, establishment of public and private research and development stations. Secondly, on-farm testing with effective feedback of results to researchers and thirdly, production of new technologies by developers. Finally, this information is made available to farmers through extension.

Farming systems research stresses the importance of integrating tests of new technology on the farmers' fields. Broadly, three levels of research are involved. Collinson (1982) identified the first as disciplinary and commodity research at capacity level, which is mostly utilizing research information on proven technology available from developed countries. Secondly, promising technology is then tested on research stations in different agricultural areas based on their technological requirements relating to their production problems. Thirdly, technology which is performing at research centres is tested on the farmers' fields. On the basis of these results, extension recommendations ¹⁵ should be formulated.

Feedback from the tests also assists researchers to focus further on technologically appropriate commodities. In addition, knowledge is gained on the socio-economic and sometimes cultural barriers preventing agricultural productivity. Also researchers are provided a basis for determining whether government policies are effective and whether the right and intended results are being achieved. More importantly, in the context of the green revolution, researchers can monitor environmental and ecological aspects of technology transfer. ¹⁶

15. A discussion of the extension methodology is beyond the scope of this paper. However, collaboration of scientists and extension workers is imperative in evaluation of technology.

16. See Stevens D.R. & Jabara, L.C., 1984, **"Agricultural Development Principles"**, John Hopkins University Press, Baltimore.

STUDIES IN FARMING SYSTEMS RESEARCH

Flinn (1978:262) noted three important research areas when studying and developing descriptive and quantitative inventories of farming systems. Firstly, agronomic and economic studies of agricultural production must be undertaken to determine:

- (a) the attitudes, values and objectives of the farmer and his family
- (b) existing levels of the farmer's technology, resource use and rationale for management of resources.
- (c) technological, bio-physical and socio-economic factors which define the constraint set in which the farmer must make and implement his decisions.

It is important that the complexity and the interaction between the biological, physical, and socio-economic component of farming systems be recognized. It is therefore important that a multi-disciplinary team be involved in the survey.

Flinn (1978) recommended socio-economic research as well as studies in soils management and land utilization, crop improvement and management, crop protection and agricultural engineering. Procedures and problems, especially from the agricultural economists viewpoint, are well documented (Collinson, 1972; Kearl 1976). This ensures that farming management surveys consider human as well as ecological factors

when designing problem orientated agricultural research projects.

Secondly, soils and land capability surveys must be conducted. The FAO (1976a) recommended that baseline soil surveys should be directed at determining soil characteristics in relation to land use potential as well as classifying soils, mapping boundaries, predicting their response and hazards and their suitability for roads and other structures. More detailed follow-up surveys should then be conducted on the ecologically most promising areas.

This information is useful for planners when evaluating likely shifts in agricultural production, identifying areas for production campaigns and the preferred location for transport routes and other services such as processing facilities.

Thirdly, agro-climatological analysis should be undertaken to assess the biologic relevance of various crops and management systems in a region.¹⁷ Work at the Commonwealth Scientific Industrial Research Organisation in Australia has demonstrated the usefulness of simple agro-climatic models (Rose, 1975). These models can be used to identify crops that have the greatest physical and economic advantage for any given area as well as for

17. It may not be necessary for farming systems scientists to conduct the agro-climatological analysis themselves. This work may be subcontracted to institutions with specialists and research facilities.

any areas within it which have the greatest advantage. They can also be used to determine how productivity might be raised for any given crop or area. Analysis of weather records (coupled with soil and crop data) for a region have been shown to be useful in evaluating the potential and likely productivity of crops and cropping systems for various soil types in a region.

As noted in chapter 3, most problems of increasing subsistence food production are largely bio-technical. Therefore, techniques designed to reduce these constraints must be developed with a clear awareness of the objectives, circumstances, and constraints faced by the farmers if they are to be adopted by a significant portion of the farmers. It is also important that research design must consider the farmer's preferences, their priorities for allocating resources (land, labour, capital) and their financial and managerial capacity.

FARMER-BACK-TO-FARMER MODEL

This case study is an example of a successful interdisciplinary farming systems research in Peru involving researchers from the International Potato Centre which illustrates the guiding principles for teams working toward solving technological problems. The research team comprised social and biological scientists who were concerned with storage and post-harvest losses of potatoes and were concerned with designing a system to

reduce pathological and physiological losses of potatoes. Although the emphasis here is on agricultural technology, this model should be of value in interdisciplinary research dealing with appropriate technology and development in other fields. Also while it is dangerous to extrapolate findings from one region to another, there are principles which apply equally well when designing research related to indigenous agriculture, whether it be in PNG or Peru.

The first step in this model involves diagnosing and understanding the farmer's problem. The farmers were interviewed by the anthropologist after consultation with the biological scientist which then resulted in a common definition of the problem. By drawing knowledge from both disciplines and the farmers, the problem was defined as seed potato storage with specific emphasis on reducing sprout length and improving seed tuber quality.

The next step involved interdisciplinary team research to identify and develop a potential solution to the problem. With the problem more narrowly defined, the team's research task was to solve the technological challenge in such a way that was acceptable to the farmers. This involved the anthropologist continuing field research (focusing on acceptability) and constantly feeding his findings to the technical scientists (focusing on appropriateness) who intensified on-station experimentation.

With successful on-station results, the next step was on-farm testing and adaptation to better adapt the proposed solution to the farmer's conditions. With farmer cooperation, the research team set up on-farm experiments which yielded similar results to on-station experimentation. Repeating the on-farm trials using feedback from farmers, the technology was tested to suit the conditions of farmers. The technology now appeared ready and thus entered the final phase of farmer use, adaptation, and diffusion.

The final step involved farmer evaluation/adaptation basically to modify technology to fit local conditions and understand farmer response. A follow-up evaluation is necessary, not only to validate or negate preceeding research phases but to seek new directions in improving the new technology. Central to this evaluation is the need to obtain information on farmers' behavior as they begin to experiment and use the technology on their own.

The new technology was continuously being refined and altered by farmers. In other words, adaptive research was being undertaken by farmers themselves, well after the scientific team had finished its major adaptation and testing activities. The farmers were noted as being proud of these changes and the research team was convinced that farmers would be more likely to accept changes if they actively participate in the research process.¹⁸

18. This brief account of the model is drawn from Rhoades, R. & Booth, R., 1982, **"Farmer-Back-to-Farmer: A model for generating acceptable agricultural technology**, *Agriculture Administration* 11, 127-137.

SUMMARY

The farm operation is a very complex one. A wide variety of activities are carried out to maximize utilization and reduce risk. It is therefore very important that intervention intended to create change must be carefully evaluated to prevent imbalances that would otherwise occur due to the tedious balance of the system.

Several shortcomings were noted which results in farmers being too slow to adopting these technologies or sometimes not at all. Firstly, the technology may not be profitable for the farmer despite excellent results on the research station. Secondly, the technology may not appropriate which means it has little relevance to the farmers production problems. Thirdly, the farmer may not be aware of the existence of new productive technology and this results in delays in technology the being adopted. Farming systems research enables researchers to ensure that these conditions don't prevail particularly in the context of agricultural technology transfer.

Farming systems research emphasises that technology should not be designed, introduced and abandoned by applied scientists. Information must be collected on the technology's acceptance or rejection by farmers, the final judges as to the appropriateness of a proposed technology transfer.

CHAPTER 7

DEVELOPING A NATIONAL FOOD MARKETING
STRUCTURE

INTRODUCTION

Many authors recognize that improved food marketing can contribute to economic growth and development. Early proponents of marketing in development included Drucker (1958) who pointed to the key role of marketing as an organizing force to dynamize development. Galbraith's and Holton's classic study of Puerto Rico's marketing system in the early 1950's revealed the significant economic savings that could be achieved through improvements in the island's food marketing system. Recent proponents include Etemad (1984) who concluded that marketing can be a 'potent catalyst' in economic development.¹⁹

19. Many others disagree and warn that some marketing institutions and processes can adversely affect development by increasing dependency and concentrate benefits with the wealthier groups. See N. Dholakia and R. Dholakia "Missing links: Marketing and Newer Theories of Development" in G. S. Kindra (eds), *Marketing in Developing Countries*, St Martin's Press, New York.

