

INSTITUTE OF NATIONAL AFFAIRS

DISCUSSION PAPER NO. 19

**PLANTATION AGRICULTURE IN
IN PAPUA NEW GUINEA**

by

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June 1985

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P.O. Box 1530,
Port Moresby
Papua New Guinea**

PRICE: K10.00

Telephone: 21 1045

ISBN No. 9980-77-053-8

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PREFACE

The present report on plantations is one of a series of studies to be undertaken during 1985 by I.N.A. research visitors. The others are an analysis of smallholder agriculture by Dr. Barry Shaw of the Australian National University and a study of agricultural extension services in Papua New Guinea to be carried out by Professor Frank Jarrett of the University of Adelaide.

The author of this work, Mr. C. C. Goldthorpe, is an agricultural planner from the United Kingdom with a long experience of tropical tree crops in Africa and South East Asia. His thesis is fairly straightforward: commercial enterprises play an important role in the (export) tree crop sector. Such enterprises work best if they are relatively large, are run on sound business lines and have land tenure characteristics which permit investment planning and a time cycle consistent with the economic life of the crop.

In fact Mr. Goldthorpe points out that, internationally, management structures are what distinguish plantations from most other types of commercial agriculture. In turn, the need for hierarchical structures is dictated by the nature of the crop - perennial and, in large degree, harvested throughout the year. The manual labour force required by this type of agriculture is more specialised than that common to other farming enterprises and their tasks are more akin to those of factory workers than farm labourers.

He describes plantations as considerable earners of foreign exchange and employers of labour and points out, that as plantation crops have to be treated before export, they are usually associated with significant processing plants providing an excellent example of manufacturing attuned to the nation's rural base. Of course, they also spawn a number of industries catering to their needs: in transport, marketing, finance and in the more technical needs of insecticides, plant breeding and engineering. As Dr. Shaw, in a forthcoming I.N.A. research report will claim, plantations are the least import reliant of any industry operating in Papua New Guinea today, and thus create high value added domestically.

Mr. Goldthorpe is critical of some of the management practices in vogue in Papua New Guinea plantations and finds, generally, that the large foreign owned enterprises are best in this regard. He advocates, for the short run, recruitment of experienced senior overseas personnel from countries hosting successful plantations combined with a long term program to produce competent local managers.

He subscribes to a theory of plantation development which accepts that, ultimately, their ownership and management is repatriated. It is shortsighted, however, he asserts to insist on that localisation too early in the process - all that will be localised will be moribund estates. A forward looking policy based on acceptance of foreign investment will guarantee a gradual and orderly transition, via a variety of ownership structures, including joint ventures, towards a viable indigenous industry.

In terms of that plantation cycle Mr. Goldthorpe sees the sequence in Papua New Guinea as having been stopped before "capitalistic consolidation" in respect of significant portions of the cocoa and coconut sectors; while in other cases, particularly in coffee, a much younger industry than the other two, repatriation has reached an advanced stage. Just what impact the latter will have on attempts to restart the cycle in the former is yet to be revealed. But, as he points out the management required to bring the estate sector to international standard cannot be sustained by sub-optimally sized holdings.











What has caused the negative perception of plantations in this country is a confusion over the Melanesian desire to maintain the local ownership of land with the need for long term planning within plantation enterprises. The key to the land issue is a system of leasehold, granting secure occupancy to the lessee while maintaining the rights of the traditional owners. The key to the ultimate localisation of the plantation economy is the encouragement now of efficient plantation companies, of whatever ownership structure, to work the available leasehold land.

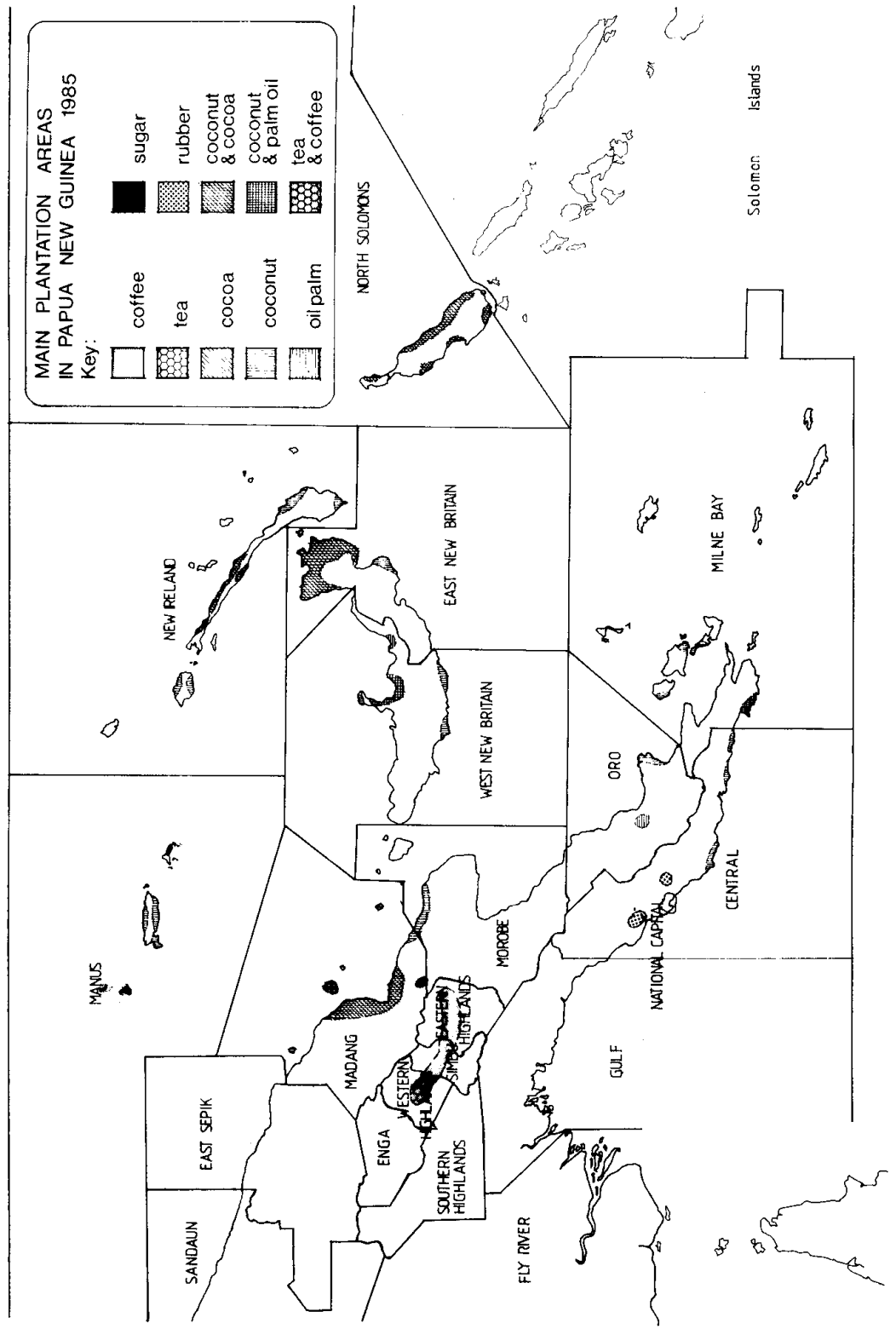
In looking at the prospects for "privatising" agricultural extension Mr. Goldthorpe cautions us on two fronts: "technology" is principally simple drainage, weeding and pruning in the smallholder context; and the two systems, smallholder and estate, are fundamentally different agronomically and organisationally leaving only a small role for technology transfer. These issues will be taken further in forthcoming I.N.A. studies.

The I.N.A. puts forward this study on plantation agriculture in Papua New Guinea as part of its contribution to debate on agriculture.

**MAIN PLANTATION AREAS
IN PAPUA NEW GUINEA 1985**

Key:

- | | | | |
|---|----------|---|--------------------|
|  | coffee |  | sugar |
|  | tea |  | rubber |
|  | cocoa |  | coconut & cocoa |
|  | coconut |  | coconut & palm oil |
|  | oil palm |  | tea & coffee |



SUMMARY OF RECOMMENDATIONS

1. Statement of government policy: A definitive statement of government policy towards plantations should be published, preferably in conjunction with the Medium Term Planning Strategy. This is essential if investors are to have sufficient confidence to commit their funds for the long gestation periods common to tropical tree crops.
2. Restructuring of the industry: The legislation associated with the Plantation Redistribution Scheme should be abolished so as to allow amalgamations of existing plantations, especially in the cocoa/coconut industries. Only large plantations can generate the revenue necessary if competent management is to be engaged. This will guarantee, in the long term, a viable industry available gradually to come under local ownership and control.
3. Abandoned estates: Following on from 2 above, efforts should be undertaken to encourage the amalgamation of abandoned estates with adjacent viable plantations. As a means to this end it is suggested that the Department of Primary Industry, the Copra Marketing Board and the Cocoa Industry Board carry out a survey of moribund plantations. In conjunction with an international agency such as the World Bank, the Papua New Guinea Government could then undertake a feasibility study of the rehabilitation of such estates.
4. Tree crop research: Steps have already been taken to revive research into tropical tree crops in Papua New Guinea. Research institutes jointly funded by industry and government will embark upon studies suggested by both industry and government representatives. It is suggested that as smallholders will supply a high proportion of the funding for such research that the Department of Primary Industry ensures that issues of relevance to the smallholder sector receive adequate attention. Such matters would include research into disease resistant crops and husbandry techniques for low input farming systems.
5. Technology transfer: Due to their different farming systems, possibilities for technology transfer between the estate sector and smallholders is limited. Also, estates do not generally employ persons with experience in agricultural extension, so any activities of this sort mounted by the estate sector would have to be separately funded and managed. The situation is somewhat different in the context of nucleus estates where outgrowers and central estates are both part of an integrated operation supplying uniform quality produce to a centralised processing mill. Nucleus plantation and outgrower development programmes allow modern

agricultural techniques to be implemented at the beginning of a project by farmers unfamiliar with the crop. This is brought about by routine supervision of the small growers under centralised management. Top management in large scale agricultural development schemes need to be highly skilled in view of the size and complexity of the schemes but field supervision of farmers can be done with personnel of only limited skills and experience. The nucleus estate organisation therefore allows the economic use of scarce management skills in situations where such skills are at a premium.

6. Executive recruitment policy: It is suggested that the plantation industry should adopt a two tier recruitment policy. The first, lower tier, would be the employment of personnel with supervisory and man management skills. These men need have no training or direct experience of plantation agriculture. Recruits of this type would include former non-commissioned officers from the Defence Force and police sergeants. They would be employed at the senior supervisor/junior assistant level but in the main they would not be promoted further.

The second tier of recruitment would be personnel with higher formal educational qualifications preferably in agriculture. They would be of managerial potential and the more able would be expected to take over senior posts both on the plantations and at head office. Pending the ultimate localisation of such positions, which would be promoted by in-house training programs, it is recommended that such personnel be recruited from English speaking countries with a plantation tradition in Asia and Africa, rather than from labour markets skilled in temperate zone agriculture.

7. Labour conditions: It should be part and parcel of the recommended restructuring and rehabilitation programme of the plantation industry to introduce a labour policy more in keeping with standards of living and social attitudes appropriate to the mid 1980s rather than the late nineteenth century. A more suitable labour policy would de-emphasise short term indentured contracts and encourage family groups, more settled living conditions, better training and would provide stronger inducements to workers from adjacent areas.
8. Land tenure: Plantations require secure long term leases if they are to grow perennial tree crops with a production and replanting cycle of 15 - 50 years. Security in this context does not imply an inviolate and perpetual proprietary right to a landholding. The 99 year usufructuary title granted by the government on land alienated for agriculture provides sufficient security of tenure for all the plantation crops grown in Papua New Guinea, and it is therefore recommended that it become the norm for plantation enterprises.

Chapter 1

Objectives of Study

Plantation agriculture is not an agricultural system indigenous to Papua New Guinea nor indeed to any tropical country. It is a product of Western capitalist enterprise and as such was directly associated with the colonisation of the tropical world by the European nations. In Papua New Guinea the first plantations were established in the Gazelle Peninsula and northern coast of New Guinea in the 1880s by German colonists. It is thus appropriate that the Institute of National Affairs should have commissioned this review of the plantation sector 100 years after the introduction of the plantation system and 10 years into Independence.

To many Papua New Guineans the very term "plantation agriculture" brings to mind the expropriation of land and exploitation of labour during the colonial era. Even former expatriate agricultural officers with many years experience of the Papua New Guinea rural economy have questioned the suitability of the plantation mode of production to the Melanesian cultural tradition (McKillop 1981). Yet, the plantation sector, which is increasingly nationally-owned, remains an important means of production of export crops and vital to the national economy. The ambivalent attitude to plantations is reflected in political opinion and government circles by a tacit acceptance of the economic importance of plantations coupled with a reluctance to make policies that would encourage the expansion of this sector of the economy.

One of the main objectives of this study is to argue that plantation agriculture is superior to alternative agricultural systems for the production of tropical perennial crops. The viewpoint is taken that the plantation system is ideologically neutral and unlike traditional peasant agriculture, the industrialised system of plantation agriculture is based on non-local, non-national technology which operates quite independently of cultural norms. It is hoped that once it is accepted by the country's policy-makers that the plantation system is a rational and efficient means of agricultural production the plantation sector will receive official encouragement to take an increasing role in economic development.

First of all the study defines what is meant by the term plantation agriculture and examines the characteristics of this economically important mode of agricultural production. The study examines the crops grown under the plantation system of agriculture in Papua New Guinea. The role of the plantation industry in the economy of Papua New Guinea is then discussed.

The organisations and management structures within the plantation sector are examined in some detail and an assessment is made of the relative efficiency of management within each organisational group. The possibilities of a formal transfer of knowledge from the estates to the village producer of cash crops is related to the technology of production of the plantation crops. In the final chapter a set of policy recommendations is put forward for the expansion of a viable plantation industry.

Chapter 2

Characteristics of Plantation Agriculture

2.1 Problems in definition

Conroy (1981) in his introduction to the Institute of Applied Social and Economic Research seminar on the Papua New Guinea plantation industry asks what exactly do we mean by the word plantation? His reason for posing this rhetorical question is that plantations cannot be defined purely as an economic organisation but there are social, political and philosophical dimensions that have to be taken into account in any discussion about plantations. Greaves (1959) also states that the term plantation has a connotation and colouring depending on a number of aspects, political no less than economic, historical as well as sociological.

Agricultural geographers who study the classification of farming systems similarly have difficulties in defining the plantation system. Definitions by geographers in standard texts such as Courtenay (1965, 1980), Grigg (1970,1974), Harrison-Church (1969), Laut (1968), Morgan and Munton (1971) and Symons (1966) generally emphasise scale of operations in terms of land area, labour force and capital inputs, crop specialisation in tropical locations, and export of the finished product. Other features commonly considered to be characteristic of plantations are metropolitan domination of finance and business decisions, centralised control of estate operations, concentration on perennial crop production, dependence on imported labour and processing of the harvested crop. The listing of supposedly diagnostic criteria has been questioned by Jackson (1969) and Courtenay (1970,1980) as examples can readily be found of plantations that differ in one or more of the generally recognised characteristics. Plantations may be small; produce for the home market; or employ local labour. Increasingly nowadays they may be owned by the domestic private sector within a national economy, or be government-owned and operated.

2.2 Definition of plantation agriculture

A recent study of plantation agriculture (Goldthorpe 1983) uses a synthesis of organisation theory, the farm management branch of agricultural economics, and agricultural geography to examine the characteristics of this complex and widespread system of agriculture. Central to the examination is the view that plantations are agribusiness organisations whose main objective is to cultivate, process and market the produce of tropical crops at a profit. Plantations thus differ in a very important respect from smallholder producers in that

plantations are strictly business organisations with clearly defined financial objectives. As a form of business institution plantations are capable of being analysed by techniques used in organisation theory to examine social organisations.

An examination of the management structure and operations of plantations growing a range of crops across the tropical world reveals that a hierarchical organisation structure in which there is a high degree of standardisation of agricultural production techniques and specialisation of labour is typical. In contemporary organisation theory the term "bureaucracy" is used to describe the well-defined, formalised organisation structure with a high concentration of authority and high structuring of work activities. The characteristic features of bureaucratic organisations are a strict hierarchy of management control and a high degree of specialisation of the workforce (Blau and Meyer 1971, Burns and Stalker 1961, Perrow 1970, Pugh et al 1983).

For the purposes of this study the following definition is used to describe plantation agriculture in Papua New Guinea:

Plantation agriculture is the production of perennial export crops in a mono-culture or duo-culture cropping system in typically large scale, bureaucratic agribusiness organisations which are termed plantations or estates. The distinguishing features of Papua New Guinea plantations compared to small farm producers of the same export crops are -

1. Bureaucratic organisation structure with management and supervisory positions arranged in a strict hierarchy.
2. Employment of wage labour with agricultural production techniques standardised and broken down into a number of specialised tasks.

Plantations therefore are agricultural enterprises with a full bureaucratic organisation structure in the sense used in contemporary organisation theory. The characteristic features of estate agriculture are a formal hierarchy of management control, specialisation of the workforce and standardisation of agricultural techniques.

Within the plantation sector there is an areal continuum between small plantations covering only some score of hectares and larger production units with landholdings thousands of hectares in size. There is a direct correlation between size of enterprise and bureaucratic structure. Large organisations have a more rigid and defined bureaucratic structure than small

organisations (Child 1977, Pugh and Hickson 1976, Pugh et al 1983). Analysis of the internal structure of plantations in Papua New Guinea shows that larger plantations covering some thousand of hectares have a much more formalised hierarchical structure than medium and small sized plantations (see chapters 5 and 6). Barlow (1978) too, has noted this characteristic in his study of the Malaysian rubber industry.

2.3 Definition of smallholding agriculture

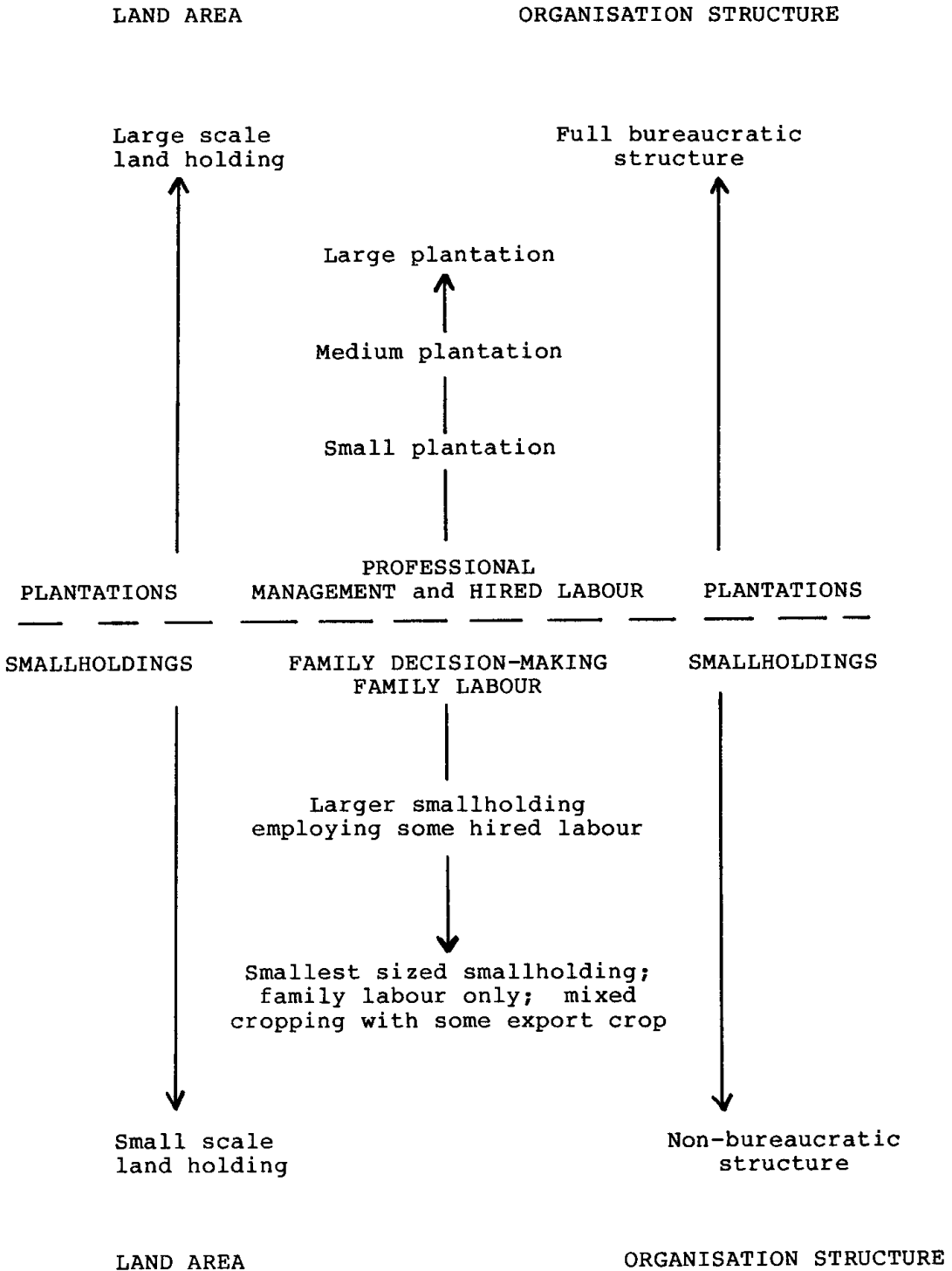
Bureaucratic structure and employment of hired labour are the diagnostic criteria that separate plantation agriculture from smallholder producers of tropical perennial crops. The basic distinction between smallholding and plantation operations becomes quite clear once the management/hired labour criterion is applied. Smallholding producers are independent decision-makers who use family labour which may work on its own, or in conjunction with some hired workers. Where professional management is employed as for example in the 20 hectare coffee development blocks in the Highlands, or the family exercises the managerial function exclusively and hires workers for agricultural production, the enterprise is classified as a small plantation or mini-estate. Small growers of perennial crops in nucleus estate and satellite outgrower schemes (e.g. oil palm projects at Hoskins, Bialla and Popondetta) are not regarded as belonging to the genuine smallholder sector. They are a part of centrally managed, strictly supervised, quasi-plantation projects which have many features of the plantation mode of production (see Chapter 8). In contrast where independent village producers grow some cash crop for sale to a central factory they would be classified as belonging to the smallholder sector.

Nevertheless in both the Highlands and Islands regions the difference between plantation and non-plantation enterprises is blurred because the scale of activities forms a continuum. That is to say there is no distinct break between the areas of holding which may be designated as plantations and those which would be considered as smallholdings. The distinction between smallholding and plantation is not based on area of landholding but on management structure and employment of agricultural workers. The ideas expressed above about the classification of smallholding and estate producers of the export crops are illustrated in Figure 1.1.

2.4 Characteristics of smallholding production

2.4.1. Poor yields/low incomes. Smallholder producers of perennial crops are, according to Ruthenberg (1980), inherently weak in husbandry by comparison with the performance of estates which leads to losses in yields. Grigg (1976) notes that

Figure 1.1
Classification of plantation and smallholding agriculture



smallholders rarely attain the high standards of farming found in plantations, the quality of their products is generally low and they are slow to adopt new methods. The Rubber Research Institute of Malaysia considers that compared to estate production "the peasant system of smallholdings suffers from several defects which collectively manifest themselves in low production....and inferior quality of products". Furthermore, "the typical small producer finds it difficult to take advantage of new technologies and economies of scale" (Ani and Ariffin 1981). Perumal (1981), notes that smallholders growing perennial tree crops are characterised by low levels of technology and income. Thus an important consequence of low yields and poor quality produce is low farm incomes despite the fact that unpaid family labour is employed.

Yield data from large estates are easily recorded and the figures have a high degree of accuracy. The collection of yield figures from a large number of independent smallholdings on the other hand, is difficult and it is generally acknowledged that data from this sector are less reliable than from estate sources. Even in Malaysia which publishes detailed annual statistics on rubber production, no reliable data on smallholding yields are provided. (Rubber Statistics Handbook 1979). It is estimated, however, that yields of rubber from smallholdings are about 40 per cent lower than estate yields (Bank Negara Malaysia 1978) while Sekhar (1979) states that yields of Malaysian smallholdings are below 800 kilogram per hectare. Figures from the Department of Primary Industry on Papua New Guinea production of the more important export crops support the view that smallholdings generally produce considerably less per unit of land area compared to large estates. Table 2.1 illustrates the point.

Table 2.1
Papua New Guinea estate and smallholding yields

Crop	Yield kg/ha	
	estate	smallholding
Rubber ^{a)}	500 - 600 (av) 1400 (best managed)	200 - 600
Coconut ^{b)}	900	500
Cocoa ^{c)}	440	330
Coffee	2000 d)	700 e)

Source: a) Carrad (1981)
 b) Sackett and Williamson (1973)
 c) Godyn (1974)
 d) Department of Primary Industry (1985a)
 e) Carrad 1985

Data that compare estate production of oil palm with independent village outgrowers (as opposed to settlers) production in West New Britain are particularly interesting. The comparison is made in Table 2.2

Table 2.2
Estate and village outgrower oil palm yields 1980 - 1984

	Yield tonne ffb				
	1980	1981	1982	1983	1984
Estates	20.88	19.97	27.81	21.28	21.49
Village Outgrower	6.80	5.70	7.10	5.90	11.9

Source: New Britain Palm Oil Development 1985

Yields in both estate and smallholding sectors increased dramatically in 1982 with the introduction of the Cameroonian oil palm pollinating weevil (before 1982 natural pollination was low and artificial pollination was practised). The doubling of yields in the smallholder sector in 1984 was a direct result of the nucleus estate moving in to take over the management and harvesting of what were basically abandoned village oil palm blocks. In other words the village smallholding sector changed in status from genuine smallholding to a quasi-plantation system outgrower.

Table 2.3 shows the position in other countries which are major producers of plantation crops.

Table 2.3
Estate and smallholding yields

Country	Crop	Yield kg/ha.	
		estate	smallholding
Malaysia (a)	Rubber	1600 *	800
Java (b)	Rubber	1019 *	467
Sri Lanka (c)	Rubber	1000 *	450
Malaysia (d)	Cocoa	1080	850
Kenya (e)	Coffee	1078	633
Kenya (f)	Tea	2000	1000

Source:

- | | |
|---|----------------------|
| (a) Planters Bulletin 1981, Sekhar 1979 | (e) Whitaker 1984 |
| (b) PESI Study 1982 | (f) Ruthenberg 1980. |
| (c) FAO/World Bank 1979 | (* large estate |
| (d) Agricultural Bank Malaysia 1981 | sector only |

2.4.2. Low cost production. Ruthenberg (1980) considers the fact that peasant production can still compete with estates, despite "obviously poor cultivation and husbandry techniques", can be explained by low costs of production. The recurrent cost schedules of estates and smallholdings are different since most of the labour employed by small farmers is either unpaid family labour or receives far less than the rates laid down by minimum wage legislation that apply on estates.

Ruthenberg (1980) argues that "the whole situation is different as far as costs are concerned" between estates and smallholdings. He notes that a large-scale estate must bear an investment cost for:

- (a) land clearing and crop establishment;
- (b) workers' houses, hospital, roads and other infrastructure; and
- (c) the factory.

In family holdings there is no expenditure on expensive infrastructure nor is there investment in capital intensive processing equipment. Estates must bear the costs of clearance work, whilst on smallholdings the land is in any case cleared to grow subsistence crops. It costs little extra for farmers to set plants of a future perennial crop in the cleared land. Intercropping the perennial crop with arable food crops in the early years bridges the period when there is no harvest. These combined benefits, according to Ruthenberg (1980) give the smallholder a distinct cost advantage.

On the other hand, Grigg (1970), takes the viewpoint that it is difficult to make a convincing economic case for the superiority of the smallholding over the plantation. Indeed, the latter's efficient farming methods and power of earning foreign exchange would seem to be powerful assets to a developing country (Grigg 1970).

2.4.3. Low risk. Smallholders are more resilient to trade depression than estates since farmers tend to be highly price elastic with their inputs. In times when producer prices fall peasant farmers cease production and neglect their crop. The farmer has his cash earnings reduced in this period but he still has his livelihood from subsistence cultivation. When commodity prices increase the trees are harvested once again, and farm incomes rise accordingly (Fisher 1968, Ruthenberg 1980). In contrast, estates tend to maintain husbandry and production levels, irrespective of ups and downs in commodity prices. Ruthenberg (1980) considers these differences explicable by the relatively short time horizon of smallholders compared to the long term view taken by plantations. Another important reason why estates continue production is the large fixed cost in overheads and labour wages that have to be paid irrespective of world market fluctuations.

2.5 Characteristics of estate production

The farm management advantages of growing perennial tree crops on a large scale do not lie in the labour economy. The use of labour saving equipment is important only with perennial field crops like sugar cane at Ramu and where harvesting can be mechanised as on the tea plantations in the Wahgi Valley. The competitiveness of plantations growing shrub or tree crops in relation to smallholdings with their cheap production methods is based, in the opinion of Ruthenberg (1980) on:

1. The rapid and consistent use of technical advances in crop production.
2. The more efficient organisation of delivery of the crop to the processing factory.
3. The more efficient processing of the product.
4. The better access to markets and capital.

Large plantation enterprises take advantage of modern technology and typically operate their own in-house research establishments or contribute financially to the maintenance of a central experimental station. The skilled supervision of labour and scientific management of land by professional managers and specialists result in high standards of crop production and concomitant high yields. Compared to smallholdings, plantations harvest larger quantities per hectare. Furthermore, the high degree of control in handling a perishable commodity results in raw material of considerably better quality being delivered to the factory. Processing of the crop is carried out to high standards so that the quality of the end product can be sold at advantageous prices. Large size makes for economies of scale especially in the use of complex, expensive processing equipment and transport facilities. By-products and residues being sold off to local manufacturers, or used as fuel in the processing factory, or returned to the land as fertiliser, are used efficiently. All told, a return per hectare, or per worker is obtained that is typically higher than that from small farmers. Plantations therefore produce high net earnings of foreign exchange and a high taxable income which can be used for general economic development (Allen 1972, Arthur *et al* 1968, Barlow 1978, Binns 1958, Courtenay 1965, 1980, Farmer 1963, Fisher 1968, Grigg 1970, 1974, Jones 1968, Morgan 1978, Perumal 1981, Robertson 1963, Ruthenberg 1980, Webster 1982, Wickizer 1958a, 1958b, 1961.)

2.6 Difference between estate and smallholding production

The evidence from Papua New Guinea and other countries with a plantation economy suggests that the estate sector is a high productivity/high quality/high income producer of plantation

commodity crops while the opposite holds true for small farm producers. Peasant production of perennial crops tends to be characterised by low yield/low quality output compared to the potential achieved on estates which leads to low family incomes, and poor returns per worker, per hectare and per tonne of produce. Smallholders are low cost producers compared to plantations. Nevertheless, they are inefficient producers of export crops because low yields and poor quality caused by low input cultural techniques and reliance on low standards in processing technology result in low farm incomes to the family and loss in export earnings to the nation.

This is not to say that in the complex mixed cropping systems characteristic of cocoa, coconut and coffee farming total production measured in terms of energy (labour energy in/food plus some cash crop out) is not high. It is the cash incomes generated from sales of the commodity crop which are low. The value of foodstuffs and luxury crops such as betel vine and areca (betel) nut is high.

Although plantations have high fixed costs brought about by the employment of skilled management and large numbers of hired workers they are efficient producers. The efficiency of plantations is due to high yields and a good quality end product and the spreading of fixed costs over a large land area. Plantations are the innovators in the introduction of new crop varieties, new cultural methods and improved agricultural produce. The relevant economic aspect of these innovations is that rising wages can be absorbed by higher yields per hectare and improved output per worker.

It is argued that the discussion so far indicates that the estate and smallholding sectors are two quite distinct agricultural systems for the production of perennial export crops. Plantations are not very large scale smallholdings; nor are smallholdings very small plantations. It is suggested therefore that the systems are complementary and not competitive and that the encouragement or expansion of one need not be to the detriment of the other.

In a nutshell plantations are high input/high output producers of export crops. Smallholdings are low input/low output growers of the same crops. If the Government of Papua New Guinea wishes to increase foreign exchange earnings from the export of agricultural products then the way it should do so is clear. It should encourage the plantation sector to produce to maximum efficiency. Simultaneously smallholder growers should be encouraged to increase production within their low input/low output systems by appropriate advice from the government controlled and financed agricultural extension service.

Chapter 3

The Plantation Crops and The Technology of Production

3.1 Plantation crops

There are seven perennial crops listed in Table 3.1 which are grown in Papua New Guinea in the plantation mode of agricultural production. The locations of the main plantation areas are shown in the frontispiece map.

Table 3.1
Plantation crops

Crop	Location of plantations	Botanical classification
Rubber	Central/New Ireland	tree
Oil palm	West New Britain/Oro/Milne Bay	palm
Coconut	Islands & Coastal Mainland	palm
Cocoa	Islands & Coastal Mainland	tree
Tea	Western Highlands	shrub
Coffee (arabica)	Highlands	shrub
Sugar Cane	Madang (Ramu Valley)	herbaceous perennial

The six tree crops are grown predominantly for export production although local consumption of fresh coconuts is important. In the case of sugar cane the bulk of production is for the domestic market though recently there have been export sales to a number of countries including the United States of America. Apart from tea where smallholder production is insignificant all crops are grown to a greater or lesser extent on smallholdings (see Chapter 4).

Tea and arabica coffee are crops of the tropical highlands. In Papua New Guinea tea is grown on an estate scale only in the Western Highlands on alluvial soils in the Wahgi flood plain and in the Southern Highlands. Coffee plantations are more widely distributed. The main centres of production are near Kainantu and Goroka in Eastern Highlands Province and the Mt. Hagen/Banz district in Western Highlands Province.

Commercial sugar production takes place on only one large scale plantation in the Ramu Valley in Madang Province. Rubber production is found on a minor scale in New Ireland. The major rubber plantation producing areas are at Sogeri and Galley Reach in Central Province. Oil palm is grown in three

enclaves on the northern coasts of West New Britain and Oro Provinces. A new oil palm development is scheduled to begin in 1985 for Milne Bay Province. Coconut and cocoa estates are found in lowland situations in the Island provinces and in coastal districts on the Papua New Guinea mainland. The Gazelle Peninsula in East New Britain, New Ireland, the North Solomons and Madang are major producers of both crops.

Mono-cropping is the rule for rubber, oil palm, tea, coffee and sugar cane culture. The inter-cropping of cocoa and coconut is a common practice and this technique which has been widely adopted in South East Asia was pioneered in Papua New Guinea. Nevertheless there are a number of sole cropping cocoa and coconut properties.

It is argued in this chapter that the methods of crop production followed on plantations influence the manner in which the classical economic factors of production (namely land, labour and capital) are used. This in turn influences the structure of the plantation industry in Papua New Guinea.

Plantation production technology may be divided into:

1. Crop husbandry or agronomic technology, which deals with the farm management and agronomic practices surrounding the cultivation and harvesting of the crops.
2. Processing technology which is concerned with the treatment of the freshly harvested crop in a factory situated on the plantation or in an associated central mill.

3.2 Technology of agronomic production

The agricultural production techniques involved in rubber, oil palm, coconut, cocoa, tea and coffee culture are remarkably similar despite the difference between crops. Characteristics of tree crop agriculture typically include minimal land preparation before planting, preparation of planting material in an irrigated nursery, individual planting of advanced material at low densities (higher in the case of tea and coffee), minimum tillage techniques after planting, establishment of leguminous green manure plants, individual care of the plants, a long gestation period before maturity, manual harvesting, non-seasonality or long seasonality of harvest, and a long production cycle. Pruning is an important cultural practice for the beverage crops, tea, coffee and cocoa. Sugar cane, on the other hand, is a perennial field crop which is not reared in nurseries before planting, requires a considerable degree of land cultivation and removal of all

the aerial parts of the plant during harvesting. Many operations including planting and harvesting are mechanised. Sugar production therefore can be considered from the farm management viewpoint as something between arable farming and tree crop culture. The main agro-management features of the crops grown in Papua New Guinea are summarised in Table 3.2.

Weed control in sole crop coconut plantations is by hand, the vegetation being cut by a grass knife. In the other tree crops weed control is by spraying chemical herbicides. The herbicides are generally applied by manually operated knapsack sprayers and on the more progressive estates low-volume controlled droplet applicators are used.

Harvesting operations are typically difficult to mechanise except in the case of sugar cane which is a field crop, and tea where a crop of green leaf is taken from a flat plucking table. Although operations such as rubber tapping, cutting oil palm bunches, picking cocoa pods and coffee cherries may be difficult to mechanise the collection systems for moving the crop from field collection points to the processing factories are by road haulage systems. The transport systems used on sugar cane, oil palm and tea estates where large quantities of vegetative material need to be transported are highly sophisticated.

Four of the crops under discussion, rubber, oil palm, coconut and tea have non-season harvesting and crop more or less continuously throughout the year. Cocoa harvesting lasts about 10 months out of the twelve although there are two discernible peaks in production. Some coffee is picked in every month but the bulk of the harvest is cropped in the "flush" from May to September. Sugar cane in the Ramu Valley is harvested over a long season lasting 7 months from May to November.

3.3 Technology of processing

The technology of primary processing ranges from complex to simple. The scale of processing operations also varies from large scale to small scale, the scale of production being correlated with the complexity of processing. Generally there is a high degree of urgency for processing as the crop deteriorates rapidly if not treated within 24 hours of harvest. Tea, rubber, oil palm, coffee and sugar cane all require processing quickly if the quality of the end-product is not to suffer. Only cocoa and coconut can be left for several days after harvest without affecting crop quality.

Table 3.2
Agro-management features of plantation crops in Papua New Guinea

Crop	Years to first crop	Years to peak yields	Years of production	Seasonality of harvest	Harvested portion
Rubber	5 - 6	15	25 - 30	Nonseasonal	Latex
Oil palm	3	8 - 20	15 - 25	Nonseasonal	Fruit
Coconut (tall)	7	12 - 15	50 - 100	Nonseasonal	Fruit
Coconut (hybrid)	3	12 - 15?	25 - 50?	Nonseasonal	Fruit
Cocoa	2	5	15 - 30	Long season	Fruit
Tea	3	6 - 8	50 - 100	Nonseasonal	Leaf
Coffee	3	4 - 7	30 - 70	Long season	Fruit
Sugar cane	1	1	3	Long season	Stem

Source: Fieldwork 1985

Oil palm, tea, sugar cane, technically specified rubbers and green coffee bean production all require complex processing or handling in large units that typically need a large catchment area to keep the factories supplied with the crop. Non-complex equipment is characteristic of coconut, parchment coffee, cocoa and sheet rubber production. Specialist engineers and a skilled labour force are employed to operate the larger factories with sophisticated equipment and ancillary plant. No formal education and training in technical skills need be acquired to run coconut kilns, rubber sheet factories, cocoa fermentaries and coffee pulperies. At the simplest level of process technology, such as sun drying of copra, no special equipment is necessary. The production of palm oil for export requires specialised port handling facilities and shipping services.

The export markets for tropical commodity crops are mainly in industrialised North America, Europe, Australia and Japan which require uniform products suitable for further manufacturing, processing or blending. Emerging markets which are likely to become more important as industrialisation increases and living standards become higher are China and India (rubber), Pakistan (tea and oil palm) and West Asia (tea, coffee and oil palm). The emphasis in primary processing is therefore to produce standard products of guaranteed quality acceptable to the international trade. Crumb rubber and palm oil, for example, are sold to specified technical standards with strict financial penalties for products not meeting guaranteed specifications.

A summary of the most important technological characteristics of production namely complexity and scale of processing and seasonality of harvest for the seven Papua New Guinea plantation crops is made in Table 3.3.

Table 3.3
Main technological characteristics of production

Crop	Characteristics of production			
	Seasonality of harvest		Complexity and scale of processing	
	non seasonal	long season	high/ large scale	low/ small scale
Rubber -				
- technically specified	X		X	
- other rubbers	X			X
Oil palm	X		X	
Coconut	X			X
Cocoa		X		X
Tea	X		X	
Coffee - green bean		X	X	
- parchment		X		X
Sugar cane		X	X	

3.4 Technology and the economic factors of production

3.4.1 Land. The reason for plantation agriculture using large tracts of land is twofold. Firstly, tree crop agriculture typically is an extensive cropping system with the trees being grown at low densities, and secondly, large areas of mature crop are required to service factories for crops needing complex, large scale processing. Tree and shrub crops are grown at low densities compared to field crops such as sugar cane, cereals and tropical legumes because of the size of individual plants and the area covered by their canopies. Oil palm for example is typically planted at a stand of about 140 palms per hectare with 9 metres distance between each plant. The size of plantation necessary to supply a modern 30 tonne mill with raw material is about 6,000 hectares of palms. The technology of processing dictates that extensive areas of crop land are required for the economic processing and handling of crumb rubber, oil palm, tea, green bean coffee and sugar cane. Coconuts, cocoa, parchment coffee and sheet rubber production, on the other hand, have only simple process operations so that a marketable commodity can be produced on small estates.

3.4.2 Labour. Plantations are large employers of labour because the agronomic features of plantation tree crops make it difficult to mechanise cropping operations. Contrary to the opinion of many economists (Beckford 1972, Dennis no date, Hla Myint 1980, Jones 1968) the viewpoint of this study is that plantation labour is, and always has been, expensive. It is expensive in the absolute sense in that it is wage labour compared to the alternative of non-wage family labour in surrounding smallholdings. Plantation labour is also expensive in relative terms even though wage rates may be low. In fact, the major cost item on estates is labour and frequently represents 50 per cent or more of total outgoings (Courtenay 1965, Ruthenberg 1980). Data from Malaysia presented in Table 3.4 illustrate the point.

Table 3.4
Labour costs : Malaysia

Crop	Labour cost as percentage of operating costs
Rubber	60
Oil palm	40
Cocoa	40
Tea	60

Source: Goldthorpe 1983

The situation in Papua New Guinea indicates that the labour component in coffee and copra/cocoa plantations is in the region of 50 per cent of current operating costs (DPI 1985a).

It follows that if the expensive labour force is to be used with optimum economy for the profitable running of a plantation it is necessary for the work programme to be planned to keep a stable workforce in continuous employment throughout the year. To make maximum use of high cost labour, harvesting is spread over as long a period of the year as possible. Furthermore, if only one or two crops are grown in mono-culture or duo-culture cropping systems relatively unskilled labour can be more easily supervised and brought to a high degree of productivity, especially if there is specialisation of labour tasks and standardisation of the agricultural operations.

3.4.3. Capital. Plantations require large amounts of capital to finance their operations. The reasons for the large financial outlay are basically the large size of plantation holdings, the long gestation period before crop maturity and peak yields are achieved, high infrastructure costs and the cost of processing equipment. The estate infrastructure of a road network to evacuate the crop from the field, accommodation for a large workforce and provision of administrative buildings represent a considerable capital cost. Land is not a major capital item in Papua New Guinea as plantation land is held either on 99 year agricultural leases granted by the government or, in some cases German freeholds.

In crops requiring complex processing in large scale production units such as sugar cane, oil palm and tea, a large amount of capital is tied up in the factory and ancillary plant, and harvesting and transport equipment. Bulk storage and handling facilities are necessary for oil palm. The capital costs of processing and handling equipment therefore form a substantial portion of the capital costs of plantation development. A new oil palm mill for example costs over K10 million at current prices which represents in the order of 20-25 per cent of investment in an oil palm development project. Simple processing technology such as for cocoa, coffee and coconuts, on the other hand, requires relatively little expenditure on factories and equipment. Large estate production of these crops is more capital intensive than smaller units as the scale of operations is larger. The larger coffee and cocoa production units typically invest more on processing than smaller estates because they produce a premium product. Thus large coffee estates produce export quality green bean; smaller plantations produce parchment coffee that requires further processing into green bean in a processor's factory.

Chapter 4

Plantations in the National Economy

4.1 Treecrop sector

The agricultural sector in Papua New Guinea contributes roughly one third of market gross domestic product. Agricultural exports account for a large proportion of total exports, over 40 per cent in the late 1970s (World Bank 1981). Within the sector, four tree crops namely, coffee, copra, cocoa and oil palm contribute over 90 per cent of the export earnings for agricultural produce.

Writing in the Australian Financial Review of 1 March 1985, Michael Byrne notes that Papua New Guinea's real economic growth each year is determined by fluctuations in the main agricultural and metal commodity prices. In 1984 the country's real gross domestic product grew by a 4.9 per cent, the direct result of a boom in exports of agricultural products (Byrne 1985).