In PNG, the importance of food marketing has not been adequately recognized. This chapter examines evidence from other developing countries to provide some insights into improving marketing capacity.

FOOD MARKETING IN PAPUA NEW GUINEA

Papua New Guinea has yet to develop an adequate food marketing strategy. The IFAD mission to PNG (1980:40) noted that an effective national development approach to food marketing does not yet exist. Bourke (1982) noted that politicians, planners and administrators in Papua New Guinea did not recognize the importance of the domestic food sector but instead focused on export crops. This is also reflected in the PNG Government's white paper on agriculture (1990) which does not have specific policies on domestic food marketing.

Lack of accurate data on the size of the industry may explain this. In the highlands, sale of food was estimated to be worth only K600,000 (Munull and Densley, 1977:7). Other studies indicate that this market is considerably larger. MacEwan (1977) estimated that the value of all locally grown and marketed produce in PNG was K31 million while another study in 1984 estimated total value at K52 million. Bourke (1985) through field observations estimated the value of locally grown and marketed food to be "in excess of K50 million per year" (Bourke, 1985:12).

The domestic food industry appears to be considerably large and in the same order of some export crops. This stresses the need for considerable government investment in marketing. Given its importance to the economy, the marketing capacity of the domestic food sector must be improved.

COMMON FOOD MARKETING PROBLEMS

Most LDCs are faced with declining per capita food production and in some cases are relying on food aid for survival. They face common food distribution problems because they have similar food distribution patterns and are characterized as largely agrarian economies with little natural and capital resources and poorly developed infrastructures, which are attempting to feed rapidly urbanizing populations with low income per capita.

About 60% to 80% of an urban family's income is spent on food alone. This high percentage results partly from inadequate food distribution systems, with as much as half the costs attributable to assembling, processing and distribution services in the flow through the channel from the rural producing areas to the urban consuming units. Luqmani and Quraeshi (1984) estimated that post-harvest losses accounts for 20-30% of food produced in LCD's. Similarly in PNG, a study by the Fresh Produce Development Company (1990) revealed post-harvest losses of 30-50 per cent are quite common.

Despite the vigorous growth of food demand, some characteristics of the retailing sector inhibit expansion. This is especially true in the case of food stuff that require re Fridgerated facilities and adequate display in retail stores. Rama (1992) in his study of the Chinese system noted that the marketing network which was managed and controlled by the Government was unproductive before the economic reforms.

Hence, levels of investment in food distribution were very low. As a result, "not only are retail facilities not numerous enough to meet the requirements of large urban areas, but the services in retail stores are also sometimes inadequate" (Rama, 1992:150). Poor store technology, traditional selling methods and a lack of motivation of sales persons were noted as some of the causes of this situation (ibid: 150).

Meanwhile, food marketing systems in the industrialized countries have undergone drastic changes. New technology in packaging, processing, transport, storage and information processing has permitted the development of supermarket chains that are closely integrated both vertically and horizontally. Concentration of wholesale purchasing through these food marketing chains has had important repercussions on the organisation of food supply at the farm, assembly and processing levels.

The demand for large quantities of well-packed and standardized food products has gone much further; organisation to meet this

demand has permitted mass merchandizing. The productivity of labour in food marketing has thus increased considerably, bringing down costs, and this in turn has opened up new and expanded markets for farmers produce.

DEVELOPING A MARKETING STRUCTURE

It has been tempting to take this pattern of development in developed countries as a model for less developed countries. Most marketing system studies advocate a move towards a capital intensive type of system ²⁰ and have advocated market reforms at macro level followed by or in conjunction with micro level reforms ²¹ while others have proposed individual initiatives at micro level leading to desired macro changes in distribution. ²² Those subscribing to these macro/micro marketing initiatives have focused on and often recommended transfer of relatively

20. Abbott, J.C., 1964, "Marketing and Area Development Studies" in Greyser, A.S.(ed), **"Toward Scientific Marketing"**, American Marketing Association, Chicago, pp.425-426; Bartels, R., 1978, **"Marketing and Economic Development"** in Slater, C.C. ed., **Macro-Marketing: Distributive Processes from a Societal Perspective: An Elaboration of Issues**, University of Colorado; Holton, H.R., **"Marketing Structure and Economic Development"**, *Quarterly Journal of Economics*, 67:1957, pp 348-349

21. Lee, D., 1978, **"Channel intervention from a macro perspective: the Lesotho, Africa, examination"** in Slater, C.C. ed., op. cit; Bucklin, P.L., **"Improving food retailing in developing Asian countries"**, *Food Policy*, 2,2:1977, p121.

22. Bretherton, S.I., 1978, **"Does the Marketing activity in Mexico help the country's development"** in Slater, C.C., ed., op. cit; Cundiff, E. and Marye, T.H., 1979, **"Marketing and the production-consumption thesis in economic development"** in Fisk, G. & Nason, W.R. & White, D.P., eds, **"Macromarketing: Evolution of Thought"**, Graduate School of Business Administration, University of Colorado, Colorado.

capital-intensive mass marketing technology as a solution to problems related to the distribution of consumer staples in LDC's. ²³

They have underscored the importance of achieving economies of scale through the co-ordination and integration of traditionally fragmented institutions and operations. Luqmani and Quraeshi (1984) noted that attempts at nurturing market co-ordination schemes have not been successful because development planners have not gained the endorsement of channel participants.

In addition, many people involved in food and agricultural marketing in LDC's have considered their traditional marketing systems to be outdated and technologically obsolete. Investment funds have gone into elaborate forms of storage and processing, conveyor line grading and packing and other visibly advanced marketing facilities, without sufficient attention to how these fit into the marketing system and to the economics of maintaining them. Development agencies went along with these proposals only to find out later that the new refrigerated stores or processing facilities were used far below capacity or not at all. The bias of financing agencies towards the provision of physical

23. FAO, 1977, "Critical Issues in Food Marketing Systems in Developing Countries", Development Centre of the OECD, Paris; Galbraith, K.J. & Holton, H.R., 1955, "Marketing Efficiency in Puerto Rico", Harvard University Press, Cambridge.

facilities for marketing has been a continuing constraint to a balanced development of marketing. Lee (1986) noted that most of the allocated funds are spent constructing the required infrastructure and introducing improved farming practices with little regard for marketing. The traditionally production-orientated farmers do not know how to tackle the marketing problems effectively which results in 'second stage problems' because marketing efficiency is not in line with the change in the production technology. It is now increasingly recognized that technologies for marketing must be chosen with reference to local conditions, in particular labour costs, marketing organisation and the socio-cultural environment.

The second major problem in many LDC's has been the negative attitudes of governments towards private enterprise, basically considered inefficient, exploitative and lacking in innovation. Government policy has been to promote the growth of cooperative marketing organisations and parastatals, assigning them monopolies for the handling of major products and important areas of marketing. The general justification was the need to assist small farmers to market their produce or obtain inputs, together with the need to deliver food to low-income consumers at subsidized prices. It is therefore, important that these parastatal organisations maintain efficient performance. Whether these organisations faced with a range of responsibilities can maintain efficient performance is not clear as evaluation and monitoring is difficult. However, evidence available seems to

indicate the contrary. In Papua New Guinea, the government owned Fresh Food Marketing Corporation set-up to improve the conditions of smallholder farmers and effectively utilize the potential capacity of the rural sector in food production failed after three years. The reason was noted as inconsistent supplies and variable quality produce from smallholders leading to diseconomies of scale, particularly in terms its 'sweet potato rice' producing plant which was forced to operate below capacity. ²⁴

In Karachi (Pakistan), modern, cheap and much need storage facilities was provided by the Government but remained underutilized. This was because of the reluctance on the part of the channel participants (retailers and wholesalers) to relocate their traditional domain of business. ²⁵

In Puerto Rico, the Department of Agriculture established grading, washing and packing facilities for fruit and vegetable farmers and wholesalers, as a rural collection point. These facilities remained un-utilized because of reluctance by producers and wholesalers to perform these upgraded functions. ²⁶

24. Treblecock, M., 1986, "Public Enterprises in Papua New Guinea, Institute on National Affairs, Port Moresby.

25. Lugmani, M., 1978, "Improving the Effectiveness of Food Distribution in Developing Countries, Michigan State University, Michigan.