The Bank of Papua New Guinea (1985) notes that in 1984 significantly higher exports of agricultural and forestry products boosted exports to a record K793 million even though mineral prices were depressed. The share of minerals in total exports for the year fell to below 50 per cent for the first time since 1978. The higher returns from tree crop exports reflected both higher volumes of production (except in coffee) and significantly higher world market prices.

Tables 4.1 and 4.2 show the value and volume of exports from the tree crop sector from 1975 to 1984 respectively.

Within the tree crop sector the performance of the oil palm industry has been very strong and it could be that in the next year or two exports of palm oil and palm kernels may take over from coffee as the number one export crop. The coffee industry has performed well recording increasing production over the past nine years. The coconut and tea industries have maintained production. The cocoa and rubber industries have performed poorly overall and production has declined.

As Tables 4.1 and 4.2 illustrate, except for oil palm and possibly coffee, consistent upward trends were not evident in commodity exports during the period studied. Rubber exports showed an inexorable downward slide, being in 1983 about half

Table 4.1
Value of Exports in K'000 f.o.b.

	1974/75	1975/76	1977	1978	1979	1980	1981	1982	1983 ^{a)}	1984
Rubber	2576	2654	2897	2630	3497	3751	3403	1406	2167	2100
Palm oil	6786	6617	8582	10483	14441	11956	14223	21655	23740	75500
Coconut	43092	19906	34835	36705	67094	39587	31984	24988	44019	88500
Cocoa	29091	39137	86350	62955	60872	46877	34325	32180	41837	67000
Tea	3866	3977	9068	7833	7982	8507	7131	6682	10391	14900
Coffee	35828	99997	136801	106801	121343	116315	75159	76727	94844	100700
Total	121239	172288	278533	227457	275229	226993	116225	163638	216998	348700

a) excluding palm kernels

Table 4.2
Volume of exports - tonnes

	1974/75	1975/76	1977	1978	1979	1980	1981	1982	1983 ^{a)}	1984
Rubber	5445	4911	4152	4135	4025	4027	4537	2337	2735	2800
Palm oil	18438	27086	24531	28413	34527	33347	44031	76715	77940	131700
Coconut	122020	122804	117476	121252	121702	124062	134162	101950	114889	134200
Cocoa	35498	31321	29392	27129	27994	29718	28479	29487	27224	34100
Tea	4489	4871	6192	6979	6978	7915	6959	6475	7234	7300
Coffee	35874	48147	37565	46163	48364	50257	47006	40845	52624	494000

a) excluding palm kernels.

of what they had been in 1974/75 - 2,800 tonnes compared with 5,445. Copra volumes fluctuated around a base of about 125,000 tonnes, rising to 134,000 tonnes in 1984 compared to 115,000 the previous year; but 134,000 had also been the level of exports in 1981. Cocoa was much the same at the end of the period as it had been in the beginning, about 35,000 tonnes; but during this period it had only exceeded 31,000 once and that was in 1975/76 and the level then was only 31,321. Coffee output rose, but erratically, and in 1984 was 3,000 tonnes less than it was the year before, although the 1983 figure was 12,000 tonnes up on 1982. Only oil palm increased consistently - from 18,000 tonnes in 1974/75 to 131,700 in 1984. In only two years did output drop below the level of the preceding year.

When export prices are taken into account the picture changes slightly. Rubber values are still down, but not quite so spectacularly whereas in oil palm values have increased nearly twelvefold compared with a growth factor of only about 8 in volumes. Coconut has doubled, but the growth has occurred in the last year (and is mainly due to prices). Cocoa is doing well, but coffee has not returned to the boom conditions of the late 1970s.

As a rough standard of comparison, average growth rates have been calculated for exports of the six crops for the period 1974/75 to 1983 and for the subperiods 1974/75 to 1979 and 1979 to 1983. An exponential trend has also been fitted for each of the commodities for the entire period. The results are shown in Table 4.3. For rubber and palm oil the change is inexorable - upwards for the latter, consistently down for the former. For the other crops the experience indicated in the two periods differs, especially for cocoa, coffee and tea. In coffee and tea most of the growth was in the 1970s while for cocoa the 1980s have been much brighter.

4.2 Plantation and smallholder production

The National Statistical Office (NSO) presents its figures under the headings "largeholding" and "smallholding". In the following discussion the NSO largeholding classification is taken to be synonymous with the terms "plantation" or "estate" as used in this report. The NSO definition of largeholding is:

"A largeholding is defined as a holding used for agricultural purposes having an area of 10 hectares or more."

Table 4.3
Export volumes, major tree crops
Papua New Guinea 1974/75 to 1983

	Average annual growth rates per cent per annum			Trend rate of growth ^a per cent per annum
	1974/75 to 1983	1974/75 to 1979	1979 to 1983	
Rubber	-8.2	-7.3	-9.2	-7.7
Palm oil	19.7	17.0	22.6	18.6
Coconut	-0.7	-0.1	-1.4	-0.8
Cocoa	-3.3	-5.8	-0.7	-2.0
Coffee	4.9	7.8	2.2	2.7
Tea	6.1	11.7	0.9	5.3

Note: (a) Based on exponential trend 1974/75 to 1983.
Source: Table 4.2

A smallholding is an agricultural holding less than 10 hectares. The official definitions of plantation and smallholding therefore roughly correspond to the definitions put forward in Chapter 2. Holdings more than 10 hectares in size would tend to employ hired labour. Family labour is likely to be used on farms less than 10 hectares in area.

The current breakdown between smallholder and plantation production in the tree crop sector is presented in Tables 4.4 and 4.5. Smallholders dominate production in coffee (75 per cent), cocoa (69 per cent) and coconut (58 per cent). In the oil palm industry production is split equally between large and small growers. Plantation production is more important in the rubber (86 per cent) and tea (100 per cent) industries.

Table 4.4
Smallholder production 1983

	Proportion of total sectoral production	Trend 1979-83 % change	Number of smallholders
Rubber	14	- 12	7,976
Oil palm	48	+ 11	4,500
Coconut	58	+ 1	107,554
Cocoa	69	+ 2	70,508
Tea	negligible	n.a.	279
Coffee	75	+ 4	266,748

Source: Department of Primary Industry 1985b, Table 4

Table 4.5
Plantation production 1983

	Proportion of total sectoral production	Trend 1979-83 % change	Number employed
Rubber	86	- 14	1,300
Oil palm	52	+ 23	5,000
Coconut	42	- 6.5	10,000
Cocoa	31	- 12	8,000
Tea	100	0	3,000
Coffee	25	+ 1	7,000

Source: Department of Primary Industry 1985b, Table 4

In the estate sector the position of the oil palm industry is very healthy. Plantation production increased by 23 per cent over the five years 1979-83. Coffee and tea production on estates remained more or less constant over the same period. Production declined by 14 per cent for rubber, 12 per cent for coconut and 6.5 per cent for cocoa from 1979-83. The rate of replanting in all three crops was negligible in the late 70s and early 80s so that the fall in production cannot be attributed to the felling of old stands and replacement by immature trees. The decline in production was probably caused by a fall in yield from senile planting material and the abandonment of areas with such low yields as to be uneconomic to continue production.

Table 4.6 shows that in 1983 the plantation industry contributed 37 per cent to export earnings from the rural tree crop sector earnings of K271.8 million.

Table 4.6
Value of plantation production 1983

	K000
Rubber	1,892
Oil palm	13,052
Coconut	18,489
Cocoa	12,827
Tea	10,400
Coffee	23,664
Total	80,324

Source: Department of Primary Industry 1985b

The figures in Table 4.5 show that an estimated 34,300 persons were employed in the tree crop plantation sector in 1983. There has been a significant fall in employment from about 45,000 in 1979 and 1980. The mechanisation of tea plucking provides part of the explanation, but the general decline of estate production in rubber, coconut and cocoa has also played an important part. Given its short history the performance of the oil palm industry in generating jobs is impressive (Department of Primary Industry 1985b).

The growth in the plantation sugar cane industry since 1982 can only be described as impressive. Production of cane sugar in 1983 and 1984 amounted to 33,000 tonnes and 34,000 tonnes respectively with an annual value of over K20 million. Exports to the U.S.A. in 1984 totalled 11,400 tonnes valued at K3.7 million. Ramu sugar plantation is also a large employer. The plantation employs 1,200 full time workers. The labour force rises to 1,800 during the harvesting campaign when casual labour from the Highlands is taken on.

4.3 Structure of plantation sector by landholding

The statistics in this section of the report have been taken mainly from the National Statistical Office report on rural industries in 1980. The structure of the tree crop plantation sector is shown in Table 4.7.

Table 4.7
Structure of plantation sector 1980

	No. of Estates	Area ha.
Rubber	51	9,583
Oil palm	17	7,916
Coconut	454	92,866
Cocoa	340	51,538
Tea	14	2,330
Coffee	172	7,156
Total	1,048	171,389

Source: National Statistical Office 1982, 1983, 1984a & b.

The actual number of estates is less than 1,000 as there has been double counting of dual crop coconut/cocoa estates in the statistics, as is shown in Table 4.8.

Table 4.8
Number of largeholdings (all crops)
by province 1981

Province	Number	Area '000 ha.
Western	10	5
Gulf	13	3
Central	85	59
Milne Bay	58	13
Oro	16	12
Southern Highlands	31	3
Enga	19	n.a.
Western Highlands	84	35
Chimbu	20	1
Eastern Highlands	74	15
Morobe	64	57
Madang	54	32
East Sepik	19	3
West Sepik	9	4
Manus	11	3
New Ireland	103	34
East New Britain	134	61
West New Britain	36	25
North Solomons	54	26
Total	894	393

Source: Department of Primary Industry 1981

The number of individual properties in the tree crop sector is more likely to be in the region of 700-800 when the inter-cropped estates are taken into account. This statement is supported by 1981 DPI statistics which details the number of large holdings (all crops, including livestock) by province.

Plantations growing rubber, coconut and cocoa have been classified into small, medium and large according to area in Table 4.9. The medium sized estates have been sub-divided into two classes. A similar exercise has been carried out for coffee plantations but using a smaller set of parameters for each class. This is shown as Table 4.10.

In rubber, coconut, cocoa and coffee the small estates are the norm - in each crop over 60 per cent of holdings is small as Table 4.11 illustrates. Even the distribution of estates in the medium sized category is skewed towards the smaller end of the scale. The number of large estates is minute. These figures indicate that the median size (the point at which 50

per cent of estates are smaller and 50 per cent are larger) for rubber, coconut and cocoa estates is less than 200 hectares. The figure is less than 50 hectares for coffee plantations. However, a Department of Primary Industry survey (1985a) of a sample of coffee estates shows the average size of the sample as around 100 hectares.

Table 4.9
Size of estate : rubber, coconut and cocoa
(numbers) 1980

	Small 10-200 ha.	Medium 200-600 ha.	600-1000 ha.	Large 1000 ha.
Rubber	38	7	5	1
Coconut	278	149	19	8
Cocoa	245	88	3	4

Source: National Statistical Office 1983

Table 4.10
Size of estate : coffee (numbers) 1980

	Small 10-20 ha.	Medium 50-100 ha.	100-200 ha.	Large 200 ha
Coffee	116	38	13	5

Source: National Statistical Office 1983

Table 4.11
Relative size distribution of estates 1980

	Small	Per cent Medium	Large	Total
Rubber	74	24	2	100
Coconut	61	37	2	100
Cocoa	72	27	1	100
Coffee	67	30	3	100

Source: Tables 4.9 and 4.10

The significance of these figures is that the vast majority of these estates are too small to support a professional planter as a manager. Only the large estates i.e. over 1,000 hectares for rubber, coconut and cocoa and over 200 hectares for coffee will generate sufficient cash flow to provide salaries comparable to those earned by senior plantation management in countries with open economies such as Malaysia.

The estate oil palm industry is dominated by three large producers. The industry is structured on the nucleus estate/outgrower model (see Chapter 8). Details of the area under oil palm in 1983 are shown in Table 4.12

Table 4.12
Structure of oil palm industry

	Hoskins	Bialla hectares	Popondetta
Nucleus estate	5,600	2,000	4,500
Outgrowers (settlers and village)	7,600	4,100	4,900
Total	13,200	6,100	9,400

Source: Fieldwork 1985

The tea industry has seven large scale estates around 400 - 500 hectares in size with black tea factories on site. The seven smaller tea estates sell their green leaf to neighbouring factories for processing into made tea.

4.4 Crop technology and the structure of the plantation industry

It is argued that an examination of the technology of production of the plantation crops grown in Papua New Guinea helps explain the manner in which the plantation sector is structured. The production of palm oil, tea and sugar is dominated by large scale plantation companies which can call upon substantial amounts of capital to finance their operations. Estates that produce these crops generally tend to be large scale operations. In size they typically cover hundreds or even thousands of hectares and employ large numbers of workers. Oil palm is not produced by the genuine smallholder sector but by outgrowers in centrally managed, supervised nucleus estate schemes. An international

agricultural company has recently taken over for redevelopment a rubber estate group which includes the one large scale rubber plantation in the country.

The coconut, cocoa and coffee sectors which require only simple process technology are dominated by small growers both in the smallholding and estate sectors. Coffee estates are small in size typically covering 50 hectares or less. Only 18 coffee estates are over 100 hectares. The typical estate producer of cocoa and copra is small. The median size of coconut and cocoa estates is less than 200 hectares. Twenty-seven coconut estates and seven properties growing cocoa have an area over 600 hectares. It is probable that the seven cocoa estates are also coconut estates as most cocoa is grown as an inter-crop under coconut shade. The number of mono-crop cocoa plantations is relatively small. As will be seen in the next two chapters ownership of plantations growing coffee, cocoa and coconut is diverse. Control of these plantations ranges from expatriate trading companies with plantation interests, local plantation companies and business groups, to individual proprietary planters.

Chapter 5

Foreign Plantation Companies

5.1 Structure of plantation industry

The plantation sector in Papua New Guinea may be classified into five distinct categories based on ownership, management structure and scale of operations. The classification is:

1. International plantation corporation
2. Expatriate plantation company
3. National management company
4. Management consultancy company
5. Proprietary planter.

The organisation structure of each class will be examined in this Chapter and in Chapter 6. A general assessment will also be made of the standard of management in each category of the industry.

In Chapters 3 and 4 it was argued that the technology of crop husbandry and crop processing influenced the structure of the plantation industry in Papua New Guinea. The following examination shows that the production of palm oil, cane sugar, crumb rubber and black tea typically takes place on large scale plantations managed by non-national plantation groups. The plantations may be joint ventures with national interests or they may be wholly foreign owned. Parchment (and green) coffee, cocoa bean and copra production on the other hand are carried out on much smaller sized properties. Ownership in these cases is much more likely to be national although expatriate interests both joint stock company and individual are still important.

5.2 International plantation corporations

International plantation corporations are largescale agribusiness organisations with plantation interests in other parts of the tropics especially in Africa and Asia. They have high experience in plantation management and employ staff at a senior level who have had estate management experience in countries other than Papua New Guinea. Through their international contacts they have immediate access to the latest developments in crop husbandry and crop processing technology. The plantation corporations are therefore "innovation makers" rather than "innovation takers" in the context of the local plantation sector. The standards of estate management therefore are equal to anywhere in the world.

Ownership of the plantation assets may be wholly foreign, or more typically, joint venture enterprises are formed with government and local business interests. No matter whether the plantation corporation is a major or minor partner in the enterprise, management of the plantations is by the corporation. In the case of joint ventures the foreign company signs a management agreement with the locally incorporated estate company. Expatriate personnel with knowledge of the crop gained in other countries are employed in senior management positions. All companies have an active policy of upgrading and training local personnel to senior management posts. In some cases the training programme involves formal courses and study tours in associate companies overseas.

The crops grown by these corporations typically are new to Papua New Guinea such as tea, oil palm and sugar cane, which while a traditional crop in the subsistence section has not been previously grown on a large scale. Black tea, palm oil and cane sugar were first produced in commercial quantities in the early 1960s, 1970s and 1980s respectively. This sector of the plantation industry therefore is an innovator in the planting of new economic crops. International companies have invested heavily in the recent past (and are continuing to do so) in all three of these crops and in the case of palm oil and cane sugar they include companies relatively new to Papua New Guinea.

There are five international corporations which manage plantation developments in this country. These are:

Booker Agricultural International Ltd. (U.K.)	sugar
Commonwealth Development Corporation (U.K.)*	oil palm
Harrisons and Crosfield PLC (U.K.)	oil palm & coffee
McLeod Russell PLC (U.K.)	tea and coffee
Sipef (Belgium)	oil palm & rubber.

The largest operator is the Harrisons and Crosfield group which with the government has formed two joint venture plantation companies. New Britain Palm Oil Development Ltd. has 6,298 hectares of oil palm at Mosa in West New Britain and 430 hectares of coffee near Banz, Western Highlands Province. A new oil palm project of 6,000 hectares is to be developed by Kapiura Plantations Pty. Ltd. immediately to the east of the Mosa complex. Work on this scheme began in 1985 and is scheduled to be completed by 1990.

* cocoa and rubber development projects in the planning stage.

Figure 5.1 shows the organisation structure of the estates management departments in the Lae head office of Harrisons and Crosfield (PNG) Ltd. Figure 5.2 illustrates how the oil palm plantation complex at Mosa operates in seven functional departments. The oil palm plantations are part of a nucleus estate and satellite outgrower project (see Chapter 8 for a discussion about the nucleus estate concept). There is therefore a separate smallholder affairs department which normally would not be found in a non-nucleus estate enterprise. Figures 5.3 and 5.4 show the organisation of a typical oil palm estate of around 1,000 hectares and the process engineering department which is responsible for milling the palm oil. The management structure of Koban coffee plantations, one of the largest coffee estates in the country, is given in Figure 5.5. The position of extension manager normally would not be found on other coffee plantations. In this case the company is wishing to purchase coffee from surrounding smallholders in order to increase throughput of its green bean factory.

Ramu Sugar Ltd. is a joint venture company between Papua New Guinea investors both government and private, Commonwealth Development Corporation and Booker Agriculture International Ltd. Management of Ramu Sugar is by Booker Agriculture International Ltd., a firm with great experience in operating major sugar cane development projects.

Ramu plantation is divided into three sections or divisions which cover 5,000 hectares. An additional 680 hectares of cane are grown by outgrowers on the edge of the estate boundaries for processing in the Ramu mill. The company began producing sugar in 1982. In 1983 a total of 363,000 tonnes of cane were processed into 33,000 tonnes of sugar. The figures for the 1984 campaign were 362,000 tonnes of cane with an outturn of 34,000 tonnes of sugar. Molasses and ethanol are produced as by-products. Figures 5.6 and 5.7 illustrate how production at Ramu Sugar is organised.

Figure 5.1
Harrisons and Crosfield estates management organisation chart

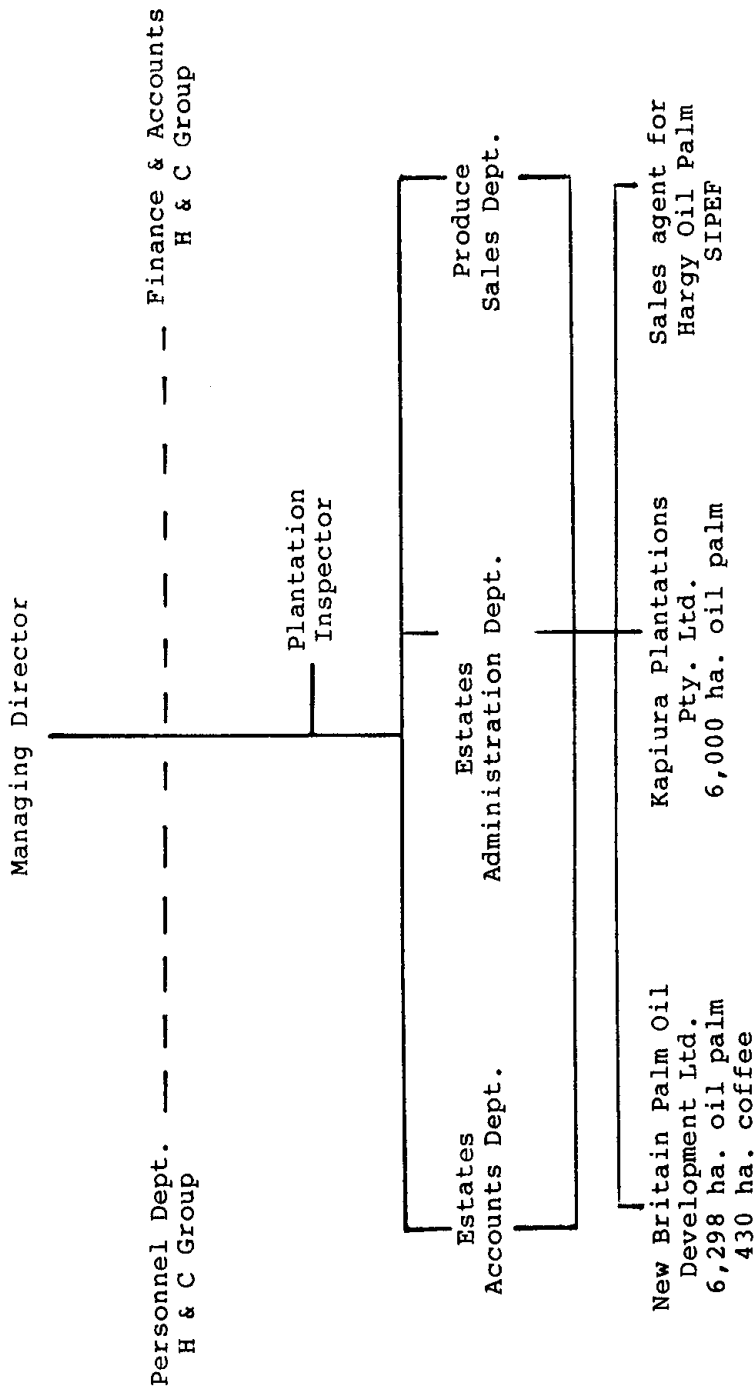


Figure 5.2
New Britain Palm Oil Development - Mosa oil palm complex organisation chart

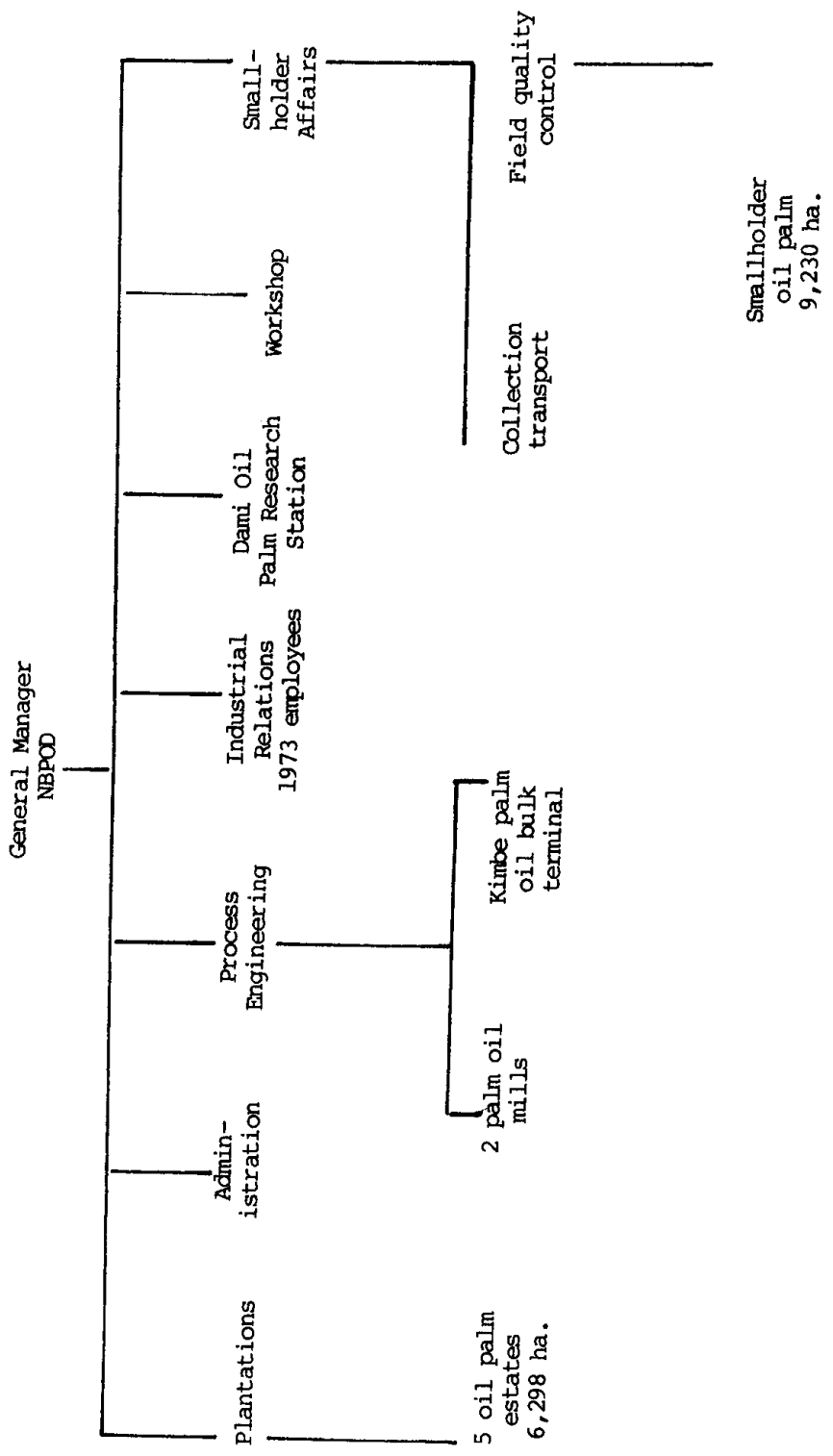


Figure 5.3
Oil palm estate (1,000 hectares) organisation chart

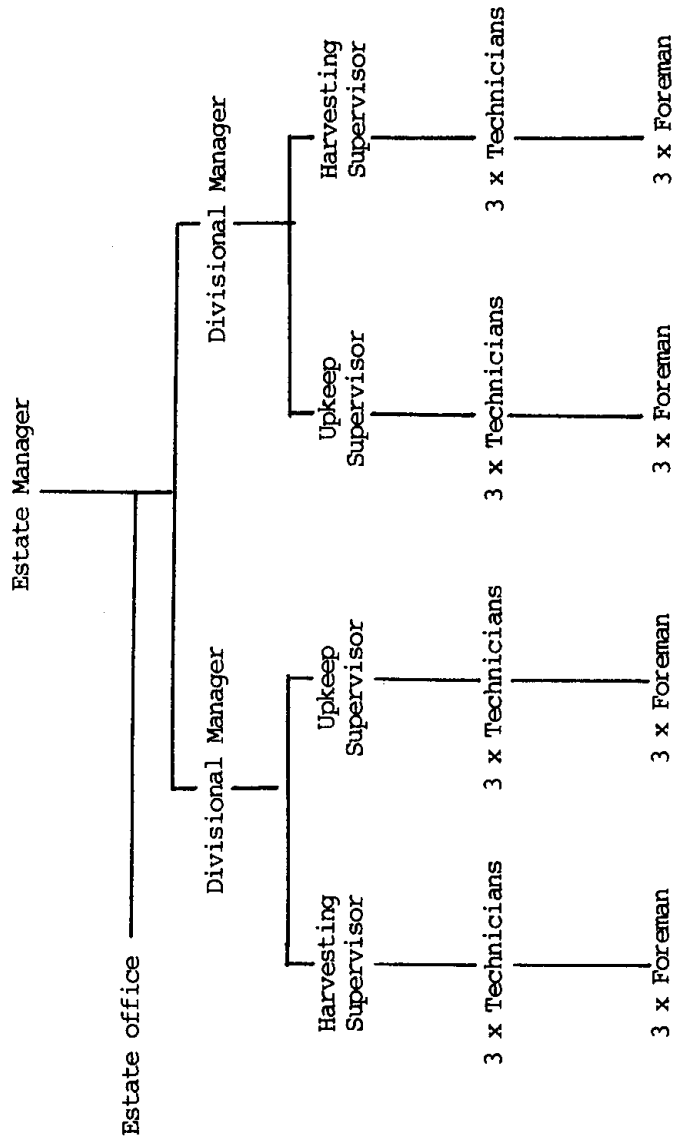


Figure 5.4
Mosa oil palm complex - Process engineering department - organisation chart

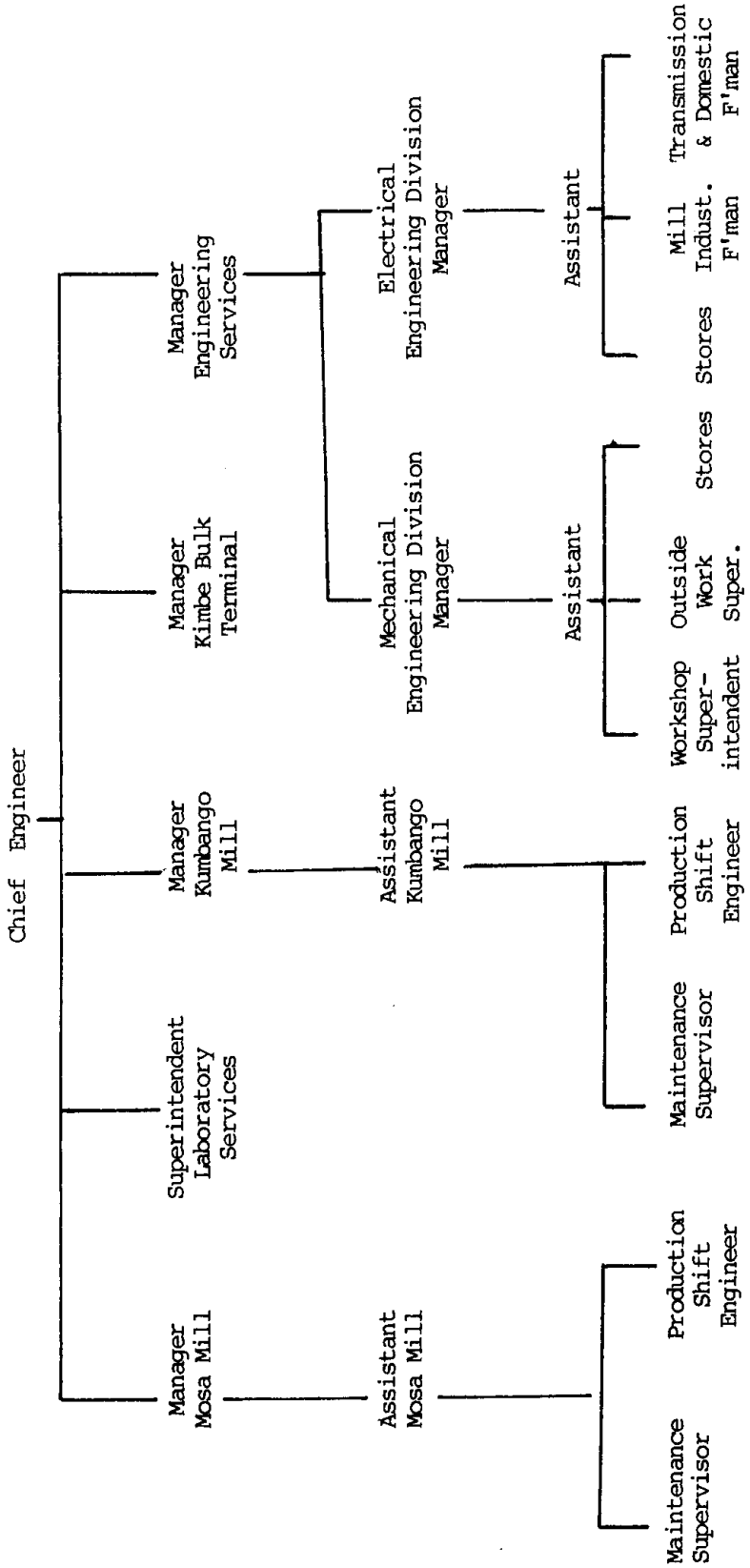


Figure 5.5
 New Britain Palm Oil Development
 Koban coffee plantations (500 plus hectares), organisation chart

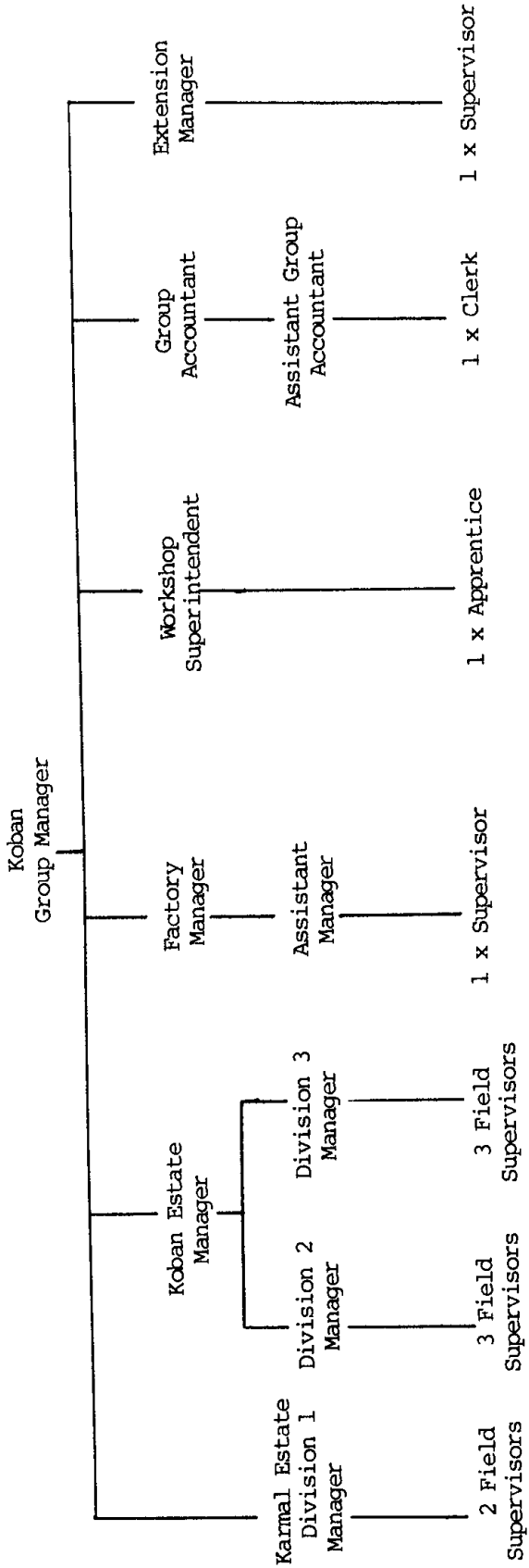


Figure 5.6
Ramu Sugar organisation chart

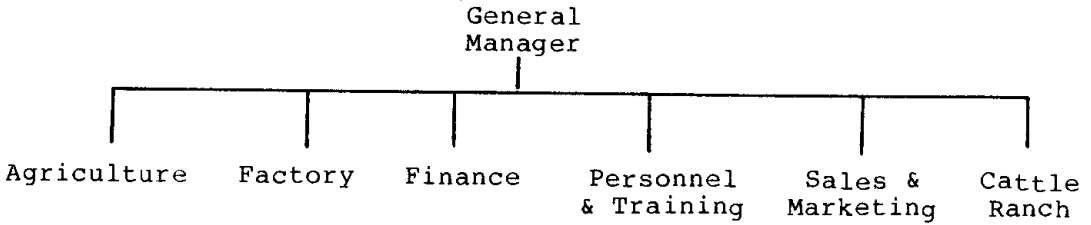
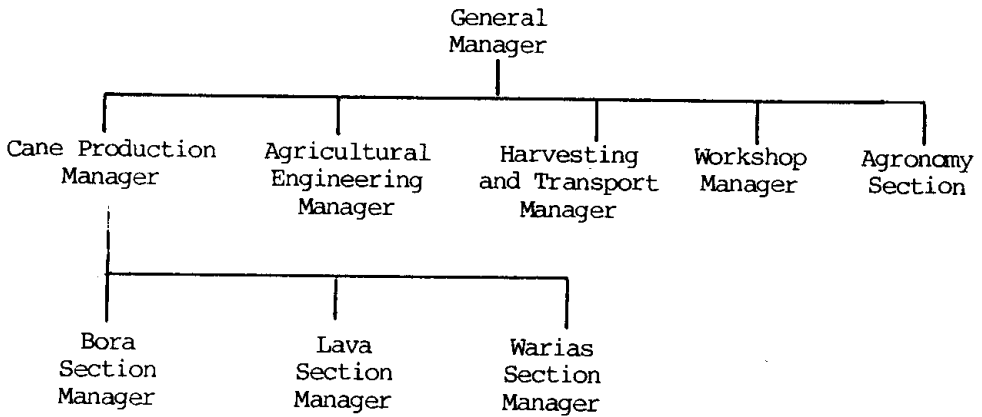


Figure 5.7
Ramu Sugar : Agriculture organisation chart



5,000 ha. sugar cane

5.3 Expatriate plantation companies

Four firms financially controlled from overseas form this part of the plantation industry. Two of them have strong Australian connections. These are W. R. Carpenter and Burns Philp. The companies have major commercial interests in trading and/or shipping services in addition to their plantations. Carpenters plantations are organised into two separate companies according to crop and location. The tea and coffee plantations form one company which operates from Mt. Hagen. The coconut and cocoa

estates are run as Coconut Products Ltd. which is based in Rabaul. The Burns Philp Plantation Division is also located in Rabaul. All of Burns Philp's estates are copra or cocoa bean producers except for one rubber estate at Cape Rodney. The estates belonging to these groups are all company owned. In other words the financial control lies overseas although all the companies are managed within Papua New Guinea and there may be shareholdings by Papua New Guinea investors.

The London based commodity traders S and W Beresford operate the 1,200 hectares Numa Numa coconut/cocoa plantation in joint venture with the Bougainville Development Corporation in North Solomons Province.

W. R. Carpenter Estates Company with its head office in Mt. Hagen has seven estates in the Mt. Hagen/Banz area of the Western Highlands. The company owns three tea estates (1,400 hectares) and four coffee estates (800 hectares). Each plantation is run as an independent unit, the estate manager reporting to the general manager in Mt. Hagen. Managers with experience of tea and coffee culture and processing have been recruited from India, Sri Lanka, Kenya and Zimbabwe. The estates are therefore run to the highest international standards.

The company's investment programme in tea is particularly impressive. The company pioneered and has successfully developed machines for harvesting green leaf, spraying chemicals and applying fertilisers. The development of the tea harvester has been especially innovative as the machine has been designed to cope with the soft ground conditions found in the Wahgi Valley. The tea harvesting machine has probably saved the Papua New Guinea tea industry from gradual extinction in view of the difficulties tea estates have in training and retaining experienced pluckers. One machine can replace 80 pluckers. The quality of pluck is much higher compared to hand plucking. This is the reverse experience of other tea growing countries where hand pluckers only take "the tip and two". The management structure of the 480 hectare Aviamp tea estate is given in Figure 5.8.

The coconut and cocoa plantations owned by Burns Philp and Coconut Products Ltd. range typically from about 200 to 600 hectares in size. Management at the plantation level is very variable. There is a definite policy of recruiting nationals with agricultural qualifications however the turnover of local assistants is reported to be high. Most of the expatriate managers are of Australian and New Zealand origin who have had little experience of tropical agriculture prior to taking up residence in Papua New Guinea.

The problems of small sized properties and variable management has been overcome to some extent by both plantation companies grouping their estates into geographical units of 750 - 1,500 hectare areas controlled by a group manager. The individual estates are therefore treated as divisions with a divisional manager in charge who reports to the group manager. The group managers in turn report to the company's head office in Rabaul.

Two organisation charts (Figures 5.9 and 5.10) based on the management structure of Coconut Products Ltd. are shown as examples as how this sector of the industry is structured. Coconut Products Ltd. has 8,500 hectares of plantations divided into approximately 5,000 hectares monocrop coconut and 3,500 hectares dual crop coconut/cocoa. The company has 26 plantation management units organised under six group managers. In addition there are a number of development units under separate managers who are responsible for the production of field planting material in central nurseries and the planting development programme in group estates. Three isolated estates report directly to head office in Rabaul.

Figure 5.8
Aviamp Tea Estate - 480 hectares

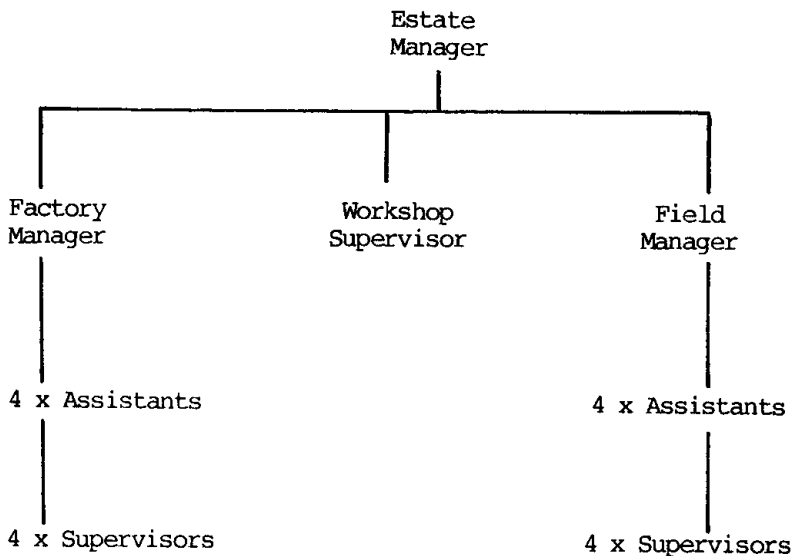


Figure 5.9
Coconut Products Ltd. - organisation chart

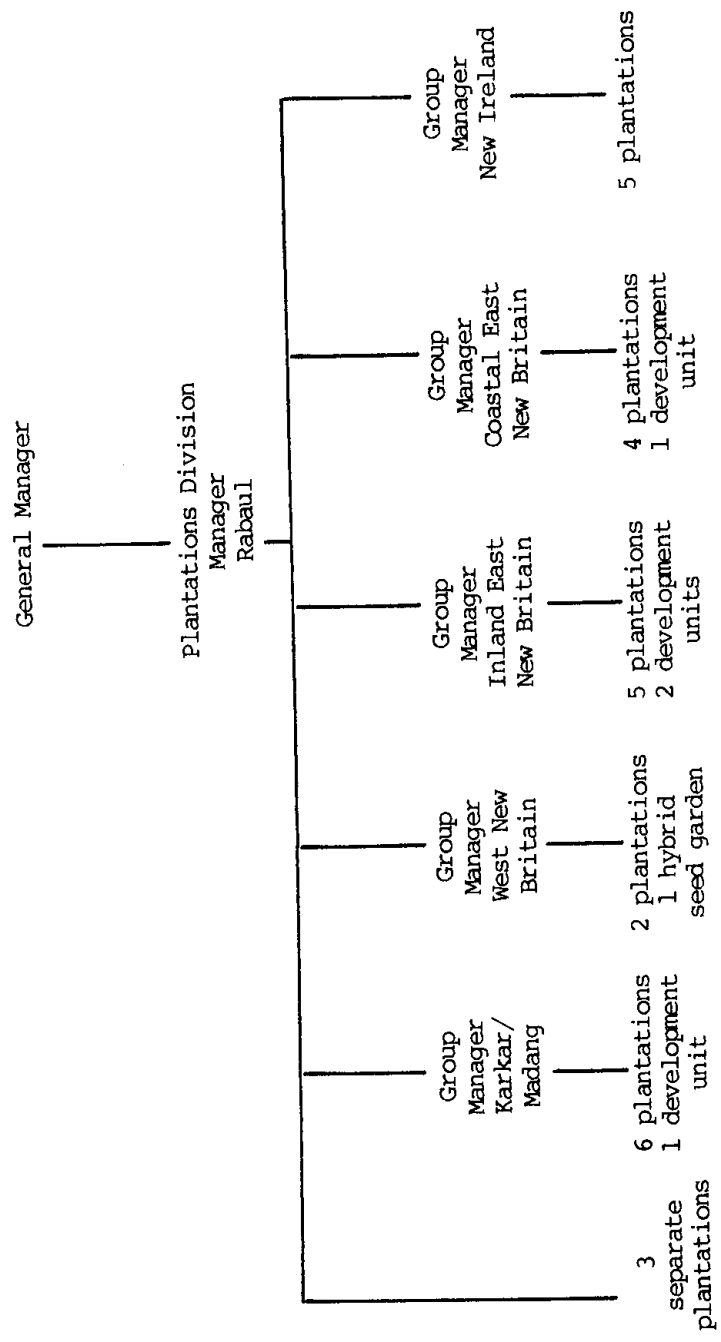
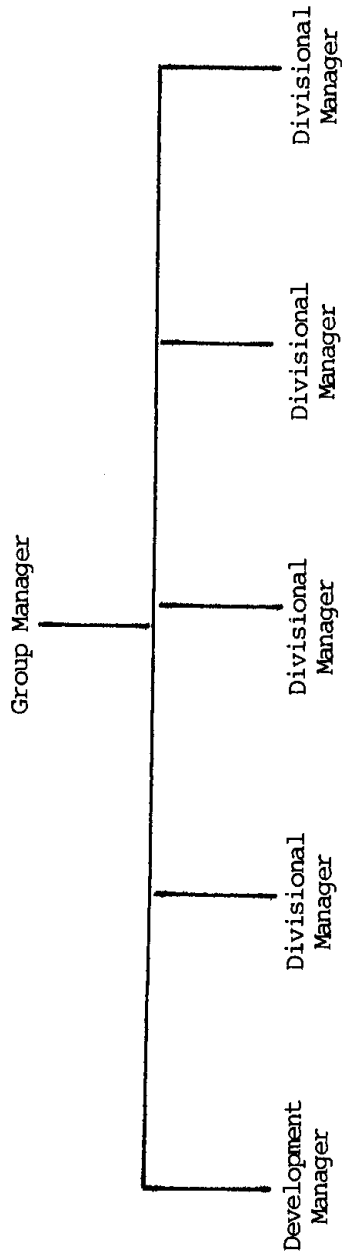


Figure 5.10
Coastal East New Britain group organisation chart



Coastal East New Britain group = 1,700 ha. in 4 plantations ranging in size from 240 - 650 ha.