26. Riley, M.H., 1970, "Food Marketing in the Economic Development of Puerto Rico", Latin American Studies Centre, Michigan State University.

In another case in Puerto Rico, Independent Stores Incorporated (ISI) was set up by the Economic Development Administration with government support to develop retailer-owned wholesaling operations through the extension of credit, technical advice and management programmes. Despite these incentives, few retailers believed the system was feasible and they declined to participate. Consequently, the ISI had to be disbanded. ²⁷

IMPROVING MARKETING EFFICIENCY

The development of efficient food systems requires improvements in three major areas. Firstly, improvements in in the operative or technical efficiency and secondly, pricing or economic efficiency. Thirdly, there should be a focus on engaging, training and improving the skills of the channel participants as well as removing other socio-cultural barriers to become efficient operators. Creating a technical and economically conducive environment is not enough as evidenced by available marketing literature.

Luqmani and Quraeshi (1984) noted in their study of Latin American food marketing systems that the focus by distribution planners and scholars is on technical and economic efficiency only and emphasised the need to develop co-ordinated channel

27. *ibid*, p.65

linkages for a balanced marketing development. Similarly, Kriesberg (1986) also noted that in LDC's, gradual and systematic improvements in the overall marketing systems help lower food costs, boost purchasing power of wages, and can lead to more equitable income distribution.

According to the US Department of Agriculture, in LDC's the marketing problems one would face at different stages of development in marketing systems would vary from country to country, depending on a host of environmental factors. It noted that after preliminary identification of marketing problems at different stages of the system's development, there was a need to define the problems concisely. Firstly, in terms of the linkages of the particular problem with other activities in the marketing system and secondly, the readiness of the individuals and institutions principally involved to make the changes required.

Meissner (1986) argued that the capital-intensive mass marketing technology (mainly supermarkets) was not a solution to problems of less developed countries and recommended labour intensive methods using more appropriate (modified) technology to suit local conditions and the state of marketing development.

SUMMARY

The development of efficient food systems requires improvements

in technical efficiency and economic efficiency as well as securing the involvement of channel participants to be efficient operators by removing constraints. Within this context, consideration must firstly, be given to human and institutional capabilities as marketing activities are performed by individuals working within the framework of many varied institutions. The institutions give form and continuity to the individual actions and the overall marketing process.

Secondly, in terms of innovation and technological change, one must consider the capability of private as well as public institutions to carry out marketing changes. Kriesberg (1976) noted that change and improvements in marketing are a continuous process, in which the private sector can be an important innovative element. A system may be judged efficient because traders are charging reasonable prices for performing their marketing functions. But technological change may help integrate activities and reduce costs, thereby providing a different basis for measuring efficiency.

This is important in the context of LDC's because the private sector is often efficient in economic terms but backward in terms of technology and institutional arrangements. New infrastructure may improve technical efficiency as compared to existent facilities but institutional arrangements may impede reaching higher levels of efficiency.

These factors make it mandatory to look beyond the physical facilities and consider whether associated policies and institutional arrangements will encourage further initiative and innovation in the marketing system. Specifically, will project-linked policies open up the market to additional entrepreneurs? Will credit and import policies encourage importation of appropriate new technology in the marketing system? Will traders have incentives to seek means of lowering their operating costs? These are some of the questions that should be examined when attempting to institutionalize desirable changes in marketing systems of LDC's like PNG.

CHAPTER EIGHT

SMALLHOLDER MARKETING PROBLEMS

INTRODUCTION

Self reliance and equal distribution of income are the connerstones of development planning in PNG. Many integrated rural development projects are undertaken with the view of alleviating rural poverty, improving the conditions of subsistence farmers and effectively utilizing the potential capacity of this sector in food production and economic development. Examples include the Marketed Fruit and Vegetables Project, funded jointly by the New Zealand and PNG governments and the Smallholder Market Access Food Supply (SMAFSP) project funded by the PNG Department of Agriculture and Livestock.

Similarly, in almost all developing countries, many rural development programmes or projects are being implemented, supported by multi-lateral or bilateral financing agencies and respective governments, jointly or solely while even some smaller scale projects are being implemented by farmers without

contributions from international agencies or their own governments.

These rural development projects or programmes successfully construct the required infrastructure and introduce improved farming practices and new production technologies leaving the risk of marketing to farmers. The traditionally subsistence orientated farmers do not know how to tackle the marketing problems effectively which leads to 'second stage problems' because marketing efficiency is not in line with changes in production technology. In this chapter, we shall examine some common smallholder marketing problems and consider possible solutions.

SMALLHOLDER MARKETING PROBLEMS

A comprehensive study on subsistence food production in PNG by Shaw (1985) revealed that despite efficiency in production, marketing was difficult and costly. These marketing problems often cause the farmer to suffer economic losses, despite good harvests, and lose interest in any additional advice. The marketing problems may lead to further complications. For instance, failure in marketing may force many farmers to default repayment of loans from agriculture banks, leading to problems in the agricultural credit system.

Removing marketing constraints is therefore critical for making any rural development programme successful. Some of these marketing problems are discussed.

PRODUCTION ORIENTATION

Many farmers, especially small farmers, are traditionally subsistence orientated and slower in adapting to change in marketing. They produce crops or products which they have traditionally produced with little consideration for marketing, even when the changing or changed market structure requires improved produce or entirely different produce. This is particularly important for highly perishable produce such as fruit and vegetables. The attitude of assuming the existence of markets or considering marketability at the harvesting stage of production leads to failure in marketing and causes frustration on the part of the farmers.

Fisk (1978) noted that this problem was widespread in the Pacific and attributed this to farmers lacking effective means of assessing future market prospects.

SMALL MARKETABLE SURPLUS

A critical problem of smallholder marketing is the farmer's small

marketable surplus. Small farmer often don't produce enough staples for household consumption which includes feed for livestock. We noted in chapter 3 that there is a lack of 'intrarural specialization' with smallholders focusing on export crop like coffee, copra and cocoa and not marketable domestic food staples. This is because export orientated cash crops have relatively efficient marketing systems. ²⁸ Bourke (1983) noted that smallholders have relatively larger marketable surpluses of fruit and vegetable and other traditional staples but the quantity is still not large enough to warrant effective marketing which often involves moving produce to distant markets.

For small farmers in rural areas who have no access to sophisticated farming implements, the efficiency of production is scale-neutral. But for effective marketing, the economy of scale is the critical element. Small marketable surplus provides weaker ground for bargaining with wholesale traders. Direct marketing by the farmer becomes impractical because of the high marketing costs involved, particularly transport costs (Epstein, 1982; Bourke, 1985; Shaw, 1985; Jarrett and Anderson, 1989). Therefore, small farmers have to depend on wholesale traders or larger buyers for marketing of their crops in the main urban

28. See Jarrett, G.F. and Anderson, K., "Growth, Structural Change and Economic Policy in Papua New Guinea: Implications for Agriculture", National Centre for Development Studies, Pacific Policy Paper No.5, ANU, Canberra.

markets like Port Moresby and Lae. In most cases, produce is sold in nearby periodic markets.

INEFFECTIVE RURAL ASSEMBLY MARKETS

Periodic rural markets are patronized by the small farmers. These rural markets serve as assembly markets which are linked with larger secondary markets or urban wholesale markets (Epstein, 1982). Small farmers are the main sellers since larger or commercial farmers who have large marketable surpluses bypass the rural periodic markets in selling their produce. These markets have no storage facilities and many do not even have shelters but just open space. Most of these market places are owned by local governments, and are managed directly by the local government or by a contracted party. Produce wholesalers come to these markets to buy farmers produce while the 'market authority' is only concerned with collecting market fees (Epstein, 1982).

INEFFICIENT MARKETING PRACTICES

Partly due to the small marketable surplus and partly due to the lack of awareness, inefficient marketing practices employed by the small farmers results in higher post harvest losses, higher marketing costs and lower prices. Often produce is transported using inappropriate packaging. Perishable produce was regularly

observed being delivered in cigarette boxes and plastic flour sacks. ²⁹

In another case, perishable produce was transported by a smallholder from the highlands to Port Moresby in a 20 feet dry container which resulted in total loss of the whole consignment when it reached the market 5 days later. ³⁰ A study by FPDC (1990) revealed postharvest losses of 30-50 percent are common for produce shipped from the highlands to Port Moresby.