Chapter 6

Local Management Companies and Proprietary Planters

6.1 National plantation management companies

Chapter 6 looks at the sector of the industry largely managed and controlled by Papua New Guinean interests.

Local management companies can for convenience be divided into three groups according to the locations in which they operate.

1. National firms (in the sense of nationwide).
2. Islands region firms.
3. Highlands region firms.

6.1.1. National agencies

National Plantation Management Agency: The government owned National Plantation Management Agency (NPMA) was originally set up in 1976 to manage plantations transferred from expatriate owners to customary group owners under the Plantation Redistribution Scheme. The Agency manages 38 plantations. It also has the major share (295) of the 20 hectare coffee blocks developed in the Highland provinces and is involved in lowland cocoa development blocks (see Section 6.4). It does not own any of the plantations that it manages. The managers of the estates however are employees of NPMA which appoints them to individual plantations.

As a government controlled organisation the NPMA has social objectives besides purely commercial goals. These have been stated by NPMA's Managing Director to be:

- (a) the management and rehabilitation of plantations;
- (b) the training of national managers; and
- (c) the transfer of benefits to the new customary owners of the plantations.

The plantation owners purchased their properties from the former expatriate owners under loans provided by the Alienated Land Redistribution Trust Fund. Finance for the rehabilitation and replanting of the plantations have in many cases been provided by commercial banking institutions and the Papua New

Guinea Development Bank*. The NPMA is generally managing the plantations as a condition laid down by the lending agencies until their loans for purchase and redevelopment have been repaid. The relationship between the customary owners and the agency therefore has an element of coercion in it unlike most other plantation agency agreements. It still remains to be seen whether the owners will continue with the services of NPMA after their loans have been paid off.

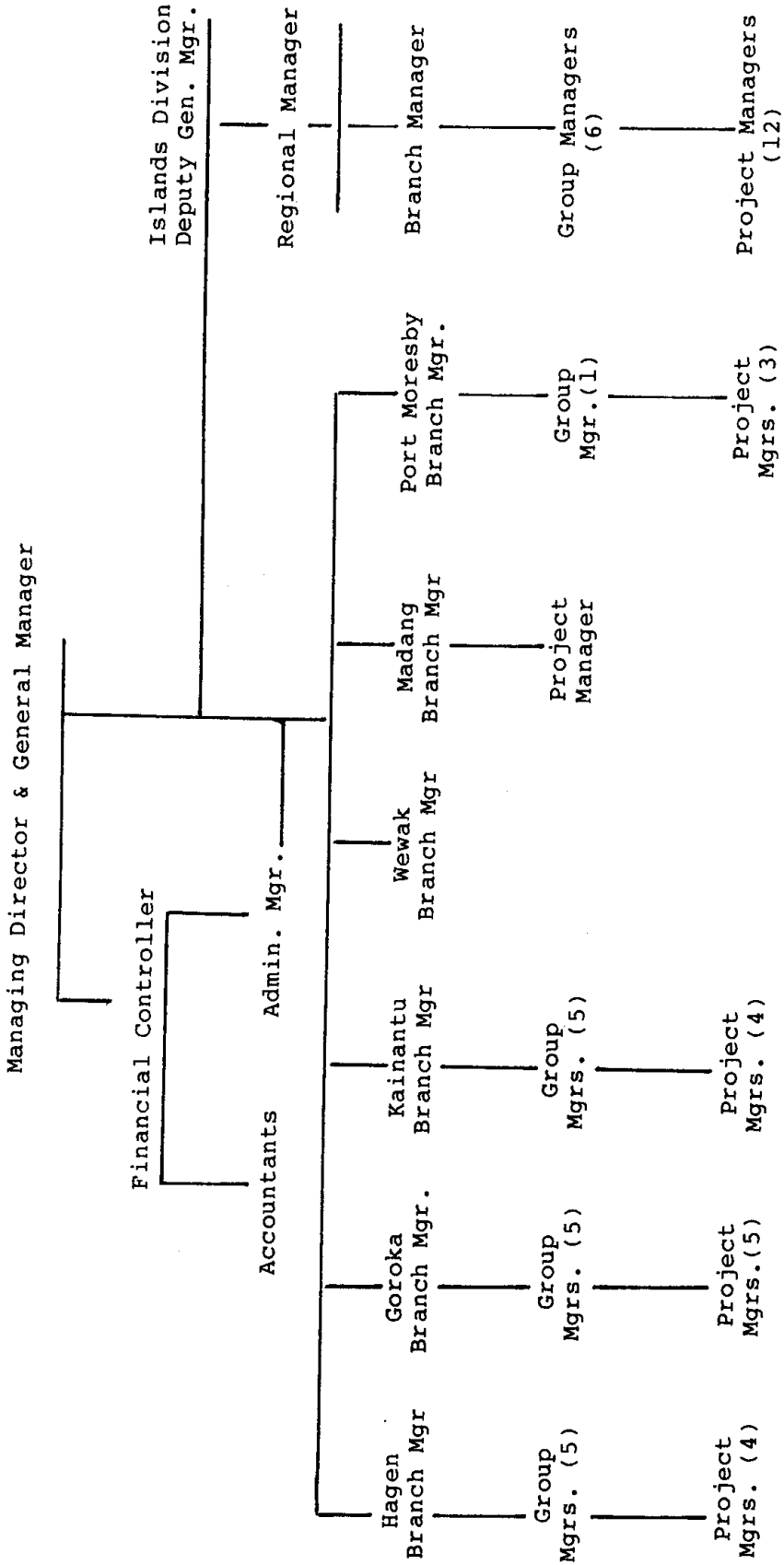
NPMA is constrained to some degree in the standard of management services it can offer by the fact that it does not have its own investment funds for estate rehabilitation. The ultimate control of estate finances rests with the lending agencies. Agricultural standards are therefore not as high as in the best run plantations in the expatriate plantation company sector. Nevertheless the achievements of NPMA are impressive given the constraints under which it operates.

The spread of operations covers North Solomons, East New Britain, Madang, East Sepik, Eastern Highlands, Simbu, Western Highlands and Central provinces. Crops managed include coffee, cocoa, coconut and rubber. NPMA has 25 expatriate staff with estate management experience in Papua New Guinea, India, Sri Lanka and Malaysia. There are 60 national personnel in executive positions. The management structure of NPMA is set out in Figure 6.1.

Angco Group: The Angco trading group is one of the major buyers and exporters of coffee and cocoa in the country. Angco owns three coffee plantations near Mt. Hagen. It also manages, but does not own, one sole crop cocoa property (100 hectares) and two dual crop cocoa/coconut (640 hectares) estates in Bougainville. The group's main activities through its subsidiary company Angcodev are concerned with the management of 20 hectare coffee and cocoa "mini-estates" financed by the Development Bank. The management of these development blocks is discussed in Section 6.4. Angco has management interests in Western Highlands, Eastern Highlands, Madang, East Sepik, East New Britain and North Solomons. Both local and expatriate managers are employed.

* Recently renamed the Papua New Guinea Agriculture Bank.

Figure 6.1
National Plantation Management Agency - organisation chart



6.1.2 Islands region companies.

New Guinea Islands Produce Company: This company is involved in cocoa trading in East and West New Britain. New Guinea Islands Produce Company restricts its plantation operations to the Gazelle Peninsula of East New Britain where it owns and operates 640 hectares of coconut and cocoa in four estates. The company also manages another five properties totalling over 1,500 hectares of cocoa and coconut for traditional landowners.

Expertise in cocoa culture has been gained from Malaysia through the employment of Malaysian nationals. The organisation structure of this local plantation management company is given in Figure 6.2.

Poliamba: The Poliamba plantation company manages 22 estates along the eastern coast of New Ireland. It owns 6,500 hectares of copra, coconut and rubber plantations. The group also manages another 5,000 hectares of mainly coconut plantations for Burns Philp and other foreign, non-resident owners. A 400 hectare tea estate is owned by Poliamba in Southern Highlands Province.

There is a proposal that the Poliamba properties and plantations belonging to other interests should merge to form the first Papua New Guinea plantation corporation. The new consolidated plantation group would control some 12,000 hectares in New Ireland. Part of the proposal is that finance and management provided by an international plantation organisation would be used to rehabilitate, upgrade and replant the existing plantations. New plantation developments may possibly be established on virgin land if the scheme goes through.

The copra and cocoa plantations in New Ireland are managed in three groups headed by a group manager. The rubber plantings and crumb rubber factory are controlled separately. Figure 6.3 shows the management structure of Poliamba. Expatriate managerial staff from the Philippines and Australia are employed as well as national executive personnel.

Figure 6.2
New Guinea Island Produce Company - organisation structure

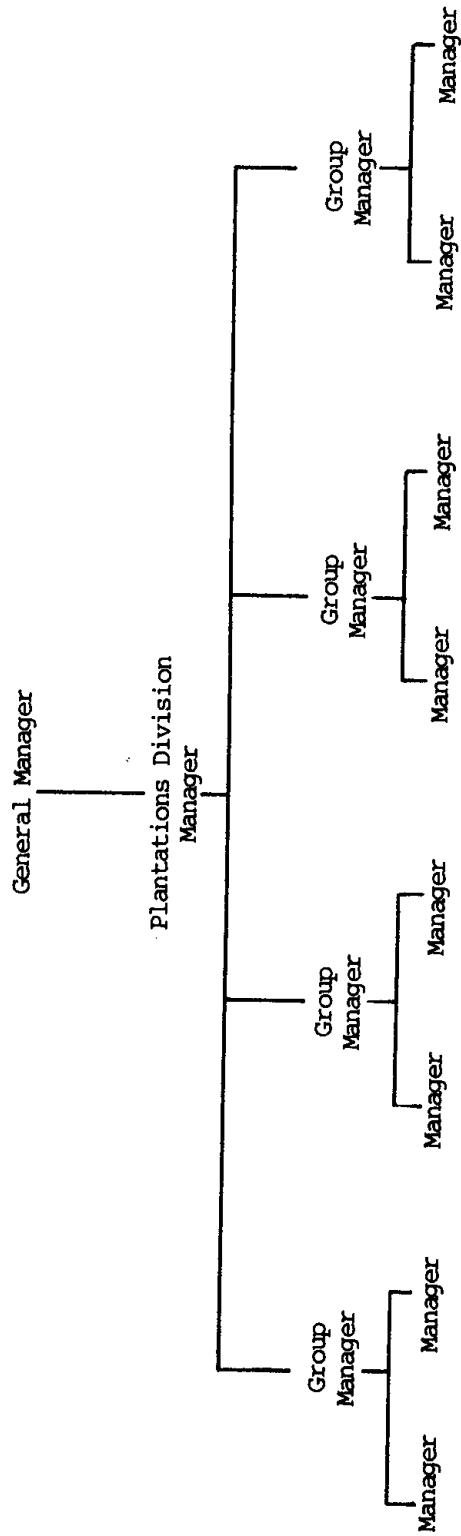
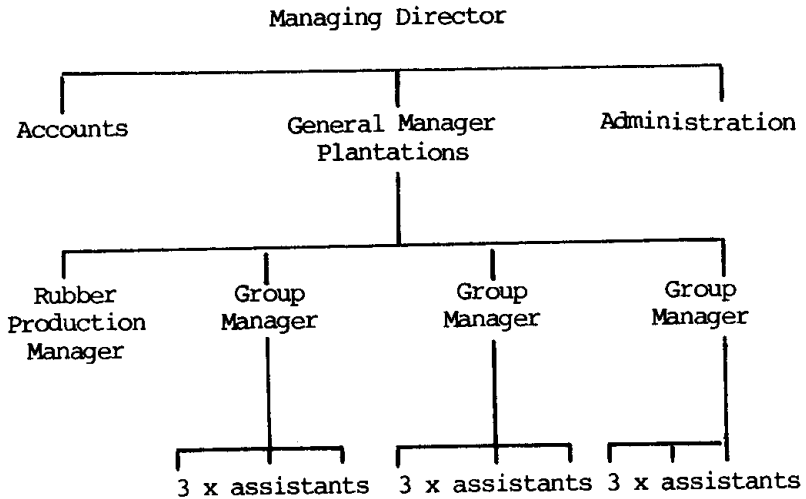


Figure 6.3
Poliamba - organisation chart



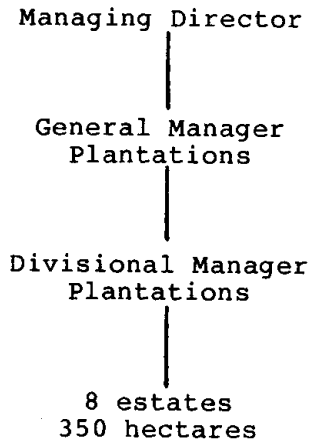
6.1.3 Highlands region companies.

Locally owned plantation management agencies concerned with coffee production in the Highland provinces tend to be small scale operators doing business in a restricted area around one of the towns in the region. In many cases the plantation management agency is only part of a much larger business concern with diverse commercial interests, e.g. KKB in Kainantu, Collins and Leahy, and Gouna Development Corporation in Goroka.

Some firms such as KKB restrict their activities to estates, others manage both plantations and 20 hectare coffee development blocks. Ownership of the estates may be wholly by the company e.g. Gouna, partly company e.g. KKB, or totally by outside interests e.g. Ou Pty. Ltd. in Mt. Hagen.

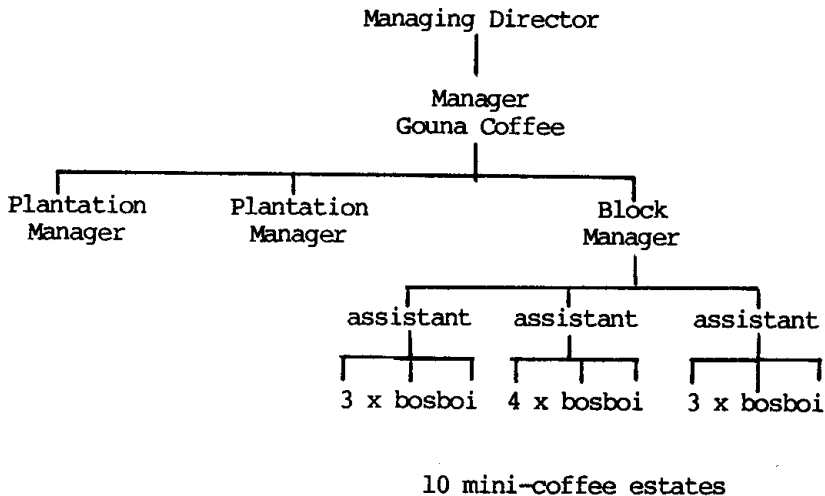
The Kainantu based company KKB provides management services to coffee plantations owned by traditional groups besides having its own company estates. In total 350 hectares of coffee are managed in eight properties. Technical coffee and general agricultural management expertise has been introduced into this group by the employment of an experienced planter from Zimbabwe. The organisation of the KKB coffee plantations is shown in Figure 6.4. On the smaller properties a resident bosboi is in day to day control. National managers are resident on the larger estates.

Figure 6.4
KKB organisation chart



In Goroka the Gouna Development Corporation owns two coffee plantations totalling 100 hectares and acts as managing agents for ten 20 hectare mini-estates funded by the Development Bank. Ou Pty. Ltd. in the Western Highlands manages 3 coffee plantations and 14 Development Bank coffee blocks. The management structure for both companies is very similar; the organisation chart of Gouna Development is shown as an example in Figure 6.5.

Figure 6.5
Gouna Development Corporation - organisation chart

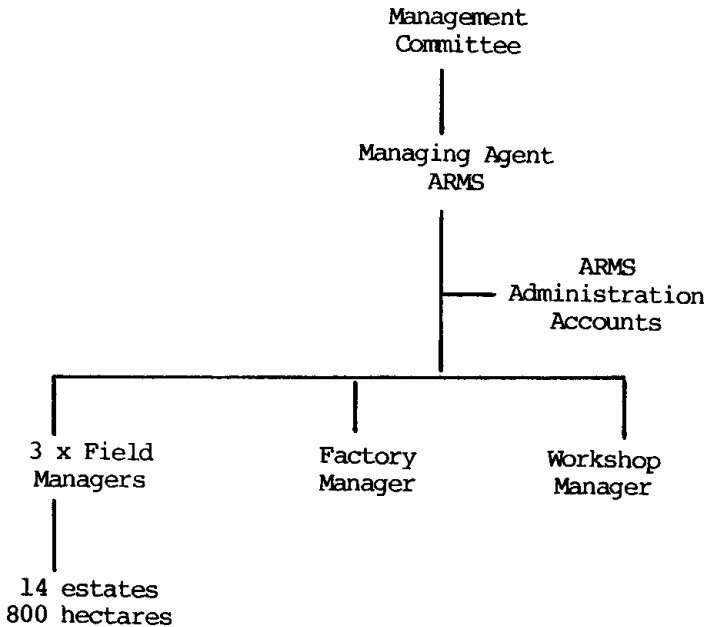


6.2 Management consultancy companies

Management consultancy companies manage locally owned coffee plantations in the Highlands. They do not, however, employ the estate managers. The managers are employed by the plantation owners. The consultants provide a full range of management services including financial control, procurement of supplies and agricultural expertise.

Agricultural and Resources Management Services Pty. Ltd. (ARMS) manages the Wahgi Mek plantation group near Banz. The Wahgi Mek group has 14 estates planted with 800 hectares of coffee. It produces green bean in a modern 5,000 tonne/year factory. Wahgi Mek has an export licence; it is therefore one of the few coffee producer/exporters in the country. The organisation structure of the Wahgi Mek plantation group is shown in Figure 6.6

Figure 6.6
Wahgi Mek plantation group organisation chart



6.3 Proprietary planters

The typical proprietary planter is an owner/manager of a small scale coconut, cocoa or coffee estate. There is the occasional planter who owns an estate growing a crop requiring complex processing such as tea or oil palm. The

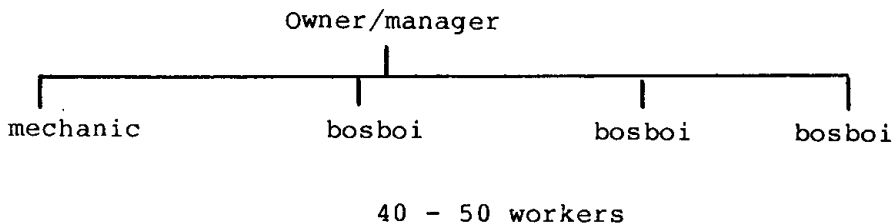
production is sold off the estate as raw material for factories on nearby large plantations.

Proprietary planters may be classified as:

- (a) national; and
- (b) expatriate - active
- inactive including absentee

The characteristics of estates belonging to proprietary owners is that they are small scale units which are under capitalised both managerially and technologically. This is not to deny that there are some owner/managers who are progressive, forward thinking, technically competent and shrewd financial investors. Such planters run profitable enterprises but it must be admitted that they are in a minority. The management structure of a typical small scale coconut or cocoa estate of 100 - 200 hectare size in this sector of the industry is given in Figure 6.7

Figure 6.7
Proprietary estate organisation chart



A number of the expatriate owner/managers include former Australian servicemen who by now have reached the end of their working careers. There has been little or no investment in their estates for 20 years or more so that the trees are senile and the plantations are in a moribund condition. An even smaller proportion of owners have abandoned their properties. They are resident overseas, mainly in Australia, as the proprietors now have Australian citizenship or were born there and had served in the armed forces.

The indications are that the majority of these owners would be willing to sell their estates. Under the provisions of the Plantation Redistribution Scheme they are unable to sell to foreign plantation companies who may be willing buyers. On the other hand local business groups cannot raise the capital to purchase the estates and carry out a rehabilitation programme. The reluctant planters are

therefore locked into a situation not entirely of their own making. From the national point of view these plantations are a wasting asset because of their declining productivity.

6.4 20 hectare development blocks

The government has since 1979 encouraged the development of "mini-plantations" on land owned by traditional groups. The main thrust of this development effort has been coffee planting in the Highlands with a much smaller programme of cocoa projects in lowland situations. The size of the development blocks averages around 20 hectares although some blocks may be as small as 5 hectares or as large as 50 hectares. Finance for the programme has been provided by the Papua New Guinea Development Bank on-lending funds from international and bilateral agencies. A condition of loan finance has been that the land-owning group employs professional management and that group members should work on the project or provide "sweat equity".

The government owned National Plantation Management Agency is involved heavily in coffee and cocoa block management. Angcodev, a subsidiary of the commodity trading company Angco Pty. Ltd. was established with the expressed purpose of managing development blocks. In the Highlands a number of smaller management companies such as Gouna Development and Ou are involved in the management of a limited number of blocks in compact geographical areas.