A number of studies have been conducted on periodic markets in the Pacific region since the 1960's, most notably by Epstein (1982) and Bourke (1985) on PNG and elsewhere in the Pacific by Brookfield (1969) among others. The general characteristics were described as:

- (1) absence of wholesale transactions
- (2) produce being sold in bundles
- (3) lack of bargaining between buyers and sellers
- (4) sellers not trying to force a sale
- (5) very little overt competition between sellers
- (6) short term prices for most classes of goods were
inflexible

29. See FPDC, 1991, "Shipping Horror", Fresh Produce News No. 52, Central Highlands Printers, Mt Hagen.

30. See FPDC, 1991, "Packaging Horror", Fresh Produce News No. 49, Central Highlands Printers, Mt Hagen.

- (7) There was little or no horizontal trading within the market
- (8) imported goods were not traded
- (9) earnings derived from market sales were only part of most vendors' total income and
- (10) market places acted as a social centre as well as a centre for trading food.

These inefficient marketing practices, coupled with inadequate facilities lead to high losses. Densley (1977) noted that the absence of adequate collection and marketing facilities as well as marketing services were constraints to increasing food supply to urban areas.

In addition, storage facilities for perishable crops are not available at either the farmer's houses or at periodic markets utilized by the small farmers. These factors combined lead to lower prices received by the small farmers and weaken the small farmers' competitive position in the market.

CREDIT AVAILABILITY

The agricultural credit institutions (agricultural banks, cooperatives) in LDC's provide short-term production loans to farmers. In principle such loans are available and many small farmers benefit from these loans. However, for various reasons,

it is difficult for farmers to obtain production loans without collateral. In PNG, Jarrett and Anderson (1989) noted that the rural credit policies of banks in PNG weakened the position of smallholders. In particular land tenure appears to be a major constraint. Hau'ofa, Proctor, Ward and Yen (1978) noted similar constraints in the Pacific including inaccessibility of lending institutions. In addition, the small farmers also require marketing loans to purchase appropriate packaging material and other inputs to enhance the postharvest quality of the produce. Lee (1990) noted that because of high transaction costs involved, most countries do not offer such loans. Large farmers, however, can avail themselves of production and marketing loans even from commercial banks.

LACK OF GROUP ACTION

Several studies have revealed that group efforts are critical for successful smallholder marketing (Hardaker, 1974; Lee, 1990). Transport difficulties are noted as a major constraint to efficient marketing in the Pacific. In other LDC's, agricultural co-operatives are organized by the government to utilize the benefits of economies of scale, although many such cooperatives are not so active. The most common function of these farmers' cooperatives are to act as agents of agricultural credit institutions, fertilizer and other input marketing institutions, or government food procurement agencies.

Except in a few countries where farmers' cooperatives function relatively more efficiently, many small farmer often do not participate in group actions. Some explanations that have been given are: distrust among farmers; distrust of the management group; lack of managerial skills and technical knowledge on marketing; and lack of operational funds (Wong, 1979; Donner, 1977).

IMPROVING SMALLHOLDER FOOD MARKETING

The generalized problems indicated in the previous discussions are the most common problems in PNG. Based on the identified problems, it is possible to consider a general approach to the basic directions of the measures to be taken to improve smallholder marketing. These measures are divided into those that require government action, with active farmer participation and those requiring initiative from the farmers but supported by government and other public institutions. Stevens and Jabarra (1988) noted that government actions should focus on supporting technological and institutional change, increasing competition and improving marketing management.

FARMER TRAINING ON MARKETING

Improved marketing practices can be adopted without additional

costs or with little costs if the farmer is willing to adopt innovation and it pays off immediately through better prices. Abbott (1974) noted that proper grading of fruit and vegetables normally gives a higher income to farmers than selling the same quantity ungraded. Similarly, Stevens and Jabara (1988) noted that pricing efficiency can be increased by grading. Other studies have proved that although improved packaging of fruit and vegetables cost a little more than the traditional jute or flour sacks, the total value received by the farmers was higher because of the good quality of the contents and less spoilage due to the improved packaging, even after deducting the incremental costs of the packaging (Lee, 1990). The training of farmers on improved marketing practices and the farmer's willingness to adopt such innovations are necessary to increase marketing performance (Stevens and Jabara, 1988).

PRODUCTION AND MARKETING CREDIT

Production and marketing credit is required for an individual farmer as well as for a group of farmers to purchase production and marketing inputs. In PNG it is very difficult for individual farmers or small farmer marketing groups to obtain credit from banks or credit institutions because small farmers lack of mortgageable security or because these marketing groups are not registered under the law. Arrangements should be made to provide loans, not necessarily against a physical asset as a security but

the feasibility of the project activities and the expected marketability and profitability as security.

There is evidence of such an arrangement between the Agriculture Bank of PNG and potato farmers in the Western Highlands. Some small contract farmers in the province were given loans up to K2000 by the bank to purchase production and marketing inputs based on marketing contracts with Pacific Products Limited, a large potato processor in Port Moresby. Approval for the loans was conditional on obtaining a contract, evidence of ownership of land and project feasibility carried out by the bank. Most small farmers, however, are unable to meet these requirements. Nevertheless, such undertakings by the bank facilitates a conducive environment for further improvements within the marketing system.

DEVELOPMENT OF RURAL MARKETS

Availability of efficient rural periodic markets facilitates the small farmers marketing efforts. In PNG, periodic markets are found in all urban areas, in many rural areas, and on plantations, government and mission stations. They range in size from the very large urban markets of Port Moresby, Rabaul and Lae, to small collections of a few road side sellers along major highways (Bourke, 1985).

These markets should be regulated and certain marketing practices required, such as standardized weights and measures, fixed market fees and standard methods of payments and grading to increase marketing efficiency (Stevens and Jabara, 1988). In addition, these markets, particularly those in the urban areas, require proper management to disseminate market information and are absolutely necessary for purposes of price formation (Hardaker, 1975).

PRODUCTION PLANNING

One of the biggest marketing obstacle faced by traditionally production-orientated small farmers is the concept of product planning. Careful selection of the product or crop with consideration of marketability is a good starting point. Fisk (1978:18) recommended that this be based on marketing advice by a competent authority. Small farmers are often slow in adapting to change, despite the changing market situation, and continue to grow traditional crops using traditional methods. The farmer should consider production in terms of comparative advantages and land availability. If the farmer has little land, the farmer should consider labour intensive crops which require relatively smaller land and have a relatively higher market value. For intensive cultivation of these produce, the farmer must continuously learn about new varieties and new cultivation practices.

MARKET CONTRACTS

The small farmer's produce may either be sold at nearby periodic markets or to a pre-determined wholesaler. In any case, to whom and how the produce is to be marketed should be planned beforehand. In order to achieve a higher selling price it is necessary to negotiate with wholesalers, if not individually then as a group.

When the marketable surplus is a sizeable quantity, either because of intensive specialized cultivation by an individual farmer or because of pooling of the marketable surplus of many small farmers, successful marketing arrangements can be made by contracting with a selected wholesaler on a longer-term basis. The produce can be delivered to the contracted party with an understanding that it will be sold at the prevailing market price. Such a longer-term contract is beneficial to both the farmer and the wholesaler once the customer relationship is established. Such arrangements are a key factor in many successful small farmer marketing systems.

Bourke (1983) showed that obtaining contracts with an institutional consumer, such as a hospital, school, prison or military unit, was a good way to secure the market for the farmers produce. Similarly, the IFAD special mission to PNG (1980) stressed contracting arrangements, especially with the large mining companies, in designing a national food marketing

structure. Such contracts may be made individually or as a group. The most important factors for making such production/marketing contracts a success and long lasting in time are:

- (1) the most practical and flexible pricing formula which automatically reflects the changing price situation in the market and:
- (2) longer-term commitment for the long-term interest of the farmer and the contractor.

GROUP MARKETING

One of the main problems of marketing by smallholders is the "smallness" of their marketable produce which results in higher marketing costs, a weaker bargaining position and ineffective marketing practices. Group action by small farmers is the most effective solution to the problem as, unlike production, the principle of economies of scale governs marketing efficiency (Hardaker, 1974). It is recommended that the group should consist of homogenous small farmers who have similar marketing problems in the village. It may be an informal marketing group of 10 to 20 members or a formally registered farmers association or primary cooperative (Lee, 1990).