The standards on the mini-estates are patchy. An undoubted problem for those management agencies covering numerous projects over a large land area is that expensive management resources are dissipated so that supervision is less than fully effective. The most successful projects of this type are where there is intensive supervision and minimal involvement of the landowners in providing labour. In such cases the management company appoints its own employees as the resident supervisor and workforce. It operates the block as a mini-estate in exactly the same manner as agency house type management companies run large scale estates. A significant feature of the smaller companies is that they run their own plantations which produce export quality green bean. All the cherry from the mini-plantations under their control is processed in their factories and marketed as export bean by the company.

Chapter 7

Size and Efficiency

7.1 Introduction

The purpose of this chapter is to predict how the plantation sector may develop if it is to become a more effective institution for the production of the export commodity crops. Before making prognostications about future events it is considered useful to examine the evolution of the system in other countries with a plantation economy. The historical sequence of the crops grown and the variety of institutional forms that the plantation system has taken may provide some pointers as to how the industry in Papua New Guinea may evolve in the future.

The distinguished Dutch economist Boeke (1953) was the first to put forward a cycle of development for plantations in the Netherlands East Indies. Boeke's cycle appears to be applicable to the plantation system more or less wherever it survives as a viable agricultural production system. Nevertheless, the cycle does not take into consideration developments in ownership and financial control since 1945 and an extension of the cycle has been suggested by Goldthorpe (1983). Former Professor of Geography at James Cook University, Townsville, Percy Courtenay (1965, 1970, 1980) in turn has put forward reasons why modern-day plantations concentrate on perennial crop production in the humid tropics.

While the following generalised scheme is applicable to most plantation companies it should also be borne in mind that certain plantations arose in rather different circumstances. These were established when large producers of manufactured goods wished to safeguard part of their raw material sources. Tyre producers such as Goodyear and Firestone (USA), Dunlop (UK) and Michelin (France) established their own rubber plantations, while Unilever began plantation interests in order to supply its soap and margarine factories with vegetable oils. The two large American banana producers (United Fruit and Standard Fruit) began as shipping companies rather than agricultural concerns and became plantation owners in order to guarantee cargo for their refrigerated vessels.

7.2 Boeke's plantation cycle

In the "pioneer" stage the proprietary planter is the entrepreneur who takes high risks in opening up new land and deciding what crop to plant. Such frontier plantations were the spearhead of European enterprise in underdeveloped and often unsettled countries and grew a wide variety of crops.

They had typically been faced with transport difficulties, which had limited their distribution first to tide water and then to places within easy reach of railways (Courtenay 1970). They had needed to recruit labour from afar (slave, indentured or free immigrant) to provide a workforce. What distinguished the frontier or pioneer plantation, however, were the authority and purposes of the planter (Boeke 1953, Thompson 1959) and its abundant use of cheap land and relatively cheap labour (Courtenay 1970). It thus managed to grow a wide range of crops. Traditionally tobacco, cotton and sugar cane have been the pioneer crops in plantation developments and these three crops were among the first to be grown in Papua New Guinea (McKillop and Firth no date, Allen no date).

In the "capitalistic expansion" phase, the limited liability company appeared and the isolated proprietary enterprise became part of a public plantation company. In many cases the estates were taken over by their creditors in periods of low commodity prices. The large Papua New Guinea trading companies such as Burns Philp, W. R. Carpenter and Steamships Trading Co., expanded their plantation interests in this matter in the 1920s and 1930s (Dennis no date). The planter became an employee manager and administrator who had to accept his instructions from a board of directors and, in the last instance, from the owners of capital abroad. The setting up of these companies by absentee owners also led to the formation of plantation management companies or "Agency Houses" which undertook complete management in the field and provided secretarial, accountancy and marketing services to companies within the agency (Drabble 1973). It was early in this stage that the plantation began to concentrate on perennial tree crops to provide the basis of modern plantation enterprise (Courtenay 1970). This occurred when increasing labour costs brought about by the organisation of plantation workers and provision of welfare services led to certain crops grown by the frontier plantation being produced more cheaply on smallholdings or farms. Courtenay (1970) considers this to be especially true of the annuals such as tobacco and cotton, leaving the production of perennials on plantations.

The third and final phase in Boeke's cycle is that of "consolidation". Separate estate companies combine into larger units within the Agency House and eventually holding companies are formed on capital reorganisation. Rationalisation of estate operations is carried out as small estates are amalgamated into economic production units. This too is a period of diversification on the estates as new perennial crops are introduced in order to spread the investment risk. A large degree of vertical integration takes place; besides operating agricultural plantations the companies usually control their own research and advisory services, port installations and marketing arrangements. There also may be investment in downstream manufacturing activities. Goldthorpe (1983) has coined the term the "plantation corporation" to describe the final stage of the period of consolidation. This occurs when

all the plantation companies of an Agency House and the peripheral activities come under the financial and managerial control of a central public company: the plantation corporation.

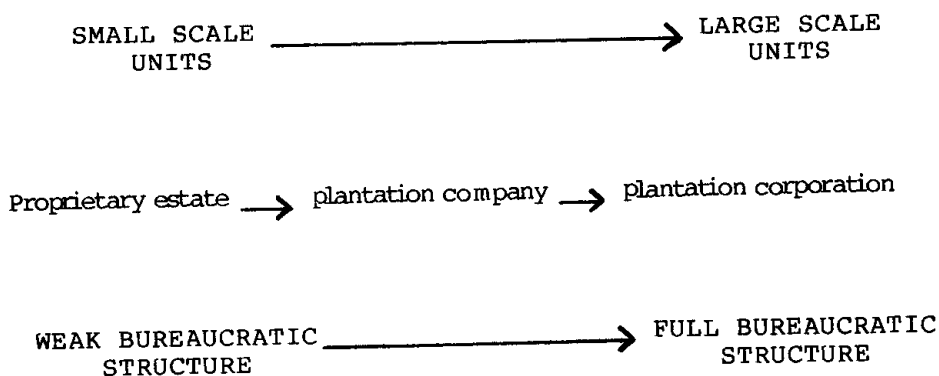
Boeke's cycle of plantation development finishes with the consolidation phase. However, it is put forward that there now is sufficient evidence to suggest a fourth stage which is termed the period of "repatriation". In this stage of the development cycle, control moves from the overseas financial centre and becomes "repatriated" in the nation in which the plantations are situated. In countries with a basically capitalistic or mixed economic structure "repatriation" occurs when a controlling interest in the plantation company is bought by nationals either as private individuals or government controlled investment funds. "Repatriation" is encouraged by national legislation which, on the one hand, makes local domicile more advantageous from the taxation point of view and, on the other, allows local stock market quotations to encourage more domestic investment.

In Papua New Guinea the operation of the Plantation Redistribution Scheme was designed to transfer plantations from foreign to local ownership. "Repatriation" of all the large London companies has already taken place in Malaysia by purchase of their assets either by negotiation or on the London stock market. The Malaysian Government plans for all corporate plantations to come under national control by 1990. "Repatriation" also takes place when foreign owned companies are nationalised such as the former Dutch estates in Indonesia and all foreign estates in Sri Lanka, Guyana and Zaire. "Repatriation" could also be said to apply in the case of new joint ventures between national interests, private or government, in partnership with foreign firms as typically the local partner holds the controlling interest in such enterprises. Joint ventures with international plantation companies in Papua New Guinea include new developments in oil palm and sugar cane.

7.3 Papua New Guinea: An immature plantation economy

The distinguishing feature about the plantation sector in what may be termed mature plantation economies is the emergence of the large scale plantation corporation as the dominant plantation enterprise. The historical sequence from smallscale proprietary estates to the plantation corporation is illustrated in Figure 7.1.

Figure 7.1
Evolution of the plantation system



It will be recalled from Chapter 2 that large scale enterprises are more formalised bureaucratic institutions than smaller organisations. Thus the plantation industry in advanced plantation economies has become more bureaucratised over time. This occurred as individual estates amalgamated into larger production units and plantation companies became larger through takeovers of smaller business organisations.

The structure of the Papua New Guinea plantation economy as described in Chapter 6 and 7 shows that plantation enterprises in this country range in ownership from proprietary planters to highly structured plantation corporations. A comparison between the structures of the plantation corporation (Figures 5.1, 5.2, 5.6), expatriate plantation company (Figure 5.9) and national plantation management company (Figures 6.1, 6.2, 6.3, 6.4, 6.5) and proprietary planter (Figure 6.7) shows a decreasing bureaucratic internal structure as the enterprises become smaller. Individual estates which are large in size show a more rigid internal structure than small estates. Plantations such as those growing oil palm (Figure 5.3), sugar cane (Figure 5.7) and tea (Figure 5.8) are large scale agricultural production units. Their internal structure is a full bureaucracy with management and supervisory positions arranged in strict hierarchy. Figure 7.2 gives a generalised picture of the organisational structure found on the international plantation corporation estates of around 5,000 - 6,000 hectare size. At the apex of the hierarchy is the general manager and in descending order departmental or estate managers, divisional managers, assistant managers, senior supervisor, junior supervisors and foremen. At the base of the pyramid are the workers who typically number between 1,500 - 2,000.

Figure 7.2
Generalised organisation chart of international
plantation corporation operation
(8 levels of hierarchy)

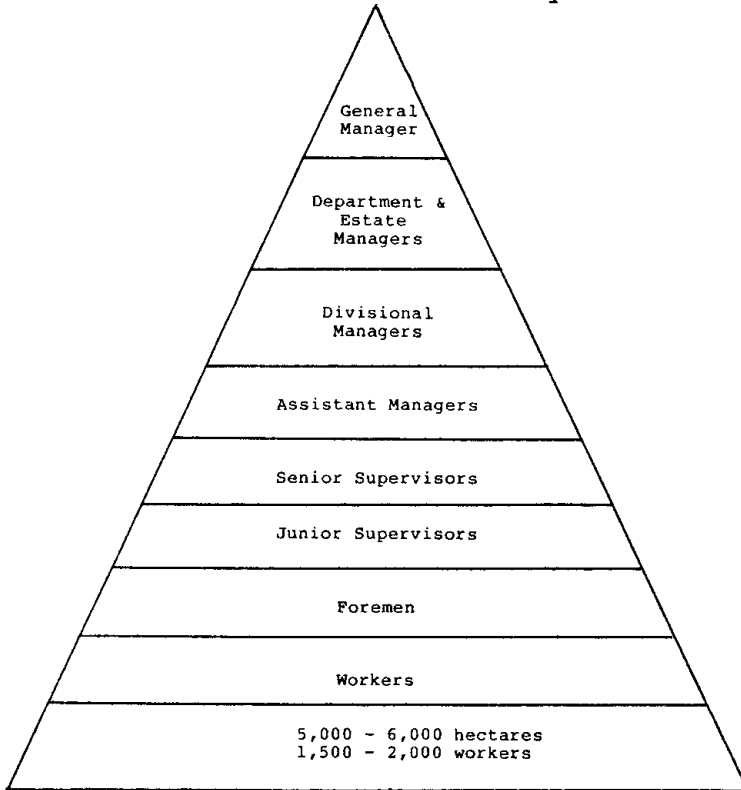
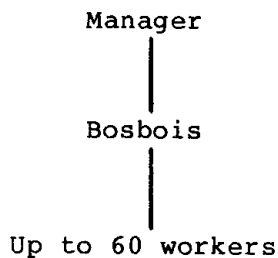


Figure 7.3 shows the organisation structure of a mono-crop coconut plantation of about 300 - 400 hectares in area. The structure is only very weakly bureaucratised there being only one supervisory position (bosboi) between the labour gang and the manager. This management structure is found on both company owned plantations and those operated by owner/managers.

Figure 7.3
Typical coconut estate organisation structure
100 - 400 hectares
(3 levels of hierarchy)



The manager on the typical coconut property is also his own factory manager and workshop supervisor compared to his counterparts on similar sized coffee and tea plantations. The weak hierarchical structure is a function of the relatively low labour demand and simple technology of production (both agronomic and processing) required in coconut culture compared to coffee and tea production. A similar management structure is found on mono-crop cocoa properties and cocoa/coconut inter-cropped plantations although more labour would be employed than on a sole crop coconut estate of the same size. Large scale coconut and cocoa plantations such as Numa Numa (1,200 hectares) on Bougainville Island have a much more strongly hierarchical management structure as there is a direct correlation between degree of bureaucratisation and size. A simple structure of manager/bosboi is also typical of small scale coffee plantations (say 50 hectares) in the Highlands although large scale coffee plantations (see Figure 5.5) are full bureaucracies.

The problem of small, fragmented, weakly structured estates has been overcome to some extent by gathering a number of estates together under the control of a group manager. The individual estates are then run as divisions of the larger group with a divisional manager in charge. These arrangements are found both among national management companies and the Burns Philp and Coconut Industries Ltd. coconut/cocoa plantations. The organisation structure of this type of institutional arrangement is shown in Figure 7.4. The size of these plantation groups vary but for coconut/cocoa growers the size typically ranges from 750 - 1,500 hectares.

Figure 7.4
Group plantation organisation structure
(4 levels of hierarchy)



750 - 1,500 hectares of coconut/cocoa

The institutional arrangements in the Papua New Guinea plantation sector are varied. They range from fully bureaucratic plantation companies to individual ownership of plantations. The plantations themselves cover estates with rigid hierarchical management structures to estates which have only weak formal structures. In view of this diversity compared to other countries with a well-developed plantation sector Papua New Guinea may be described as an immature plantation economy.

7.4 Size and efficiency

It still remains necessary to explain why the historical sequence in plantation developments is from small scale to large scale units. Is it that large estates are more efficient producers of perennial crops than small scale producers?

Sackett and Williamson (1973) in an agricultural economic survey of the Papua New Guinea copra industry showed a strong relationship between the size of plantation and cost of production. Table 7.1 shows the breakdown in cost for the various sizes of plantations. Small plantations have an annual cost of production of K130/tonne compared to K97 for the largest estates. The large production units are therefore more efficient producers of copra than small units.

A survey of the cocoa plantation industry was carried out by Godyn (1974). Table 7.2 shows the breakdown in the cost components for the various size of plantations.

Table 7.2 indicates that costs of production on plantations producing over 70 tonnes of cocoa are significantly lower than on plantations producing less than 70 tonnes. It is interesting to note the economies of scale that the larger plantations are able to achieve in both management and labour compared to the smaller plantations. In fact the larger plantations require on average only half the management and labour input per unit of output than the plantations producing between 5 and 24 tonnes.

Godyn also observed that costs of production on sole cocoa plantations were much higher than on multi-crop plantations. He found that the weighted average cost of production on sole cocoa plantations was K511 compared with K384 overall. He attributes this largely to two factors; first that all costs are allocated to cocoa only and secondly to the fact that the overall size of operation on sole cocoa plantations is smaller than that of multi-crop plantations of the same category.

Table 7.1
Weighted average costs of producing copra by size category 1971/72
kina/tonne

Size category	Producing less than 50 tonnes	50-99	100-199	200-399	Over 400	All Plantations
Labour	65	63	55	44	35	43
Materials	10	10	9	12	14	12
General	17	18	18	19	19	19
Freight	8	8	9	10	10	10
Total non-managerial cash costs	100	199	91	85	78	83
Management	22 (3)*	21 (5)*	18 (9)*	12 (13)*	12 (11)*	13(41)*
Total cash costs of production	122	120	109	97	90	96
Depreciation	8	8	8	8	7	8
Total annual cost of production	130	128	117	105	97	104

* Here the average is based upon only the number of observations indicated in parentheses.

Source: Sackett & Williamson (1973). The original data quoted in \$A per ton.

Godyn further observed that yields varied according to size and that in 1972/73 yields from the smaller plantations equalled 0.22 tonnes per hectare; the plantations producing between 24 and 69 tonnes had yields totalling 0.29 tonnes per hectare while the larger plantations had yields of 0.53 tonnes per hectare.

Table 7.2
Cost of cocoa production by size category 1974
(kina/tonne)

	5-24 tonnes	24-69 tonnes	Over 70	Weighted Average
Labour	274	197	139	165
Materials	21	35	46	41
General	105	118	47	69
Freight	13	6	14	12
Management	94	104	49	67
Depreciation	44	35	25	29
Total Costs	551	495	320	384

Source: Godyn 1974

It would therefore seem that there is sufficient evidence to assume that size and efficiency are linked and that "as production increases so efficiency, expressed in terms of costs per tonne of output increases" (Densley and Wheeler, no date).

Analysis of the financial performance of rubber estates over a number of years by the Rubber Research Institute of Malaysia shows that there are large variations between the performance of estates in different size groups. Large estates, defined as over 400 hectares managed by Agency Houses, have yields 20 per cent more than small estates below 200 hectares in area. Large estates show gross annual profits about 30 per cent more than small estates. The conclusion of the Rubber Research Institute is that large plantations are generally superior to smaller estates in terms of yield per hectare, earnings per tapper, revenue per hectare and revenue per kilogramme of rubber (Barlow 1978, Courtenay 1979, Planters Bulletin 1977, Planters Bulletin 1979, Planters Bulletin 1981).

Khera (1976) in his economic study of the Malaysian oil palm industry compares production from small Malaysian owned and large foreign owned plantations. He noted that in 1969 foreign owned estates accounted for 89 per cent of total production of

palm oil though they owned about 77 per cent of the total mature acreage. On the other hand, Malaysian estates had 22 per cent of total mature acreage but produced less than 11 per cent of total palm oil tonnage. He concludes that "the technical advantages in processing, transporting, harvesting, grading, and bulk shipping would appear to throw the balance of advantage strongly towards large estates, for clearly the adoption of such sophisticated methods is quite out of the question for small Malaysian estates."

The superiority of large plantations over small plantations in terms of production is also evident from the Javanese rubber industry. The large government owned plantations typically covering 2,000 hectares or more had in 1980 average yields of 1,000 kilogrammes per hectare. The small private estates on the other hand, with an average size of only 300 hectares, yielded 520 kilogrammes per hectare. An examination of the profit and loss accounts of the small plantations showed that they were barely breaking even compared to the healthy financial position of the large public sector estates (PESI Study 1982).

The evidence from Papua New Guinea, Indonesia and Malaysia covering four important crops in each country's national economy point to the fact that large scale plantations with a formal bureaucratic structure are more efficient producers than small scale plantations with a weak hierarchical, internal structure. Large plantations therefore enjoy a comparative advantage over small estates. To parody Schumacher (1973) in plantation agriculture "Big is Beautiful" or at least small is quite definitely inefficient. It is suggested that one of the main reasons for the efficiency of large plantation units lies in the quality of the management that they employ. Small plantations generate only sufficient income to afford low grade managers. Large units on the other hand can carry the cost of high grade management paid at internationally competitive rates of pay.

7.5 Implications for Papua New Guinea plantation sector

The implications for the Papua New Guinea plantation sector are fairly obvious if it is accepted that the country's trade policy is to maximise foreign exchange earnings partly through the production of cash crops. Plantation developments in Papua New Guinea have produced a wide range of estate performances with varying scale of operations and operational efficiencies. In each crop there are examples of capital intensive and technologically progressive firms, highly efficient by international standards. In copra, cocoa, coffee and rubber production there are also many small scale estates which are inefficient producers. Restructuring of the small plantation sector is necessary to maintain competitiveness in world markets. Small estates need to be consolidated into larger, more financially secure and viable units.

It is interesting to note that the largely national owned coffee industry has changed in structure from small to larger units over the past few years. The average size of coffee holdings has risen substantially and continually over a 19 year period. The average size of a sample of coffee estates investigated by the Department of Primary Industry (1985a) was around 100 hectares in the early 1980s compared to about 30 hectares in the middle 1960s when the industry was in its infancy. Such a trend has not taken place in the copra and cocoa industries in part because of the provisions of the Plantation Redistribution Scheme. In Chapter 6 it was suggested that expatriate owners of small estates are unable to find financially sound buyers of copra and cocoa plantations because of the restriction of plantation land transfers to nationals. Consolidation and expansion of the coffee plantation industry has largely been financed by the commercial banks. Coffee has been regarded by the financiers as a low risk agricultural investment compared to copra and cocoa in the Islands. One of the reasons for this attitude is that the existing coffee plantings are young so that future crops can generate sufficient cash flow to service the debt. In the case of the defunct cocoa and copra plantations yields are declining due to the senility of the planting material. The cash flow from these plantations is generally decreasing. The banks are reluctant to lend money on land while the Plantation Redistribution Scheme legislation remains on the statute books. These two factors largely explain why finance has not been available to rehabilitate the plantations in the island provinces.

The political ideology of a country has an overriding influence on the choice of organisations chosen for the implementation of agricultural development policies (Hunter, Bunting and Bottrall 1976). Unless the political climate and laws are favourable to the establishment and maintenance of plantation agriculture, this sector will not develop. There is widespread agreement that the legislation associated with the Plantation Redistribution Scheme is impeding the restructuring of some parts of the plantation sector. The laws need to be repealed if a viable plantation industry based on large scale production units is to be established. Once an unconstrained market in plantation land is operating small outlying estates can be sold off. Finance from these sales may be used to purchase estates adjoining groups of existing plantations to create large units that can support a viable management structure. It is envisaged that there will be a free transfer of land between national and expatriate plantation groups and between individually owned and company owned estates. Depending on the corporate strategy of individual companies, some companies may contract their overall plantation operations albeit in larger estate units, other companies may enlarge their plantation business activities.

Such a course of action may result in foreign plantation groups expanding their operations over a short period. When a

historical perspective is taken however the plantation industry in this country has already entered the "repatriation phase" of the plantation cycle. Eventually financial and managerial control of the expatriate plantation companies will move to Papua New Guinea. It is far better that when this happens the industry be in large, financially viable units than be small, fragmented and barely solvent as segments of the industry are today.

7.6 Standards of management

There is, generally, a gradation in the level of management in the plantation industry from large scale units to small scale units. Large estates generate sufficient cash flow to enable management positions to be filled by experienced personnel who because of their ability are internationally mobile. These plantation managers (national and expatriate) are equal to any in the world and many expatriates have had middle to senior management experience elsewhere.

Small sized properties, on the other hand, typically earn only sufficient to pay for low grade managers. In the case of national managers they would, if in government service, only be eligible for relatively junior positions because of their lack of formal educational qualifications. If this type of manager was to be employed in an international company he would be offered a supervisory (non-executive) position, in the first instance. Promotion to the executive ranks would then depend on ability and performance. Many of the low grade Australian and New Zealand managers could not expect to be employed in managerial posts in their countries of origin. The international plantation corporations, on the whole, do not consider this type of person to be executive calibre and therefore do not recruit them. They typically would not be of sufficient ability to be considered for middle to senior management posts in the expatriate and local Papua New Guinean companies which employ them. One of the local plantation management companies in coconut/cocoa hires personnel at the senior supervisor (conductor) and junior assistant level in Malaysia and appoints them to managerial positions in this country. In other words senior non-executive and junior executive staff are recruited in Malaysia for managerial posts in Papua New Guinea.

The general conclusion is that, apart from the international agricultural companies, the general standard of plantation management is low compared to countries in South East Asia, South Asia and Africa. Perhaps the plantation companies resident in Papua New Guinea would be better employed looking to these countries for management experience rather than appointing personnel of doubtful agricultural experience and managerial calibre from nearby countries.

Chapter 8

Transfer of Technology to Smallgrower Sector

8.1 Role of government

The problem of how to raise the productivity of the tree crop smallholder sector is one of immense complexity. It is not only confined to Papua New Guinea but similar problems are faced in all countries in the humid tropical world. There can therefore be no easy answers. Any solutions are likely to work only in the long term as small farmers become better informed and the rural subsistence sector enters more into the cash economy.

The terms of reference for this study included an investigation of "the scope for, and method of, direct technology transfer from the estate sector to the smallholder/village sector". The short answer is that the study sees no scope for direct transfer of technology to the village sector unless the plantation industry is willing to set up an agricultural extension service that duplicates and competes with, or substitutes for, the existing government services. The plantation sector is unlikely to do this given that plantations are run on commercial lines with clearly defined business objectives. There is no profit in running an agricultural advisory service directed at the smallholding sector unless the government decides to disband its own extension operations and contracts out the extension function on a cost-plus basis to the plantation industry. This would require a fairly fundamental re-examination of the roles of government vis-a-vis the commercial agricultural sector with regard to small growers. From the standpoint of the estates it would imply a willingness to take over some aspects of the extension function from the Department of Primary Industry. The government would have to accept that it had a diminished role in the provision of smallholder advisory services to the tree crop sector. Those plantation managers most involved with smallholders through the operation of nucleus estate schemes growing sugar cane and oil palm are unanimous in recognising the importance of the government in providing an independent, impartial watchdog service between the company and the small outgrowers. The nucleus estate projects do not wish to see the withdrawal of the Department of Primary Industry service from their schemes. It is doubtful if less well managed plantation companies or plantation management agencies would be willing to recruit agricultural advisory staff and set up a new smallholder extension service given the problems that have arisen in the management of the 20 hectare mini-coffee estates in the Highlands. The firm opinion of this study is that the provision of smallholder advisory services is a public service function of government. In the open economy of Papua New Guinea the role of the estate sector is to produce export tree crops at the lowest possible unit cost and so maximise foreign exchange earning. To become involved in the provision of

agricultural extension services to small farmers will only dissipate scarce management resources.

The viewpoint sometimes expressed that plantation managers or assistants can go into surrounding small farms to teach smallholders the correct techniques of tree crop husbandry is regarded as naive. In the first place the executive staff on plantations are (or should be) fully occupied in managing their estate and their labour force. A plantation manager's position is a full time job. Secondly, the requirements both as regards personality traits and training between an estate manager and an advisory officer are different. Plantations attract and employ more authoritarian-type personalities who are at ease working in strict hierarchies. Organisational psychologists have coined the term "bureaucratic personality" to describe the personality traits of people who work in bureaucratic organisations (Burns and Stalker 1961, Gouldner 1963, Merton 1963). Merton concludes that the bureaucratic structure tends to produce an actual or apparent domineering attitude in its functionaries and an emphasis on disciplined, methodical performance of work activities. An extension worker, on the other hand, has to persuade his clients (the farmers) to follow a certain course of action which they will do in their own time. This is in contrast to the plantation manager who orders his labour to do a job. The advisory officer therefore needs high communication skills in order to sell an idea to the smallholder and persuade him to implement it.

If plantations wish to advise smallholders then they will have to employ their own smallholder advisory officers. Certain firms may be willing to employ extension officers as a public relations exercise while commodity prices are high when salary and other overheads can be absorbed. They will however not be so willing during a run of low prices when profit margins are being squeezed and their boards of directors are calling for economies to be made in all departments. It may be argued that the cost of an estate extension service may be paid for by the estate factory purchasing raw material from smallholders and deducting the cost from the purchase price. This is feasible where the factory is the monopoly buyer. For plantation factories in the existing coffee, cocoa and coconut growing areas of the country this option is not available. There is a free market in coffee cherries and wet cocoa beans which are sold at the roadside to small traders who act as agents for local pulperies and fermentaries. Numerous small coconut drying kilns are found in the copra producing regions. The situation is however different for the crops requiring complex processing in large scale factories and this is discussed in section 8.4 which discusses nucleus estate/outgrower schemes.

8.2 Farming systems perspective

The discussion in Chapter 2 indicated that smallholders grow the perennial export crops under a different system of

agriculture compared to plantation producers. Smallholder coffee and copra/cocoa producers typically grow their cash crop as part of a complex, multi-storey, cropping system which is highly productive when measured in terms of labour energy inputs and calorific energy outputs. It is then perhaps no surprise to find that the smallholding sector dominates production of these three crops and that production has marginally increased over the five year period 1979-83 (see Table 4.4). Nevertheless yield levels from the multi-storey/low physical input system are low so that only modest cash incomes are generated and foreign exchange earnings are not maximised.

The problem is how to increase yields by appropriate inputs that are compatible with the complex, stable, low risk ecological system that forms the smallholders' farming pattern. To introduce the estate mode of production of high physical inputs requiring a high degree of managerial skills would, it is suggested, lead to ecological disasters on almost every smallholding and probable financial ruin for each smallholder that adopted such measures.

Without wishing to appear simplistic it is suggested that the main constraints on smallholder production of coffee and cocoa (the two most important smallholder crops) are in weeding, pruning and shade control. In certain situations such as the Wahgi Valley drainage is also important. Competition from weeds is probably a major factor contributing to low productivity from smallholder coconuts. The constraints on productivity can be ameliorated by the provision of advice on pruning methods, the need for weeding and correct shade policy. Weeding, pruning and thinning or planting shade trees are all labour intensive activities that can be provided free of charge using the smallholder's own labour.

8.3 Nucleus estate/outgrower project concept

Where the plantation sector can make a direct contribution to the transfer of technology to smallgrowers is in integrated nucleus estate and satellite outgrower projects. The nucleus estate project concept has been accepted in Papua New Guinea for a number of years. There are three successful oil palm development programmes run as nucleus estate/outgrower projects at Hoskins and Bialla in West New Britain and at Popondetta in Oro Province. Sugar cane is grown under the nucleus estate system by Ramu Sugar. The initial concept for tea production in the Western Highlands was that of nucleus estate development. Tea however failed to gain ready smallholder acceptance because of low world prices, the availability of more attractive alternative crops such as vegetables and coffee and the need for continuous work the year round to maintain an even plucking table. Rubber is produced in a variant of the nucleus estate system at Cape Rodney and Gavien settlement

schemes which are managed by the Department of Primary Industry. Crumb rubber is produced in the schemes' central factory which is supplied with raw material from surrounding smallholdings.

Nucleus estate/outgrower schemes are termed quasi-plantation projects by Goldthorpe (1983) as they are development projects that have adapted the hierarchical management structure of plantations to deal with the circumstances of small farm perennial crop production. The farmers in centrally managed, nucleus estate projects are called outgrowers because they grow the crop under the supervision of project staff and send the harvested produce to a central project factory. The participants in quasi-plantation projects are not smallholders in the usual sense of the word since they follow the instructions of project management and have no choice where to sell their produce. Smallholders are independent farmers who make their own decisions about what cultural practices and agricultural techniques they wish to adopt. They sell their crop to the highest bidder and are not tied to only one outlet.

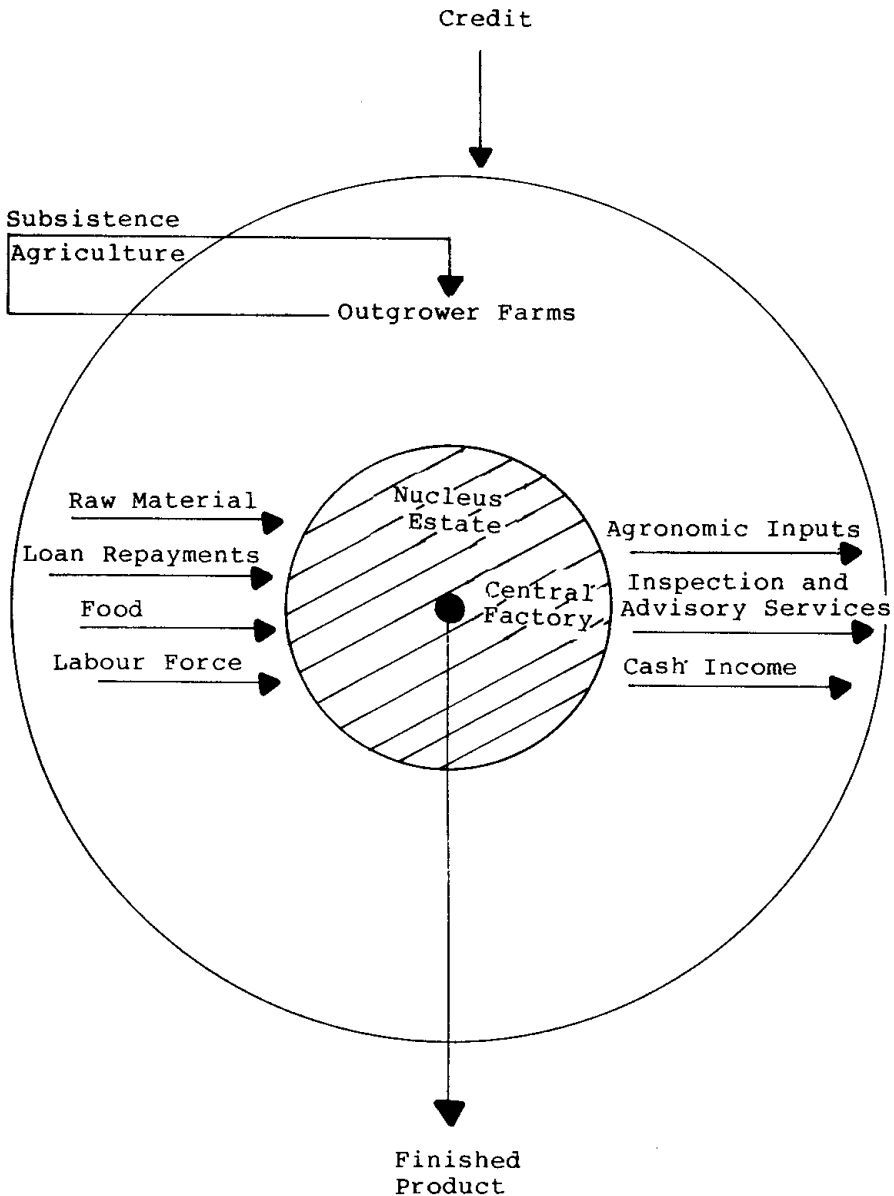
A nucleus estate project consists of a central plantation and associated processing factory surrounded by satellite small farms. A basic concept is that the estate and factory complex act as a focal point for outgrower development. The estate provides agronomic, management and commercial services to farmers growing the same crop as the nucleus estate. The range of services should enable the outgrowers to attain the same levels of crop husbandry, yield and product quality as the estate. In practice, small producers, on average, do not obtain the same yields as the estate average and agricultural standards are lower. Specifically the nucleus estate sets an example to the outgrowers by having high agricultural standards.

The central plantation is run on commercial lines. The estate normally should be of sufficient size to provide a guaranteed minimum throughput for the central processing factory, at the very least, to recover its capital and operating costs. The reason advanced is that crops requiring complex processing such as tea and oil palm need expensive factory installations and that the commercial risks involved in a development scheme demand an assured throughput to guarantee a return on the investment. The central factory, in its turn, provides a guaranteed market for the outgrowers' produce. The outgrowers are subject to close supervision in their husbandry practices in order to produce raw crop in sufficient quantities and of adequate quality for the processing mill to export a high quality end product. Through deductions from payment for raw material the nucleus estate also provides a means of collecting farmer loan repayments.

The usual concept of a nucleus estate is a production unit of a size to support the best professional management. The outgrowers development then need only carry the cost of the additional staff involved, not the full cost of project management. (Christensen and Densley, no date, Fiennes 1982, Hartley 1977, Phillips 1965, Phillips and Collinson 1976, Ruthenberg 1973, 1980, Swynnerton 1970).

The relationships between the nucleus estate and the many smallgrowers for their mutual benefit is shown in a diagrammatic form in Figure 8.1.

Figure 8.1
Nucleus estate concept



8.4 Advantages of nucleus estate projects

Nucleus estate schemes attempt to combine the best features of plantation and smallholder methods of production and to overcome the weaknesses of both. That is, they exploit the advantage of low cost family labour and combine it with the large scale plantation mode of crop production under skilled management. The gaining of pecuniary economies (higher prices of outputs, lower costs of inputs and lower commercial risks) together with economies of scale in processing and marketing are a major economic justification for nucleus estate projects. Nucleus plantation and outgrower development programmes allow modern agricultural techniques to be implemented at the beginning of a project by farmers unfamiliar with the crop. This is brought about by routine supervision of the smallgrowers under centralised management. Top management in large scale agricultural development schemes needs to be highly skilled in view of the size and complexity of the schemes but field supervision of farmers can be done with personnel of only limited skills and experience. The nucleus estate organisation therefore allows the economic use of scarce management skills in situations where such skills are at a premium.

Quasi-plantation schemes therefore use scarce economic resources in an efficient manner. Because the institutional arrangements are based on proven plantation methods of crop technology, innovations such as new crops and cultural practices are successfully introduced, physical inputs such as pedigree planting material and fertilisers are supplied, credit is channelled to the farmers, their crop is processed in modern factories and sold at premium market prices. The integration of plantation and smallholding systems of production incorporate the benefits of high standards in crop husbandry and processing technology with family labour. Production from high yielding crops and the outturn of premium quality produce have a concomitant effect on farm incomes. Outgrower cash incomes on nucleus estate projects are high compared to surrounding smallholders following their traditional system of agriculture.

Nucleus estate projects are very suitable for the plantation crops that require heavy investment in transport and large scale factory facilities such as sugar cane and oil palm. The high capital cost of processing and handling equipment can be spread between the estate and outgrower participants.

The success of nucleus estate schemes depends to a great extent on the outgrowers supplying all their crop to the central factory. The processing equipment can then be operated at its full design capacity so that the unit cost of manufacturing is low and can be shared equally between all scheme participants. It is important in situations where development loans have to be repaid that all the outgrowers' produce is

sent to the central processing plant. The full amount of loan deductions can be made so that debt repayments are completed on schedule. One way of ensuring that all harvested produce is sent for processing is by the factory having a monopoly. In Papua New Guinea there is no market for oil palm fresh fruit bunches, rubber latex or coagulum and raw sugar cane except to the central factory on agricultural development schemes. It is very doubtful if nucleus estate schemes were to be established for copra, cocoa and coffee in areas where these crops are grown traditionally that the projects would be successful unless very tight control were established. There would be a propensity for the scheme participants to sell their crop to village traders for ready cash. However nucleus estate schemes for these crops would be successful in enclave situations such as new development projects in the Fly and Strickland valley basins.

8.5 Nucleus estate oil palm schemes in Papua New Guinea

Oil palm is grown on three nucleus estate/outgrower projects at Hoskins and Bialla in West New Britain and Popondetta in Oro Province. The Hoskins project was established in 1967, Bialla in 1972 and Popondetta in 1976. The same basic financial arrangements have been adopted for each scheme. An international plantation corporation has taken 50 per cent of the shares in an estate company and provides management, processing and marketing services. The government has taken the remaining 50 per cent of the shareholding. Despite the potential for a dead-locked board, with two equal shareholders, no problems have arisen.

The structure of the nucleus estate schemes in 1983 is detailed in Table 8.1

The outgrower component of the schemes are developed by the government with the Department of Primary Industry providing the direct extension service to the farmers. On all schemes the area of outgrower plantings exceeds the estate area. (The study regards this as a fundamental project design fault as the central mills are too dependent on the outgrowers for their raw material. During periods of low palm oil prices the outgrowers reduce or cease harvesting so that the processing facilities run at less than design capacity.) Both Hoskins and Popondetta schemes have been supported by World Bank credits and loans. The outgrower sector at Bialla is financed entirely from Papua New Guinea government resources. Credit for the small grower plantings has been provided through on-lending through the Papua New Guinea Development Bank. The central processing and lack of alternative market outlets provides the opportunity to deduct debt service payments at source. As a result of this, coupled with general prosperity in the industry, most smallholders have repaid their loans, frequently well ahead of schedule. Average income per oil palm outgrower in 1983 was almost K1,500, over five times the national average cash income per smallholder.

Table 8.1
Structure of nucleus estate oil palm schemes 1983

	Hoskins	Bialla	Popondetta
Nucleus Estate Co.	New Britain Palm Oil Development Ltd Est. 1967	Hargy Oil Palm Pty. Ltd Est.1972	Higaturu Oil Palms Pty. Ltd. Est.1976
Shareholding	50% PNG Gov. 50% H & C (U.K.)	50% PNG Gov. 50% Sipef (Belgium)	50% PNG Gov. 50% CDC (U.K.)
Management	H & C	Sipef	CDC
Planted Areas - hectares			
Estate	5,600	2,000	4,500
Outgrowers	7,600	4,100	4,900
Total	13,200	6,100	9,400

Source: Department of Primary Industry 1985b.

The managing agents of each estate company are responsible for all marketing of oil and kernels on a commission sales basis. All oil is exported crude with the bulk of sales being to Europe. There is no local market for crude oil. The bulk of the kernels are sold to Japan. The system works well and there have been no difficulties in disposing of production. The price for smallholder fresh fruit bunches (f.f.b.) is determined by a formula which takes account of world prices, transport and processing costs. Mills are virtually assured of recovery of all costs under recovery of all costs under the formula. The result is that while smallholders receive most of the benefit of price booms, they also bear the brunt of price falls. Smallholder prices are very variable under the formula. The Papua New Guinea Development Bank has provided some relief from the effects of low prices by suspending or reducing debt service payments at times of very low prices. However, in 1983, a price stabilisation scheme was set up to stabilise smallholder prices. Estate production is not covered. The scheme operates on similar lines to the coffee and cocoa funds, with levy and bounty payments based on deviations from the moving average of prices in real terms. (Christensen and Densley no date, Department of Primary Industry 1985b).

8.6 Popondetta oil palm scheme

8.6.1 Nucleus estate and central mill complex. The nucleus plantation and palm oil mill on the Popondetta scheme are managed by the British Government controlled Commonwealth Development Corporation (CDC). The Corporation has been a pioneer in the development of the nucleus estate concept. It operates 16 nucleus estate/outgrower projects in Latin America, Africa, Asia and the Pacific region growing rubber, coconuts, oil palm, sugar cane, banana, tea and cocoa. In Kenya, Uganda and Malawi CDC manages small grower schemes growing tea and coffee which are organised as central factory schemes without nucleus estates (CDC 1984).

Development at Popondetta began in 1976 with the establishment of the nucleus estate. The nucleus estate complex in 1985 totalled 4,815 hectares divided into three estates which employed 1,203 workers. The scheme has a central, 60 tonne per hour mill which processes fruit from both the estate and outgrower components of the project. Production in 1983/84 financial year was 34,847 tonnes of palm oil and 5,697 tonnes of palm kernel valued at K21.7 million.

The structure of the scheme in 1985 is shown in Table 8.2. The management organisation of the nucleus estate/mill complex is given in Figure 8.2.

Table 8.2
Structure of Popendetta oil palm scheme 1985

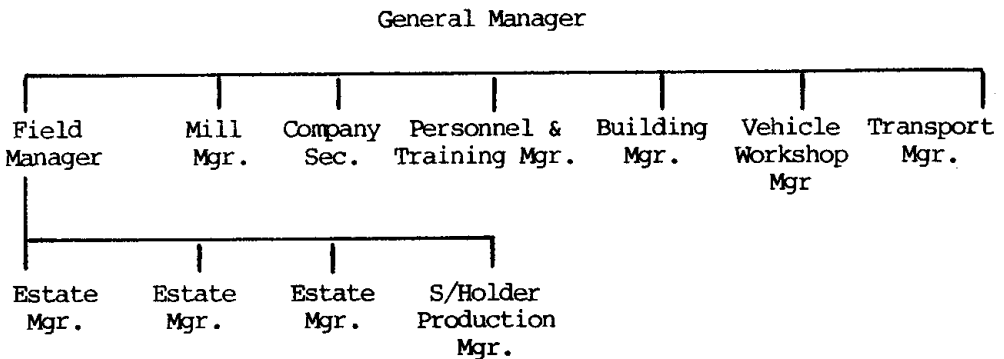
	Area hectares	No. of employees/outgrowers
Nucleus estate	4,815	1,203
Outgrowers	5,218	1,364
Total	10,033	

Source: Higaturu Oil Palms Pty. Ltd. (1985)

The nucleus estate employs a Smallholder Production Manager whose job it is to liaise with the Department of Primary Industry Smallholder Project Coordinator on all aspects of outgrower plantings and harvesting.

The nucleus estate/factory complex consists of three distinct operating units:

Figure 8.2
Higaturu Oil Palms Pty. Ltd. - organisation chart



1. Nucleus estate
2. Palm oil mill and port storage facilities
3. Transport fleet to carry the outgrowers' crop to the mill.

8.6.2 Outgrower component. The outgrower sector of the project consists of two components namely a settlement scheme and village oil palm plots. The settlement scheme consists of 2,980 hectares which are farmed by immigrants from other parts of Papua New Guinea. There are some 2,237 hectares of oil palm planted by villagers on their traditional land holdings. Each settler has between four and six hectares of oil palm. In the case of the villages their oil palm plots are between two and four hectares. The structure of the outgrower component of the scheme in 1985 is shown in Table 8.3.

At completion there will be a total of 1,400 outgrower plots. The project is financed by a US\$12 million loan from the World Bank which was signed in January 1977.

Table 8.3
Outgrower component 1985

	Area hectares	Number of families
Settlers	2980.5	752
Village	2237.5	612
Total	5218	1364

Source: Higaturu Oil Palm (1985)

The settlement scheme is divided into a number of blocks of land each between 1000-1500 hectares in size. Each block is made up of approximately 200 farm plots grouped around its own village centre containing school, clinic, meeting hall, market and other services. Land settlement follows the linear pattern in which the houses are built alongside the road with the plot of land directly behind the house. The farmers are settled as family units on six hectares of land leased from the government on a 99 year agricultural lease.