Wortman and Cummings (1978) noted that a good way to encourage

small farmers to organise group marketing was through their hearing of success stories from similar farmers within the country. In any country, there are a group of small farmers at village level who are successfully marketing their produce. Although these small farmers are also under similar socio-economic and political environments, some may respond better than others (Penny, 1969). Collinson (1972) noted that success stories from within a country or region by other small farmers may be effective in motivating other small farmers. The success may be due to support and encouragement given by the government, religious groups, private development agencies, or may be initiated entirely by farmers themselves.

Lee (1990) noted that training of small farmers by using successful small farmers as a teacher-cum-motivator has proved to be the most effective way of promoting small farmer group action for marketing improvement. Leaders of successful small marketing groups can be the best 'teachers' and 'motivators' to encourage and stimulate other farmers to follow, because they can communicate with each other more effectively, and the stories by leaders of successful small farmers based on their own experience have more convincing powers.

CONCENTRATION AND SPECIALIZATION

After the efforts to promote small farmers' group action have

become reasonably successful, a practical and effective approach to accelerate efficient marketing is to encourage development of "concentrated and specialized" production and marketing activities, which may be called small farmers' 'estates'. After a careful feasibility study, a certain locality is defined as a particular crop estate. The Niugini Tablebirds Pty Ltd poultry estate outside of Lae is a case in point.

Necessary supporting infrastructure such as hatchery, storage, poultry slaughterhouse, veterinary service and extension services are provided by the company and small farmers within 10 to 15kms in radius are encouraged to produce poultry. Medium-term loans for poultry pens are provided. Since participating farmers are in a closely supervisable area, a credit scheme was found to be effective. These farmers who participated in the programme formed an association and the management office is located at the centre where all the above mentioned infrastructure and supporting facilities are available. Chickens are brought to the estate for selling when they reach selling age. ³¹

In a similar way, many kinds of small farmer 'estates' for other fruit and vegetables may be created. Once they are known to the traders and once the quantity is large enough, various marketing

31. See Smith, H.G., 1985, "Niugini Table Birds Pty Ltd", Marquell Press, Goroka.

innovations may be brought in and traders will be attracted for direct purchasing. Such 'estate' concepts have been successful in some developing countries (Lee, 1990).

MARKETING EXTENSION SERVICES

For the implementation of a small farmer marketing programme, as has been discussed above, the crucial support to be provided by the government is 'marketing extension services'. In all the developing countries, crop and livestock production orientated extension service are available, although often the number of field extension workers and their quality is inadequate. However, marketing extension service are not available in most of the developing countries (Lee, 1990). For the marketing programme to be efficient, an efficient extension network is necessary. The marketing extension worker will be required to:

- (i) advise the farmers on product planning, i.e., what crops to produce, considering marketability and economics,
- (ii) assist the farmers in securing a market for the farmers' produce, by either organising production-marketing contracts with processing industry or wholesale traders, or by making marketing arrangements with wholesale markets,

- (iii) advise the farmers on 'planned shipment', i.e., staggering of harvesting time in order not to 'glut' the market,
- (iv) advise the farmers on improved marketing technologies and practices, such as improved grading, packing, storing, handling and transport of produce,
- (v) promote the farmers' group organisation for marketing, and
- (vi) arrange marketing credit for the farmers.

It is not necessary to have a marketing extension worker at every village. The marketing extension worker can best operate through farmers' groups or through the farmers 'estate'.

It may be difficult for the government to initiate an entirely new extension system for marketing only. A practical approach would be to train selected persons from among the existing crop production extension workers to become marketing extension workers. They may be part of the existing marketing system but specializing in marketing extension. A specific professional training programme may be organized to train marketing extension workers. Such a training programme may be initiated, under technical support from the government marketing department, or

professional marketing agencies, and with institutional support from the existing agricultural extension department. ³²

SUMMARY

In a traditional subsistence economy in PNG, food marketing was a simple affair. People grew their own food and derived their other needs from local sources, with marketing confined to local exchanges. Following colonization and development, the whole scope and pattern of marketing functions have been transformed. As an increasing proportion of the population becomes employed in non-agricultural production, new marketing channels are needed to bring food from the farms to urban areas.

The marketing problems discussed may not affect all farmers equally. However, for small farmer marketing, essential ingredients that will ensure an effective marketing system are: (1) economies of scale (2) increase in bargaining power (3) encouragement of group action (4) motivation of innovation (5) improvements in marketing efficiency. An effective marketing system will ensure that as the country develops, adequate amounts

32. Much of this is drawn from work by Lee C.Y., 1990, "Removing Marketing Constraints in Rural Development" in Marketing Systems for Farm Products in Asia and the Pacific, Asia Productivity Organisation, Tokyo.

of food are made available to the growing urban population at reasonable prices, on a regular and reliable basis, of the appropriate quality and variety. The produce from the producers to the consumers will occur without avoidable waste and result in benefits to both producers and consumers if an effective marketing system is developed.

CHAPTER NINE

DEVELOPING A FORCED PACE FOOD PRODUCTION STRATEGY

INTRODUCTION

PNG is entering an era where agricultural development is imperative for sustained economic growth. In particular, subsistence agricultural development, including food production, must be accelerated. In earlier chapters, several reasons were noted for increasing productivity in subsistence agriculture.

Firstly, higher incomes among a large number of smallholders is essential for general economic advancement and improved rural standards of living as well as enlarging the domestic market for locally manufactured goods. Secondly, self-sufficiency in food production will insulate PNG from international uncertainties. Thirdly, less foreign exchange will be spent on produce that could be produced within the country, thereby increasing employment of rural people. Finally, the neglect of the rural poor will lead to unrest and violence. In PNG as already noted, this is being reflected in the high social tension and crime

rates presently experienced. Throughout this paper, I have indicated that the highest priority in agriculture should be on increasing farm income through increased productivity and on achieving widespread participation of the subsistence producers. Evidence indicates that the first concern of these smallholders is higher incomes. Therefore, the focus of this paper is on increasing smallholder productivity.

While there is no blueprint for rapid agricultural development which is applicable to all countries or regions within countries, for every region, commodity, or problem, certain actions can be initiated and the purpose of this chapter is to outline these alternatives. In addition, case studies of strategies undertaken in other developing countries are discussed to outline their relative merits.

COMMODITY PRODUCTION PROGRAMMES

The agricultural economy of PNG is based on a wide array of crop and animal species. The most dominant crops are tree crops mainly coffee, copra, cocoa and more recently palm oil. These crops have enjoyed success because they have clear arrangements for production, processing, marketing, research and the extension and training of personnel, synchronized by a semi-government body comprising representatives of diverse groups interested in the commodity, such as the various Commodity Boards in PNG.

Evidence shows that while these crops were initially planted on estates, smallholder production presently dominates these commodity sectors. The principles that have made these crops successful can be extended to basic food crops including domestic staples. Organized properly and adapted to local farming conditions, national commodity programmes for domestic staples like taro, sweet potato, bananas and irish potatoes can raise productivity and incomes rapidly and widely.

For each commodity a central group with technical expertise must be organised to establish goals and devise strategies for accelerating output. This group should determine how input supply, marketing, and technical services should be improved and to identify target regions for early attention. This group will also be responsible for establishing relations with scientific and other institutions in other countries from which information and materials for trial can be requested, and to ensure smooth operations involving all relevant institutions and individuals. The cases of rice in the Philippines and maize in Kenya may help illustrate this.

THE PHILIPPINES: RICE

The Philippines, facing a rice shortage of 700,000 tons because of a poor crop in 1973, launched the "Masagana 99" rice production programme to combat this situation. The major elements

of the campaign included:

- A package of improved farming practices, developed on-farm as well as at experimental stations.
- Promotion of the use of recommended varieties and fertilizer applications.
- A campaign to control pests and diseases including the supply and use of pesticides.
- Easy access to credit for participating farmers
- Improved extension activities including mobility.
- An informational and educational campaign
- The price support, procurement and storage programme strengthened.
- Target areas of high production potential were identified to focus programme inputs.
- A management system, operating at each level from the national government down to the farmer, was instituted to plan, implement, and monitor the progress and problems of the program.