Responsibility for the planting programme and supervision of the smallholder oil palm plots is by agricultural extension staff belonging to the Department of Primary Industry. Work is organised individually with each settler family being responsible for all agricultural operations on their plot of land. Supervision, inspection and advisory work is undertaken by 16 extension officers headed by the Project Coordinator (4 rural development officers, 9 rural development technicians, 3 rural development assistants). This provides a ratio of field staff to oil palm plots of approximately 1 : 100.

The physical layout of each settlement block was completed before the family arrived on the project. Six hectares of land were demarcated and four hectares felled (without burning or clearing) by contract labour before the settlers arrival. The timber provided fuel for cooking and the trash provided organic material for the soil. Each settler was responsible for holing and planting under the direct supervision of the extension officers. The palms were supplied from a central nursery managed by the nucleus estate. All four hectares were planted over a six month period. Subsequent immature and mature upkeep and harvesting of the palms has been undertaken by the settler families.

The planting pattern on the village oil palm plots has been slightly different. The villagers were responsible for clearing their own land. Two hectares were cleared in the first instance under Department of Primary Industry supervision. After this has been planted the second two hectares are felled at a time when the villager is ready and with the agreement of the Project Coordinator.

Settlers and villagers harvest the fruit on a strict 14 day cycle, carry it to the roadside and stack it on nets which have been previously delivered by the transport operations of the nucleus estate. Nets are picked up by a truck mounted crane, weighed and a delivery docket issued to the settler. The trucks deliver the fruit direct to the mill. Loan repayments of a 50 per cent deduction from the farm gate incomes is made by the Papua New Guinea Development Bank. Many outgrowers have now paid back or are nearing completion of their loan repayments.

Chapter 9

Recommendations

9.1 Statement of government policy

The plantation sector contributes approximately 40 per cent to export earnings from the tree crop sector. Compared to smallholding agriculture the estate sector is a high productivity/high quality/high income producer of export crops. Plantations therefore produce high net earnings of foreign exchange and a high taxable income that can be used for general economic development. They also are significant employers of labour.

The economic advantages of plantations are tacitly recognised by the government. There is however no official policy statement that the government recognises the valuable roles that the plantation industry can play in contributing to the development of Papua New Guinea. The forthcoming publication of the medium term development strategy for the agriculture, forestry and fisheries sector presents an ideal opportunity for the government to take a positive stance and indicate to the plantation industry its important economic function in the country's development programme.

9.2 Restructuring of the industry

Large estates are more efficient producers of perennial crops than small plantation units. Most estates producing coffee, cocoa, coconut and rubber are small scale units which are inefficient producers. Restructuring of the small plantation sector into large financially viable units is necessary to maintain competitiveness in world markets.

The indications are that some restructuring is already under way in the largely nationally owned coffee industry and that plantation sizes have become bigger over the past twenty years. There appear to have been few amalgamations among copra/cocoa producers. Most estates in this sector are of such small size that they cannot generate sufficient cash flow to employ high grade managers. A large international plantation corporation has recently taken over a group of rubber estates and rationalisation of rubber production is underway.

The legislation associated with the Plantation Redistribution Scheme has severely impeded the restructuring of the coconut/cocoa estate industry. The legislation should be repealed to allow easier transfer of properties between foreign plantation interests. Some short term sacrifices in relation-

ship to the political objective of promoting national ownership and control would be required. In the long term however control of the plantation industry will pass to national business interests. It is clearly better for Papua New Guineans to acquire financially viable plantations rather than run-down properties which are barely profitable.

9.3 Abandoned estates

In East New Britain there are some 70 plantations owned by expatriates that have been abandoned and their owners have left the country (Manning 1984). A similar situation exists in New Ireland where approximately 130 properties are reported to have been deserted. There are therefore some 200 derelict estates either barely producing or producing nothing at all.

Assuming that the plantations range in size from 150 - 200 hectares, between 30,000 and 40,000 hectares of estate land is lying idle. If this land was to be planted with hybrid coconut which yielded an average 3 tonnes per hectare the potential production of copra would be in the region of 90,000 - 120,000 tonnes per year. At current prices of around K500 per tonne this represents a value of K45 to K60 million per year.

Supposing that half the land area could be planted with hybrid cocoa which yielded on average 1 tonne per hectare then these estates could produce approximately 15,000 to 20,000 tonnes of cocoa per year. Assuming a current f.o.b. price of K1,500 per tonne the value of production would be in the region of K22.5 to K30 million per year.

Thus the value of lost copra and cocoa production at current world market prices from these abandoned plantations ranges from about K65 to K90 million per year. Can Papua New Guinea afford to lose the annual contribution to foreign exchange earnings and taxation which this represents?

It is recommended that the Department of Primary Industry in cooperation with the Copra Marketing Board and Cocoa Industry Board carry out a survey of the derelict plantations. This would be in order to ascertain the number of abandoned plantations, the area of land, ownership and status of land title of each property. Once these questions had been answered it is recommended that the government approach one of the international funding agencies such as the World Bank, Asian Development Bank or European Development Fund to finance a feasibility study for the rehabilitation of these plantations.

9.4 Tree crop research

Research in the three most important small farmer crops, coffee, cocoa and coconut will shortly be taken over by industry-funded research institutes. Finance will be raised by a research levy on exports. There will be joint control of the research policy by representatives appointed by commercial agricultural interests and the Department of Primary Industry. The major part of the funding for the research stations will be provided by the smallholder sector since they produce the greater proportion of each crop. The Department of Primary Industry therefore has the responsibility for looking after the interests of the majority producers.

In Chapters 2 and 7 the view was put forward that plantation and smallholding crop production are two different farming systems for the cultivation of the same export crops. The research requirements of plantation agriculture and smallholding agriculture therefore differ. Research programmes for the plantation sector need to be tailored to the high input/high output mode of production. The objective in breeding programmes for example will be for high yields given plantation standards of agricultural management, crop husbandry and high physical inputs.

The goals of a smallholder-oriented programme should be to achieve modest yields in a farming system with low inputs. Breeding for disease resistance for example is likely to be of higher priority in a research scheme designed for smallholders compared to one for estates. The role of the Department of Primary Industry in research policy committees is to ensure that the needs of the smallholders are not neglected and research programmes are not cut back when commodity prices are depressed.

9.5 Executive recruitment policy

Plantations are employers of a large labour force. The main operating cost component on any plantation is labour. The management of the workforce is therefore the prime aspect of plantation operations. Proper management of labour and the retention of an adequate labour force are the most important attributes of the successful estate manager. If it is possible to quantify management of estates (as opposed to the management of plantation companies) then man management would score 75 points out of 100. The remaining 25 per cent would be shared between crop husbandry management and estate administration. The job of the plantation manager is not to decide agricultural policy or the rate of the planting programme. That is the function of the plantation company head office.

The general recruitment policy on plantations is to take on newly qualified personnel who have completed a formal agricultural course at certificate, diploma or university level. The turnover of these recruits is reported to be very high.

The great gap in the management structure on the typical small-sized plantation in this country is at the supervisory/junior assistant level. The need for this class of supervisor will become more apparent when the plantation industry is restructured into larger management units.

It is suggested that the plantation industry should adopt a two tier recruitment policy. The first, lower tier, would be the employment of personnel with supervisory and man management skills. These men need have no training or direct experience of plantation agriculture. Recruits of this type would include former non-commissioned officers from the Defence Force and police sergeants. They would be employed at the senior supervisor/junior assistant level but in the main they would not be promoted further.

The second tier of recruitment would be personnel with higher formal educational qualifications preferably in agriculture. They would be of managerial potential and the more able would be expected to take over senior posts both on the plantations and at head office. This class of recruit should be transferred from estate to estate in his early years to gain experience in a planned training programme. It is hoped that the prospects of promotion to manager and group manager within a relatively short time scale will lead to lower personnel turnover rates than at present.

Until sufficient national personnel of managerial calibre have been trained to take over plantation management posts there still will be a need to employ expatriate staff. In the past Papua New Guinea has largely looked to Australia and New Zealand for its supply of estate managers. Probably the majority of these recruits have had no experience of tropical conditions before they arrive in Papua New Guinea and almost all have had no experience of plantation crops.

It is recommended that the plantation industry should change its recruitment policy with regard to expatriates. Tropical agricultural management expertise of high standard is available in Asia and Africa. Malaysia, Sri Lanka and India are English speaking countries in Asia that could be fruitful ground for the recruitment of managers. In Africa, Zimbabwe has a pool of experienced managers in tropical crop production that could be utilised to good effect in Papua New Guinea.

9.6 Labour conditions

A major contrast between the international companies and the other groups of plantations in Papua New Guinea (especially in the Island provinces) is in labour recruitment policy. The policy of the international groups is to employ family labour as they wish to maintain a settled, permanent labour force in the interests of encouraging high labour productivity. The workers on new crop development projects such as sugar and oil palm are housed in individual dwellings built to international standards grouped together in attractively laid out estate villages. The houses are provided with garden plots, bathroom and toilet facilities, water and electricity. Nevertheless most such labour consists of migrants not villagers from the immediate area.

The general policy on other categories of plantations is to recruit bachelor status men often from the Highlands on 1-2 year contracts and house them in barrack type accommodation with the minimum of social amenities. Often the conditions under which such labour is recruited and housed in the copra/cocoa plantations of the Islands and rubber estates in Papua has not changed by any significant degree since the days of the Niuguinea Kompagne. While conditions cannot change overnight it should be part and parcel of the recommended restructuring and rehabilitation programme of the plantation industry to introduce a labour policy more in keeping with standards of living and social attitudes appropriate to the mid 1980's rather than the late nineteenth century. A more suitable labour policy would de-emphasise short term indentured contracts and encourage family groups, more settled living conditions, better training and would provide stronger inducements to workers from adjacent areas.

9.7 Land tenure

One of the factors causing a decline in production and investment in the estate sector is the fear that plantation land may be acquired under the Plantation Redistribution Scheme. This study has recommended the removal of the Plantation Redistribution Scheme laws from the statute books.

Plantations require secure long term leases if they are to grow perennial tree crops with a production and replanting cycle of 15 - 50 years. Security in this context does not imply an inviolate and perpetual proprietary right to a landholding. The 99 year usufructuary title granted by the government on land alienated for agriculture provides sufficient security of tenure for all the plantation crops grown in Papua New Guinea.

The Anglo-Saxon concept of freehold is alien to Melanesian cultural conditions. In Papua New Guinea plantation land held under freehold is on land grants given by the German colonial authorities. As the laws of a country should ultimately reflect the social aspirations and culture of the people it is felt that the retention of freehold land is rather an anachronism. The abolition of freehold and replacement of freehold titles by new 99 year agricultural leases would be, it is suggested, politically popular and in keeping with Melanesian mores.

The abolition of freehold in these circumstances would not lead to any loss of confidence by the plantation industry. Another advantage of the replacement of freeholdings by long term lease-holdings would be that all plantations situated on non-traditional land would be held under a uniform and simple system of land tenure.

Appendix 1
List of plantations, stations and
processing factories visited

	Province
Niugini Table Birds	Morobe
Zifasing Cattle Ranch	Morobe
Ramu Sugar Plantation	Madang
Bebere Estate	West New Britain
Hoskins Oil Palm Scheme	West New Britain
Kumbango Palm Oil Mill	West New Britain
Dami Oil Palm Research Station	West New Britain
PNG Oil Palm Research Station	West New Britain
Clifton Planation	East New Britain
Vimy Plantation	East New Britain
Gunanur Plantation	East New Britain
Taboona Plantation	East New Britain
Tavilo Plantation	East New Britain
Tokiala Plantation	East New Britain
Vunapua Plantation	East New Britain
Lowlands Agricultural Research Experiment Station, Kerevat	East New Britain
Taribo Settlement Scheme	East New Britain
Keravat Settlement Scheme	East New Britain
Natava Hybrid Coconut Demonstration Plot	East New Britain
Malapau Hybrid Coconut Demonstration Plot	East New Britain
Smallholder Cocoa	East New Britain
Lakuraman Plantation	New Ireland
Patlongat Plantation	New Ireland
Ketsimur Plantation	North Solomons
Kurwina Cocoa Quaratine Station	North Solomons
North Nasvi Cocoa Factory	North Solomons
Raranka Plantation	Eastern Highlands
Aionora Plantation	Eastern Highlands
Tuka Plantation	Eastern Highlands
Biampa Plantation	Eastern Highlands
Kainantu Coffee Factory	Eastern Highlands
Lapalo Plantation	Eastern Highlands
Viviato Plantation	Eastern Highlands
Gavero Plantation	Eastern Highlands
Kalpa Dupnui Plantation	Western Highlands
Pau Farm Plantation	Western Highlands
Paka Unite Plantation	Western Highlands
Kinjibi Plantation	Western Highlands
Kinjibi Coffee Factory	Western Highlands
Aviamp Estate	Western Highlands
Koban Estate	Western Highlands
Koban Coffee Factory	Western Highlands
Kilip Goi Plantation	Western Highlands
Madan Plantation	Western Highlands
Smallholder Coffee	Western Highlands
Higaturu Oil Palms	Oro
Popondetta Smallholder Scheme	Oro
Doa Estate	Central

Appendix 2

List of Persons Interviewed

- T. A'Bear, Ramu Sugar Ltd., Madang Province
- M. Ainslie, Aviam Estate, Western Highlands Province
- T. Amero, KKB Ltd., Eastern Highlands Province
- L. Andersson, Burns Philp Plantations Ltd., North Solomons Province
- M. Apelis, East New Britain Provincial Government
- M. Areori, East New Britain Provincial Government
- R. Arneson, Hassall and Associates Pty. Ltd., National Capital District
- B. Awford, Ramu Sugar Ltd., Madang Province
- A. Ayton, Higaturu Oil Palms Pty. Ltd., Oro Province
- S. Ballard, Department of Primary Industry, National Capital District
- P. Barker, Department of Primary Industry, National Capital District
- A. Barnes, Department of Primary Industry, West New Britain Province
- S. Barnes, Higaturu Oil Palms Pty. Ltd., Oro Province
- A. Baupua, Morgan Equipment Pty. Ltd., North Solomons Province
- B. Beck, Coconut Products Ltd., East New Britain Province
- M. Benjamin, West New Britain Province
- J. Benn, Harrisons and Crosfield (PNG) Ltd., Morobe Province
- C. Benton, Department of Primary Industry, Oro Province
- A. Benton, Higaturu Oil Palms Pty. Ltd., Oro Province
- A. Bergqvist, Gouna Development Corporation, Eastern Highlands Province
- B. Bolton, Angco Pty. Ltd., North Solomons Province
- R. Brandt, Morgan Equipment Pty. Ltd., North Solomons Province
- L. Bridgeland, East New Britain Province
- P. Brown, Hassall and Associates Pty. Ltd., National Capital District
- R. Bull, Asian Development Bank, National Capital District
- C. Campbell, New Britain Palm Oil Development Ltd., West New Britain Province
- B. Cariappa, Koban Plantations, Western Highlands Province
- B. Carrad, Department of Primary Industry, National Capital District
- J. Christensen, Department of Primary Industry, National Capital District
- B. Clayton, National Plantation Management Agency Pty. Ltd., East New Britain Province
- J. Colman, Madan Plantation, Western Highlands Province
- R. Colman, Madan Plantation, Western Highlands Province
- P. Colman, Madan Plantation, Western Highlands Province
- B. Corin, KKB Ltd., Eastern Highlands Province
- H. Coulter, Cocoa Industry Company Ltd., East New Britain Province
- T. Crabb, New Britain Palm Oil Development Ltd., Morobe Province
- R. Darlington, Koban Plantations, Western Highlands Province
- R. Darragh, Planters Association of PNG, East New Britain Province
- L. Dem, Koban Plantations, Western Highlands Province
- J. Diuvia, Coconut Products Ltd., East New Britain Province
- R. Dixon, New Ireland Chamber of Commerce, New Ireland Province
- Dufe, Karanka Plantation, Eastern Highlands Province
- D. Dunbar-Reid, Planters Association of PNG, East New Britain Province
- J. Eastwood, Vimy Plantation, East New Britain Province
- V. Eri, Harrisons and Crosfield (PNG) Ltd., Morobe Province
- T. Fairhurst, Koban Plantations, Western Highlands Province
- K. Fairweather, Pagini Holdings, Port Moresby
- S. Fox, Collins and Leahy, Eastern Highlands Province
- G. Gardiner, Highlands Associates, Western Highlands Province

M. Gehde, PNG Development Bank, National Capital District
R. Gillbanks, Harrisons and Crosfield (PNG) Ltd., Morobe Province
C. Gimbol, Department of Primary Industry, Eastern Highlands Province
J. Grose, Poliamba Pty. Ltd., New Ireland Province
D. Hagon, Agricultural & Resources Management Services, Western Highlands Province
L. Hannett, Bougainville Development Corporation, North Solomons Province
B. Hansen, Niugini Table Birds Pty. Ltd., Morobe Province
R. Harbottle, Commonwealth Development Corporation, Port Moresby
B. Hargreaves, Ou Pty. Ltd., Western Highlands Province
H. Harries, Dami Oil Palm Research Station (NBPOD Ltd.), West New Britain Province
B. Hart, Coconut Products Ltd., East New Britain Province
J. Harvey-Jones, Department of Primary Industry, Eastern Highlands Province
B. Hastie, Coopers & Lybrand, North Solomons Province
E. Illaia, Ramu Sugar Ltd., Madang Province
M. Ivarami, Cocoa Industry Company Ltd., East New Britain Province
J. Jacobsen, Morobe Bakery Pty. Ltd., Morobe Province
S. Jaffe Werie, Department of Primary Industry, West New Britain Province
C. Jeffes, Koban Plantations, Western Highlands Province
S. Jeffreys, Coconut Products Ltd., New Ireland Province
J. Joughin, Department of Primary Industry, National Capital District
R. Joycey, Vimy Plantation, East New Britain Province
K. Kaenk, Harrisons and Crosfield (PNG) Ltd., Morobe Province
E. Kaivovo, East New Britain Provincial Government
E. Kallasar, Assistant Secretary Planning, New Ireland Province
S. Kamane, Department of Primary Industry, Morobe Province Province
M. Kamoi, Coconut Products Ltd., East New Britain
C. Ketsimur, Cocoa Industry Board, North Solomons Province
J. Kiele, Department of Primary Industry, National Capital District
O. Lataiu, East New Britain Provincial Government
G. Lawson, Poliamba Pty. Ltd., New Ireland Province
J. Leahy, Gouna Development Corporation, Eastern Highlands Province
J. Lewis, Kofena Plantation, Eastern Highlands Province
B. Lloyd, Angco Development Ltd., Eastern Highlands Province
D. Lloyd, KKB Ltd., Eastern Highlands Province
D. Loh, Lowlands Agricultural Research Experiment Station, Kerevat, East New Britain Province
G. MacIntyre, Ramu Sugar Ltd., Madang Province
M. Manning, New Guinea Islands Produce Company, East New Britain Province
R. Manuda, East New Britain Provincial Government
H. Marmelstein, Sipef, Central Province
C. McConaghy, Coffee Industry Association, Eastern Highlands Province
F. McGuire, Higaturu Oil Palms Pty. Ltd., Oro Province
J. McKenzie, Aviam Estate, Western Highlands Province
B. McKillop, Shedden Pacific Pty. Ltd., National Capital District
J. McNichol, W. R. Carpenter (PNG) Ltd., Western Highlands Province
T. Menendez, PNG Oil Palm Research Association, West New Britain Province
J. Menneer, Harrisons and Crosfield (PNG) Ltd., Morobe Province
W. Merriless, Bunum Wo Estate, Western Highlands Province
R. Morgan, KKB Ltd., Eastern Highlands Province
T. Nan, Koban Plantations, Western Highlands Province
R. Naug, National Plantation Management Agency, Eastern Highlands Province
P. Nerau, Bougainville Development Corporation, North Solomons Province
M. New, Bebere Estate (NBPOD Ltd.), West New Britain Province
J. O'Donohue, Vunapau Plantation, East New Britain Province
J. Oke, PNG Banking Corporation, National Capital District
C. Olbery, Koban Plantations Western Highlands Province

- R. Palm, Angco Pty. Ltd., Eastern Highlands Province
- T. Peachey, Queensland Dept. of Primary Industry, Eastern Highlands Province
- I. Prendergast, Department of Primary Industry, National Capital District
- O. Pukam, Department of Primary Industry, West New Britain Province
- G. Rady, Department of Primary Industry, National Capital District
- J. Rana, Bunum Wo Estate, Western Highlands Province
- S. Ranibe, Department of Primary Industry, Eastern Highlands Province
- T. Reid, PNG Development Bank, National Capital District
- S. Retnam, New Guinea Islands Produce Company, East New Britain Province
- J. Ridges, New Ireland Provincial Government
- E. Robinson, Booker Agriculture International Ltd., Port Moresby
- K. Rutter, Asian Development Bank, National Capital District
- A. Schultz, Koban Plantations, Western Highlands Province
- Y. Srikhanta, SIPEF, National Capital District
- A. Stamford, Harrisons and Crosfield (PNG) Ltd., Morobe Province
- P. Tainde, Department of Primary Industry, West New Britain Province
- S. Taniung, North Nasioi Producers Cooperative Ltd., North Solomons Province
- T. Teveli, Department of Primary Industry, Eastern Highlands Province
- J. Tikari, Bunum Wo Estate, Western Highlands Province
- P. Tremethick, Principal Bankers' College, National Capital District
- A. Uechtritz, Zifasing Cattle Ranch Pty. Ltd., Morobe Province
- V. Vai, Department of Primary Industry, National Capital District
- J. Vugts, New Britain Oil Palm Development Ltd., West New Britain Province
- R. Warabe, Department of Primary Industry, West New Britain Province
- K. Ward, Department of Primary Industry, National Capital District
- D. West, Queensland Department of Primary Industry, Eastern Highlands Province
- C. Williams, Collins and Leahy, Eastern Highlands Province
- K. Williamson, Higaturu Oil Palms Pty. Ltd., Oro Province
- D. Willoughby, Aviamp Estate, Western Highlands Province
- K. Wright, Angco Pty. Ltd., North Solomons Province

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Printed by the Hebamo Press, Pty, Ltd.
P.O. Box 6033, Boroko, PNG.