Masagana 99 was a forced-pace campaign to quickly move research results to farmers. Improved technology was accompanied by simultaneous efforts to supply material inputs, credit, information and markets. The delivery system involved the activities of a wide-ranging group of organisations with a modern management system designed to direct the campaign. This resulted in rice production increasing by 35 percent by 1976.³³

KENYA: MAIZE

In 1955 Kenya began a maize improvement program. This program involved introduction of new technology, particularly hybrid maize as well as farming techniques to maximize farmers' yields and profits. Strong cooperation by research and extension staff enabled farmers to adopt this technological package through field trials on-farm and on experimental stations, seminars and district tours. The research strategy was focused on continuous development high-yielding hybrid varieties and an extension strategy was to use hybrids to stimulate good management practices. Efficient use was also made of foreign technical assistance to supplement local resources.

Large farmers initially responded well to this program, with all

33. This brief account is drawn from a seminar paper by Drilon, J.D., 1976, "Masagana 99: An integrated Production Drive in the Philippines", University of Reading, London.

large farmers using hybrid seed within 6 years. Between 8 and 11 years, 80 per cent of the subsistence producers also adopted hybrid seed as well as good management techniques. The program was so successful, over half of all maize planted is hybrid. Kenya is at present, in addition to meeting all its domestic maize requirements, a net exporter of maize.

It should be noted that some of the prerequisites for increasing production were in place before the program was undertaken. The transport system was adequate. Input supplies including seed and fertilizer were available to farmers on time and at reasonable costs. The price of maize was fixed before the program commenced and a wide network of buying points already existed.

The main lesson to be learned from this is that a profitable technology package, giving significantly higher yield levels than traditional farming methods was the main requirement. Kenya had people and organisations that could be mobilized, adapted, and coordinated to provide the services needed to make the new technology available to farmers. This case is also evidence that small farmers, given the opportunity, will adopt appropriate technology as quickly as large farmers. ³⁴

34. This account is drawn from Gerhart, J., 1975, "The Diffusion of Hybrid Maize in Western Kenya", CIMMYT, El Batán, Mexico.

AREA DEFINED CAMPAIGNS

The defined area approach involves increasing output and incomes in a specific area. This concept is not new in development. Morss, Hatch, Mickelwait and Sweet (1976); Nelson (1973) in Latin America and Lele (1975) in Africa showed that its application led to increased productivity and incomes in agriculture, with both large and small farmers benefiting. The criteria in selecting areas depends very much on economic, political and technical considerations. The prospects for success or failure, however, depends on the programs' focus and approach, available technology and experience in the project area, channel of communication, input supply, credit, markets, farmer groups and local institutions, specialist training and financial and political support. The following two projects may provide some insight.

COMILLA: BANGLADESH

This project based in Bangladesh was one of the first and most innovative rural development projects undertaken from 1964 to 1970. Average yields of rice doubled during this period, as did the incomes of participating farmers. The project emphasized four interdependent activities to teach farmers to be effective in managing their own resources and public resources to attain their goals.

Firstly, a local government council was created to mobilize the people through their elected leaders and ensure responsiveness as well as providing public and private services such as credit and extension activities. It also served to facilitate contact with other relevant departments and institutions. Secondly, a rural works program was created to construct roads, drainage channels and embankments which provided employment of the landless labourers during the dry months. Their priority needs were protection from flooding and better access to markets. The third activity was an irrigation program. This involved utilizing the roads and flood control works to provide water during the dry periods from rivers and canals as well as from tube wells. The fourth activity involved organizing cooperatives to enable farmers to modernize their farming techniques and to acquire inputs such as credit.

Several problems were noted. The subsidies such as the concessional interest rates could not be sustained and proved to be a drain on the economy. The wealthy farmers dominated the cooperatives and thus the credit funds. The important lesson from this project is that successful rural development requires sustained support to improve productivity and incomes. ³⁵

35. See Khan, A.H., 1974, "Reflections on the Commilla Rural Development Project", OLC, American Council on Education, Washington.

PUEBLA: MEXICO

This project was undertaken in 1967 in Puebla in Mexico, a valley of 116,000 hectares and farmed (mainly maize) by 43,000 families. During the project, maize yields increased by 30 percent on unirrigated cropland and net income to farming families increased by 45 percent.

Prior to the project, maize yields were static at 1.3 tons/hectare. All roads were adequate, as was accessability to input supplies, credit and markets. These agricultural service institutions, however, were not serving small farmers. Land reform had been undertaken previously. Scientists were concerned that maize varieties and agronomic practices developed on research stations in Mexico were not reaching small farmers. A project was set up to find out why this was happening and to determine if efficient techniques for promoting a rapid increase in maize production could be developed. If this was the case, the second objective was to teach leaders (successful maize farmers) for maize promotion and operating programs.

The project began with an assessment of the problems, resources and activities of people in the project area. Following this, field trials were conducted on-farm. Further trials provided more detailed information. Using this information, appropriate technology was designed for the local enviromental conditions.

Major organisational changes were made. The project area was divided into five agro-climatic zones and technical agents assigned to each zone together with support staff. As the number of farmers participating in the program increased, agricultural service institutions supplying production inputs such as fertilizer and credit were forced to participate. An evaluation unit built into the project uncovered problems and provided a basis for program changes to improve those conditions. In addition, a training component was built into the project to transfer skills and knowledge.

The success of the project led to this approach being utilized in other states in Mexico as well as other developing countries like Colombia and Peru. The project was successful because it followed a planned approach with built-in mechanisms for learning and subsequent readjustments.

A methodology for promoting substantial increase in maize production was developed which basically involved farming systems research to ensure that new technologies and agricultural production input services became more responsive to farmers needs. ³⁶

36. See CIMMYT, 1975, "The Puebla Project: Seven Years of Experience: 1967-1973. CIMMYT, El Batán, Mexico and Winkelmann, D., 1976, "The Adoption of New Maize Technology in Plan Puebla, Mexico", CIMMYT, El Batán, Mexico.

REORIENTATION AND SYNCHRONIZATION OF SERVICES

Many national organisations and agencies in PNG were not designed to support forced-paced strategies outlined in this chapter. Ward and Procter (1980) note this as a constraint to agricultural development in PNG as well as the Pacific. To accelerate agricultural development, the third strategy is reorientation of government agencies and educational institutions to become responsive to the needs of farmers.

This strategy should involve, firstly, strengthening delivery of services required to make them easily accessible to farmers. Secondly, arrange the mix and intensity of public agricultural activities to meet the most current needs in each part of the country.

Thirdly, all public agricultural agencies should be reorganised to make them more development orientated. The way most public organisations and institutions in PNG were setup and organised was heavily influenced by political considerations and colonial antecedents. The institutions were transferred from public service structures in Australia, where rapid development was not a major concern.

Fourthly, an appropriate pattern of agricultural planning should be installed to provide for (a) both long and short term national requirements on a continuously revised basis; (b) the varying

needs of different regions; (c) and involving relevant agencies and technical personnel in the planning process.

Fifthly, modernize operating procedures and patterns of administration in all public agencies to attract and retain competent staff, to expedite purchase and the delivery of materials and services, to streamline transactions between departments and permit greater delegation of authority.

Failure to synchronize activities at all levels, from cabinet to the individual rural community, will delay, reduce, or prevent progress. These changes and reorientations require much effort and will very much reflect the government's political will.³⁷

SUMMARY

Since the 1960's, there has been heightened concern about the world food situation. This has resulted in significant developments to increase agricultural productivity. Three proven and complimentary approaches to agricultural development have been noted.

37. Much of this work is drawn from Mosher, A., 1969, "Creating a Progressive Rural Structure", Agricultural Development Council, New York and Mosher, A., 1971, "To Create a Modern Agriculture", Agriculture Development Council, New York.

Firstly, commodity-orientated production programmes which are designed to achieve established goals for domestic consumption or export. Secondly, defined-region campaigns to increase productivity and incomes of as many people as possible, using whatever combinations of commodities, techniques and services feasible. Thirdly, synchronized and reoriented government services to speed progress.

Large-scale mechanized farming (whether by agribusiness, individuals or state farms) may increase production but it usually does not expand employment and raise incomes of a large number of rural people. It has been shown that farmers will change quickly to high-yielding crop production systems if the requisites for their participation are satisfied.

Therefore, nations such as PNG that are forced to rapidly develop agriculture, should be advised to use an agricultural development strategy that embraces a combination of commodity production programs, defined-area campaigns, and the reorientation and synchronization of services and institutions.

CHAPTER TEN

SUMMARY AND CONCLUSIONS

SUMMARY

Agriculture plays an important role in the economic growth of LDC's, at least in the initial stages of development. Considerable resources are transferred, both into and out of agriculture, but mostly from agriculture to other faster growing sectors of the economy, to stimulate economic growth. Agriculture's contribution are: (a) increased food production to improve existing nutritional levels for a rapidly increasing population; (b) provision of employment for a rapidly expanding rural population; (c) provision of scarce foreign exchange to import capital equipment and intermediate goods that cannot be produced at home; and (d) it supports industrial development by providing raw materials and labour for local industries and serves as a source of capital formation.

Agriculture's share of GDP is expected to decline relatively as resources are shifted out of agriculture into other sectors and

as international prices for agricultural products relative to non-agricultural products, decline over time as the world economy grows. Agriculture's share of GDP in PNG is expected to decline faster than other slow growing economies, as a result of a boom in mineral exports, which results in resources moving from the tradables to the non-tradables sector. This has resulted in a rapid structural transformation which has served to "push" rather than "pull" underemployed rural labour out of agriculture and into industry.

Thus, the agricultural sector in PNG is expected to grow less rapidly than it otherwise would. Food production, particularly domestic staples, are expected to decline further as subsistence producers move in and out of production depending on returns to labour. To offset the decline in the relative prices of agricultural goods, agricultural productivity growth has to be faster than other sectors of the economy.

Available evidence indicates that the traditional farmer is economically rational and that through a process of trial and error, the traditional farmer gradually arrives at an optimal solution to the allocation of the limited available resources. Traditional farmers are not traditionalist by choice. Agricultural techniques have been developed over centuries, through years of accumulated experience of generations of farmers. Traditional farmers cannot normally adopt technological innovations unless the circumstances in which they operate are

first changed. Firstly, new technology must be generated to improve farming systems. Secondly, this technology must be transferred to the farmer who should be instructed on how to use it. Thirdly, essential conditions such as production incentives and facilities (infrastructure) as well as markets for produce should be provided. Finally, an appropriate strategy for promoting technological change must be formulated.

This is not reflected in government policy in PNG. Public investments can enhance the quality and quantity of resources in agriculture. Two trends are noted that may have dire consequences for agricultural development in PNG. Firstly, the government is underinvesting in agriculture relative to other developing countries. PNG is missing out on benefits from agricultural research, particularly food production, as both producers and consumers benefit. Secondly, the main beneficiary of agricultural research in PNG presently is the non-food plantation (export) sector. Investment in research and extension is the key to increasing agricultural productivity. Given the importance of food in economic development, equal consideration in terms of investment in research must be given to food as well as cash crop production.

Farming systems research ensures that the benefits of agricultural research are available to smallholders who are the major food producers in PNG. The important role of agricultural research in diagnosing weaknesses in existing farm systems and

evaluating possible improvements to increase resource productivity is widely acknowledged. In traditional agriculture this role is more enhanced because efforts to increase agricultural productivity through the use of new and profitable technologies often don't include farmers, the end users, to determine the appropriateness and/or acceptance of the technology. This results in a one way communication flow and blanket research programs, characteristic of LDC's with scarcity of funds and skilled manpower.

Farming systems research is considered an alternative means of transferring appropriate technology to smallholder farmers to increase productivity. It ensures that technology is not designed, introduced and abandoned by applied scientists. It allows information to be collected on the technology's acceptance or rejection by farmers, the final judges as to the appropriateness of a proposed technology transfer.

Improving subsistence productivity is only part of the problem. The next stage involves moving the rural surplus to the urban consumers where it is required. An effective marketing system will ensure that as the country develops, adequate amounts of food are made available to the growing urban population at reasonable prices, on a regular and reliable basis, and of the appropriate quality and variety.

For this reason, some form of government intervention is

required. It is a common fallacy to assume that market factors when left to their own devices, will lead to increased productivity and efficiency within the distribution system. A national food marketing structure should be designed to achieve the higher social objectives of self sufficiency in food production.

In LDC's, the private sector is often efficient in economic terms but backward in terms of technology and institutional arrangements. This factors make it mandatory to look beyond physical facilities and consider technological and institutional improvements within the marketing system.

Smallholder farmers have particular marketing problems. While these marketing problems may not affect all farmers equally, the essential ingredients that will ensure an effective marketing system are: (1) economies of scale (2) increase in bargaining power (3) encouragement of group action (4) motivation of innovation (5) improvements in marketing efficiency.

Since the 1960's, most LDC's have attempted to increase food production via increases in agricultural productivity. Three proven and complementary approaches to agricultural development have been noted.

Firstly, commodity-orientated production programmes are designed to achieve established goals for domestic consumption or export.

Secondly, defined-region campaigns are designed to increase productivity and incomes of as many people as possible, using whatever combinations of commodities, techniques and services feasible. Thirdly, there is the approach of synchronizing and reorienting government services to speed progress.

Large-scale mechanized farming (whether by agribusiness, individuals or state farms) may increase production but it does not expand employment and raise incomes of a large number of rural people. Farmers will change quickly to high-yielding crop production systems if the requisites for their participation are satisfied.

For this reason, nations such as PNG that are forced to rapidly develop agriculture, should be advised to use an agricultural development strategy that embraces a combination of commodity production programs, defined-area campaigns, and the reorientation and synchronization of services and institutions.

CONCLUSION

Subsistence agriculture provides a livelihood, albeit at a very low level, for the bulk of the population in developing countries. In PNG, 85 percent of the population depend on agriculture and continue to produce at subsistence level. One of its main drawbacks is that it is self-perpetuating, and because

it produces very little or no surplus over the requirements of producers, its contribution to the national economy is minimal. Low productivity in agriculture leads to human poverty. The rapid population growth in PNG means that the rural labour available is unable to be absorbed in productive agriculture employment.

Much of the underemployed rural labour is presently being "pushed" out of agriculture into urban centres. Meanwhile, industry in PNG, especially the manufacturing sector, is stunted because it is faced with high production costs, particularly high wages determined largely by high food prices. Therefore, industry is unable to absorb the surplus labour, leading to high unemployment and social tension.

It is anticipated that the influences of these growth-generating forces on the mobilization and allocation of resources could change the commodity terms of trade in favour of (and thereby shifting resources to) the non-agricultural sectors while maintaining profits in both the agricultural and non-agricultural sectors. The crucial ingredient in this mechanism would be continuous performance-enhancing production technology and cost-reducing technological change in food marketing.

It is anticipated that improved productivity in smallholder food production, particularly the production potential of high-yielding varieties and the subsequent spinoffs to other commodities, distributed effectively, will be sufficient to make

the growth rate of supply exceed demand. As a result food prices might decline and gradually lower wages and raw material prices for manufacturing, thereby opening up new profit possibilities for the non-agricultural sector, particularly manufacturing.

While the commodity terms of trade might turn against agriculture, the profitability of agriculture could be maintained or even improved if the new technology lowers unit cost curves for agricultural commodities at a rate which is more than sufficient to offset declining commodity prices. A significant portion of these profits might be reinvested into further agricultural modernization, thereby creating a continuing demand for the output of these non-agricultural sectors.

The marginal physical product of agricultural labour will rise but if agricultural prices decline, the marginal value product of agricultural labour (which is low but positive) will increase only slowly, if at all. The result will be that agricultural wages will rise little on average even if agricultural production increases rapidly.

In contrast, it is anticipated that the manufacturing sector will utilize the profits generated initially as a result of gains in agriculture to increase investment and raise labour productivity. Manufactured products usually face relatively high-income elasticities of demand which means the prices of manufactured goods should remain relatively steady at the rates of growth

anticipated. The result would be higher wages for manufacturing employees and more jobs for the unemployed. Through forward and backward linkages, other sectors of the economy would also benefit, thus achieving broad based economic growth.

It is therefore important that considerable momentum be generated within the industrial sector to stimulate industrial development. While this will take time, rural development programmes are requisite, if not mandatory, at this stage because of their relevance both for generating supplementary employment to effectively utilize underemployed rural labour as well as making a significant contribution to improving the economic infrastructure of the country.

CHAPTER ELEVEN

POLICY RECOMMENDATIONS

POLICY CONSIDERATIONS

Transforming traditional agriculture in PNG requires an understanding of the decision making process of the farm household or subsistence unit that policy is attempting to influence. Operational decisions on production, marketing and consumption, as noted in chapter 4, are made by individual farmers. Therefore it is important that the characteristics of the decision making process be incorporated into the agricultural policy framework.

Firstly, the 'pure' subsistence family farm provides all of its labour requirements from within the family and consumes all its output while the 'pure' commercial farm hires all its labour input and sells all its output. Most small farmers in PNG are in-between, consuming part of their products and providing some of the factors of production used in the production process.

Within this framework, the household allocates its labour in relation to the satisfaction derived from leisure and from farming (with its associated monetary rewards) and allocates its production in proportion to the relative satisfaction derived from directly consuming that product as opposed to consuming something else which might be purchased from the money obtained when the product is sold. Each household complex or family farm has its own particular utility function as well as its own production function. The economic behavior of a family is considered 'rational' when the family farm has achieved subjective equilibrium, i.e., when it has maximised its utility, subject to its income equation.

Secondly, it was noted in a number of developing countries, that improvements in transport and communication widens the horizon of small farmers and this results in economic relations becoming progressively monetized and technological changes increasingly reinforced. This results in a progressively large number of farmers being brought into the economic matrix as the growth process gathers momentum.

Thirdly, the transition from a largely subsistence to a largely commercial orientation is a very important consideration. Several factors were noted which can intervene to cause factor allocations to deviate from the allocations for maximum output. The first factor noted was a diversity of behavior within a large group as indicated by the range of farm sizes. This implies a

range of abilities and opportunities with regard to education, capital stock, farming knowledge, access to credit and attitude to risk. Experience in a number of developing countries has revealed that when economic opportunities are presented and new terms of reference established with regard to input costs, the input/output response, work/leisure ratio or consumption/sales ratio, some farmers respond much faster than others.

Finally, physical factors set limits for some farmers. Certain crops can only be produced in certain areas. For example, potatoes require cooler growing climates and will only grow in provinces or parts of provinces more than 800 metres above sea level. Therefore, in such cases, the choice is basically determined by physical factors.

These factors are very important and should be taken into account when attempting to formulate specific policy tasks.

SPECIFIC POLICY TASKS FOR INCREASING FOOD PRODUCTION

It is important to note that a farmer's objectives which influences operational decisions, may not always be consistent with the social objectives outlined in chapter 3. Therefore, some government intervention is required to aggregate private decisions to ensure consistency with agricultural development objectives.

The general policy challenge is where to start and create a dynamic state, to be sustained and strengthened over time and space, within agriculture, from agriculture to non-agriculture, and then returned via linkages. As noted in chapter 4, the production function is the crucial component. In the policy context, the tasks appear to fall within the following categories.

RESEARCH AND EXTENSION

Research must be of a continuing nature and targeted specifically at small farmers to ensure that new appropriate technology is made available at progressively lower unit costs. This technology must be applicable to a large number of smallholder farmers, operating under diverse farming conditions, to maintain profitable levels of operation (including the productive investment of profits) in an environment of gradually declining relative agricultural food prices. Productive on-farm research on food, particularly traditional staples should be undertaken along-side present protective research programmes on export crops.

Extension programmes should be based on results of successful on-farm trials based on interdisciplinary problem-solving research and directed primarily at 'innovators' and secondly, at 'laggers'. The 'laggers' will only participate once they have

been assured, through observation of the 'innovators', that the risks are not high and new high yielding varieties are much more profitable than the traditional varieties.

There is a further group which has not been mentioned previously, particularly in the more densely populated provinces. This is the group that has fewer resources especially land, and may not be able compete with the progressive farmers who often have more land and capital. This group will require special extension assistance, particularly in terms of intensive farming methods to enable them to compete economically with the progressive farmers, thereby preventing them from being pushed out of agriculture too quickly and adding to the present problems of high unemployment. In other areas, special programmes like the South Simbu Rural Development Project in the Simbu Province, funded by the World Bank on the basis of inter-personal equity, may be required.

These programmes may have a primarily social orientation, but maintain as much production impact as possible to integrate these persons into the present economic matrix. This may be a temporary solution and in the long run, it will be necessary to expand non-agricultural production to absorb these marginal agricultural workers.

INPUT MARKETING AND DISTRIBUTION

The government, either directly through its own activities or by

influencing private decision making through its macro economic policies, must make production inputs available. Production inputs must be made available in the quantities demanded by the farmers, at the right time and place and of the types demanded by the farmers for full production potential to be achieved. This includes domestic production of inputs. However, it should be noted that these inputs must be produced and made available at no additional cost to the country. Should cheaper imported inputs be available, the most cost effective alternative should be considered so as not to preempt achieving the overall social objectives.

PRODUCT MARKETING AND DISTRIBUTION

The marketing or distribution system should function effectively to facilitate input and output sales. In terms of output sales, at micro level, smallholder marketing constraints must be removed and at macro level, technological and institutional barriers which impede resource transfer must be overcome, to effectively move produce from the rural producers to urban consumers at lower prices. In the long run investments in economic infrastructure, including transport and communication, will bring more smallholders into the modern cash economy. These marketing functions must be achieved at the lowest price and with the greatest efficiency possible.

FOOD PRICING POLICIES

Food pricing policies have not been mentioned in this paper. Nevertheless, it is a very important consideration. A production orientated economic climate is a crucial element which plays a major role in guiding private decisions. While the vagaricies of weather patterns may never be totally stabilized with technology such as irrigation facilities, prices can be controlled, especially sharp declines. Stable prices provide an economic environment that decrease production risks and allow the farmer to make optimal use of inputs.

The policy mix noted aims at firmly establishing a production base in PNG. The crux of the proposed programme is to keep unit costs declining, to use profits for capital formation and to extend the new technology to remoter areas of PNG, to ensure their more meaningful participation in the economic development. Strengthening food research, improving and strengthening the smallholder marketing and distribution system, and creating an economic enviroment to stimulate growth-orientated production and marketing decisions are the basic programme requirements.

POLICY IMPLEMENTATION STRATEGY

The policy tasks can be implemented in several different ways. However, the three complementary approaches are relevant to PNG,

although the specifics may differ among commodities, regions and institutions.

COMMODITY PRODUCTION PROGRAMMES

For each commodity, there are systems by which the commodity is produced, harvested, marketed, processed, stored and transported locally or internationally. The commodity production programme focuses on increasing the production of that commodity, and hence, the incomes gained from it. The concept is simple to execute and can provide significant and quick gains if the government is willing to establish clear goals for output and farmer participation, and invest required resources and ensure cooperation between the private and public sector agencies.

DEFINED-AREA CAMPAIGNS

This programme is widely employed to achieve widespread gains in the productivity and incomes of rural people. It may be limited in a particular locality to make intensive effort to increase productivity and profitability of one or a few commodities, or it may encompass comprehensive efforts to improve agriculture, education, housing, health care, as well as to provide non-farm employment through integrated development. Defined-area development enables a better understanding of a rural community,

its resources, problems, potentials, and the aspirations and activities of the people, and permits subsequent changes in the community to be measured and quantified. The ability of public and private agencies to co-operate can be determined and the weaknesses corrected. Innovations can be tested, and errors minimized prior to widescale application. Such defined-area programmes allow project staff, through work with the farmers and others, to become skilled in solving farm-level problems.

REORIENTATION AND SYNCHRONIZATION OF GOVERNMENT SERVICES

The reorientation and synchronization of the activities of diverse government agencies and of private industries, (many of which were not designed to support forced-pace action), and the decentralization of marketing and supply systems are also required. To be effective at local levels, coordination must occur at every level of government, including the ministries.

The most comprehensive and desirable approach to accelerated subsistence food production in PNG is a combination of commodity-orientated and defined-area efforts, supplemented by the strengthening of relevant institutions, and attention to the synchronization of the many services required for the success of either approach.

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